Special Commission of Inquiry into the

Waterfall Rail Accident

Final Report

Volume 1

January 2005

The Honourable Peter Aloysius McInerney QC

Special Commission of Inquiry into the Waterfall Rail Accident

NEW SOUTH WALES

17 January 2005

Her Excellency Professor Marie Bashir AO
Governor of the State of New South Wales
Office of the Governor
Macquarie Street
SYDNEY NSW 2000

Your Excellency,

I was appointed by Letters Patent issued on 3 February 2003 and varied by Letters Patent issued on 28 May and 29 October 2003, and 28 April, 12 August and 28 October 2004, under the authority of the Special Commissions of Inquiry Act 1983 to inquire into and report to Your Excellency on the following matters:

1. the causes of the railway accident at Waterfall on 31 January 2003 and the factors which contributed to it;

2. the adequacy of the safety management systems applicable to the circumstances of the railway accident; and

3. any safety improvements to rail operations which the Commissioner considers necessary as a result of his findings under matters (1) and (2).

By the said Letters Patent it was declared that sections 22, 23 and 24 of the Act shall apply to and in respect of the Special Commission the subject of Your Excellency's Letters Patent.

The Letters Patent, as so varied, stated "AND OUR further will and pleasure is that you do, as expeditiously as possible, but in any case on or before 31 January 2005, deliver any interim report that you consider appropriate to make and your final report in writing of the results of your inquiry to the office of Our Governor in Sydney".

I delivered my interim report on 15 January 2004. I now present my final report for Your Excellency's consideration.

Yours faithfully,

The Honourable Peter Aloysius McInerney QC

FRONTISPIECE

Aerial view of accident site

TABLE OF CONTENTS

VOLUME 1

VOLUME 2

LIST OF FIGURES

LIST OF ABBREVIATIONS

Advisory Board	Independent Transport Safety and Reliability Regulator Advisory Board
ALARP	As low as reasonably practicable
ARTC	Australian Rail Track Corporation Limited
ATMS	Advanced Train Management System
ATOC	Association of Train Operating Companies (United Kingdom)
ATP	Automatic Train Protection
ATRICS	Advanced Train Running Information Control System
ATSB	Australian Transport Safety Bureau
AWS	Automatic Warning System
C311	Train run which G7 was operating at the time of the accident
CASA	Civil Aviation Safety Authority
CEO	Chief Executive Officer
CTRS	CountryNet Train Radio System
DDIC	Double deck intercity train
Displan	Emergency services disaster plan
ECG	Electrocardiogram
EDR	Emergency door release
G7	The Outer Suburban Tangara train set involved in the accident
Goninan	A Goninan & Company Limited
GRN	Government Radio Network
ICS	Incident Command System
ITSRR	Independent Transport Safety and Reliability Regulator
K10	A ten question psychological screening questionnaire
kg	Kilograms
km/h	Kilometres per hour
Maintrain	Heavy maintenance facility at Auburn
METRE	Making Electric Trains Run Easier
mg	Milligrams
MIM	Major incident management
ml	Millilitres
mm	Millimetres
NTSB	National Transportation Safety Board
OTSI	Office of Transport Safety Investigations
Pacific National	Pacific National Pty Limited
PRISM	Performance, Regulation, Investigation and Safety Management
Qantas	Qantas Airways Limited
RAC	Rail Access Corporation
RailCorp	Rail Corporation New South Wales
RIC	Rail Infrastructure Corporation
RMC	Rail Management Centre
RSA	Rail Services Australia
RSSB	Rail Safety and Standards Board (United Kingdom)
RTBU	Australian Rail, Tram and Bus Union, New South Wales Branch
SCOI	Special Commission of Inquiry into the Waterfall Rail Accident
SMSEP	Safety Management Systems Expert Panel
SPAD	Signal Passed At Danger
SRA	State Rail Authority of New South Wales

SRPD	Safety Reform Program Director
TIDC	Transport Infrastructure Development Corporation
TPWS	Train Protection Warning System
TSSIP	Train Services Safety Improvement Program
VKG	NSW Police radio call sign
WorkCover	WorkCover Authority of New South Wales

EXECUTIVE SUMMARY

1. Introduction

On 31 January 2003 at approximately 7:14 am, a four car Outer Suburban Tangara passenger train, designated G7 and travelling from Sydney Central railway station to Port Kembla, left the track at high speed and overturned approximately 1.9 kilometres south of Waterfall railway station. The train driver and six passengers were killed. The train guard and the remaining 41 passengers suffered injuries ranging from minor to severe.

By Letters Patent issued on 3 February 2003, and subsequently varied, the Hon. Peter McInerney QC was appointed under the Special Commissions of Inquiry Act 1983 to inquire into and report on:

1. the causes of the accident and the factors which contributed to it;

2. the adequacy of safety management systems applicable to the circumstances of the accident; and

3. any safety improvements to rail operations considered necessary as a result of the findings under matters 1 and 2.

On 15 January 2004, the Commissioner presented his interim report, dealing with the first term of reference. The findings contained in the interim report are summarised in chapter 2 of the final report.

The second stage of the Inquiry was concerned with the second and third terms of reference.

This Executive Summary is not intended as a substitute for the final report, which should itself be read. It is impossible to summarise exhaustively or comprehensively the final report in a document of this length.

That this very serious accident occurred so soon after the Glenbrook rail accident, and the fact that many improvements to rail safety recommended in the Glenbrook reports had not been implemented, led the Commissioner to conclude that the organisational deficiencies in the safety of rail operations in New South Wales were much greater than believed at the time of the Glenbrook Inquiry.

A more detailed examination of those deficiencies than occurred in the Glenbrook Inquiry was obviously required. Accordingly, the Commissioner sought the assistance of a number of experts in transport safety to determine the most appropriate and effective way of investigating the deficiencies.

Although documents provided by the State Rail Authority (SRA) indicated that the organisation purported to have a system for internally managing safety, comparison of the purported system with the known deficiencies indicated that, whatever the documentation claimed, the reality was different.

The task of identifying the deficiencies in safety management that caused the Waterfall accident was complicated by the extensive legislative changes which came into effect at the

beginning of 2004 and which included the transfer of the SRA's passenger operations to a new organisation known as Rail Corporation New South Wales (RailCorp) and the creation of two new safety regulatory bodies, the Independent Transport Safety and Reliability Regulator (ITSRR) and the Independent Transport Safety and Reliability Advisory Board (the Advisory Board).

Before the new legislation commenced, two experts retained by the Special Commission, Dr Graham Edkins and Dr Robert Lee, the latter of whom subsequently was appointed as Deputy Chairperson of the Independent Transport Safety and Reliability Regulator Advisory Board, had recommended an extensive safety review of the SRA, the Rail Infrastructure Corporation (RIC) and the former rail safety regulator, to establish whether the documented safety management systems of each entity contained the necessary elements for overall management of safety, and whether they were effective. After the 2004 legislative changes, this review required an examination of both the old and new organisations.

The Special Commission established a panel of experts, known as the Safety Management Systems Expert Panel (SMSEP), to oversee and analyse the results and factual findings of a safety management systems review of the organisations. A leading international expert in safety auditing was retained to design the review process and assemble a team of experienced safety auditors, to gather the necessary material.

The results of the review are contained in a detailed report made by the SMSEP, which is reproduced in volume 2 of the final report. The panel's findings are discussed below and throughout the text of the final report.

The Glenbrook Inquiry demonstrated the benefit that can be gained from interstate and overseas experience in transport safety matters. Prior to the Waterfall accident, that experience was not utilised by the SRA. If it had been, the accident may have been avoided.

The Commissioner obtained the Premier's permission for Counsel Assisting to undertake extensive investigations overseas. Many of the recommendations made in the report are based upon the practices and systems adopted in countries such as the United Kingdom, other European Union countries, Canada and the United States of America. There is a significant degree of uniformity in the essential elements of such systems in those countries.

Examination of the deficiencies in safety management identified by the SMSEP required an examination of corporate governance of safety management. Management of safety cannot be divorced from the overall management of the railway business in which a company is engaged. A chapter of the report is devoted to corporate governance of safety management.

Good safety management is not only a moral obligation, it is good business practice. Unsafe railways do not operate as efficiently or profitably as safe railways.

During the course of the Inquiry, Parliament enacted legislation establishing ITSRR, which was described as independent. The Inquiry was not consulted in relation to the structure or model of safety regulation contained in that legislation. Aspects of the legislation, relating to the need for separation and independence of accident investigation, had been considered and rejected by the Commissioner in the second interim report of the Glenbrook Inquiry, delivered in November 2000. Those aspects are further discussed in the report.

Significant reforms to rail safety are currently being considered at the national level. These will, if supported and adopted in New South Wales, improve rail safety in this State. Those reforms are discussed in the report.

The conduct of this inquiry has been an extraordinarily long and arduous process. This is largely a result of the range and depth of the problems that have existed and continue to exist in the rail industry in New South Wales. The task has been made all the more difficult by the introduction of the new legislative regime and the new system of safety regulation. It was necessary to consider the effectiveness of such organisations in the management and regulation of rail safety in New South Wales.

The amount of material it has been necessary to consider is indicative of the size of the task. More than 178,000 documents, consisting of more than 701,000 pages, were provided to the Special Commission. One hundred and thirteen hearing days were required. Two hundred and three witnesses gave evidence.

2. Interim Report

Investigation of the causes of the accident at Waterfall proved to be an extraordinarily difficult task. The cause of the accident was not apparent. The train driver was deceased and the guard claimed to have no recollection of events prior to the derailment. While G7 had been fitted with a data logger, it was not operating at the time. Consequently, there was no record of the actions of the deceased driver in the period immediately before the derailment.

In the interim report of this Inquiry, the Commissioner concluded that the mechanism of the accident was a high speed rollover. G7 was travelling at approximately 117 km/h as it entered the curve on which it derailed. The speed limit at that point was 60 km/h.

Extensive investigation and testing led to the conclusion that both the condition of the track and associated infrastructure, and mechanical malfunction of G7 could be excluded as possible causes of the accident. Deliberate or reckless behaviour on the part of the train driver could also be excluded.

The train driver, Mr Zeides, had a number of risk factors for coronary artery disease. Post-mortem examination revealed that he had a 90 per cent blockage of the left anterior descending coronary artery. While this did not establish conclusively that he had a heart attack, the preponderance of evidence was that he was at considerable risk of an incapacitating cardiac event.

Being able to exclude the possible causes mentioned above, the inference from the known state of Mr Zeides' health led the Commissioner to find that he suffered a sudden incapacitating heart attack at the controls of G7.

That conclusion led the Commissioner to examine why, in those circumstances, there was a failure of the deadman system, which is supposed to prevent an accident of this kind if the train driver has a sudden heart attack. The deadman system was designed to stop the train unless the train driver maintained continuous pressure on either a spring-loaded hand control or a foot pedal. The foot pedal was designed so that if too much or too little pressure was applied, the emergency brakes would be applied.

Expert evidence before the Special Commission indicated that an incapacitated driver weighing more than 110 kilograms could, by the static weight of his legs, hold the foot pedal in the set position whilst G7 was in motion, preventing an emergency brake application. Mr Zeides weighed 118 kilograms at autopsy.

The Commissioner was satisfied that Mr Zeides was using the foot pedal when he had a heart attack and that the foot pedal failed to operate as intended.

It became apparent that the SRA had information for approximately 15 years that the deadman foot pedal in Tangara trains had the inherent deficiency that train drivers over a certain weight could set the pedal inadvertently if they became incapacitated. In attempting to determine why such a dangerous state of affairs had been allowed to exist for such a long period, the Commissioner concluded there were serious deficiencies in the way in which safety was managed by the SRA over that period of time.

Apart from the unsafe rolling stock, it was also necessary to understand why the train guard failed to take any action when it became apparent G7 was travelling at excessive speed sufficient to alarm the passengers, and how the train driver, a person at considerable risk of a heart attack, could have passed the periodical medical assessments.

As well as these obvious deficiencies, there were deficiencies in the way in which the safety regulatory system operated. The safety regulatory regime in place, which had as its purpose the prevention of incidents of this kind, failed to operate on this occasion. This must be regarded as one of the indirect or latent causes of the accident.

In response to the first term of reference, the Commissioner determined that the factors identified extensively in the interim report directly or indirectly caused or contributed to the accident. These are summarised in chapter 2 of the final report.

The findings in the interim report allowed the Commissioner to identify a number of areas where further consideration was necessary for the purpose of reporting on the second and third terms of reference. Those matters are the subject of the final report.

The second stage of the Inquiry was conducted at a time of substantial legislative changes enacted in the Transport Legislation Amendment (Safety and Reliability) Act 2003. That legislation provided for a review of the operation of the amendments after a period of 12 months from the date of assent to that Act. The second and third terms of reference require consideration of what recommendations should be made in relation to the legislative regime currently in place, in addition to the matters identified in the interim report.

3. History of Rail Safety Management

It is not possible to divorce railway safety from general railway management. Only by identifying what has happened in the past can recommendations for future change be placed in context.

The first feature of the New South Wales rail system that is significant is that it has, since 1855, been government owned. The history of the rail system from the 1850s to the 1970s is outlined in chapter 3 of the report.

The State Rail Authority of New South Wales was constituted as a corporation by the Transport Authorities Act 1980. The Authority was reconstituted by the Transport Administration Act 1988 as a corporation operating both passenger and freight railway services.

Rail Safety Act 1993

Up to 1993, the State Rail Authority had a general statutory duty for the safety of the rail network. In that year the Rail Safety Act 1993 (the 1993 Act) was enacted, with the object of promoting the safe construction, operation and maintenance of railways. That Act was the first attempt in any Australian jurisdiction to legislate comprehensively in relation to rail safety.

The 1993 Act provided, among other things, for:

- a scheme for the accreditation of the owners and operators of railways and for the certification of railway employees performing safety work;
- the development and monitoring of safety performance standards;
- the carrying out of regular safety compliance inspections;
- the reporting of notifiable occurrences; and
- the holding of inquiries into railway accidents and incidents.

The accreditation system was designed to attest:

- the fitness and competency of accredited owners to safely construct and maintain infrastructure;
- the fitness and competency of accredited operators to safely operate railways and to construct and maintain rolling stock; and
- that the safety standards proposed by accredited persons had been accepted by the regulator, the Director General of the Department of Transport.

Under the 1993 Act, applicants for accreditation were required to submit comprehensive safety management plans and, if accredited, to revise those plans annually.

The initiatives contained in the 1993 Act may have led to a much safer outcome in the New South Wales rail system had it not been for the changes that occurred in 1996. The restructuring that occurred in that year had a profound effect on both the safety and efficiency of the operation of railways in this State.

Disaggregation and restructuring of the railways in 1996

Prior to 1 July 1996, the State Rail Authority was a single, vertically integrated statutory authority divided into four divisions, all of which reported to the one Chief Executive Officer and Board. The divisions were CityRail, CountryLink, FreightRail and a Property Division.

Safety responsibilities were undertaken by the different divisions but subject to centralised management and co-ordination.

In 1995, New South Wales became a signatory to the National Competition Policy Agreement, designed to implement the recommendations of the Hilmer Report on microeconomic reform.

Two elements of that agreement are relevant to the restructure of the New South Wales rail system. First, public monopolies were to be stripped of any regulatory functions, prior to being exposed to competition. Secondly, a regime was to be established to enable third-party access to significant Government-owned infrastructure facilities.

The first requirement had already been addressed by the 1993 Act. The second requirement provided the impetus for the major restructure of the State Rail Authority which was effected by the Transport Administration Amendment (Rail Corporatisation and Restructuring) Act 1996 (the 1996 Act).

Despite bipartisan support for this legislation, neither the Government's nor the Opposition's expectations for a significantly improved railway industry were realised.

The 1996 Act constituted two State-owned corporations, the Rail Access Corporation (RAC) and FreightRail Corporation, and two statutory authorities, the Railway Services Authority (RSA) and the State Rail Authority (hereafter referred to as SRA). The effect was to replace a single vertically integrated statutory authority with a horizontal structure. With the subsequent corporatisation of RSA, the SRA remained the only part of the railway that was not corporatised.

The principal objectives of the SRA included the operation of efficient, safe and reliable railway passenger services. Operation of rail services by the SRA continued to be subject to the 1993 Act.

None of the intended outcomes of the restructure eventuated for the RAC, RSA or the SRA.

On 9 June 2000, the Office of the Co-ordinator General of Rail was established, responsible to the Minister for Transport (the Minister), and Mr Ron Christie was appointed to that office. Subsequently, the Minister gave directions to the Boards of the RAC and RSA requiring those corporations to implement the decisions and instructions of Mr Christie in the day-to-day management of their operations.

Second interim report of the Special Commission of Inquiry into the Glenbrook Rail Accident

The recommendations contained in the second interim report of the Glenbrook Inquiry, delivered on 1 November 2000, included:

- the merger of the functions of the RAC and RSA into a single statutory authority, to be known as the Rail Infrastructure Authority;

- establishment of an Office of the Rail Regulator;

- establishment of a Rail Safety Inspectorate and the transfer of responsibility for safety regulation from the Department of Transport to that Inspectorate;

- establishment of a Rail Accident Investigation Board and the transfer of responsibility for rail accident investigation from the Department of Transport to that Board; and

- that development of the legislation dealing with the establishment of the Inspectorate and the Board not commence until the delivery of the final report of the Glenbrook Inquiry.

Transport Administration Amendment (Rail Management) Act 2000

Notwithstanding the recommendation of the Glenbrook Inquiry to postpone any legislative changes to the New South Wales rail system until after the final report of that Inquiry was delivered, the Transport Administration Amendment (Rail Management) Act 2000 (the 2000 Act) was introduced into Parliament in November 2000 and assented to on 6 December 2000.

Under the 2000 Act, the RAC and RSA were to be merged into the Rail Infrastructure Corporation (RIC). The Act also made changes to the SRA. The principal objective of the SRA was to be to deliver safe and reliable railway passenger services in an efficient, effective and financially responsible manner.

The 2000 Act also provided for the establishment of a Rail Regulator, but the relevant provisions had not been proclaimed to commence when the whole Act was eventually repealed in 2003.

Final report of the Special Commission of Inquiry into the Glenbrook Rail Accident

The final report of the Glenbrook Inquiry, delivered on 11 April 2001, contained recommendations for:

- random breath testing of railway employees engaged in safety critical work;

- drug testing of employees involved in an accident or incident;

- the accreditation of rail organisations by the Rail Safety Inspectorate (the Inspectorate);

- the Inspectorate to be required to refuse accreditation to an organisation unless satisfied that –

    (a) it had a rigorous safety management system conforming to the highest international standards;

    (b) it had an effective safety management plan for implementation, monitoring and improvement of its systems;

    (c) the Board, Chief Executive and senior management considered the safety of the organisation's activities as its first priority;

(d) it had an effective system for identifying safety risks and effective mechanisms for controlling those risks, monitoring the effectiveness of the controls and adjusting them accordingly;

(e) it had a effective system for determining the priority of activities for removing, reducing or controlling particular risks; and

(f) it had the resources to ensure that the safety of rail operations could be maintained under any circumstance;

- the Inspectorate to be required to make public all notices of accreditation;
- the Inspectorate to have responsibility for ensuring accredited organisations comply with its accreditation and any conditions or restrictions thereto;
- the Inspectorate be given power to impose a range of sanctions to enforce compliance;
- the Inspectorate be given power to conduct safety audits;
- the Inspectorate be given power to inspect any person or thing which might give rise to an unsafe activity or outcome;
- all safety audit reports of the Inspectorate to be made public;
- the Minister for Transport to be given power to direct the Inspectorate to conduct a safety audit or inspection and the report of any such audit or inspection to be made public;
- the Inspectorate be given power to serve any accredited organisation with written notice requiring specified action to be taken or stopped which the Inspectorate has reasonable cause to believe may give rise to an unsafe activity or outcome, and for legislation to be introduced making it an offence to fail to comply with such a notice;
- the Inspectorate to be within the Department of Transport; and
- the legislation creating the Inspectorate to provide for its independence from ministerial control.

The Rail Safety Act 2002 (the 2002 Act), which commenced eight days after the Waterfall rail accident, was said to enact the Government's response to the final report of the Glenbrook Inquiry. During its passage through Parliament, it was criticised as not providing real independence for the rail safety regulator and the accident investigation panel. The 2002 Act provided for an accreditation scheme for operators of railways, the purpose of which was to attest, among other things, that an operator's system for the identification, management and control of risks had been accepted by the regulator, the Director General of the Department of Transport. Investigation of accidents and incidents was to be carried out by the Director General or a rail investigation panel at the request of the Director General.

The Transport Administration Amendment (Rail Agencies) Act 2003 was enacted following the creation of the Special Commission of Inquiry into the Waterfall Rail Accident and constituted a new entity, Rail Corporation New South Wales (RailCorp), and transferred to it the rail passenger functions of the SRA, from 1 January 2004.

On the same date, the Transport Legislation Amendment (Safety and Reliability) Act 2003 constituted a new regulator, ITSRR, with functions including accrediting railway operators and holding inquiries into accidents. ITSRR is to be independent of ministerial control in exercising those two functions. The regulator is required to refer accreditation matters and accident reports to the Advisory Board and consider its advice. That Act also provides that ITSRR is to have a division called the Office of Transport Safety Investigations, headed by a Chief Investigator. The appointment, dismissal and conditions of employment of the Chief Investigator are to be at the recommendation of the Chairperson of the Advisory Board.

It is not surprising when one looks at the history of legislative and administrative changes to the New South Wales rail industry, particularly in recent years, that the major passenger train operator and the safety regulator have, within each, the safety deficiencies identified in the interim report, in the SMSEP report and in the final report.

4. Safety Management System Review

The Commission's second term of reference was to inquire into the adequacy of the safety management systems applicable to the circumstances of the accident.

The SMSEP, a panel of six people with extensive experience in safety management, was appointed to review the safety management systems of the SRA, RailCorp and ITSRR.

The panel's review was based on an examination of material gathered during an extensive safety review of RailCorp and ITSRR, conducted by a team of 11 experienced safety auditors.

The report of the SMSEP was submitted to three independent experts for peer review. Based on the reviewers' comments and the evidence adduced in the public hearings, the Special Commission is satisfied as to the quality and reliability of the work done by the SMSEP. The report of the SMSEP is reproduced in volume 2 of the final report.

SRA/RailCorp

Using the airline industry as a model, the Safety Management Systems Review Director identified 23 basic elements against which the adequacy of the SRA and RailCorp's safety management systems was assessed. A further six elements, specific to the rail industry, were added to that list.

The findings of the SMSEP in relation to those 29 elements indicated profound weaknesses in the management of safety by the SRA and RailCorp. The SMSEP identified six particular areas where deficiencies in safety management were the most significant.

Safety management

- Many senior managers lacked awareness of contemporary safety management principles and practice and lacked relevant technical qualifications in system safety, risk management or human factors;
- Risk management was conducted on a reactive rather than a proactive basis;
- Document control processes for distributing safety critical information were lacking;
- Systems for holding managers accountable for safety performance were lacking;
- While staff took safety seriously, their focus was on occupational health and safety (OH&S), not broader system safety;
- A "blame culture" made it difficult for staff to raise safety concerns; and
- Drivers were induced to violate rules and procedures to meet on-time running requirements.

Human factors

- RailCorp and the SRA did not have a documented human factors policy; and
- When an accident occurred the response was governed by the traditional "blame and train" paradigm, rather than an analysis of the limitations in human capabilities and behaviours the accident might reveal.

Training systems

- There was no formal structured and integrated process to identify training requirements;
- With minor exceptions there had been no significant changes in the design or delivery of training since the Waterfall rail accident;
- Training was strongly focussed on OH&S and safeworking procedures, rather than system safety; and
- There was no safety management system training for management personnel.

Emergency preparedness

- Emergency response planning was inadequate and those plans in existence were not tested; and
- There was no co-ordination of these plans with emergency services.

Asset management and maintenance

- There was no comprehensive process to ensure fitness for purpose and design integrity of new equipment or of changes to existing equipment.

Safety reform agenda

- RailCorp had developed the safety reform agenda in recognition of the need for major systemic change throughout the organisation, however, it is unlikely the goals of the agenda will be achieved in the time frames envisaged.

Safety climate survey

A safety climate survey was conducted of a cross-section of RailCorp employees, to determine the organisation's safety culture.

None of the different groups interviewed expressed the view that rail operations were safe. The overall view was that safety had barely improved since the Waterfall rail accident.

ITSRR

The review of ITSRR was based on 11 elements derived from an analysis of other transport safety regulation frameworks.

The SMSEP found that although ITSRR has more resources than its predecessor, it lacks the technical resources to carry out audits of rail operations.

In the area of accident investigation, there is a perceived lack of independence.

General

The SMSEP review demonstrated an ongoing lack of appreciation within RailCorp of the reasons why accidents such as Glenbrook, Waterfall and Hexham occur. There was an unwillingness to engage in critical self-examination.

The SRA had a grossly inadequate safety management system at the time of the Waterfall rail accident and this was a significant underlying cause of that accident.

That the former rail safety regulator accredited such an organisation indicates the accreditation regime failed to achieve its purpose of ensuring rail safety.

Unless the deficiencies are addressed and an integrated safety management system developed by RailCorp and approved by ITSRR, it is likely further serious accidents will occur.

Key recommendations

The Commissioner recommended:

- RailCorp should establish a safety management system containing the 29 elements identified in the SMSEP report.

- The ITSRR should ensure that RailCorp establishes a safety management system containing the 29 elements identified in the SMSEP report, and ensure the ongoing monitoring and improvement of the safety management system established.

5. Emergency Response

The emergency services personnel who responded to the Waterfall rail accident acted with great courage and dedication, at times risking injury or death. However, there are several important lessons to be learned from the evidence as to the emergency response.

Despite a combination of circumstances indicating something seriously was amiss, staff at the Rail Management Centre (RMC) were reluctant to contemplate the possibility of a derailment and delayed initiating a major incident response. Communication between the RMC and the site was hampered by inadequate equipment and the absence of protocols for clear and precise language. Accessing the site was made difficult by inaccurate information and lack of knowledge about access gates and tracks. Emergency services personnel had to work among catenary wires not knowing whether the electricity had been isolated. The means of access to the trapped passengers was not readily apparent to the rescuers. Despite the existence of a protocol for such incidents, there was no proper site control established until after the rescue phase was completed.

Fortunately on this occasion, the delay, confusion and lack of co-ordination did not result in any additional deaths, but could have done so in different circumstances and must therefore be avoided.

From 1997, the SRA had conducted a small number of exercises, in conjunction with the emergency services, to test the preparedness for various emergency scenarios. Although these exercises highlighted several deficiencies in procedures, no action appears to have been taken to improve the performance of the rail industry or the emergency services in response to serious rail accidents.

Key findings

The Commissioner's findings on the emergency response are contained in chapter 5. The Commissioner identified a number of deficiencies in the emergency procedures, including:

- The RMC did not trigger a major incident management response until 7:32 am, although information sufficient to do so was known 14 minutes earlier.

- Power to the area was not isolated until 8:06 am; during the intervening period several attempts were made to reset circuit breakers that had been tripped by the derailed carriages – fortunately, these were not successful.

- Valuable time was lost by police, fire brigade and ambulance officers as a result of inaccurate information as to the location of the accident, and lack of knowledge about access gates and tracks.

- Emergency response personnel were not aware of the external door release on Tangara carriages, which would have enabled passengers to be promptly evacuated.

- The train guard was not permitted to use the most efficient means of communicating critical information to the RMC, namely the Metronet radio in his cabin.

- There were other communications equipment deficiencies, including the lack of awareness of signal telephones by emergency response personnel, and the fact that satellite telephones were not immediately available.

- There were deficiencies in communications procedures, including the fact that there was no single nominated contact person at the RMC and no compliance with any language protocol.

- The procedure for identifying a site controller in charge of the accident site was not followed.

- The emergency services were not operating under a co-ordinated response plan.

- There was no proper site control; there were unauthorised persons on the site and congestion on the access track caused by vehicles with the keys removed.

- The rail commander on site failed to perform the emergency response function intended for that role.

Key recommendations

The Commissioner's recommendations regarding emergency response are detailed in chapter 25. The most important recommendations are:

- Staff at the RMC to receive training in quickly and accurately assessing potential emergencies and providing precise and reliable information to the emergency services.

- A dedicated telephone line be established between the RMC and any Emergency Services Control Centre.

- A designated staff member at the RMC should act as the rail emergency management co-ordinator and be the sole point of contact with rail and emergency services personnel involved in the response.

- The RMC should be equipped with a transcriber system or mimic board to enable identification of the precise location of any train.

- All train guards should be trained in the use of the Metronet radio and instructed to use it in any emergency.

- Procedures should be put in place to ensure that the power supply to the area of an accident can be immediately isolated, if necessary.

- Satellite telephones should be provided to all rail commanders at any emergency.

- Signal telephones must be maintained in working order.

- All emergency services stations should be provided with keys to and maps showing all gates to RailCorp tracks within their geographic areas.

- A railway disaster plan (rail displan) be developed to ensure co-ordinated response to accidents.

- The rail displan to include a uniform incident command system under a unified command structure.

- The rail displan to provide for the site controller to have complete control of the site until the rescue phase has been completed.

- The incident command system should clearly identify the roles of the rail commander, site controller, police commander and commanders of the other emergency services and the way in which each is to work together.

- The location of the command post for site control should be identified by a distinctive flashing light.

- The role of the rail commander should be to provide support and assistance to the site controller and emergency services personnel.

- The rail commander to have complete authority over any rail employees attending the site of an accident until the rescue phase has been completed.

- RailCorp should develop and implement an emergency response plan; such plan should be subsumed by the rail displan in the case of serious accidents or incidents.

- The RailCorp emergency response plan should include action checklists for each relevant employee.

- Operational rail staff to be trained in the action check list relevant to each person.

- The RailCorp emergency response plan should be provided to all emergency response agencies and emergency services personnel should be trained in any rail-specific features.

- The RailCorp emergency response plan to include a requirement for the debriefing of all senior rail and emergency response personnel involved in any rail accident.

- All emergency response personnel to be trained in the features of railways that are relevant to their work, such as the location and operation of emergency door releases.

- Regular field training exercises should be conducted by RailCorp with the emergency services.

- Uniform terminology for describing the status of the electricity should be used by all railway personnel, electrical service providers and emergency response personnel.

- All rail employees to be trained to commence any emergency communication with the words "Emergency, emergency, emergency", then identify themselves, the train, its location, what has occurred, the approximate passenger load and whether death or injuries have occurred.

- All communications protocols must be strictly enforced.

- A direct line of communication be established between the RMC and Emergency Services Operations Centre.

- A centre for training of emergency services personnel should be established by RailCorp and be equipped with features replicating railway infrastructure and rolling stock.

6. Design and Procurement of Rolling Stock

It was important to examine the circumstances in which G7 was placed into service with the inherently deficient driver safety system identified in the interim report.

Despite the fact that the Tangara was a new design concept and the first train was to be delivered within 11 months of the date of the contract, critical design, engineering and project management systems were not put in place before construction of the trains commenced. Had that happened the design deficiency in the deadman foot pedal which ultimately contributed to this accident should have been detected and rectified at an early stage.

This deficiency in project management must be regarded as an indirect cause of the tragedy on 31 January 2003. The same mistakes should not be repeated in the design of future rolling stock.

Key findings

The Commissioner made several criticisms of the process by which the Tangara trains were designed and commissioned. These are discussed in chapter 6 and detailed in chapter 24. The main findings were:

- The SRA failed to conduct an adequate risk assessment of the deadman foot pedal to determine whether it was fit for purpose.

- The SRA failed to conduct a risk assessment in the design phase of Tangara trains to determine whether the driver safety system would stop the train and thus control the risk of accident resulting from a train driver becoming incapacitated.

- The SRA failed to do a design review of the driver safety system in Tangara trains to determine whether the design concept of the deadman foot pedal would control the risk of collision or derailment if a driver became incapacitated.

- The SRA failed to implement an engineering management system before manufacture of the Tangara trains commenced.

- The SRA failed to investigate whether the functional requirements of the driver safety system would be met by the design proposed for the deadman foot pedal.

- The SRA failed to prepare a functional performance specification for the driver safety system in Tangara trains, prior to commencement of manufacture.

- The SRA failed to determine whether the design of the driver safety system, and in particular the deadman foot pedal, would work before the manufacturer was contracted to build Tangara trains.

- The SRA failed to prepare a functional performance specification to identify the means by which there would be verification of the design specification of the driver safety system in Tangara trains.

- The SRA failed to put in place a quality assurance program during the construction of the trains.

- The SRA failed to implement a system of regular review during the construction of the trains to determine that the driver safety system was going to achieve the functional purpose.

- The SRA failed to conduct a risk assessment to determine whether or not a vigilance device should have been added to the deadman safety system in Tangara trains.

- At the time of the design of the trains, there was no rail safety regulator or system of safety regulation to ensure that rolling stock was fit for purpose or had adequate driver safety systems.

- No systems were put in place after the enactment of the Rail Safety Act 1993 so that the safety regulator could be satisfied as to the safety of passenger rolling stock.

- The SRA failed to conduct a risk assessment in 1993 when Tangara trains were modified for use in the outer suburban area, although such use clearly created a greater risk of collision or derailment resulting from a driver incapacitation.

- The SRA failed, prior to 2004, to fit vigilance devices in Tangara trains to control the risk of collision or derailment, resulting from driver incapacitation.

Key recommendations

The Commissioner's recommendations regarding design and procurement of rolling stock include:

- Railway owners and operators should have a quality assurance programs for the design and construction of rolling stock and regular reviews of construction to ensure that rolling stock satisfies the original functional performance specifications.

- The rail safety regulator should set standards for the design, manufacture, testing and commissioning of rolling stock to ensure that rolling stock is fit for purpose.

7. Driver Safety Systems

The interim report came to two important conclusions about driver safety systems. First, the Waterfall rail accident occurred because of a failure of the deadman system on G7. Secondly, the accident could have been avoided had a vigilance device been fitted to G7.

Vigilance devices provide an additional level of protection, however, limitations such as the lack of overspeed protection mean that circumstances could exist where the use of a vigilance device would not prevent an accident of the kind that occurred at Waterfall.

Consequently, there remains a clear need for RailCorp to evaluate all available options for driver safety systems.

The final report of the Glenbrook Inquiry discussed various means of automatic train protection (ATP) that could be used to overcome deficiencies in driver safety systems, but stopped short of recommending the introduction of ATP, because of the cost and the relative immaturity of the technology, among other reasons.

Since the Glenbrook Inquiry final report substantial developments have occurred overseas with ATP technology. Some of these have been adopted in other Australian States.

A level 2 ATP system allows for a more efficient use of available infrastructure, whilst ensuring high levels of safety. This type of technology is currently used in Western Australia and should be used on the RailCorp network. The level of train protection for both passenger and freight rail operations should be similar across Australia.

Key findings

The Commissioner's findings on driver safety systems are contained in chapter 7. They include:

- A significant deficiency in the SRA's safety management was that on its Outer Suburban Tangara trains, if the train driver became incapacitated in an automatic signalling area and there was no other train in the section, the only mechanical protection was the deficient deadman system.

- When the Tangara design was modified for use in outer suburban areas, a risk analysis should have been conducted. Such analysis would have identified the issues with the driver safety system.

- Vigilance devices should have been installed on Tangara trains when the deficiencies of the deadman system were first identified in 1988.

- The SRA focussed on signals passed at danger and failed to control the risk of a rollover occurring in an area where the signals were green.

Key recommendations

In relation to driver safety systems, the Commissioner recommended:

- All trains must be fitted with a minimum of two independent engineering defences to minimise the risk of derailment or collision in the event of train driver incapacitation.

- RailCorp should progressively implement level 2 ATP with the features identified in chapter 7 of the final report.

- All new rolling stock should be designed to be compatible with at least level 2 ATP.

8. Risk Assessments and Risk Control Procedures

The Glenbrook Inquiry final report highlighted the fact that the then current rail safety regime did not reflect recent developments in safety management, and recommended the establishment of a Rail Safety Inspectorate. Nothing was done in relation to that recommendation until after the Waterfall accident, with the creation of the so-called independent regulator, ITSRR. Some of the deficiencies of that body are discussed below under Rail Accident Investigation in relation to chapter 16.

A successful safety management system involves using a systematic process for managing risks and reducing them to an acceptable level. It is not disputed that, at the time of the Waterfall accident, the SRA and Rail Infrastructure Corporation (RIC) did not have an integrated safety management system. The dominant culture of the SRA was not one of safety, but of on-time running. Whilst on-time running is essential for a rail system, it is more likely to be achieved if the system is operating safely.

To achieve both safety and on-time running, requires the ability to identify hazards that can disrupt services or compromise safety and efficiently manage the risks those hazards create. In the area of risk perception and analysis, there was a failure to fully appreciate the hazardous nature of the activities being carried out at the time of the Glenbrook and Waterfall accidents.

There appeared to be a mindset among many rail staff that since trains had been running every day without serious accidents, there was nothing to worry about. When that exists, as soon as there is a degraded mode of operation, for example the signal failure at Glenbrook or the driver's heart attack at Waterfall, then catastrophic results may occur. These are perceived as being "bad luck", rather than as the result of a deep-seated underlying failure to properly manage risk.

When risks such as the deficient deadman foot pedal are known to management and nothing is done, the inference is that management does not know how to determine what risks are acceptable, and what risks are not acceptable and need to be eliminated or reduced to an acceptable level.

The hazard that materialised at Waterfall was predictable and avoidable by proper risk analysis. The hazard to be managed was driver incapacitation in an outer suburban area leading to a high speed rollover. The time at which that hazard should have been managed was when the Tangara contract was varied to provide for modification to the last 80 cars for outer suburban services.

Had an effective analysis been conducted as part of the change management program, to determine the extent to which the driver safety system was going to be effective in

controlling the risk of a runaway train, the deficiencies in the deadman foot pedal would have been identified.

The kind of examination carried out by Dr McIntosh, an expert retained by the Inquiry, would have soon disclosed that the risk was not controlled because around 40 per cent of Tangara train drivers could, due to their weight, hold the deadman foot pedal in the set position in a moving train, when incapacitated.

During the Inquiry, RailCorp represented that it was using modern risk assessment techniques to manage safety. The falsity of that assertion can be clearly seen with the Safety Reform Agenda and the milestones imposed on RailCorp as conditions of its accreditation, discussed in chapters 21 and 22, respectively.

In summary, the process of risk management involves understanding the nature of the system or activities to be managed, identifying the hazards that exist in the system and putting in place controls to eliminate the risks arising from the hazards or, if the risks cannot be eliminated, then to minimise their effect. Then, verification must be undertaken to ensure the controls actually control the risks or mitigate them to an acceptable level.

The SMSEP review found that the SRA conducted risk analysis in a reactive way, and this was the primary reason for the failure to identify the risks of an accident of the type that occurred at Waterfall. There was no process to identify hazards which had not yet led to an incident or accident. With no experience of a high speed rollover in an outer urban area resulting from driver incapacitation, a reactive approach to risk assessment was never going to identify that particular situation.

An organisation which conducts systematic analysis of hazards, proactively assessing and controlling them, is to be preferred.

Near misses were not identified as precursor events, in the SRA's analysis processes, because attention was directed to incidents that had produced an accident. There was also a concentration on recent incidents, with little analysis of older events that may have been significant in terms of particular types of risk. For this reason, low probability high consequence accidents of the kind that occurred at Glenbrook and Waterfall have continued to plague the New South Wales rail system.

The persistent failure of the SRA, and now RailCorp, to manage risks associated with inadequate communications has been a feature of their inadequate safety management for several years, as demonstrated by the Glenbrook, Kerrabee and Hexham accidents.

There has also been a failure to learn from accidents outside New South Wales, such as the Footscray accident in June 2001, which identified inadequacy of medical controls and the susceptibility of the same type of foot pedal as in the Tangara to inadvertent circumvention, and the high speed rollover accident in June 1984 at Morpeth, in the United Kingdom.

Adequate risk assessment requires a rail organisation to be reactive in terms of information to be gained from incidents over a long period of time, both inside and outside the network. Such a reactive approach is obviously necessary in any risk management system, but it must not be the only approach. It will not prevent low probability high consequence events of the

kind that materialised at Waterfall. That is why a rigorous process of overall risk assessment must be carried out by RailCorp.

A good illustration of the limited ability of RailCorp to conduct even the most elementary of risk assessments can be found in the installation of vigilance systems in Tangara trains, following the Waterfall accident. The vigilance devices installed made the same sound as the guard's all clear bell. In trying to control a low probability high consequence event, such as occurred at Waterfall, RailCorp had increased the risk of a high consequence event, a train beginning to move from the platform while passengers were still getting on or off.

Key findings

A discussion of the evidence concerning risk assessments and risk control procedures and the Commissioner's findings on those matter are contained in chapter 8. The Commissioner identified a number of deficiencies in risk assessments and risk control procedures, including:

- There was no system within the SRA, and now RailCorp, for analysing activities to identify the hazards in those activities, then putting in place controls to eliminate or control the risks created by the hazards, and validating whether the controls reduced the risk to an acceptable level.

- SRA, and now RailCorp, staff, particularly managerial staff with safety responsibilities, were not trained in systematic risk assessments.

- The SRA, and now RailCorp, responded to incidents and accidents after they occurred, rather than examining systems and putting in place controls to prevent accidents or incidents.

Key recommendations

The Commissioner's recommendations regarding risk assessments and risk control procedures include the following:

- RailCorp should undertake risk assessments of each of its activities as follows:

    - identify the features of the system, subsystem or activity, to determine what makes it work in terms of equipment, infrastructure and human factors;

    - identify all hazards that may exist within the system, subsystem or activity;

    - identify what controls are in place to eliminate or minimise the risks associated with any identified hazard;

    - test the validity of the controls to ensure the risk is eliminated or reduced to an acceptable level and, if not, institute additional controls;

    - specify, in safety documentation, the level of any residual risk;

    - in the case of low probability, high consequence risks retain the services of an independent verifier to certify that all risks of such potentially catastrophic

accidents have either been eliminated, or controlled to the extent identified by the independent expert;

- the Board of RailCorp certify that it regards any residual risk of such an accident as acceptable, notwithstanding the severity of the consequences, by reason of the cost of further measures to control the risk; and

- provide to ITSRR records of the processes of hazard identification, risk assessment, risk control, independent verification and certification, and any Board certification relating to high consequence, low probability accidents.

- The ITSRR should conduct its own risk assessment in relation to the risk of high consequence, low probability accidents and, if necessary, direct RailCorp to conduct a further risk assessment to reduce the residual risk to an acceptable level.

9. Data Loggers

The task of this Inquiry was made more difficult because the recommendation in the Glenbrook Inquiry final report to fit operational data loggers to SRA trains had not been implemented. If the data logger already fitted to G7 had been working at the time, it would have been possible to readily determine a number of important facts, including: that the train driver did not operate the controls from shortly after leaving Waterfall station; that there was no defect in the way G7 was operating from the time it left Waterfall station until the derailment; and that there had been no emergency brake application as a result of the deadman system being activated. Establishing these facts from other sources took many hundreds of hours of engineering and other investigation.

The history of the decade-long project to install data loggers is an example of poor project management and poor industrial relations by the SRA. Although the project dates back to 1993, the contract for the installation was only finalised a month after the delivery of the Glenbrook Inquiry final report, in April 2001. The events that unfolded thereafter illustrate a number of deficiencies in the SRA's safety management systems.

The relevant union, the RTBU, was legitimately concerned about the reliability of the information being obtained from the data loggers, particularly if it was to be used for the monitoring or disciplining of drivers. There was evidence that some data loggers were incorrectly recording train speed. The approach of the union was eminently reasonable. The level of distrust between employees and management that was apparent from the evidence on this project is not a very good foundation on which to develop a good safety culture.

The program for the installation of data loggers was handled inefficiently by the SRA. The workers who were to install the devices were given inadequate training and instructions. It was decided that installation would be accommodated within the routine maintenance cycle of each train, up to 360 days.

Installation was not completed until June 2003. Had it not been for the criticism expressed during the public hearings of this Inquiry, it is probable that this would have been further delayed.

The history of the data logger project speaks eloquently of poor industrial relations, deficient planning and deficient processes for the implementation of projects, each of which is as critically important to the management of safety as data loggers themselves.

Key findings

A discussion of the evidence concerning data loggers is contained in chapter 9. The Commissioner found:

- The SRA failed to implement an adequate system for program management of specific projects, such as the installation of data loggers.

- One of the main reasons for the delay was technical difficulties encountered by those responsible for installing data loggers.

- The RTBU was properly concerned that inaccurate information could be used adversely against its membership, in the "us and them" culture that existed within the railway.

- The SRA failed to implement an adequate system for program management of specific projects, such as the project for the installation of data loggers.

Key recommendations

The Commissioner made the following recommendations regarding data loggers:

- The ITSRR should impose a standard for the collection and use of data from data loggers.

- The standard should provide that such information must be accessed in the case of an accident or incident and can be accessed to monitor driver performance generally.

10. Communications

Although the Waterfall rail accident was not caused by a communications failure, there was evidence of several deficiencies in the communications procedures after the accident. Of greater concern is the fact that, although the Glenbrook Inquiry final report identified communications deficiencies as being a major cause of Glenbrook and three other accidents, many of the recommendations of that Inquiry relating to communications appear to have been ignored.

The failure to establish an independent Rail Safety Inspectorate, as recommended, may partly explain why a number of the communications recommendations were not fully implemented. No standard for railway communications between various operators has been established. Uniform communications systems between operators have not been implemented. Most importantly, communications protocols have not been strictly enforced.

The accident at Hexham on 12 July 2002 highlights a number of very serious ongoing communications deficiencies on the New South Wales rail network. It occurred when an empty coal train, travelling on designated coal train lines, derailed and the empty wagons

fouled adjacent main lines. Approximately eight minutes later, a passenger train collided with one of those wagons. The train driver, guard and ten passengers were injured.

No one communicated with the passenger train driver to inform him of the situation. There were three kinds of communications equipment available to the various trains, train controllers and signallers involved, but no one system was common to all of them. The coal train driver contacted the train controller at Broadmeadow on the CountryNet system, using the emergency mode, but the train controller was not sufficiently trained in the operation of that system and inadvertently cancelled the emergency call. If all the trains had been on the same radio system and an emergency transmission had been broadcast, the collision would not have occurred.

The Commissioner described as disgraceful the fact that the communications recommendations in the Glenbrook Inquiry final report were not fully implemented, and that communications failures of the kind witnessed at Hexham have continued to occur.

Incompatible communications equipment and inadequate training in its use was also in evidence at Waterfall.

The Waterfall, Hexham and Glenbrook rail accidents, and the other accidents considered by the Glenbrook Inquiry, all point strongly to the need for compatibility of communications systems throughout the network. It is essential that drivers, controllers, signallers, guards and trackside work gangs communicate using the same technology. The need for compatibility will increase as new operators begin operating on the New South Wales network. In the area where the Hexham accident occurred, new operators have commenced operations with apparently incompatible communications equipment.

However, there is no point in having compatible equipment unless procedures for its use are standardised, so that, for example, everyone involved describes the same subject matter in the same way.

The former SRA had produced a protocol which appeared to address some of the deficiencies of lack of clarity and conciseness of communications, and there was evidence that some training in this area had been instituted, but various tape recorded communications played during the Inquiry showed there was still a failure to enforce protocols.

Borrowing from communications protocols enforced in the United States, the use of the phonetic alphabet, protocols for receiving and ending transmissions and the clarity with which numbers are to be pronounced should be part of communications procedures for all trains operating in New South Wales, if not throughout Australia.

The very serious rail accidents discussed in chapter 10 highlight the urgent need to address the deficiencies in communications in the rail industry. In summary, equipment should be compatible and accessible to all train crews; there should be interoperability of equipment for all trains entering New South Wales from other States; staff involved in controlling train movements should be selected to ensure they have the communication skills needed; procedures and protocols should be standardised and mandated by regulations, making them a condition of accreditation; and the rail safety regulator should audit against these requirements and enforce compliance.

Key findings

In relation to communications the Commissioner found:

- The effectiveness of the emergency response following the Waterfall rail accident was impeded by deficiencies in communications procedures and equipment, including incompatible communications systems.

- Notwithstanding the recommendations in April 2001 in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident, little progress was made by the SRA, and has been made by RailCorp, in their implementation. In particular:

  (a) there has been no proper implementation or strict enforcement of communications protocols;

  (b) no standard for railway communications between rail operators has been established; and

  (c) uniform or integrated communications systems have not been implemented.

- The lack of progress by the SRA and RailCorp in the area of communications has been brought about by ineffective management.

Key recommendations

The Commissioner's recommendations for improving communications include:

- There must be compatibility of communications systems throughout the rail network. It is essential that all train drivers, train controllers, signallers, train guards and supervisors of trackside work gangs in New South Wales be able to communicate using the same technology.

- Communications procedures must be standardised throughout the rail network, so that all railway employees describe the same subject matter in an identical way.

- All RMC communications related staff should be selected upon the basis of the ability to convey information clearly, accurately and concisely and to follow strict communications protocols.

- All communications protocols must be strictly enforced by all accredited rail organisations.

- The ITSRR should audit the RMC to ensure communications protocols are being followed. The sanction for non-compliance with communications protocols should be identical to that in the aviation industry and involve immediate removal from duty. Any RailCorp employee not following communications protocols should be required to undertake further training. If, following return to duties after such training, the officer continues to fail to comply with communications protocols, that officer is not to be employed in communications related work.

- Communications protocols and procedures should be standardised and mandated by regulations making them a condition of accreditation.

- ITSRR should ensure that, as a condition of accreditation, each of these recommendations is carried into effect and should audit against them to enforce compliance.

- The ITSRR should conduct random audits of accredited rail organisations for compliance with communications protocols.

- There should be interoperability of communications equipment between all trains operating on the New South Wales rail network.

11. Train Maintenance

The maintenance history of G7 was discussed in the interim report. In the course of the technical investigations done on G7 during the first stage of the Inquiry, a number of deficiencies were identified in the SRA's systems for maintenance of trains and repair of defects. In particular, deficient records meant the Commissioner was unable to make a finding as to whether lack of maintenance caused or contributed to the accident. However, the Commissioner was able to infer from other material that G7 was functioning correctly on the morning of the accident.

Chapter 11 examines the systems for both categories of train maintenance, planned and unplanned.

There are a number of components to the planned maintenance schedule for each train:

- inspection by the train crew as part of daily preparation,

- 30 day inspections,

- 90 day inspections,

- wheel turning inspections, and

- regular component changeouts (every six and 12 years).

Evidence was given that when defects were identified in the course of daily crew preparation and the driver followed correct procedure and reported the fault, often the response was to reprimand the driver for making the report, rather than to rectify the defect. If drivers are discouraged from reporting defects and trains are taken into service with defects, from time to time it is inevitable that services will be disrupted. This has implications for both safety and reliability. Drivers may be tempted, or prevailed upon, to operate the trains in a way which is inherently unsafe. There were many examples in evidence of drivers having pressure exerted on them to operate defective trains in service.

The daily crew preparation process is defective in two respects, timing and record keeping. It takes place minutes before the train is due to go into service. If an inspection was carried out

after the train finished service for the day, there would be an opportunity to rectify any defects at that time.

Inspection of the daily crew preparation sheets for G7 and other trains revealed many missing sheets. If defects are not reported or recorded, then the chance of them being rectified is nil. There is no reason why records of all defects cannot be entered into a database, to facilitate tracking of defects to rectification.

It is part of the 30 day inspection to check the records for any outstanding defects, but in the absence of a reliable system for recording defects, they are unlikely to be picked up during the 30 day inspection, unless they relate to one of the matters that is checked every 30 days.

It was impossible to determine from the incomplete maintenance records for G7 whether or not the 90 day inspections had identified any defects.

Provided maintenance plans are regularly revised, staff are properly trained, particularly in record keeping, and the effectiveness of plans is audited, the system of periodic maintenance appears to be satisfactory.

Unfortunately, the same could not be said for unplanned defects reporting and rectification.

There were a number of deficiencies in the systems for reporting defects. Drivers report defects in one of two ways. The first is by calling the defects officer on the Metronet radio. The experience of many drivers who sought to report defects this way was that no one answered the call. When someone does answer, whether or not a record is kept depends on whether the defects officer can advise the driver how to overcome the defect. If it cannot be settled immediately, arrangements are made for an equipment examiner to meet the train. If the equipment examiner believes he has rectified the problem then no record is kept. The absence of proper recording prevents any tracking of defects or identification of any trends.

If the examiner cannot rectify the problem, it is then recorded, and the train will either be taken out of service, if it is a safety critical matter, or if it is less critical, it will remain in service. There were often differences of opinion as to whether a particular defect was safety critical. Two drivers gave evidence of instances where they believed that a defective radio in one train, and a shattered window in the other, were safety critical, but their supervisors took a different view. There needs to be a clear definition of what constitutes a safety critical defect. The only sensible way of identifying a safety critical defect is to do so on the basis of a risk assessment.

The other means of reporting a defect is by filling out a report and handing it to someone at the nearest station to be faxed to the defects unit. This depends upon the document being faxed. An audit conducted in 2002 showed that on a number of occasions station staff failed to fax the reports.

The obvious way of remedying these deficiencies is by training and supervision, including supervision of the defects officers to ensure they answer calls and properly record reported defects. All unplanned defects should be reported, whether or not equipment examiners can rectify the defects.

Some effort has been made to encourage drivers to report defects by allowing them access to the computer database from certain locations, known as kiosks. Obviously enough, if the defect is not entered in the system, the driver cannot determine what has become of the reported fault. Other problems with using the kiosks were also identified.

The fundamental deficiency in this area is the lack of any overall integrated system for dealing with both defects and maintenance matters. This is compounded by having two separate sections involved in defects reporting and maintenance, the defects unit, which is in one division, and Passenger Fleet Maintenance, a division in itself.

Maintenance systems were described as theoretical in content, incapable of full implementation and lacking any means of verification. Maintenance plans had not been revised since 1995.

The maintenance plan should be regularly revised. There should be a proper procedure for confirming that any reported defect has been investigated and certification that it has been rectified. The new plan should be straightforward, practical and easy to understand. It should then be distributed to the fleet management section, the train crewing section, the defects section and railway station staff, so that everyone knows the processes to be followed.

Key findings

The Commissioner identified a number of deficiencies in relation to train maintenance, including:

- The SRA and RailCorp used defective systems for documenting train maintenance.
- The SRA and RailCorp used defective systems for dealing with train driver complaints of defects in that:
  - (a) complaints were ignored or discouraged;
  - (b) complaints were not recorded; and
  - (c) complaints were not finalised and certified.
- SRA and RailCorp record keeping in respect of defects complaints was inadequate.
- The SRA and RailCorp had no adequate system of feedback to drivers of the results of defects reports.

Key recommendations

The Commissioner made a number of recommendations for RailCorp to improve train maintenance, including:

- All drivers' defects reports should be entered into a computerised record and tracked to finalisation.

- No train should enter into or remain in service if, in the opinion of the driver, any defect creates a risk of injury.

- All reported defects should be certified by a person in a supervisory position as having been rectified.

- Train inspections should be carried out at the time of stabling, as well as a part of train preparation prior to entering service.

- RailCorp should create the position of team leader, responsible for a group of approximately 30 drivers, to ensure that training needs are being met and drivers' safety concerns are being properly addressed.

- Defects reporting, recording and rectification should be integrated with the regimes for train maintenance.

- The defects unit should be combined with the passenger fleet maintenance division.

- Maintenance plans should be revised annually.

12. Alcohol and Drug Testing

In the course of investigating the causes of the Waterfall accident, the possibility of alcohol or drugs being involved needed to be considered. Although these were excluded as causes or contributing factors, the processes for determining the fitness for duty of train crew became relevant.

There is no doubt that random testing for alcohol should form part of the safety management of railways. If motorists are subject to random breath testing, those involved in driving trains carrying up to 1,000 passengers should be subject to similar scrutiny.

The Glenbrook Inquiry final report, in April 2001, recommended the introduction of random breath testing of railway employees engaged in safety critical work. That recommendation was not implemented until October 2003. There was little evidence as to the cause of the delay. The only explanation provided was the need for consultation with relevant unions.

That report also recommended examination of a system for enabling the immediate and reliable assessment of fitness for duty of safety critical employees. There was no evidence that any such investigation was carried out.

There was, however, evidence of a program, called the "Are you OK?" program, which consisted of the signing-on officer asking the employee whether he or she was fit to commence work. There was no evidence as to the number of employees who admitted they were unfit to work. Also, such program would be ineffective if an employee exercises so-called "joiner rights", and joins a train at a station, instead of the depot, as Mr Zeides did on the day of the Waterfall accident.

Key recommendations

The Commissioner recommended:

- Random alcohol testing should be continued.

- Alcohol and drug testing should be mandatory for any train driver or guard involved in an accident or incident.

- RailCorp should continue its system of voluntary self-identification and rehabilitation of employees with alcohol or drug related problems.

13. Medical Examinations

Having concluded in the interim report that the train driver, Mr Zeides, suffered a heart attack, it was necessary to determine the deficiencies in the SRA's system of periodic medical examinations that resulted in Mr Zeides driving a train with a level of coronary artery disease that exposed him to the risk of a sudden heart attack.

The interim report identified six particular areas requiring attention.

The first was the absence of a predictive element in the medical assessments. A RailCorp officer gave evidence in the second stage of the Inquiry that medical assessments now contain a predictive element. It has been decided by RailCorp that the cardiac risk score that will trigger a referral for a stress ECG is 22. It should be noted that Mr Zeides' score was only 20. However, RailCorp indicated that it was contemplating an approach which was not purely mathematical, but involved consideration of other factors. The Commissioner found this, if implemented, to be an appropriate compromise.

The second matter identified as a deficiency was that the medical examiners lacked both occupational health and safety (OH&S) qualifications and an understanding of the nature of railway work. RailCorp has retained a medical services provider to recruit the GPs who will perform the examinations. They do not need be qualified in OH&S, but must have skills and experience in occupational health beyond that of the average GP. RailCorp has introduced its own training course to give the practitioners an understanding of the work. The medical services provider also provides RailCorp with the services of an occupational physician to review the medical assessments.

The third area of concern was the lack of information provided to the examiners. That deficiency has been addressed by RailCorp providing its medical records relating to each particular employee to the practitioner conducting the examination.

The fourth criticism in the interim report related to the absence of follow-up procedures. Employees may now be referred to a specialist or for tests, such as a stress ECG.

The fifth deficiency identified related to what happened to the information obtained. RailCorp's evidence was that attempts have been made to recruit a chief health officer. The sixth deficiency identified is the need for ongoing monitoring of the health generally of RailCorp employees.

The interim report also discussed the absence of any routine psychological assessment. RailCorp evidence was that the K10 screening test is now part of the periodic medical examinations. The Commissioner said it was not possible to make a finding that if the train guard at Waterfall had been subject to such assessment any psychological impairment would have been detected.

The safety regulator, ITSRR, has indicated that it proposes to make mandatory medical standards. That proposal is supported. There is also, at present, a national review of railway medical standards. It is obviously desirable, since trains travel from one State to another, that the same high standards exist across Australia.

The standards for medical examinations introduced or proposed by RailCorp are higher than in any of the overseas rail systems investigated by this Inquiry. Provided RailCorp continues with the implementation of those standards, this is one area where appropriate initiatives have been put in place to better ensure the safety of the travelling public. The efficiency with which RailCorp appears to have dealt with this issue is a welcome improvement.

Key findings

The Commissioner found that the SRA's periodic medical examinations of train drivers and other safety critical staff were inadequate in the following respects:

- They did not have any predictive element, to identify staff at high risk of sudden incapacitation through heart attack or stroke.
- Medical examiners were not instructed in the nature of the duties and responsibilities of the employees whose fitness they were required to certify.
- Medical examiners did not have access to medical histories of employees.
- There was no system for follow-up or referral of employees showing signs of possible future medical problems.
- There was no system for reviewing the medical reports, to maintain standards and identify issues requiring further investigation.
- There was no monitoring of medical histories to identify trends, in particular, any trends indicating deterioration in employees' health.
- Medical examinations did not include any psychological screening.

Key recommendations

To improve the effectiveness of periodic medical examinations, the Commissioner recommended that ITSRR should develop standards for periodic medical examinations which include the following:

- Medical examinations of safety critical employees must contain a predictive element, including use of a cardiac risk factor predictions chart, and follow-up procedures.

- Medical examinations must be conducted by practitioners with an understanding of the duties and responsibilities of the employees being examined.

- The medical practitioner should, with the employee's consent, have access to his or her medical history. If consent is not given, the employee must be required to undergo a more exhaustive medical examination.

- Examination reports must be reviewed by an occupational physician.

- Follow-up examinations must be arranged for any safety critical employee the occupational physician believes may be at risk of sudden incapacitation.

- Medical histories should be monitored by the occupational physician to enable identification of any trends that may indicate deteriorating health.

- Routine basic psychological screening should form part of periodic medical examinations.

- Medical standards should be reviewed at least every five years.

- When prescribing standards for medical examinations, ITSRR should consider relevant standards applied elsewhere in Australia to ensure uniformity, so far as possible.

14. Safety Document Control

The interim report reproduced a large number of documents recording the history of the deficiencies in the deadman foot pedal system in Tangara trains, one of the main causes of the Waterfall rail accident. Given the existence of this documentation, it is clear there was an inadequate system for the documentation of safety hazards and a deficient system for communication of safety information within the SRA. The SRA failed to notify the Department of Transport of deficiencies in the deadman system, in its annual safety reports and applications for accreditation.

One explanation given in evidence by SRA officers, for the failure of senior management to deal with the documented risk of the deadman foot pedal causing a serious accident, was that there was a focus on signals passed at danger (SPADs), following a spate of derailments, with the implication that this precluded any systematic analysis of the potential for other types of accident. The Commissioner found this an unsatisfactory explanation. Further, SRA managers would not accept that the documented risk had occurred or could occur in a moving train. This was not tested.

Document control deficiencies were confirmed by the investigations of the SMSEP, which concluded that there was no effective, integrated document control policy in the SRA and document control was not practised within the organisation at any disciplined level.

The functions of a safety document control system include:

- to facilitate communication about safety issues and risks;

- to identify trends;
- to enable failures to be reported and corrective action taken; and
- to identify the individuals responsible for taking corrective action.

It is not difficult to identify the way in which a system for controlling safety documents should operate. The first step is to identify any documents which may have safety implications. Then, an analysis is needed of the information that can be gleaned from them, and a plan prepared to deal with whatever issues arise. The SRA at no stage properly analysed the available documentary material or prepared any plan to deal with all the risks identified in those documents.

One of the glaring deficiencies in safety document control related to the handling of different versions or drafts. The SMSEP report found that there were two different versions of the SRA Network Incident Management Plan available at the RMC. There was evidence that some staff were using a document clearly marked "draft" as if it were the current incident management plan. It is only when a document is in its final format that it should be authorised, distributed and implemented throughout the organisation.

The SMSEP found that the SRA did have a published safety policy containing some of the necessary elements for an overall management system for safety documentation, but found little evidence of an effective process to communicate this policy to all staff, suppliers, contractors and visitors.

The deficiencies in the management of safety documentation identified in the SMSEP report were not challenged in any way. The Commissioner noted an absence of any evidence of the way in which RailCorp intends to remedy these deficiencies and expressed concerns about its ability to do so.

If RailCorp does not have control over its own documents, the safety regulator, ITSRR, will be unable to assure the public when granting accreditation that it is based on reliable data.

The SMSEP report found a lack of document control in the processes for providing information to railway station staff. Station staff felt they were swamped with unnecessary paper. This meant they could fail to pay proper attention to key safety documents.

RailCorp should avail itself of modern information technology and do so in a disciplined manner. There needs to be careful screening of documentation to ensure that information on its intranet site is as concise as it can be, and is provided in such a way that those who need to access it can readily identify what is relevant to them.

The same facility can be used to report incidents and identify who is the accountable officer and whether the necessary remedial action has been carried out. Staff at a senior executive level should have access to the same information.

The SMSEP report also investigated the way the regulator was managing its safety documentation. It found that at the time of the Waterfall accident, record keeping by the regulator was ad hoc and inadequate to provide a system for proving due diligence or

analysing the safety health of the railway. It is difficult to see how a rail safety regulator could possibly discharge its functions without the use of available computer technology.

The collection, analysis and dissemination of safety information on an Australia-wide basis would not only improve the safety of rail operations within New South Wales, but it would also improve safety procedures for operators from other States whose trains enter New South Wales. The Australian Transport Safety Bureau (ATSB) has a program for the development of standard processes for handling information about railway incidents.

RailCorp needs to develop an integrated safety information system which includes:

- the capture of all hazards, OH&S incidents, audit results, non-compliance findings and near miss reports;
- systematic analysis to focus finite resources in priority areas;
- decisions being supported by data and trend analysis; and
- the sharing with other safety information systems.

Key findings

The Commissioner identified a number of deficiencies in safety document control by the SRA and RailCorp, including:

- The SRA and RailCorp had inadequate systems for safety document control.
- The SRA and RailCorp did not have any system for identifying documents with safety implications.
- The SRA and RailCorp used draft documents in areas with safety implications as if they were the finally approved procedures.
- The SRA and RailCorp failed to communicate the contents of safety policy documents to staff, suppliers, contractors and others.
- The SRA and RailCorp did not use a comprehensive safety document management system.
- The SRA and RailCorp failed to record, collate and disseminate safety documentation in a computerised system.
- The SRA and RailCorp failed to use information technology to identify the officers accountable for managing particular safety risks, and whether or not that officer had dealt adequately with the risk.

Key recommendations

The Commissioner's recommendations regarding safety document control include:

- RailCorp should establish a comprehensive safety document management system.
- That system should provide for the distribution of electronic versions of safety documentation to staff.
- RailCorp should employ a Chief Safety Information Officer.
- RailCorp should provide access to electronic versions of safety documents to all operational staff.
- The ITSRR should have permanent access to the RailCorp intranet.
- The ITSRR should establish an electronic document control system for monitoring the safety of the New South Wales rail system.
- RailCorp and ITSRR should co-operate with national programs for the collection, collation, trend analysis and dissemination of safety critical information.

15. Train Guard and Driver Training

The interim report noted that although the train guard at Waterfall was said to have been trained to deal with emergency situations, the only possible conclusion was that such training was ineffective.

The Glenbrook Inquiry final report made a number of specific recommendations about the delivery of training. Evidence before this Inquiry was to the effect that only one of those recommendations, namely the introduction of psychometric testing in selection processes, had been implemented in full.

Recommendations that training include practical examples from local and overseas experience and that the performance of trainers be regularly assessed and audited had not been implemented.

There had been limited progress in implementing recommendations for:

- ensuring the development of safe behaviour was the principal objective of training;
- teaching the safety rationale behind rules and procedures;
- striking an appropriate balance between practical and classroom components;
- using simulators in an interactive manner;
- emphasising the importance of teamwork and ensuring employees had a clear understanding of the work carried out by colleagues;
- ensuring trainers had and maintained operational experience;
- ensuring trainers of safety critical staff developed and maintained their training skills;

- improving processes for assessing competency of safety critical staff; and

- random auditing of assessments of the competence of safety critical staff.

In relation to the last of these, there was evidence that some auditing had been done, but it appeared from the limited amount that had been done, that there were very significant deficiencies in the way in which the assessment of the competence of safety critical employees had been carried out by the SRA and RailCorp.

The SMSEP report found that there had been no significant changes in the design or delivery of training since the Waterfall rail accident. The report also found a number of other deficiencies in the design and delivery of training. These resulted from the absence of any systematic approach to training.

For there to be a systematic approach to training, it is necessary for an analysis to be undertaken of the training needs of the organisation. Developing a training needs analysis is fundamental to both the design and delivery of training. Prior to a needs analysis a task analysis for particular categories of employees must be conducted. Evidence from the safety audit showed an absence of task analysis in the development of training courses.

Evidence of the training provided to drivers and guards shows that there is a recognition within RailCorp of the need for better training, but no comprehension of the best way to achieve the objective.

This was also demonstrated in the documents produced by RailCorp in response to the training milestone set by ITSRR, as part of RailCorp's application for provisional accreditation. In view of the failure to implement all but one of the straightforward recommendations of the Glenbrook Inquiry final report, it is almost farcical to expect that an organisation with such deficiencies in its capacity to systematically analyse training needs and to design and deliver appropriate training, could achieve one of the requirements of the milestone, let alone all eleven, in the six month period stipulated. The passage of time has proved this to be correct.

It is not surprising that the safety climate survey found that most operational staff interviewed described the safety management system training, introduced in late 2000, as "rubbish" or "irrelevant". It should have been obvious it was doomed to failure, given the training and procedures manual RailCorp issued in October 2003.

The unchallenged findings of the SMSEP regarding the manual included that the document existed in isolation, had no authority and was not followed by parts of the organisation, for example, key training design and development staff within Australian Rail Training, at Petersham.

What RailCorp should be doing, under the supervision of the safety regulator, is designing a systematic approach to training which accords with what is accepted practice in all complex industries. This will require a careful and systematic analysis of training needs. The process will take years, not months. It is apparent that the development and integration of training as part of the overall safety management system of RailCorp is an area where expert assistance is required.

Key findings

The Commissioner found a number of deficiencies in train guard and driver training, including:

- The SRA failed to train guards adequately to deal with emergencies.
- The SRA and RailCorp failed to ensure that authority gradients did not exist between train drivers and guards, so that train guards were not reluctant to take action to stop a train in an emergency situation.
- The SRA and RailCorp failed to use simulators in an interactive manner.
- The SRA and RailCorp failed to use simulators to train safety critical employees, in particular train guards, to deal with particular emergency situations.
- The SRA and RailCorp failed to adequately train guards and drivers to work as a team.
- The SRA and RailCorp failed to undertake a training needs analysis, in particular, to analyse data on incidents and accidents to identify areas where safety training was necessary.

Key recommendations

The Commissioner's recommendations regarding train guard and driver training include:

- Recommendations 1 to 7 of the Glenbrook Inquiry final report should be fully implemented, save that the random auditing referred to in recommendations 5 and 7 should be carried out by ITSRR.
- RailCorp should use its simulators in an interactive manner.
- RailCorp should use its simulators to train drivers and guards to deal with degraded operations on the network.
- Train driver and guard training should encourage teamwork and discourage authority gradients.
- RailCorp must establish a task analysis for particular categories of employees and undertake a training needs analysis, to develop the skills required in particular areas.
- Training should be based upon a needs analysis, and instruction and practice.

16. Rail Accident Investigation

The Glenbrook Inquiry final report contained a number of recommendations relating to accident investigation. The evidence in this Inquiry has confirmed that all those recommendations should have been implemented. While some recommendations were partly

implemented, the majority were not, particularly the recommendation for an independent Rail Accident Investigation Board.

Rail accident investigation in places such as the United Kingdom, European Union, Canada United States of America, and in Australia at the national level, is carried out by bodies similar to the one recommended in the Glenbrook Inquiry.

After this Inquiry commenced, and without this Inquiry being given an opportunity to comment, the Transport Legislation Amendment (Safety and Reliability) Act 2003 (the 2003 Act) was enacted. It is a matter for government to introduce whatever legislation it wishes. However, the third term of reference requires the Commission to make recommendations for the improvement of the safety of rail operations. This includes improvements in relation to rail safety investigations.

Under the 2003 Act, there is provision for the Minister to review the operation of the amendments after 12 months. During the passage of the legislation, the government indicated that the review would provide an opportunity for it to consider the final outcome of this Inquiry.

Under the current safety regulation legislation, the accident investigation body is a division of the so-called "independent" transport safety and reliability regulator, ITSRR. That division is called the Office of Transport Safety Investigations (OTSI). Such a model was rejected by the Glenbrook Inquiry final report and by all the relevant expert witnesses at that Inquiry. The model was supported, however, by Mr Ron Christie, who advised the government in relation to the 2003 Act and who was the only witness at the Glenbrook Inquiry who did not acknowledge the possibility of a conflict of interest where a body required to ensure performance and reliability was also required to ensure the safety of the travelling public.

In the countries mentioned above, it is recognised that accident investigation must be independent of the regulatory bodies, because the conduct of the safety regulator itself would likely be a matter for scrutiny by the accident investigation body when it investigates an accident. To locate the investigatory body within the same organisation as the safety regulator produces an obvious conflict of interest.

There are numerous deficiencies in the present investigation model and structure.

It is hardly likely, having regard to the fact that the Chief Investigator of OTSI is appointed and removed on the recommendation of the Chairperson of the Advisory Board, that the Chief Investigator is likely to reject any advice given by the Advisory Board or its Chairperson.

Under the legislation, the Chief Investigator is required to refer any report of an accident investigation to the Advisory Board and consider its advice, which may only be verbal advice. This creates at least the perception that the Advisory Board may influence the contents of the reports of the Chief Investigator. Given the perception that the influence of the Advisory Board over the Chief Investigator is capable of reducing the impartiality and objectivity of investigations, the existence of the Advisory Board is contrary to the public interest. It is not suggested that the present Chairperson or members of the Advisory Board would act in such a fashion, but nevertheless the perception remains that deficiencies in the

management or regulation of railway operations could be concealed by this process. The Advisory Board must be abolished.

The second deficiency is that the Advisory Board has no accountability.

The position of the Advisory Board vis-a-vis ITSRR also has an adverse influence on the accountability of ITSRR. The Advisory Board may advise ITSRR that something should be done. The ITSRR may accept that advice, and act in accordance with it. A major accident may then occur as a result. The ITSRR may say that it acted on the advice it received from the Advisory Board. The Advisory Board may say that ITSRR had a choice whether to accept or reject the advice. Where, in those circumstances does the accountability lie?

The position of the Chairperson of the Advisory Board, on any view, is untenable. The Chairperson obviously exercises executive power. The removal of the Chief Investigator of OTSI can only be effected on the recommendation of the Chairperson of the Advisory Board. That is plainly an exercise of executive power, and one for which there is no accountability. There are other examples in the legislation where the Chairperson may exercise executive power in relation to ITSRR.

The executive power to be exercised by the safety regulator should be exercised only by the Chief Executive. The safety regulator does not need an Advisory Board, with a Chairperson having executive power directly or indirectly, thereby diluting the accountability of the Chief Executive.

The third deficiency also relates to the Advisory Board. It might advise ITSRR in regard to the acceptability of a particular request for accreditation. If ITSRR acts on that advice and accredits the organisation, an issue of independence could arise in any subsequent investigation.

A fourth deficiency in the present structure of accident investigation relates to resources. When conducting investigations, OTSI can utilise staff of ITSRR's Technical Panel. There are numerous potential problems with OTSI and ITSRR sharing the Technical Panel. The Technical Panel might be required to assist OTSI in a large-scale investigation, resulting in its expertise not being available to the regulator for purposes such as compliance audits and accreditation. Or, while investigating an accident, the Technical Panel may identify a failure to comply with conditions of accreditation which would attract sanctions. OTSI is required to be a non-punitive investigative body; it must not pass on any information relating to non-compliance because that may involve punitive action. What would the Technical Panel then do if subsequently asked to assist in a compliance investigation? Finally, in an accreditation application, the Technical Panel may provide assistance which leads ITSRR to grant accreditation. If a serious accident occurs because of the advice given by the Panel, and the Panel is involved in the investigation of the accident, clearly a conflict of interest would exist.

During the course of the Inquiry a question arose as to whether OTSI can of its own motion initiate an investigation of a railway accident or incident. The Commissioner is of the view that, in light of the power conferred on the Chairperson of the Advisory Board, it is unclear whether or not OTSI can commence an investigation without being directed to do so by either the Chief Executive of ITSRR or by the Chairperson of the Advisory Board. The legislation should be amended consistently with the submissions made on behalf of ITSRR and the

Ministry of Transport, to remove this doubt, and express provision made for the Chief Investigator and OTSI to initiate such an investigation.

Role of ATSB

The New South Wales rail environment has changed significantly since the Glenbrook Inquiry. For example, the country rail infrastructure has been leased for operation as part of the defined interstate network. Accidents on the interstate network must be investigated by the ATSB.

Given these developments, the independent accident investigation body for rail accidents in New South Wales should be the ATSB. There are intergovernmental arrangements that would need to be put in place, but the benefits are obvious, including a standard approach to rail accident and other transport accident investigations.

In view of the mistakes of the rail industry in the past, such as different gauges, the time has also come for national regulation of rail operations. Such an approach is consistent with the one adopted in the United States of America and Canada, and has been demonstrated to be effective and in the public interest. For the reasons previously given, the bodies that have been established in New South Wales for this purpose cannot be effective and are not in the public interest.

A permanent and independent investigative body, such as the ATSB, can conduct investigations much more efficiently than a Special Commission of Inquiry. It avoids the conflicts of interest identified in the current legislative model. It also avoids the conflict of interest inherent in the investigatory body reporting to the same minister as the safety regulator.

This does not mean that investigations should only be conducted by the independent investigatory body. The safety regulator should also conduct its own investigations for the purpose of ensuring compliance with conditions of accreditation, or prosecuting breaches of regulations. Currently, accredited rail organisations are also obliged to conduct their own investigations into rail accidents or incidents. These reports, and those of OTSI, should be subject to review by the ATSB. The advantage of rail organisations investigating every incident is that it can often lead to the discovery of precursors events, which may avoid a catastrophic accident of the kind that occurred at Glenbrook.

Whether or not an investigation is conducted by the independent accident investigation body is a matter for its discretion. If it decides not to investigate, the rail safety regulator should then exercise its discretion whether or not to investigate. The Commissioner does not recommend setting specific criteria which would mandate an investigation by the independent investigation body.

Key findings

The Commissioner found:

- The current legislative model and structure for rail accident investigation give rise to significant deficiencies in the manner in which rail accident investigations are to be conducted.

- The recommendation contained in the Glenbrook Inquiry final report to establish a Rail Accident Investigation Board, with the characteristics described in recommendations 80 to 95 of that report, was not implemented in New South Wales.

- Had these recommendations in the Glenbrook Inquiry final report been implemented, New South Wales would be at the forefront of rail accident and incident investigation.

- The model for safety investigation that has been implemented in New South Wales includes the accident investigation body, OTSI, being a division of ITSRR, the rail safety regulator. This is not what was recommended in the Glenbrook Inquiry final report. What was recommended was a truly independent accident investigation body, not one that is a division of the safety regulator. The Glenbrook final report recommended a Rail Accident Investigation Board which was legally and structurally independent of the rail safety regulator, so as to avoid any possible conflict of interest.

- In the United Kingdom, Canada, the United States of America, the European Union, and in Australia at the national level in the form of the ATSB, it is recognised accident investigation must be independent of the regulatory bodies, because the conduct of the safety regulator itself would likely be a matter for scrutiny by the accident investigation body when it investigates an accident.

- It is hardly likely, having regard to the fact that the Chief Investigator of OTSI is appointed, and may only be terminated, and that his salary, wages and conditions of employment are fixed, on the recommendation of the Chairperson of the Advisory Board, that the Chief Investigator is likely to reject any advice given by the Advisory Board or its Chairperson.

- The New South Wales public transport system is owned and run by government bodies and it is politically sensitive because commuters are also voters, thus there is an even greater need for transparency and independence in the investigation of safety incidents and accidents and in the public reporting of those investigations.

- The Advisory Board lacks accountability.

- The present legislation creates at least the perception that the Advisory Board, in giving advice to the Chief Investigator, may influence the contents of the reports of the Chief Investigator.

- Given the perception that the influence of the Advisory Board over the Chief Investigator is capable of reducing the impartiality and objectivity of investigations, the existence of the Advisory Board is contrary to the public interest.

- The position of the Chairperson of the Advisory Board is untenable. The Chairperson exercises executive power. The removal of the Chief Investigator of OTSI can only be effected on the recommendation of the Chairperson. There is no accountability for the making or failure to make such a recommendation by the Chairperson when appropriate.

- It does not need an Advisory Board with a Chairperson having the power to exercise executive power directly or indirectly, thereby diluting the accountability of the Chief Executive of the safety regulator, ITSRR, for the regulation of rail safety.

- There remains doubt as to the power of OTSI and its Chief Investigator to initiate an investigation into a rail accident or incident. It is unclear whether or not OTSI can commence an investigation without being directed to do so by either the Chief Executive of ITSRR or by the Chairperson of the Advisory Board.

Key recommendations

The Commissioner's recommendations regarding rail accident investigation include:

- The New South Wales Government should make the necessary arrangements with the Australian Government, including any necessary legislation, for the Australian Transport Safety Bureau (ATSB) to have the power to investigate all rail accidents occurring on the New South Wales rail network.

- The ATSB should deliver any report of any such investigation to the Board of any rail organisation involved in the accident, to ITSRR and the Minister for Transport Services.

- All ATSB accident investigation reports should be made public.

- The OTSI should continue to conduct rail accident investigations on behalf of ITSRR and report directly to the Chief Executive of ITSRR.

- The relevant legislation should be amended to provide expressly that OTSI and the Chief Investigator have the power to initiate an investigation.

- Legislation should be enacted and any necessary arrangements made, to enable the ATSB to review any reports of any investigation by a rail organisation or the OTSI into any serious incident or accident in New South Wales.

17. Safety Culture

As discussed in the interim report, a number of senior managers of the SRA were informed of the deficiency in the deadman foot pedal on Tangara trains, but no steps were taken to adequately test the device. The interim report also established that some train drivers were using flag sticks to jam the deadman foot pedal in the set position. Such matters are illustrative of the lack of a safety culture. Given a similar finding in the Glenbrook Inquiry final report, it was necessary for this Inquiry to determine whether any improvement had occurred in the safety culture of the SRA since 2001.

The culture of the SRA, and now RailCorp, continues to be focussed on on-time running, without adequate and proper consideration being given to safety matters. This culture is misconceived. Emphasis on safety increases the efficiency and punctuality of a railway. An unsafe railway is one where trains are not properly maintained, where train drivers are directed to do things which create a risk of incidents or accidents, which in turn disrupts the network. Safety and reliability are two sides of the one coin.

What is not appreciated by RailCorp is that safety is an integral part of the business it conducts. Instead of operational and managerial staff working towards the same objective, relations between the two were so strained that there had developed an "us and them" mentality. Drivers believed they were blamed for any disruption to services, and supervisors adopted a practice of bullying operational staff to maintain punctuality of services. Perhaps the best example of this was the tape-recorded evidence of a train controller directing a driver to proceed notwithstanding the presence of a suicidal trespasser on the track ahead.

One of the matters weighing against a good safety culture is the authority gradients that operate within the rail industry, which produce the opposite result to shared values and beliefs in relation to safety. The most noteworthy example of this was the reluctance of train guards to apply the emergency brake.

Poor relations between management and staff, and between different levels of operational staff, work against the achievement of a good safety culture. An environment of distrust and fear of punishment creates a negative safety culture. The SRA's safeworking policy, issued in November 2003, uses words such as "individual culpability". This clearly denotes a "blame culture". It is assumed there must always be an individual culpable for any incident, rather than that there are organisational deficiencies which require examination and remedial action to avoid a recurrence.

The SRA and RailCorp claimed to have a "no blame" policy. There were two problems with this policy. First, it was difficult to understand what the policy was. The second deficiency in the policy was that in practice it was not followed. There was evidence that if a driver was involved in an incident, such as a SPAD, even to a minor degree, the driver was immediately taken off driving duties and in some cases sent for psychological examination.

The SMSEP report found that, in many areas of the SRA, a blame culture continued to exist. During the course of the safety systems review it became apparent that many RailCorp personnel were not even aware of the "no blame" policy.

What is required is not a "no blame" culture or policy, but a "just culture". There must be consistency in application of such policies across the organisation, and an environment where the person making the report trusts that the person receiving the report will receive it and act on it other than in a disciplinary manner, except where there has been deliberate infringement. This does not appear to be the case with the SRA or RailCorp. When incidents occur, through oversight or inadvertence, the train driver is often blamed for the disruption to train services.

There are a number of reasons for the demise of what was once a better safety culture in the SRA:

- the disaggregation of the New South Wales railways in 1996;
- a lack of leadership;
- a culture of blame;
- the piecemeal fashion in which safety deficiencies are addressed;

- the absence of a system of reward or encouragement based on safety performance; and

- a lack of accountability and responsibility in any individuals for safety.

RailCorp has introduced what it calls "safety accountability statements", but these lack clarity and precision, and any identifiable basis upon which an assessment could be made as to whether or not the individuals had complied with their obligations. It is necessary that there be measurable criteria for the safety performance of individuals. Although statistics are kept in relation to on-time running, they do not appear to be kept for the purpose of setting targets for the reduction of incidents.

The evidence suggests that safety culture has deteriorated significantly since the 2000 Olympics, when staff were highly motivated to ensure trains would run without incident. There is cause for optimism, however, in the response of RailCorp employees to the safety climate survey conducted on behalf of the Inquiry.

Four hundred and seventy staff were approached to complete a questionnaire and 469 complied. The questionnaire comprised 34 questions on various aspects of safety. Respondents answered the questions on a five point scale, ranging from one, strongly disagree, to five, strongly agree.

The matters canvassed in the survey included:

- the extent to which staff were informed of safety matters relevant to them;

- whether staff felt able to openly discuss safety problems with supervisors;

- whether reported faults that could impact on safety were rectified;

- whether staff were given sufficient feedback in relation to safety incidents; and

- whether staff were encouraged to consider safety more important than keeping to timetables.

Overall, the perceived level of rail operations safety by all groups sampled was dismal. None of the groups' average scores on this question reached the level four representing safe on the five point scale, the overall score being 3.34, or just above the neutral position. The SMSEP said this should be of concern to RailCorp.

The picture in respect of perceived changes in rail safety over the period since the Waterfall accident gives even greater cause for concern. Across all groups, the dominant view was that there had been a barely perceptible improvement in safety in the 12 months since the accident.

The Commissioner accepted the findings of the safety climate survey and found they were in accord with other evidence.

The results of the safety climate survey and the degree of participation demonstrate that, as with the performance during the 2000 Olympics, it is possible to motivate the staff to make the improvements in the safety culture. Such improvements have been successfully made in

many other complex organisations. There is no reason why, using well established techniques and with an appropriate degree of dedication to the task by management, the same cannot be achieved within RailCorp.

Key findings

The Commissioner found:

- The dominant culture in the SRA and RailCorp was a culture of on-time running, with safety being a secondary consideration.
- The pervasive culture of on-time running prevented operational and managerial staff from considering the safety implications of decisions.
- The SRA was unwilling to engage in critical self-examination of its safety performance or the effectiveness of its safety management.
- The SRA and RailCorp had a blame culture, and not a just culture, when dealing with incidents or accidents.
- The culture of the SRA was insular and inward looking, with the result that it failed to learn lessons from experience of other railways.
- Successive Chief Executives of the SRA failed to provide the leadership essential to establish a safety culture.
- Violations of safety procedures were either not detected or overlooked by supervisory staff of the SRA.
- There was a lack of commitment to safety as the paramount objective of the organisation by senior management of the SRA.
- Senior management of the SRA failed to communicate to staff who reported to them that safety in the provision of transport services was the paramount objective of the organisation.
- The SRA and RailCorp discouraged, rather than encouraged, safety concerns to be brought to the attention of management.

Key recommendations

The Commissioner's recommendations regarding safety culture include:

- RailCorp should develop a plan, for submission to ITSRR, to address the deficiencies in safety culture, including:

    (a) the means whereby it proposes to ensure that all its operational, administrative and managerial staff consider the safety implications of any decision or action;

(b) the means whereby distrust between management and operational staff is removed and replaced by a culture in which the whole organisation is motivated towards the safe conduct of its transportation activities;

(c) the means whereby it proposes to implement a just culture instead of a blame culture;

(d) the means whereby it proposes to establish and implement accountability and responsibility of individuals for the safety of the activities that they undertake;

(e) the means whereby it proposes to measure the safety performance of individuals with accountabilities and responsibilities for safety, to determine whether their level of safety performance is satisfactory;

(f) the means whereby the Board, Chief Executive and Group General Managers intend, by their actions and behaviour, to foster the development of a safety culture in the organisation;

(g) the means whereby it proposes to reward employees for bringing safety issues to the attention of management, and the means whereby management proposes to track the safety issues raised, to ensure continual safety improvement;

(h) the means, generally, whereby it intends to replace the present culture of on-time running with a culture encouraging safe, efficient and reliable provision of rail services;

(i) the means whereby it proposes to ensure that communications protocols are followed by all employees engaged in safety critical work;

(j) the means whereby it proposes to set safety targets for the reduction of incidents and the means whereby the relevant information is to be kept and collated for the purpose of measuring safety performance;

(k) the means whereby employees responsible for particular areas are rewarded for safety improvements in their areas of activity;

(l) the means whereby it intends to integrate safety in all aspects and at all levels of its transportation activities;

(m) the means whereby it proposes to train staff in processes of hazard analysis and risk management relevant to the particular activities that they conduct; and

(n) the means whereby it will integrate the management of safety in all aspects into the general management of its business undertaking.

- If ITSRR accepts such a plan as an appropriate response to the existing weak safety culture, ITSRR should approve it and monitor the effectiveness of the plan.

18. Occupational Health and Safety

The Occupational Health and Safety Act 2000 imposes strict obligations on employers. There is a general obligation on employers to ensure the health, safety and welfare at work of all employees, with an obligation of "ensuring that systems of work and the working environment of the employees are safe and without risks to health". In view of the findings made in the interim report as to the inadequacies of the driver safety systems on G7, it appears that the SRA failed to comply with the Occupational Health and Safety Act 2000.

The SMSEP concluded that the approach to occupational health and safety by the SRA and RailCorp was, like the approach to system safety generally, fundamentally reactive. The approach to OH&S involved identifying particular incidents or classes of incidents that had occurred, for example trips, falls, lifting injuries and so on. No doubt, there are considerable benefits in analysing OH&S that way. However, when it comes to events that occur infrequently, such as train driver incapacitation, such an approach does not enable identification of that particular type of hazard. The only approach which will identify that hazard is a risk assessment of all the hazards which confront a train driver.

When the history of the deadman pedal was examined, it was clear that considerable attention had been directed to OH&S issues in both the design and subsequent modification of the pedal. This was done to make the device more convenient for drivers to use. The analysis undertaken focussed on the risk of repetitive strain injury to drivers' ankles and legs. There was no attempt to examine the system safety issue: whether the pedal would stop the train if a driver above a certain weight became incapacitated.

The Glenbrook Inquiry examined a number of accidents illustrating a failure to manage risk in an OH&S context by first identifying all the hazards and ranking the risks, in particular the accidents at Bell, in October 1998, and at Kerrabee, in August 1998.

Although the SMSEP expressed some favourable views about the OH&S systems in place in RailCorp at the beginning of 2004, its report noted that very little attention was given managing risks and the effectiveness of control measures. Other evidence was less favourable. The Chairman of the RailCorp Board described the OH&S standards within RailCorp as totally unsatisfactory.

If the management of OH&S issues has not reduced the incidence of injury to acceptable levels, the reason appears to be that the same deficiencies apply to OH&S issues as applied to risk assessment generally. The approach is reactive to particular incidents and does not involve the systematic analysis of all the hazards, the examination of the controls that are put in place and an assessment of the adequacy of those controls in reducing the risk of those hazards to an acceptable level.

It follows that for the occupational health and safety management system to work effectively, it must be integrated with and form part of the overall safety management of the organisation. What is needed is a single set of processes and procedures for conducting hazard analysis and risk assessment.

Key findings

The Commissioner's findings regarding OH&S include:

- The SRA and RailCorp approach to OH&S is reactive to particular incidents and does not involve the systematic analysis of all the hazards, the examination of the controls that are put in place and an assessment of the adequacy of those controls in reducing the risk of those hazards to an acceptable level.

- For the OH&S management system to work effectively, it must be integrated with and form part of the overall safety management of the organisation. What is needed is a single set of processes and procedures for conducting hazard analysis and risk assessment. This is lacking in both the overall management of safety in RailCorp and in the management of OH&S.

Key recommendations

The Commissioner's recommendations regarding OH&S include:

- RailCorp's approach to OH&S should be proactive and involve the systematic analysis of all current hazards, risks and controls and an assessment of their adequacy to reduce the risk of injury or death to an acceptable level.

- RailCorp should integrate its management of OH&S into its overall safety management.

- Risk assessments of OH&S issues by RailCorp should include an analysis of broader public safety risks.

19. Passenger Safety

Concern was expressed during the course of the Inquiry about the containment policy of the SRA and RailCorp, whereby passengers cannot be released from a train involved in an incident or accident unless the driver or guard, or another person using the external door release mechanism, unlocks the doors.

The history of the containment policy is instructive in relation to a number of safety management deficiencies within the SRA and RailCorp. The original recommendation, accepted by the Board of the SRA in January 1990, identified two risks, injury to passengers falling from open doorways or after unsupervised exit. It did not address the risks associated with the adoption of the policy, namely that in an accident passengers may be trapped and this could cause injury or death from fire or other hazards.

Tangara trains were originally fitted with an internal passenger emergency release facility. This was disabled on existing carriages and removed from new ones. No risk analysis was done of the risk created by removing them.

Concerns about the possibility of passengers being trapped, raised inside and outside the SRA, did not produce any examination or reconsideration of the policy. The CityRail passenger door policy, issued in April 1993 omitted any reference to emergency passenger escape.

Following a consultant's report in 1993, external door releases were fitted to those trains which did not have them. The external door release on the Tangara train was operated by a

button. On other suburban trains, including the Millennium train, a key was required to unlock the external door release. If the train crew do not have possession of a key or have misplaced the key, the passengers cannot be released by the external door release.

Since the fitting of external door releases, the facilities for passengers to escape have not changed. There remains no means by which passengers can escape from a train without being evacuated by authorised staff. As the Waterfall accident demonstrated, when the driver was dead and the guard suffered severe back injuries and was rendered unable to assist the passengers, the passengers were trapped in the train for over half an hour. It was fortunate that no fire occurred.

The external emergency door releases, themselves, were not adequately identified. Some were marked with the letters "EDR", which is less than self-evident. The inadequate labelling was demonstrated by the emergency response exercise known as Blue Rattler, discussed in chapter 5 of the report. The debrief reports on the exercise stated that:

1. No one knew the location of the outside door releases.

2. The emergency doors were unable to be opened from the inside or outside of G7.

As observed in chapter 5, all the notional passengers in that exercise died. The results of this exercise did not lead the SRA to reconsider the containment policy and nothing appears to have been done to improve the emergency escape facilities for passengers.

From the SRA's response to questions raised by the Department of Transport in 2001, it appeared there was a concern that passengers may attempt to leave the train if it is stationary on the tracks.

There are two relevant hazards that need to be managed. The first is that passengers may inappropriately use internal emergency release mechanisms and jump down onto the track into the path of an approaching train. There was no evidence before the Inquiry of any instance of death being occasioned to any person as a result of the improper use of an emergency egress facility.

On the other hand, numerous rail accidents provide clear and unequivocal evidence of the danger of death and serious injury inherent in a policy of passenger containment.

When confronted with a choice between providing an emergency escape for passengers and avoiding possible abuse of it by an individual passenger, it is clear the containment policy is not in the public interest.

It would appear that the culture of on-time running influenced the decision in favour of the containment policy for the reason that, if you contain passengers in the train, there is less risk of any of them doing anything which may disrupt the timetable.

If there was any actual statistical basis for the policy, it appears to have been based upon information gathered before the introduction of modern carriages on which the train doors can be locked while the train is in motion. The other defect in the reasoning behind the containment policy is the assumption that it must be either all or nothing. There is no need to

choose only between a system by which passengers can let themselves out of trains at any time, or a policy by which passengers are contained at all times.

The containment policy does not protect passengers in a train which is on fire or subject to terrorist attack when the train driver or guard are incapacitated or not able to react in time. There must be a means of emergency escape in such circumstances. The risk of improper use of emergency escape facilities can be controlled by other means.

Key findings

The Commissioner made a number of critical findings regarding passenger safety, including:

- The SRA and RailCorp failed to fit any means of self-initiated passenger escape to Tangara trains.

- Following the Waterfall rail accident, passengers remained trapped in the derailed G7 for a period of 30 minutes, after which time the first emergency personnel arrived.

- There was no consideration in the SRA Board paper dated 18 January 1990 relating to the so-called door security policy of the risks associated with keeping passengers locked in trains, particularly in the event of a fire in a train.

- The identification of the hazards associated with passengers trapped in trains was not the subject of any consideration on 25 January 1990 when the Board of the former SRA adopted the containment policy.

- Even though Tangara trains were originally fitted with internal emergency door releases, no risk analysis was done on the risk created by removing them. No risk analysis was done at the time and hence the fact that the external emergency door releases would not work if a train was on its side was not identified by any risk analysis.

- The culture of on-time running influenced the decision in favour of the containment policy because if passengers are contained in a train, there is less risk of them doing anything which may disrupt the movement of the train in accordance with the timetable.

- The so-called containment policy is not in the public interest.

- The containment policy does not protect passengers in a train which is on fire or subject to terrorist attack when the train driver or guard are incapacitated or not able to react in time. There must be a means of emergency escape in such circumstances. The risk of improper use of emergency escape facilities can be controlled by other means.

- There is no need to choose between a system by which passengers can let themselves out of trains at any time or a policy by which passengers are contained at all times.

- If the recommendations in the emergency response and communications chapters are implemented, the risk of any evacuating passenger being struck by another train should be reduced in negligible proportions, because quick and effective procedures would be in place to recognise that an accident had occurred.

- As a matter of individual responsibility, if people are in a life threatening situation, they should be entitled, where the circumstances justify them taking control of their own safety and well-being, to make rational and responsible decisions in their own interest. They should be given the opportunity to make their own decisions when their own lives may be in jeopardy.

- Given the forces involved in the accident, no criticism is made of the Tangara roof structure not being able to withstand those forces, resulting in the opening of the roof and the ejection of the passengers who died. No train could be designed to withstand the forces of the Waterfall rail accident and maintain its integrity.

Key recommendations

The Commissioner's recommendations regarding passenger safety include:

- The RailCorp passenger containment policy must be abandoned.

- There must be a minimum of two independent methods of self-initiated emergency escape for passengers from all trains at all times.

- All new rolling stock must be designed with an area of the roof through which emergency services personnel can access a rail car without encountering wiring or other equipment. That access point must be clearly marked.

- All new rail cars must have appropriate signage and lighting identifying escape routes.

- All passenger trains operating in New South Wales must be fitted with external emergency door releases which do not require a key or other equipment to operate.

- All passenger trains operating in New South Wales must have the external emergency door release clearly marked "Emergency Door Release".

- All RailCorp operational personnel should be trained in the location and operation of external emergency door release mechanisms.

- All emergency services personnel should be trained in the location and operation of emergency door release mechanisms.

- ITSRR should initiate or participate in the development of a national standard for crashworthiness of passenger trains.

20. Corporate Governance

The Inquiry identified many deficiencies in the management of safety by the SRA and RailCorp. The range and depth of these point to failings in the management of safety at an organisational level, indicative of failings in overall governance and management accountability.

In examining the adequacy of the corporate governance arrangements applicable to the SRA and RailCorp, it is clear that there are common failings in governance and management accountability which have affected the management of safety. However, it must be acknowledged that, as a statutory authority, the SRA operated under a fundamentally different corporate guise to that of RailCorp. The legislative differences have some bearing on the corporate governance of these entities, particularly in respect of the accountabilities between the Minister, Boards and Chief Executive.

The Board and the Chief Executive of the SRA were subject to the control of the Minister. The circumstances under which the Minister could give directions were neither prescribed nor limited, which meant that the Minister had power to intervene in the management of the SRA. RailCorp is constituted under the State Owned Corporations Act 1989, which represents a marked shift away from the previous model of ministerial control. Directions by the minister are limited to particular circumstances and must take the form of written requests to the Board. The Board is the only body that can give directions to the Chief Executive.

The SMSEP concluded that the ministerial control model that characterised the SRA was not consistent with effective corporate governance and clear accountability, primarily because the legislation failed to clearly set out the responsibilities of the key entities.

The confused responsibilities and accountabilities within the SRA extended beyond ministerial and Board level and pervaded the entire organisation. The changes made to RailCorp's governance arrangements go some way to improve governance, particularly in respect of the relationship between the Minister and the Board. However, it is apparent that many of the governance failings in the SRA have carried over to RailCorp.

Improvement in the governance of RailCorp will depend on the Minister, the Chairman of the Board and the Chief Executive fully comprehending the new legislation and changing the way they interact.

The short time frame available for the merger of the SRA and RIC to form RailCorp, by 1 January 2004, inevitably resulted in RailCorp inheriting the SRA's operating systems. This took place without any in-depth analysis of the organisational effectiveness, and deficiencies, of the SRA and RIC. RailCorp also faced the challenge of implementing substantial systemic and other changes mandated by the 2004 provisional accreditation milestones and its own Safety Reform Agenda.

The ITSRR identified six categories of safety deficiencies in RailCorp. All have a direct bearing on the efficacy of its governance arrangements and further substantiate the fact that many of the deficiencies in the governance of the SRA apply equally to RailCorp. They include:

- the lack of adequate competencies in modern, integrated safety management systems among the relevant managers;
- the lack of effective accountability in management;
- inadequate safety auditing processes;
- the capacity of the Board of RailCorp to scrutinise management; and
- a failure to appropriately manage the significant change which is required for the implementation of an effective safety management system.

The audit team and the SMSEP found that key managers charged with managing and leading safety within RailCorp did not possess competencies in line with modern safety management principles and practice. While the Chief Executive of RailCorp, Mr Graham, took strong exception to the conclusions of the Inquiry's auditors, the evidence failed to establish a sufficiently cogent basis for his confidence in the level of expertise of his managers in safety critical positions.

Whilst, the recent legislative changes have made some improvement in accountability, it is apparent that problems of this area remain. RailCorp has sought to improve accountability, by incorporating accountability statements into contracts of service. The SMSEP reviewed the safety accountability statements that were developed for each Group General Manager position and found that the language in them was generic, there was not much in the way of measurable performance indicators and nothing in the way of time lines.

The situation at RailCorp in relation to both internal and external auditing is unsatisfactory. The SMSEP reviewed an external audit carried out in early 2004 by a consultant, on behalf of a section within RailCorp, and found an absence of critical self-examination of the effectiveness of improvement actions within the organisation. RailCorp, in a document provided to the Inquiry, agreed the SRA and RailCorp approach to auditing had been insufficient, ineffective and quite fragmented.

The capacity of the RailCorp Board to scrutinise management is limited by the fact that it does not presently have the means to enable it to validate information supplied to it by management. The SMSEP was unable to establish evidence that the Board of RailCorp had information validation processes available to it. The evidence of the Chairman, Mr Bunyon, suggested that, at least to some extent, the Board of RailCorp risked being overly dependent upon management.

In relation to change management, the SMSEP report was unequivocal as to the flaws in the current approach of RailCorp:

> There is a real risk that RailCorp will be ineffective in implementing safety improvement due to poor implementation strategies.

RailCorp is in need of a comprehensive review to assess organisational effectiveness and to evaluate leadership and accountability, in order to ensure the quality and internal consistency that is required in the management of a complex organisation involving technology and human systems. The range and depth of the organisational deficiencies relating to safety

management cannot be addressed in a matter of months. It is not surprising that such deficiencies exist when one looks at the recent history of the structure of government owned railways in New South Wales. It is not difficult to see that such enormous disruption to the corporate structures of the various organisations was going to undermine effective corporate governance in relation to the management of safety.

The deficiencies in risk management skills at the senior management level in RailCorp is a major issue. They include poorly defined responsibilities and accountabilities in relation to the following:

- poor communications and information flow;
- the lack of systems for ensuring significant issues are reported to senior managers;
- inconsistency in approach to processes between departments;
- failure to subject systems to review; and
- lack of suitable skills and necessary training at all levels of the organisation.

The deficiencies in corporate governance of the management of safety and accountability within RailCorp are substantial. These issues need to be at the centre of the change management program recommended in chapter 23 the report.

Key findings

The Commissioner made the following findings with respect to successive Boards and Chief Executives of the SRA and RailCorp:

- They failed to implement a system by which each could quickly and readily obtain information as to the overall level of safety in the organisation.
- They failed to have clearly identified measures for determining the level of safety of each organisation and the safety performance of managerial staff.
- They failed to have clearly defined and appropriate safety responsibilities and accountabilities included in managerial position statements.
- They failed to have measurable criteria for assessing the safety performance of individuals in managerial positions.
- They failed to have adequate internal auditing systems in place to test the adequacy of the safety management systems in place.
- They failed to use external auditors to test the adequacy of the safety management systems.

The Commissioner found that successive Boards of the SRA failed, in a number of respects, to set strategic objectives to guide the organisation in the establishment of an adequate safety management system.

- They failed to ensure that all the necessary systems for effective information management, performance measurement, verification and document safety control were in place.

- They failed to communicate to Chief Executives the matters that they reserved for their own decision in the area of safety management, the processes by which they expected to be informed of such matters, and the time frames within which they expected to be informed.

- They failed to determine what they regarded as the bounds of acceptable risk, and to prescribe how events that may lead to unacceptable risks were to be identified and controlled.

- They failed to ensure that the strategic directions and policies of the SRA were aligned with the executive action being carried out by the Chief Executives and other senior managers.

- They failed to ensure that auditing was carried out and verification received, to satisfy them that the safety related information provided by management was sufficient for them to make informed decisions in relation to strategic policy directions.

- They failed to ensure that the SRA had adequate processes for identifying major hazards, that it had proper controls to prevent such hazards materialising, and that the controls had been tested and verified as effective, to either eliminate the risks, or reduce the probability of them occurring to an acceptable level.

- They failed to make the Chief Executives and senior managers accountable for the safety performance of the SRA.

Key recommendations

The Commissioner's recommendations regarding corporate governance include:

- RailCorp should make it a condition of employment that all level 2 managers have or obtain a formal qualification in system safety management.

- RailCorp should establish clear safety accountability statements and reporting lines for all management positions.

- The RailCorp Board should obtain regular independent external audits of the implementation of an integrated safety management system and on safety performance generally.

- The RailCorp Board should ensure that RailCorp has an adequate and integrated safety management system, including adequate systems for risk assessment, clearly defined

safety responsibilities and accountabilities for all managers, and specific performance criteria for evaluating safety performance.

- The RailCorp Board should require a full review of the safety competence of RailCorp managers, to ensure that each has the ability to bring about the recommended safety reforms applicable to his or her position.

- RailCorp should ensure that where the safety competency of any manager is deficient he or she is required to undertake relevant professional development courses.

- RailCorp should conduct internal and external safety audits to evaluate the adequacy of its safety management system and to ensure that any risk control measures are effective.

- Following completion of any external audit, a corrective action plan to remedy any identified safety deficiencies should be developed, implemented and followed up, by a formal examination of the effectiveness of the controls put in place. Senior management personnel should certify to, and be accountable for, the implementation and effectiveness of, the corrective action plan.

21. RailCorp Safety Reform Agenda

The Inquiry examined the history and progress of a RailCorp program called the Safety Reform Agenda and identified a number of deficiencies in the program.

The Safety Reform Agenda had its origins within the SRA, in 2003. A consultant had been appointed to lead a working group to manage the safety implications of the re-aggregation of the SRA and RIC, to form RailCorp, on 1 January 2004. The consultant's experience in safety management systems with regard to train operations was limited. He had no formal qualifications in safety management. A part of his brief was to devise a safety management program that would satisfy the then regulator, the Department of Transport, and the new regulator, ITSRR, that RailCorp should be accredited in accordance with the requirements of the Rail Safety Act 2002 (the 2002 Act).

The Safety Reform Agenda resulted from the regulator putting the SRA on notice that the new accreditation regime under the 2002 Act required much greater focus on risk management than had previously been the case. In November 2003, the consultant was asked to design a Safety Reform Agenda. The resulting program was approved by the SRA Board in January 2004.

The Safety Reform Agenda was said to serve two purposes:

- to form the basis upon which RailCorp would apply for full accreditation in 2005; and

- to address the types of risks revealed in the Waterfall Inquiry, so as to achieve a long-term sustainable safety culture across RailCorp.

The Agenda consisted of ten elements. These are discussed in chapter 21 of the report, along with a review of such evidence as to the progress of each element that was available.

The Inquiry had extreme difficulty in ascertaining the progress of the Safety Reform Agenda initiatives. RailCorp's response to a request for documents outlining the project status was entirely unsatisfactory and provided no assurance that what RailCorp said was being implemented was, in fact, being implemented.

The Commissioner concluded that the Safety Reform Agenda could not achieve its objectives. One of the main reasons for this was the unrealistic time frames involved. There was expert evidence that similar organisations had taken up to five years to implement an integrated safety management system. This was contrasted with various elements of the Agenda that were expected to be completed within months. The lack of detail as to how the programs were to be carried out made the deadlines even more unrealistic.

The Safety Reform Agenda was developed from other programs that were designed to meet the requirements of provisional accreditation. The approach was to use the language of the statute and the accreditation principles provided by the regulator, then add enough jargon to give the impression that something was being done about the management of safety.

In the meantime, RailCorp's operational and executive staff went about their ordinary duties in a way that bore no relationship to what was being done by the consultant, for what was perceived to be a process divorced from the main business of the organisation, the provision of train services. The evidence suggests that the Safety Reform Agenda has had a negligible impact on operational staff.

The level of detail in the Safety Reform Agenda was described as rudimentary in the extreme. The chairman of the SMSEP confirmed that, despite repeated requests, no documentation was provided to the Inquiry beyond that contained in the 22 page Safety Reform Agenda.

The SMSEP report identified inadequacies in RailCorp's organisational competency in, among other fields, human factors analysis. The subject of human factors was not even considered as an element of the Safety Reform Agenda.

The failure to conduct an audit of the entire organisation before commencing the program means that RailCorp did not have a benchmark from which it could measure the areas that needed improving.

Finally, the deficiencies relating to accountability for those persons implementing the Agenda means that the whole process has the potential to fall apart.

The necessary reforms to RailCorp's safety management systems and safety culture cannot be undertaken simply by retaining an external consultant to "develop" a Safety Reform Agenda. They require the appointment of a permanent senior officer, responsible to the Chief Executive for the development and implementation of the programs, in a realistic time frame.

Key findings

The Commissioner made the following findings regarding the Safety Reform Agenda:

- There was no basis upon which the line managers could be thought to have the skills to implement the programs identified by the Safety Reform Agenda.

- The Safety Reform Agenda was not capable, and could never have been capable, of bringing about the safety reform that is necessary within RailCorp in the 12 months required by the conditions attaching to its provisional accreditation, or indeed at all.

- The Safety Reform Agenda posed unrealistic time frames.

- In the time frame specified, it is plainly fanciful and unrealistic to expect that "an effective, consistent, integrated and predictive safety risk management framework for RailCorp" could be developed and established in a period of less than three years.

- The Safety Reform Agenda was developed from other programs that were designed to meet the requirements of provisional accreditation. The process used to meet these requirements was to use the language of the statute and the accreditation principles provided by the rail safety regulator as the means by which an attempt would be made to meet the requirements of accreditation.

- The operational and executive staff of RailCorp went about their ordinary duties in a way which bore no relationship to what was being done by the external consultant retained regarding the Safety Reform Agenda, for what was perceived to be a process divorced from the main business of the organisation, the provision of train services.

- What was fundamentally wrong with the Safety Reform Agenda was that it bore no relationship whatsoever to the way in which RailCorp was carrying out what it perceived to be its core activities. It was simply, like accreditation itself, a process that had to be undertaken, using the appropriate language with a sufficient amount of jargon, to give the impression that something was being done about the management of safety.

- The Safety Reform Agenda, consisting of not more than 22 pages, lacks detail. Notwithstanding repeated requests, no documentation was provided to the Special Commission of Inquiry beyond that contained in the 22 page Safety Reform Agenda.

- Whilst the ability to quantify the Safety Reform Agenda elements is a fundamental prerequisite to measuring the performance of RailCorp against the elements, the Safety Reform Agenda elements are not capable of being quantified.

- The subject of human factors was not considered as an element of the Safety Reform Agenda.

- The Safety Reform Agenda represents a characteristically reactive approach to rail safety management, with the use of concepts and ideas which have been borrowed from other contexts.
- The Safety Reform Agenda is poorly designed. There was no organisation-wide audit undertaken before launching into the Agenda and the result was that RailCorp did not have a benchmark from which it could measure the areas that needed improving.

- What should have been done was to use the data that was able to be gathered, to identify the hazards that existed within RailCorp, examine the controls that were in place to manage the risks created by those hazards, and then for RailCorp to satisfy

itself that those controls would be effective. If it were not possible to eliminate the hazard, then it would be necessary to identify a level at which the risk was regarded as acceptable. A program should then have been devised to control all of those risks and to co-ordinate and integrate that program within the core business activities of the organisation. The development of such a program would involve the assigning of aspects of the project to particular persons with sufficient resources to enable them to undertake the tasks for which they are accountable.

- The deficiencies relating to accountability for those persons implementing the Safety Reform Agenda means that the whole process has the potential to fall apart. Someone must take responsibility for implementing the Safety Reform Agenda. Whilst the aim was to transfer these responsibilities to line managers by 30 June 2004, this did not happen.

- While signed safety accountability statements are in place for level 2, 3 and 4 managers in the operating divisions, their language is generic and cannot be measured in a practical way. In respect of each of those project managers there needed to be a clearly defined scope of the work, a schedule setting out when the work was to be completed and a system for measuring whether or not the objectives had been achieved in time.

- The overview and the co-ordination of the programs could not be undertaken by retaining an external consultant to "develop" a Safety Reform Agenda. It required the establishment of a separate and permanent senior officer, with the modern safety management skills which the current level 2 managers lack, responsible to the Chief Executive for the development of the program and the implementation of the necessary reforms in a realistic time frame.

- The underlying deficiencies in the Safety Reform Agenda were, to an extent, reflected in the TSSIP. A lack of proper training and expertise has meant that the timetables in which to implement the charters for the six sub-programs have been unattainable.

- The fact that so many different projects were being undertaken at the one time has caused a sense of confusion among those responsible for developing and implementing the safety reforms.

Key recommendations

The Commissioner recommended:

- A Safety Reform Program Director (SRPD) should be retained to manage, as head of a Safety Reform Program Office, any safety reform program undertaken by RailCorp.

- The SRPD should work with the Chief Executive and senior management to ensure the implementation of an integrated safety management system and the cultural change required.

- The SRPD must have qualifications suitable for recognition by the Australian Institute of Project Management as a master program director.

- The SRPD should report to the Chief Executive to ensure that the accountability of the Chief Executive is not reduced.

- The SRPD should co-ordinate and integrate any existing rail safety reform programs and, in consultation with and with the authority of the Chief Executive, he or she should:

  (a) assign responsibility for particular aspects of the project to identifiable employees;

  (b) ensure that each person to whom such an aspect is assigned has the time and resources to undertake the tasks required;

  (c) identify the period of time during which such persons are required to achieve the desired outcome;

  (d) specify a clearly defined scope of work to be undertaken and, a schedule setting out when it is to be completed, and institute a system for measuring whether or not the objectives have been achieved in the time specified; and

  (e) report to the Chief Executive on a monthly basis on each aspect of the program.

- The Chief Executive should report on a monthly basis to the RailCorp Board and ITSRR on the progress of each program.

22. Safety Regulation

The system of rail safety in New South Wales is described as "co-regulation". Railway owners and operators are required to satisfy the safety regulator that they are safely managing their operations. If the regulator is satisfied as to this, the owner or operator is then accredited on the basis of the information provided. The Glenbrook and Waterfall rail accidents, and the numerous other serious accidents considered in this and the Glenbrook Inquiry reports, demonstrate that co-regulation has simply not worked in New South Wales.

The failure to disclose the safety issues relating to the deadman system on Tangara trains indicates that the system of co-regulation has not worked as intended. The failure by an accredited operator, such as the SRA, to comply with mandatory statutory reporting requirements is unacceptable, as is the lack of a proper understanding by the regulator as to the true situation within the organisation which it had the responsibility for regulating.

In the period before the Waterfall accident, the accreditation process simply became a paper shuffling exercise. At no time did the regulator attempt, by audit or other means, to verify independently that the SRA was carrying out its operations safely. It was a "tick in the box" exercise. In reality, the SRA was a self-regulating organisation which was not properly regulating the safety of its operations, with disastrous consequences.

The Rail Safety Act 2002, which came into effect eight days after the Waterfall accident, had a much greater focus on the need to manage risk than the legislation it replaced, which had embodied a more mechanistic model of safety management, relying on rules, specifications and engineering standards. Under the 2002 Act, the purpose of accreditation was to enable

the operator to demonstrate to the regulator it had the systems in place to identify, manage and properly control all the risks of the railway operations it proposed to carry out.

The 2002 Act is now largely risk-focussed. Applicants for accreditation now need to demonstrate how risks are to be managed, through such matters as an effective safety management system, clear assignment of safety responsibilities, effective control of interfaces, and arrangements for monitoring and reporting safety performance.

One difficulty with the 2002 Act is that it does not specify when, after full accreditation is granted, an owner or operator must re-apply for accreditation. Presently, RailCorp has provisional accreditation for a fixed term and must re-apply before the provisional accreditation expires. However, the legislation does not specify that a grant of full accreditation must be for a fixed period, after which it expires by effluxion of time.

In considering the reasons why rail safety regulation in New South Wales has proved to be so inadequate, since the introduction of co-regulation in 1993, the report considers a number of aspects of the system:

- Co-regulation
- The accreditation system
- Independence of the regulator
- Compliance and enforcement
- Competencies of the regulator, and
- Auditing.

Co-regulation

The 2002 Act, like its precursor, does not define the term co-regulation. In some quarters it is perceived as involving some kind of power sharing arrangement. There is no sharing of power in co-regulation. The obligation to set standards by which the operator has to abide is always on the regulator.

There are at least six essential elements of co-regulation that are vital to its effectiveness, all of which have been lacking to varying degrees in the New South Wales rail industry.

1. The relationship between railway operators and regulators must be open, transparent, and co-operative.

2. The regulator must have an effective set of regulatory tools with which to enforce compliance, together with the willingness and independence to use those tools.

3. The staff of both the regulator and the operator must be competent in system safety and risk management, system safety engineering and auditing, and have extensive railway engineering experience.

4. The regulator must have rigorous and effective processes in place with which to independently audit the operator.

5. There must be effective processes in place with which to evaluate and validate the operator's accreditation application.

6. Where the regulator requires an operator to meet safety milestones in order to achieve full accreditation, such milestones must be realistic and achievable.

One of the fundamental reasons for the failure of the accreditation process is the failure of the regulator to independently verify information submitted to it by the railway operator and thus satisfy itself that the operator has appropriate systems in place. This is partly the result of a lack of resources in the regulator. The capacity of the former regulator to scrutinise operators through field testing and audit was significantly impaired. All that could be realistically done by the regulator was to conduct desktop examination of accreditation applications. There was too great an acceptance of what the SRA stated in its accreditation applications.

The regulatory reality in New South Wales has been closer to a de facto self-regulatory environment, due to the passive approach taken by the regulator. Whilst the regulatory regime has been altered significantly with the restructure that took place at the beginning of 2004, the extent to which this has improved the ability of the regulator to access adequate information, and to properly assess the competence and capacity of the operators, remains to be seen.

At present, the information to which the regulator has access is not adequate for the purposes of assessing the competence and capacity of operators. Until RailCorp has successfully reformed itself, a process that will take time, the regulator is reliant upon questionable information. This makes the capacity of the regulator to independently assess and scrutinise RailCorp all the more important.

The success of co-regulation in New South Wales will depend on the regulator being adequately resourced. To be an effective regulator, ITSRR, must deploy its finite resources by concentrating its skills and attention on RailCorp's organisational safety and its implementation of an appropriate safety management system. The ITSRR is yet to establish that it has this capability. For the co-regulatory model to work effectively in the future, the regulator's failure to fulfil this function must be addressed.

The accreditation system

The model for the accreditation system introduced in New South Wales was a system in place in the United Kingdom, known as the safety case model. Under that model, the operator must make a case to the regulator in respect of its safety management system and risk management plan.

Whilst the present accreditation model affords the regulator extensive powers of investigation and enforcement, there is no requirement defining the extent to which the regulator should test the information submitted to it by operators. Further definition of the requirements of the regulator is required in this respect.

The Commissioner recommended the making of a regulation under the Rail Safety Act 2002, as a means of providing guidance to ITSRR and the organisations seeking accreditation, in determining whether the safety management systems in place are sufficient to grant accreditation. Annexure I to the report is a draft of such a regulation. Under the proposed regulation, ITSRR would develop guidelines, to provide further assistance to rail organisations.

One method presently employed by the regulator to improve the accreditation process has been to set milestones. These are intended to chart RailCorp's progression from provisional accreditation to full accreditation. This approach has a number of practical deficiencies.

The milestones are unclear as to what is needed to satisfy the requirements. It appears that each and every milestone would have to be met in full in order for full accreditation to be granted. The overwhelming evidence is the milestones cannot be achieved in an effective way by the time the maximum two year period for RailCorp's provisional accreditation expires at the end of 2005. This may well result in the hurried completion of milestones necessary to meet the deadlines, followed by "business as usual" as soon as the deadlines pass.

Focussing on unrealistic time limits encourages operators like RailCorp to cut corners and lose sight of the long-term necessities for an effective and integrated safety management system, in favour of meeting the short-term needs to stay in business. This encourages the same kind of reactive, "by the seat of their pants" discipline that has plagued the New South Wales rail industry for so many years.

Independence of the regulator

Concern has been expressed over the fact that ITSRR reports to the same minister that is responsible for the operation of RailCorp. To some extent, the 2003 legislation includes measures to alleviate such concerns, by introducing limitations on ministerial control.

On behalf of ITSRR, it was submitted that it was appropriate that both be accountable to the same minister. The reporting relationship was designed to secure improvement in safety procedures. ITSRR's safety advice needed to go to someone who could give direction to RailCorp. The regulatory regime was to drive improvement, an executive function.

The abolition of the Advisory Board and transfer of ITSRR's investigatory responsibilities to the ATSB, as recommended by the Commissioner, will go some way to alleviating concerns about the regulator's perceived lack of independence. Also, public scrutiny of the accreditation process will better ensure effective regulation.

Compliance and enforcement

The SMSEP determined that, prior to the Waterfall accident, the Department of Transport had not sufficiently used its authority to identify critical safety issues on the railway. As a result, it was not aware of the specific safety problems within the SRA that contributed to the accident. Even if it had properly evaluated the SRA's safety management system, it lacked many of the necessary regulatory tools to enforce safety standards.

Recent amendments to the 2002 Act have provided the current regulator, ITSRR, with additional tools to enforce a rail operator's compliance. However, the possession of new

regulatory powers and resources does not necessarily translate into regulatory resolve or competence. As the SMSEP reported, "it is yet to be seen how ITSRR will tackle serious breaches of accreditation or failure to meet milestones timeframes".

While it is unlikely that ITSRR would shut down RailCorp if it failed to meet the requirements for full accreditation by the end of 2005, it is important that ITSRR develop a comprehensive strategy to regulate the rail industry, including a systematic oversight process. The regulator must make an unequivocal internal commitment to utilise fully and effectively its new regulatory tools and to firmly enforce safety standards.

Competencies of the safety regulator

The SMSEP review revealed deficiencies in the system safety competencies of ITSRR staff. This is of particular concern because, on the evidence, these same skills are lacking in the staff at RailCorp. Whilst acknowledging that ITSRR has set goals to improve technical competencies, the regulator must take immediate, substantive steps to improve staff competencies in system safety principles, and to ensure that the staff overall has the proper mix of skills in safety management, including both qualifications and experience. Further, RailCorp is a relatively new and immature organisation and accordingly ITSRR has an even greater responsibility to ensure RailCorp is taking all necessary and appropriate actions to properly manage the safety of its operations.

Auditing

It is a fundamental principle of good safety management that the organisation creating the risks is the one that has the primary responsibility for managing and controlling those risks. In order for RailCorp to do so, it must know what risks exist in its operations. To do this effectively, RailCorp needs to have an auditing capacity. The SRA's safety audit division was disbanded at the time of the disaggregation of the railways in 1996. Rail safety cannot be achieved unless RailCorp makes substantial improvements in its own self-auditing capacity.

There are serious concerns over ITSRR's ability and commitment to audit RailCorp to the extent necessary to identify any safety deficiencies, and to verify that the systems RailCorp says it has in place, are in fact in place and are effective. To carry out the level of auditing required, ITSRR will need sufficient trained safety auditors. At the time of the SMSEP review, ITSRR was focussing too heavily on developing its "top policy structure", and in doing so had created an environment in which there were insufficient field staff to conduct audit and compliance inspections.

Both ITSRR and RailCorp have obligations to conduct thorough and ongoing audits of RailCorp's safety systems, but it appears neither is equipped to do that adequately.

Key findings

The Commissioner's findings regarding safety regulation include:

- The SRA repeatedly failed to notify the rail safety regulator of known deficiencies in the safety of its operations.

- The former rail safety regulator, the Director General of the Department of Transport, was not provided with sufficient resources to enable him to monitor, using information technology, the safety performance of the SRA.

- The SRA and RailCorp failed to provide accurate and reliable safety information to the former rail safety regulator in their applications for accreditation.

- The former rail safety regulator failed to verify whether the information provided by the SRA and RailCorp in their accreditation applications was true and correct.

- The SRA, prior to the Waterfall rail accident, failed to disclose to the former rail safety regulator the deficiencies in the deadman system on Tangara trains.

- The former rail safety regulator failed to have an adequate number of field officers to verify whether the SRA implemented the safety systems it claimed to have in place.

- The former rail safety regulator was not given sufficient legislative means to enforce adequate safety performance by the SRA.

- The former rail safety regulator failed to ensure that there were clear safety standards with which the SRA was required to comply.

- The former rail safety regulator failed to take a proactive approach of conducting field audits and requiring accredited railway operators and owners to analyse and control risks, and instead took a reactive approach to safety deficiencies, only dealing with safety issues when they arose.

- There is no rail safety regulation, guideline or otherwise to enable railway operators and owners seeking accreditation to understand the elements required in their safety management systems.

- The SRA and RailCorp failed to have a system in place to ensure that the officers who prepared applications for accreditation were receiving accurate information, and that the Chief Executive, when he signed the application, could be satisfied as to the accuracy of the information provided.

- There was lacking an open and co-operative flow of safety related information between the former rail safety regulator and the SRA.

- The former rail safety regulator was not provided with sufficient resources, including field staff, to discover, monitor, investigate and then enforce adequate safety performance by the SRA.

- There were no truly independent Rail Safety Inspectorate, Rail Accident Investigation Board and Rail Safety Regulator as recommended in the Glenbrook Inquiry second interim report and final report, to monitor, enforce, investigate and regulate the safety of the operations of the SRA and RailCorp.

Key recommendations

The Commissioner's recommendations regarding safety regulation include:

- The Advisory Board must be abolished.
- The Chief Executive of ITSRR should have sole accountability and responsibility for the regulation of rail safety.
- The ITSRR should publish guidelines to be followed by accredited organisations.
- The ITSRR should not grant accreditation to any rail organisation unless it has an integrated safety management system.
- The ITSRR should conduct field audits to satisfy itself that accredited organisations conduct their activities in accordance with the safety management system on the basis of which each was accredited.
- Accredited rail organisations should be required to re-apply for accreditation every three years.
- When considering a re-application for accreditation, ITSRR should conduct a field audit of the organisation to ensure it is carrying on its activities in accordance with the basis upon which it seeks accreditation.
- A safety management system regulation should be promulgated, specifying the requirements of safety management systems in all accredited organisations, using Annexure I to the report as a guide.
- Any barriers to communication between OTSI and ITSRR should be removed, so as to ensure that any findings made by OTSI in relation to any investigation it conducts are reported immediately to ITSRR.
- The ITSRR should ensure that OTSI co-operates and assists the ATSB in the conduct of any investigation by the ATSB of an accident or incident in New South Wales.
- The ITSRR should establish a data and information management system, containing all data and information that it requires, to continually monitor the safety of the New South Wales rail system.
- The data and information management system should, as far as possible, be compatible with any data and information management system established by the ATSB for the designated interstate rail network.
- Staffing arrangements for ITSRR should be reviewed by it to ensure that adequate staff are employed in field positions.
- Legislative changes should be enacted to ensure the complete independence of ITSRR from the Minister for Transport Services.

- All reports of the Chief Investigator of OTSI should be delivered, upon completion and without being reviewed, to ITSRR and the Minister for Transport Services.

- The ITSRR should continue to participate in the development of a national system for rail safety regulation, provided that any such system does not produce a safety outcome for New South Wales that is less than would be achieved by the implementation of all the recommendations contained in this report.

- The ITSRR must provide a quarterly report to the Minister for Transport Services on the progress made by RailCorp in implementing these recommendations, including:

    (a) a statement as to whether or not the recommendation has been implemented and, if so, is working effectively; and

    (b) if the recommendation has not been implemented, the means by which the safety objective of the recommendation is otherwise to be achieved.

- The Minister for Transport Services must table in Parliament each such quarterly report by ITSRR.

- The Minister for Transport Services should retain an independent safety auditor to provide a report confirming or qualifying the contents of each such ITSRR quarterly report.

- Integrated safety management

23. Integrated Safety Management

The report has identified a number of specific areas where safety deficiencies existed. Rectification of those deficiencies would not by itself achieve the level of safety management which RailCorp needs to operate in an acceptable way. What it needs to achieve is the integration of the safety improvements, on an ongoing basis, into the overall activities and business which it conducts.

The establishment of an integrated safety management system is crucial to the success of RailCorp in achieving the level of safety which the travelling public expects. There is considerable evidence before the Inquiry about the absence of an integrated safety management system within RailCorp.

In an organisation which does not have an integrated safety management system, information flows to particular areas of the organisation but the safety significance of the information is either not appreciated, because of a lack of capacity to assess risk, or it is not referred to those areas of the organisation where the necessary assessment can be undertaken. The history of the failure to deal with the deficiency in the deadman foot pedal is an example of this.

The SMSEP identified 29 elements that would be expected in an integrated safety management system. Whilst organisations that display all those elements and have achieved the full and seamless integration of such a system are likely to be very rare, a useful measure is to determine the extent to which a particular organisation falls short of this ideal.

In the SRA and RailCorp, there were many of the elements that would be expected in an integrated safety management system that were missing and many others that were not sufficiently developed.

An integrated safety management system requires not only that essential elements be present and fully developed, but that each of these elements is a core part of the way in which the organisation goes about its business. The SMSEP identified the failure of the SRA and RailCorp to have safety management systems integrated into their overall business operation as the "most serious deficiency".

Efficient organisations recognise that the integration of safety management into the overall business operation of the organisation is not only a public expectation, it is good business practice. Integration of safety management has been a feature of the airline industry for many years. If planes crash, passengers will not fly with an airline. Unfortunately for New South Wales commuters, if they wish to catch a train they have no choice other than to take a RailCorp train.

The obsession with the culture of on-time running, without proper attention being given to safety related matters, becomes a self-defeating exercise. Deficiencies in safety management and in the integration of safety management disrupt reliability and therefore on-time running. The safety management system must be integrated into the overall operations of RailCorp for the purpose of producing an organisation which is both safe and efficient.

Organisations involved in transport and other industries have succeeded in establishing integrated safety management systems. RailCorp must learn from the way such organisations managed the process of change. The starting point is clear and focussed leadership, from the Chief Executive down. The RailCorp Board should retain suitable qualified experts to guide the organisation in the development of a plan to achieve an integrated system. A realistic time frame would be three to five years.

This process of change management must also accommodate the existing projects that have been subsumed under the Safety Reform Agenda.

Key findings

The Commissioner made the following findings regarding integrated safety management:

- The SRA failed, and RailCorp fails to have a sufficient level of training and expertise in safety management among senior executives.

- The SRA failed, and RailCorp fails to have specific accountability statements, clearly identifying the safety accountabilities of particular management positions.

- The SRA failed, and RailCorp fails to have a system to develop action plans, based upon the results of audits, to ensure appropriate and timely close-out of action to remedy safety deficiencies.

- The SRA failed, and RailCorp fails to have a system for checking the effectiveness of the controls put in place to prevent a safety deficiency giving rise to an incident or accident.

- To the extent that the SRA and RailCorp had or have safety management systems, they are not integrated into their overall business activities, so as to make safety their paramount objective.

Key recommendations

The Commissioner recommended that RailCorp should establish an integrated safety management system which includes the following:

- a formal performance management system, incorporating measurable safety accountabilities and responsibilities for each managerial position;
- defined safety accountability statements for senior management;
- an effective means of reviewing and acting upon audit investigation and review findings;
- an effective system for managing audit and investigation findings, to ensure that any identified deficiencies have been rectified;
- criteria for recruitment and promotion of management staff, including safety management qualifications, experience and expertise; and
- development of risk management procedures, including:
    (a) analysis of the nature of the activities being undertaken;
    (b) identification of all potential hazards within those activities;
    (c) analysis of the nature of the hazard;
    (d) analysis of the risks of the hazard materialising;
    (e) development of controls to mitigate the risk;
    (f) development of systems for monitoring the effectiveness of the controls;
    (g) development of a continuing program to enhance the development of safe practices at all levels;
    (h) development of key performance indicators for safety performance by all managers;
    (i) development of a safety information data collection system which captures all hazards, occupational health and safety incidents, audit results, non-compliance findings and near miss reports;
    (j) development of a system to prioritise those safety deficiencies which require the most urgent attention;

(k) design and implementation of communications protocols, including standard phraseology, with particular standard phraseology for emergency situations; and

(l) development of training systems, based upon training needs analysis.

1. Introduction

The rail accident which gave rise to the Special Commission of Inquiry occurred on 31 January 2003 at 7:14 am when a four car Outer Suburban Tangara passenger train (hereafter referred to as G7), on run C311 from Sydney Central railway station to Port Kembla, left the track and overturned at high speed on a curve approximately 1.9 kilometres south of Waterfall railway station. The train driver and six passengers were killed and the remaining 41 passengers suffered various injuries ranging from severe disabling injuries to minor bruising and lacerations.

Prior to the Waterfall rail accident, the Glenbrook rail accident, which occurred on 2 December 1999, was the most serious rail accident in New South Wales since 6 May 1990 when an inter urban train collided with an historic steam train on the Cowan embankment near the Hawkesbury River, north of Sydney, resulting in the death of six persons and injuries to a further 100 passengers. The most serious rail accident in New South Wales prior to that occurred on 18 January 1977 at Granville when an eight car passenger train derailed and collided with the Bold Street bridge, causing the bridge to fall onto the third and fourth carriages of that train resulting in the deaths of 83 passengers and injuries to 213 passengers.

In April 2001, the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident made 95 recommendations for safety improvements to rail operations, including several recommendations in relation to structural change relating to the management of rail safety. The fate of those recommendations is the subject of further comment later in this report. A first interim report in June 2000 dealt with the causes of the Glenbrook rail accident and a second interim report in November 2000 dealt with recommendations for structural change. Both interim reports contained recommendations.

The fact that another serious rail accident could occur less than two years after the final report of the Glenbrook Inquiry was delivered, together with my perception of the public concern that the Waterfall rail accident generated, persuaded me to come out of retirement to conduct this Special Commission of Inquiry.

I sought the appointment of the same Counsel, Mr Christopher Barry QC and Mr David Cowan who assisted me in the Glenbrook Inquiry. Although Mr Cowan was able to make himself available, Mr Barry was engaged in another jurisdiction but agreed to assist on a limited basis initially and on a more permanent basis when able to do so. Mr Peter Hall QC, Mr Barry QC and Mr Cowan were appointed by the Attorney General as Counsel Assisting. Subsequently, the case in which Mr Barry QC had been engaged was settled and at my request he was also retained on a full time basis.

The investigation of the causes of the Waterfall rail accident, and the factors that contributed to it, proved to be an extraordinarily difficult task. Although I had recommended in the final report of the Glenbrook Inquiry that all trains be fitted with data loggers, that had not been implemented and consequently there was no record of the actions of the deceased train driver of G7 from the time it departed Waterfall railway station to the derailment site. It was necessary, therefore, to reconstruct the circumstances leading to the accident from all available evidence, to enable inferences to be drawn from those circumstances and findings made as to the causes of the accident.

The conclusions to which I came are contained in the interim report and the next chapter of this report deals with the contents of the interim report. The interim report dealt only with the first term of reference. The interim report made clear that there were a number of direct and latent factors which caused or contributed to the derailment. That this very serious rail accident occurred so soon after the Glenbrook rail accident and the fact that many improvements to rail safety recommended in the Glenbrook reports had not occurred, led me to conclude that the organisational deficiencies in the safety of rail operations were much greater than believed at the time of the Glenbrook Inquiry. A more detailed examination of those organisational deficiencies than occurred in the Glenbrook Inquiry was obviously required.

The capacity of a Special Commission of Inquiry to conduct such an investigation without expert assistance was limited and accordingly Dr Graham Edkins, the Director, Public Transport Safety, Department of Infrastructure, Victoria and Dr Rob Lee, who has since become the Deputy Chairman of the New South Wales Independent Transport Safety and Reliability Regulator Advisory Board (hereafter referred to as the Advisory Board), were retained to assist the Special Commission to determine the most appropriate and effective way of investigating those organisational deficiencies.

A review of documentation that had been provided to the Special Commission of Inquiry indicated that the State Rail Authority (hereafter referred to as the SRA) purported to have a system for internally managing safety. However, a comparison of the documented safety management system with the organisational deficiencies identified in the interim report persuaded me that whatever the documentation claimed about the management of safety, the reality was different.

The task of identifying the organisational deficiencies in safety management that caused the Waterfall rail accident was made more difficult by the extensive legislative changes made by the Transport Administration Amendment (Rail Agencies) Act 2003 and the Transport Legislation Amendment (Safety and Reliability) Act 2003. Although the detail of these legislative changes is discussed in chapter 3, the effect of the legislation was that the provision of train services and the maintenance of the metropolitan rail infrastructure and rolling stock were assigned to a new State owned corporation Rail Corporation New South Wales, known as RailCorp, and two new safety regulatory bodies, called the Independent Transport Safety and Reliability Regulator (hereafter referred to as ITSRR) and the Advisory Board, were created.

Each of the new organisations came into existence on 1 January 2004. The result was that it was necessary to consider the organisational deficiencies that had been present at the time of the Waterfall rail accident, the safety regulation regime that had been present at the time of the Waterfall rail accident, the nature of the new organisations and the changes, that have been or would be made, to rail safety and rail safety regulation.

Before the new legislation commenced Dr Edkins and Dr Lee had recommended, in mid 2003, that an extensive safety review of the SRA, the Rail Infrastructure Corporation (hereafter referred to as RIC) and the then rail safety regulator be conducted, to establish whether the documented safety management systems of each contained the necessary elements for overall management of the safety of the rail operations being conducted and whether they were effective in doing so. By identifying whatever deficiencies existed, it would then be possible to make the recommendations required by the third term of reference.

After the legislative changes had been made on 1 January 2004, this review required an examination of the old and new organisations.

It was necessary to consider how such an extensive task could be undertaken. I accepted the recommendation that the most effective means of conducting that part of the Inquiry was to establish a panel of experts, known as the Safety Management Systems Expert Panel (hereafter referred to as the SMSEP), to oversee and analyse the results of a safety review to be conducted by experienced safety auditors. To enable the SMSEP to have as broad a range of experience in the area of safety management as could conveniently be assembled, relevant experts were retained from various backgrounds.

Dr Graham Edkins, who has extensive experience in the airline industry and in rail and other transport modes, was appointed chairman of the SMSEP. Dr Chris Darling, the Manager, Safety Health and Risk, of BlueScope Steel (formerly BHP Steel), was appointed because of his medical qualifications and his extensive experience in occupational health and system safety management.

Associate Professor Ian Glendon, Director, Organisational Psychology Postgraduate Programs, Griffith University, Gold Coast campus, was appointed because of his world renown in, among other things, risk management, safety auditing and safety culture and safety climate analysis.

Dr Rob Lee, an expert in human factors and systems safety and a former Director of the Australian Bureau of Air Safety Investigation, was appointed because of his extensive experience in airline safety and systems safety.

Mr Ken Lewis, the former Group General Manager, Safety and Environment of Qantas Airways Limited (hereafter referred to as Qantas), was appointed to the SMSEP because of his knowledge and expertise in airline safety, which was perceived by me to be invaluable in relation to rail safety.

Finally, Mr Norman Thompson, a former staff member of the Transport Safety Bureau within the former Department of Transport, who was seconded to both the Glenbrook and Waterfall Inquiries, was appointed to the SMSEP because of his knowledge and experience of the New South Wales rail industry generally and rail safety in particular.

For the SMSEP to have material to analyse, it was necessary for that material to be gathered. The means by which this was done was to retain a leading international expert in safety auditing to design the audit process and assemble an audit team of experienced safety auditors.

Mr Nicholas Bahr, a Senior Associate of Booz Allen Hamilton Inc. in the United States of America, was retained as review director to design and develop the safety review methodology. Mr Bahr holds degrees of Bachelor of Science in Mechanical Engineering from the University of New Mexico and Master of Science in Reliability Engineering from the University of Maryland. He has written many articles on systems safety engineering and his book titled "System Safety Engineering and Risk Assessment" was published in 1997. He has more than 20 years professional experience in systems safety, security, reliability engineering and risk management, focusing on security and safety management systems and in-depth technical risk assessment.

Mr Ken Lewis, was appointed as lead auditor. In addition, the audit panel consisted of Mr Martin Baggott, Executive Manager, Transport Victoria, Bovis Lend Lease Pty Limited, Mr Barry Broom, Manager Network Safety, Queensland Rail, Mr John Evans, Safeworking Compliance Officer, Network Safety, Network Access, Queensland Rail, Mr Charles Galea, Senior Engineer, Nova Systems Consulting Pty Limited, Dr Neil Isles, Director/Principal Consultant, Ibis Business Solutions Pty Limited, Mr Brian McBride, Associate, Booz Allen Hamilton (Australia) Limited, Mr Len Neist, Senior Associate, Booz Allen Hamilton (Australia) Limited, Mr Mike Nendick, Human Factors Specialist, Human Factors and System Safety, Australian Civil Aviation Safety Authority, Mr Mike Rodgers, Consultant and formerly Manager, Human Factors and System Safety, Australian Civil Aviation Safety Authority, and Mr Alan Ross, Principal, A&K Ross Associates and formerly Rail Safety Regulator, Victoria.

Mr Bahr was based in the United States of America and his other commitments limited his ability to come to Australia to what were relatively short periods. Accordingly, it was necessary to appoint a project manager to manage the safety audit. Mr Peter Olsen, Associate, Booz Allen Hamilton (Australia) Limited, was first appointed to that position and later Mr Len Neist, one of the auditors, succeeded Mr Olsen as project manager.

The result of the work of the audit team and the SMSEP is contained in a detailed report. The detail of the methodology adopted by the SMSEP and the way in which the work was undertaken is the subject of a later chapter in this report. In view of the fact that the SMSEP report was a vital part of the Special Commission's investigations the report and its attachments comprise volume 2 of this final report.

Mr Bahr delivered the audit findings on 12 May 2004 and the SMSEP report was received on 6 July 2004, and tendered in evidence and served on the parties on the same day.

To satisfy me as to the accuracy and reliability of both the process and the results of the review and analysis that was undertaken, independent peer reviews were undertaken by Dr John Loy, Chief Executive, Australian Radiation Protection and Nuclear Safety Agency, Mr Terrence Worrall, Railway Consultant (operations and safety) and Technical Advisor to the United Kingdom Rail Accident Investigation Branch and formerly Director and General Manager of Thames Trains Limited, and Professor Emeritus James Reason, an author of international repute in the area of organisational safety management. Professor Reason's review of the SMSEP report was received on 14 July 2004, Dr Loy's was received on 26 July 2004 and Mr Worrall's was received on 5 August 2004. The parties represented before the Special Commission were then given an opportunity to consider the SMSEP report and the peer reviews and make submissions.

For the reasons that I have given in the chapter dealing with the SMSEP report, I am satisfied with the quality and reliability of the work that was done by the SMSEP and fortified in my view by the comments received from the peer reviewers which are referred to later in this report.

Mr Nicholas Bahr gave evidence about the methodology that was chosen in carrying out the audit and the reasons for it. Dr Graham Edkins, the Chairman of the SMSEP, also gave evidence outlining the findings and conclusions of the SMSEP based upon the safety audit and the opportunity was afforded the parties represented before the Special Commission of Inquiry to cross-examine him. The parties were given the opportunity of putting in writing

any material that they wished to place before the Special Commission relating to the matters dealt with by Dr Edkins in oral evidence and subsequently by the SMSEP. I shall deal with that material later in this report.

It is sufficient to observe at this stage that there was nothing put in cross-examination of any witness or by way of written material or oral submission which caused me to doubt the accuracy and reliability of the work done by the panel of auditors or the SMSEP. Indeed, as it transpired, RailCorp and ITSRR accepted the great majority of the report. I believe they could not do otherwise.

In addition to the organisational issues which the auditors and the SMSEP investigated and reported upon, there were a number of discrete matters identified in the interim report which required specific consideration. Those areas are specifically addressed in this final report.

My experience in the conduct of the Glenbrook Inquiry led me to appreciate the benefit that can be gained by being conversant with information from interstate and overseas when formulating recommendations. Many governments and rail organisations have been faced with the same problems that exist in the rail industry in this State. Prior to the Waterfall rail accident that experience was not utilised by the SRA. If it had been, the accident may have been avoided. It is for this reason that recommendation 44 was made in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident. That recommendation was as follows:

> All accredited rail organisations, the Department of Transport, the Office of the Rail Regulator, the Rail Safety Inspectorate and the Rail Accident Investigation Board should each avail themselves of the information and expertise in respect of rail safety management which exists in overseas rail organisations.

That recommendation, like so many others made in the interim and final reports of the Glenbrook Inquiry, appears to have been ignored. Accordingly, I sought and obtained the permission of the Premier for Counsel Assisting, Mr Christopher Barry QC and Mr David Cowan, to undertake extensive overseas investigations and required them to gather such information they believed could be of assistance to me in preparing the recommendations in this report. A list of the overseas and interstate experts from whom Counsel Assisting obtained information and assistance is Annexure D to this report. Their willingness to meet with Counsel Assisting and provide their views and documentation, so as to better ensure the safety of New South Wales rail passengers, is gratefully acknowledged.

Many of the recommendations made in this report are based upon what is now accepted in those countries which have thoroughly investigated the best systems to optimise rail safety. What is significant about those systems is the degree of uniformity in their essential elements which now exists in the United Kingdom, other European Union countries, Canada and the United States of America.

The deficiencies in the overall management of safety identified in the SMSEP report and the specific rail safety deficiencies identified in this report, led me to examine the safety management issues that related to corporate governance generally. One matter that is clear is that the management of safety cannot be divorced from the overall management of the railway business in which a company is engaged. An example of this to which I shall later refer, is the approach of Pacific National Pty Limited (hereafter referred to as Pacific

National) to safety management. I have regarded the issue of corporate governance in relation to safety management to be of such importance to make it the subject of a chapter of its own.

Good safety management is not only a moral obligation, it is good business practice. Unsafe railways do not operate as efficiently or profitably as safe railways.

Although the SMSEP report was critical of the organisations audited, those organisations were undergoing processes of change.

During the course of this Inquiry the government enacted legislation creating ITSRR, which was described as independent. Although this Inquiry was in existence during the drafting of the legislation, the Special Commission of Inquiry was not consulted in relation to the structure or model of safety regulation contained in the legislation. Although the system of safety regulation that has been put in place is dealt with later, it is necessary to observe that there are aspects of the ITSRR related legislation which were the subject of consideration and rejection by me in the second interim report of the Special Commission of Inquiry into the Glenbrook Rail Accident. Those aspects related to the need for the separation and independence of accident investigation. Mr Ron Christie, then the Co-ordinator General of Rail, expressed views on that topic in his evidence during the Glenbrook Inquiry. No other expert witness called to give evidence in the Glenbrook Inquiry was supportive of Mr Christie's views. For the reasons set out in the second interim report of that Inquiry, his model was rejected by me. The model recommended in the Glenbrook second interim report is that in use in the United Kingdom, Canada, the European Union and the United States. Nevertheless, Mr Christie's model was adopted by the government, together with other quite unique allocations of functions and responsibilities, as the appropriate model for safety regulation in this State in the ITSRR related legislation.

Finally, by virtue of material tendered during the second stage of this Inquiry it is apparent that significant reforms to rail safety are being considered at the national level. Counsel Assisting, Christopher Barry QC and David Cowan, met with officers of the Australasian Railways Association, the National Transport Commission, the Australian Transport Safety Bureau and the Department of Transport and Regional Services about the matters that are being considered by way of rail safety reform at the national level. There are many matters being considered at the national level which will, if supported and adopted in New South Wales, improve rail safety in this State. I shall identify those matters in the latter sections of this final report.

The conduct of this Inquiry has been an extraordinarily long and arduous process. The difficulties of doing so have been created largely by the range and depth of the problems that have existed and continue to exist in the rail industry in New South Wales. The number of matters which it has been necessary for me to address in this report is itself indicative of the extent of those deficiencies.

The task has been made all the more difficult by the introduction of new legislative regimes governing the provision of train services by the main rail commuter service provider, RailCorp, and the new system of safety regulation that has been put in place. The legislation that has been passed is complex and in many respects obscure. The organisations that have been created have inherited many of the elements and systems of the organisations they replaced. They are staffed almost entirely by persons who previously worked for the SRA,

RIC or the previous rail safety regulator. The amount of material that has been necessary to consider is itself indicative of the size of the task that had to be undertaken. More than 178,000 documents, consisting of more than 701,000 pages have been provided to the Special Commission of Inquiry. There were 520 exhibits consisting of more than 2,950 documents, in turn consisting of more than 32,900 pages tendered. One hundred and thirteen hearing days were required to hear the evidence and submissions which were concluded on 26 July 2004. Two hundred and three witnesses gave evidence.

Although there are many rail operators in New South Wales, the provision of commuter rail services is under the control of a government owned monopoly, RailCorp. At the time of the Waterfall rail accident they were under the control of the SRA. Since the Waterfall rail accident involved SRA staff and equipment, now employed and owned by RailCorp, this report is largely devoted to the deficiencies in their safety performances and the rail safety regulator's oversight of their activities.

2. The Interim Report

The Waterfall rail accident occurred on 31 January 2003 at 7:14 am. The photograph which is the frontispiece to this report shows the position of G7 after the accident. The train driver was deceased and the guard purported to have no recollection of events immediately prior to the derailment. There was no operating data logger fitted to G7.

There were numerous theories as to why G7 may have derailed, including defects in the track, the train driver's mental health, the operation of the traction motors on G7 and the significance of the fact that this was the only Tangara train fitted with alternating current (AC) rather than direct current (DC) traction motors. There were also theories about what was said to be intermittent surging of Tangara trains. There was no apparent cause of this accident.

I concluded that if it were possible to exclude defects in the track or malfunction of G7 then the other possible causes could only be deliberate or reckless conduct by the train driver or alternatively driver incapacitation. If it were train driver incapacitation, G7 was fitted with a deadman system designed to initiate an emergency brake application and bring it to a stop if a train driver became incapacitated or fell asleep. If the train driver had become incapacitated and the deadman system did not function, then it was necessary to understand why this occurred. The only way I could determine the cause or causes of the accident was to examine each of the hypotheses advanced as a possible cause and determine whether or not any of them provided a plausible explanation for the occurrence of this tragic event. The interim report analysed the evidence relating to all these matters.

Figure 2.1 Front of G7

The conclusion to which I came was that the mechanism of this accident was a high speed rollover. Three matters were of importance in leading to that conclusion. The first was that the wheels that had been on the low rail had not come into contact with ballast during the course of the derailment. Figures 2.1 and 2.2 are photographs taken by police shortly after the accident, which show that some of the wheels were shiny and some were badly scuffed.

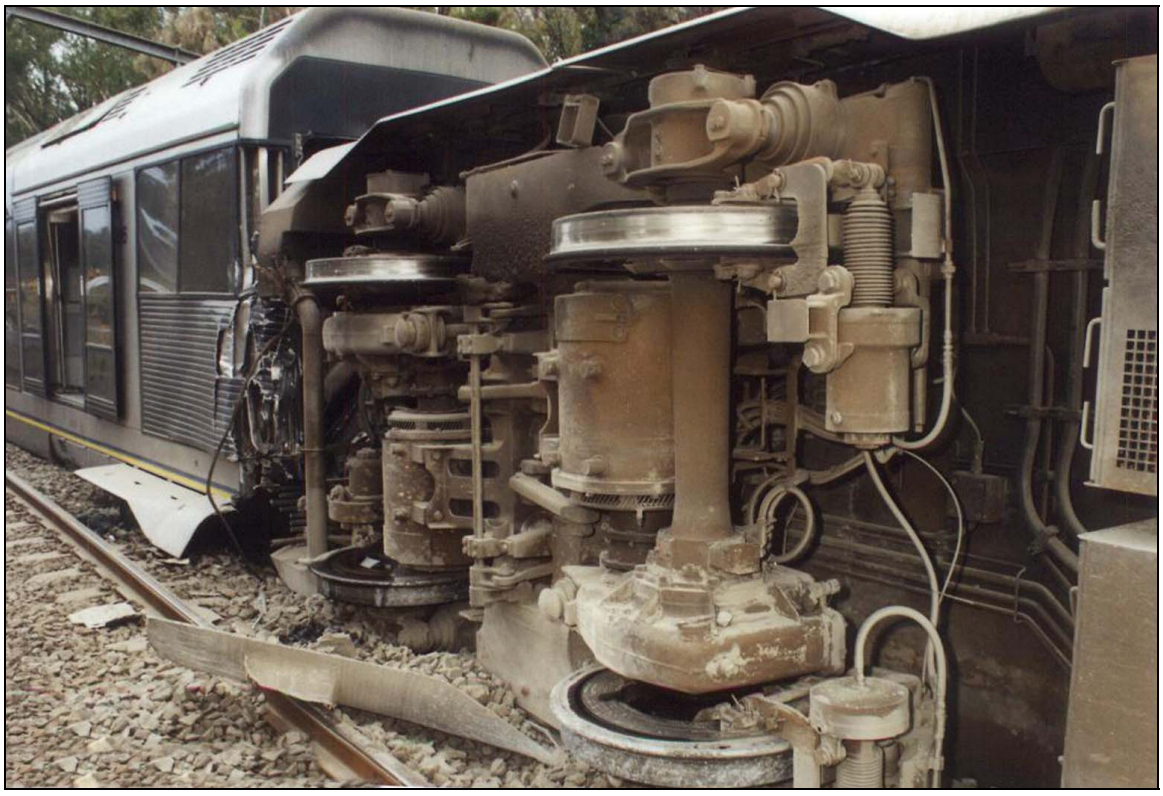


Figure 2.2 Front bogie of car three

The second matter was that calculations and computer modelling demonstrated that G7 was travelling at approximately 117 km/h as it entered the curve. However train speed entering the curve was limited by a speed board to 60 km/h.

The third matter was markings on the top of the high rail and disturbed ballast consistent with the high rail wheels of G7 losing contact with the rail as the centre of gravity of G7 moved outside the high rail. Contact of the wheels with the high rail was lost, resulting in the wheels ploughing through the ballast between the up and down lines, until G7 landed on its side. It then skated along the down tracks, colliding with overhead stanchions and a rock cutting.

Figure 2.3 shows letters of the alphabet placed adjacent to the rail by police to indicate significant markings. Part of the curve and the derailed G7 are in the background. The leading two cars of G7 returned to a vertical position following the derailment by mounting an embankment, causing them to rotate.

Figure 2.3 Track and ballast marks

It was necessary to consider whether the condition of the track contributed in any way to the high speed rollover. A very detailed and careful analysis of the gauge, versine alignment, rail elevation, twist, rail profile and absolute alignment of the track was carried out by an engineer in the employ of the track owner, RIC. His work was independently reviewed by Mr Fred Mau, a consultant to the Special Commission of Inquiry. Mr Mau was a railway engineer with 25 years experience in railway engineering, including 15 years specialisation in track engineering. He agreed with the analysis that had been undertaken, except in respect of some roughness in the track north of the derailment site, which was unrelated to the accident. It was clear the track did not contribute in any way to this accident.

The next possible cause requiring examination was whether any malfunction in G7 was a cause of the accident. The photograph on the front cover of this report demonstrates that G7 was severely damaged by the accident. It was necessary for it to be removed to premises at Maintrain, Auburn, where a detailed examination of its relevant components and systems could be undertaken. The process by which this was done is set out in the interim report and I need not repeat what was said there, other than to note that each of the relevant components was removed from G7 and examined. They were then subjected to a range of tests, including appropriate mechanical, electrical, pneumatic, metallurgical and functional tests. The conclusion reached was that mechanical malfunction of G7 had to be excluded as a possible cause of the accident.

The remaining alternatives were either deliberate or reckless behaviour on the part of the train driver or driver incapacitation. A detailed examination of the train driver's background, reputation and personal qualities excluded any reckless or deliberate conduct by him as a possible cause of the accident.

That then left two areas for examination, namely whether there was evidence which would satisfy me that the train driver became incapacitated and, if so, why the deadman system on G7 failed to apply the emergency brakes and stop the train. The train driver, Mr Zeides, had a number of risk factors for coronary artery disease, including high cholesterol and obesity. Post-mortem examination revealed that he had a 90 per cent blockage of the left anterior descending coronary artery. A stained slide of a cross-section of Mr Zeides' left anterior descending coronary artery is Figure 2.4 and immediately under it is Figure 2.5, a cross-section taken from Mr Zeides' left main coronary artery. A comparison of the two cross-sections demonstrates the extent of the narrowing of the left anterior descending coronary artery. The whitened area is the only area through which blood could pass.

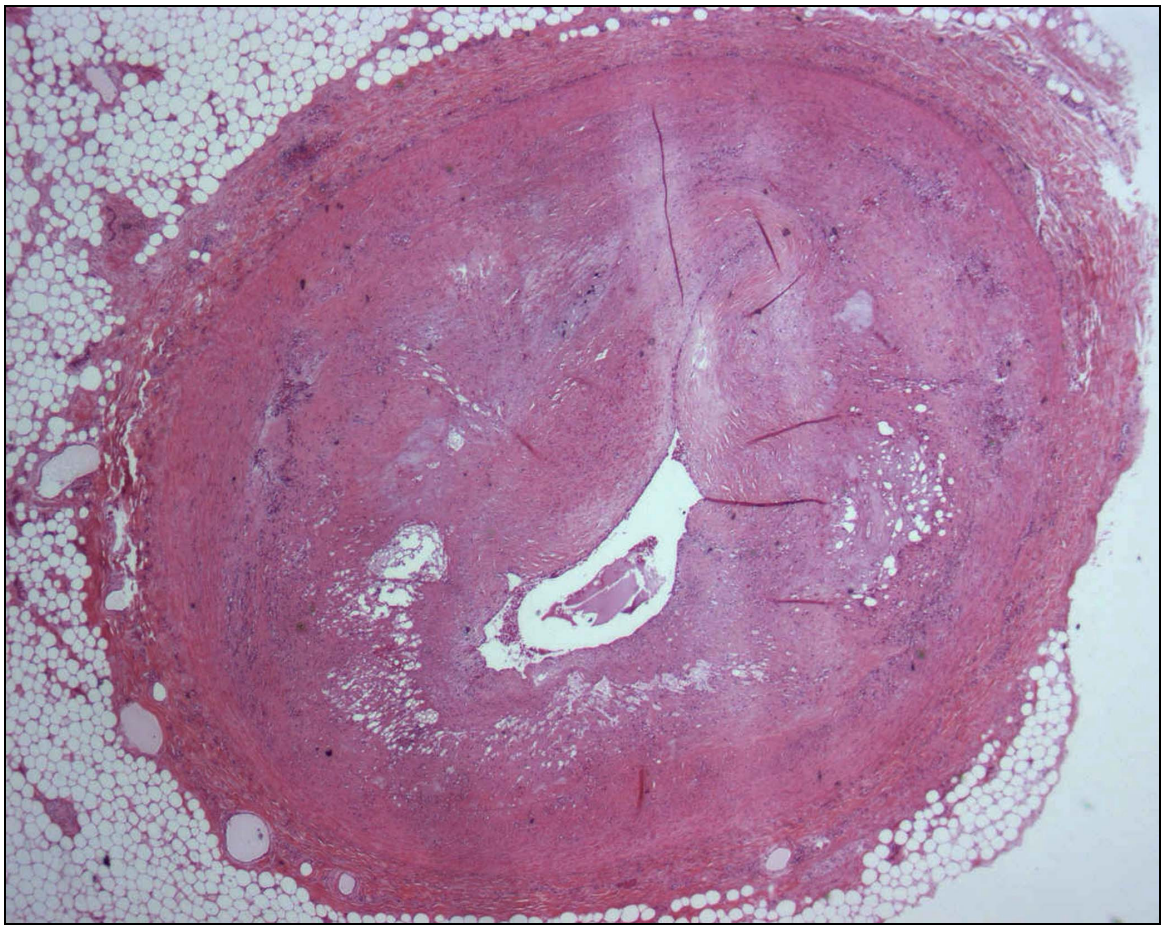


Figure 2.4 Cross section of Mr Zeides' left anterior descending coronary artery (Slide 1)

Figure 2.5 Mr Zeides' left main coronary artery without occlusions

The narrowing did not establish conclusively that Mr Zeides had a heart attack, as there was no evidence of a complete occlusion of any coronary artery. The preponderance of the evidence, however, was that he was at considerable risk of a cardiac event which could result in him becoming suddenly incapacitated. Medical opinion differed as to the mechanism by which this would occur, but notwithstanding the differences as to the mechanism, the result was the same.

Being able to satisfy myself that there was no defect in the track, no malfunction in G7 and no reckless or deliberate conduct by the train driver which caused the accident, the inference from the known state of his coronary arteries and other cardiac risk factors led me to the view that Mr Zeides suffered a sudden incapacitating heart attack at the controls of G7. It was not possible to determine whether Mr Zeides was dead or dying at the time of impact, but I was satisfied that he was so incapacitated that he had no control of G7 from the time shortly after it left Waterfall railway station.

That conclusion led me to examine why, in those circumstances, there was a failure of the system in Tangara trains which is supposed to prevent an accident of this kind from occurring if the train driver has a sudden heart attack. The deadman system depended upon the train driver keeping pressure either on the master controller, which was spring loaded and held in the right hand, or alternatively setting the master controller in the desired position then keeping appropriate pressure on the foot pedal to prevent an emergency brake application. The foot pedal was designed so that a certain pressure was needed to put it in the set position,

but if too much or too little pressure was applied, causing it to either be fully depressed or fully released, an electrical relay system triggered an emergency brake application. Figure 2.6 illustrates the mechanism by which the deadman foot pedal operated.

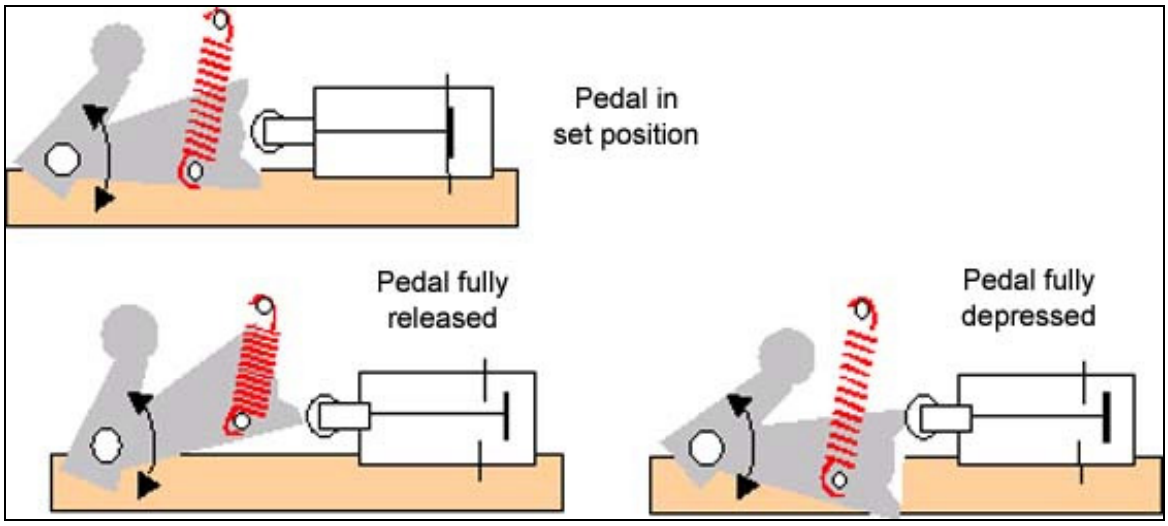


Figure 2.6 Internal mechanism of deadman foot pedal

Dr Andrew McIntosh, Senior Lecturer in Biomechanics and Ergonomics, School of Safety Science, University of New South Wales, was retained by the Special Commission of Inquiry to conduct tests on the deadman foot pedal. Following exhaustive testing and careful analysis of the results of those tests, Dr McIntosh's conclusions were as follows:

> The tests and analyses undertaken on the Tangara deadman system indicate with a very high degree of confidence that an incapacitated driver of body mass greater than 110 kilograms, such as the deceased driver Mr Zeides, could maintain sufficient force due to "dead weight" on the deadman's pedal to hold it in a "set" position. This could be achieved with both feet, one foot, with different foot placement on the pedal, wedging of the feet under the heater, and different seat positions.

Mr Zeides weighed 118 kilograms at autopsy. When the results of Dr McIntosh's empirical testing were considered with the other facts known about the accident, I was satisfied Mr Zeides was using the deadman foot pedal when he had a heart attack. The very system designed to protect the safety of passengers in those circumstances failed to operate.

Although the direct cause of the accident could be established, it was necessary to establish how a train with that inherent safety defect could be permitted to be built and utilised for public passenger transport and remain in service with that serious latent safety defect for many years. It became apparent that the then SRA had information for approximately 15 years that the deadman foot pedal in Tangara trains had the inherent deficiency that train drivers over a certain weight could set the pedal inadvertently if they became incapacitated for whatever reason. Dr McIntosh established that train motion would have no effect on this. The interim report carefully analysed the knowledge of the SRA at various stages during that 15 year period, to attempt to establish why such a dangerous state of affairs had been permitted to prevail for such a long period. The simple answer was that there were serious deficiencies in the way in which safety was managed by that organisation over that period of time.

Apart from the unsafe rolling stock, it was also necessary to try to understand why the train guard failed to take any action, given the excessive speed of G7. What was so obvious to the passengers about the excessive speed of G7 must have been even more obvious to the train guard, who had an emergency brake in the guard's compartment which, if applied, would have stopped G7. It was also necessary to determine how Mr Zeides, a person at considerable risk of having a heart attack because of his high cholesterol, weight and age, could have passed the periodical medical assessments provided to determine his fitness to drive a train.

There were not only obvious deficiencies in the way in which safety was being managed which related to inadequate medical examinations, defective processes of design and certification of trains and inadequate guards' training. There were also deficiencies in the way in which the safety regulatory system operated. A later chapter discusses in detail the evolution of safety management, although it is sufficient to observe at this stage that there was a safety regulatory regime in place which had as its purpose the prevention of incidents of this kind. The safety regulatory system failed on this occasion and this must also be regarded as one of the indirect or latent causes of this accident.

Having analysed all the relevant material referred to in the interim report, which dealt only with the first term of reference of the Special Commission of Inquiry, I was able to determine that the factors which directly or indirectly caused or contributed to the accident could be summarised as follows:

1. The train driver, Mr Zeides, suffered a sudden unexpected cardiac arrest, caused by moderate to severe coronary artery disease, shortly after G7 left Waterfall railway station and was thereafter incapacitated and not in control of G7.

2. The deadman system on G7 failed because the static weight of Mr Zeides' legs was enough to keep the deadman foot pedal [being used by him] in the set position after he had collapsed, thereby preventing an emergency brake application.

3. The incapacity of Mr Zeides and the failure of G7's deadman system occurred at a location where there was a downhill gradient leading into a curve.

4. There were no additional engineering defences on Tangara trains to provide more than one level of protection if the train driver collapsed.

5. A task linked vigilance device, if fitted, could have prevented the accident.

6. The State Rail Authority failed to install an effective deadman system on Tangara trains.

7. The State Rail Authority knowingly permitted the use of Tangara trains with ineffective deadman systems.

8. The train guard failed to apply the emergency brake so as to slow or stop G7, when he knew or ought to have known that its speed was excessive.

9. The train guard's failure to act was the product of the following:

   (a) The train guard was not adequately trained to respond to emergency situations;

   (b) The train guard was not told of the inherent defect in the deadman foot pedal and accordingly assumed that the deadman system on G7 was functioning;

   (c) The train guard did not contemplate that the train driver Mr Zeides may have become incapacitated;

   (d) The train guard was conditioned to trains travelling at speeds above the speed board limit and was therefore not alerted to the danger posed by G7's excessive speed;

   (e) The perceptions of train guards and train drivers of their respective roles and responsibilities made the train guard reluctant to act by either attempting to contact the train driver or applying the emergency brake;

   (f) The train guard was suffering fatigue as a result of his rostering and this may have impaired his ability to accurately assess what was occurring and to act decisively;

   (g) The train guard may have been psychologically unsuited to taking the decisive action that was necessary when a serious accident was imminent; and

   (h) The medical standards did not require psychological evaluation of safety critical workers.

10. The periodic medical examination of Mr Zeides was inadequate to detect the risk that he may have a heart attack for the following reasons:

   (a) The State Rail Authority medical standards did not require predictive medical examinations of safety critical staff;

   (b) There was insufficient guidance given by the State Rail Authority to the medical examiners about specific matters to examine and report upon, referrable to the risk of sudden incapacity;

   (c) The medical standards were not revised at appropriate intervals in order to bring requirements up to contemporary medical practice;

   (d) The medical examiners were general practitioners and in the circumstances did not possess the expertise to carry out predictive medical examinations of safety critical workers;

(e) The medical examiners used by the State Rail Authority were not sufficiently skilled in occupational health to determine the fitness or otherwise of safety critical workers;

(f) The medical examination of Mr Zeides was conducted by a medical practitioner who did not know or understand the real nature of his duties;

(g) The medical examination was conducted by a medical practitioner who did not know how the deadman system on a train was intended to work;

(h) The medical examiners were not provided with background medical histories to assist them in making assessments of safety critical workers;

(i) The medical standards of the State Rail Authority confused occupational health and safety with public safety when safety critical staff were being examined;

(j) There was no requirement of follow-up testing of safety critical staff who were indicating signs of possible future medical problems; and

(k) There was no overview of the results of medical examinations by a specialist Chief Medical Officer, to review the fitness or otherwise of safety critical workers.

11. The failure of the State Rail Authority to manage the risk of a high speed rollover caused by an incapacitated train driver keeping the deadman foot pedal set by the static weight of his legs was itself due to a number of underlying causes. These were:

(a) There was no adequate discussion with the manufacturer of G7 to determine the feasibility of the deadman foot pedal system as a defence to train driver incapacitation;

(b) The deadman foot pedal was not fail-safe in either its design or operation;

(c) The deadman foot pedal could be inadvertently overridden;

(d) No adequate testing of the deadman system to be installed on Tangara trains was undertaken prior to the manufacture of G7;

(e) No system was established to enable identification of safety hazards that could arise from the operation of a deadman device;

(f) There was no system of accountability or responsibility for the driver safety devices installed on Tangara trains; and

(g) There was no adequate assessment of the deficiencies in the deadman safety system.

12. The failure to identify the deficiency in the deadman foot pedal was part of a broader failure to properly manage safety in at least the following respects:

(a) There was a pervasive lack of safety awareness within the management of the State Rail Authority;

(b) There was a culture which enabled safety violations to occur, as illustrated by speeding and deliberate circumvention of the deadman system by use of flag sticks and other means;

(c) There was no integrated system for the communication of safety critical information either between different areas within the State Rail Authority or to persons in senior managerial positions;

(d) There was a failure by the State Rail Authority to learn from experiences in other rail systems;

(e) The State Rail Authority failed to notify the then Department of Transport of the inherent deficiency in the deadman system despite being legally obliged to do so under statutory reporting requirements;

(f) The State Rail Authority failed to disclose in its annual safety reports to the then Department of Transport the fact that it had information in its possession indicating that the deadman foot pedal had an inherent safety deficiency;

(g) The State Rail Authority had a weak safety culture, which prevented officers occupying managerial positions from acquiring sufficient safety awareness to enable them to deal with the risks in the operation of the deadman foot pedal system;

(h) The approach of the State Rail Authority to safety management was reactive, leading to a focus on signals passed at danger and ergonomic issues to the exclusion of other risks, such as the risk of a high speed rollover accident; and

(i) The Director General of the then Department of Transport lacked the resources to independently determine whether the safety management systems which the State Rail Authority claimed it had, existed or were effective.

The findings in the interim report enabled me to identify areas where further consideration was necessary for the purpose of determining the second term of reference and the recommendations required by the third term of reference. The interim report identified a

number of matters that it was necessary for me to investigate under terms of reference 2 and 3. Those matter were as follows:

1. Rail safety management

(a) The procedures for the purchasing, commissioning, approving and certifying of new rolling stock to ensure it is safe when put into service;

(b) Improvements to driver safety systems to better protect the travelling public against accidents;

(c) The uses made of data loggers;

(d) The systems for train drivers to report defects and for necessary action to be taken to record, remedy and provide feedback on reported defects;

(e) Systems for the communication of safety critical information within the State Rail Authority and to the safety regulator;

(f) The role and function of the safety regulator;

(g) The management of the tensions between on-time running, time tabling and speed board placement and an adequate safety system;

(h) The creation and uses of a hazard and risk register;

(i) Methods for integrating safety management and communicating safety information within the rail organisations;

(j) Methods for improving the record-keeping and management of safety related documentation;

(k) Systems for ensuring adequate handover of safety critical projects;

(l) Systems for ensuring accountability for safety management within the rail organisations and the safety regulator; and

(m) Methods whereby the level of safety awareness within rail organisations may be increased to ensure that a safety culture has a pervasive influence at all levels from senior management to operator level.

2. Emergency response

(a) Crashworthiness of trains;

(b) Emergency access to and egress from trains;

(c) Improvement of radio and telephone communications between police, ambulance, fire brigade and rail personnel in the event of a serious rail accident; and
(d) Improvement of rail accident management.

3. Human factors management

(a) Improvements to periodic medical examinations of safety critical employees;

(b) Consideration of psychological screening of safety critical employees;

(c) Improvements to systems for fatigue management; and

(d) Crew resource management training for safety critical employees.

The second stage of the Inquiry was conducted at a time when many aspects of rail safety management by the State Rail Authority and the rail safety regulator were themselves the subject of substantial legislative changes enacted by the Transport Legislation Amendment (Safety and Reliability) Act 2003, which amended the Transport Administration Act 1988. The amending legislation provided that the Minister for Transport Services was to review the operation of the amendments made by the Transport Legislation Amendment (Safety and Reliability) Act 2003, to determine whether the policy objectives of those amendments remain valid and whether the terms of the amendments remain appropriate for securing those objectives, as soon as possible after a period of 12 months from the date of assent to the 2003 Act.

The Special Commission of Inquiry was not consulted in relation to those amendments. However, the second and third terms of reference require consideration, in addition to the other matters identified in the interim report, of what recommendations, if any, should be made in relation to the legislative regime currently in place.

The task of evaluating these rail organisations is not made any easier by the fact that the structure of the system of rail safety regulation that has now been put in place is unique to New South Wales and the organisations involved have been functioning only since 1 January 2004.

The range and depth of problems identified in the Glenbrook Inquiry reports and in the interim report of this Special Commission do not occur in a vacuum. It takes many years for those deficiencies to become entrenched. The process by which deficient or poorly integrated safety management becomes part of a large organisation, such as the SRA, requires an examination of the historical circumstances leading to the present malaise. The relevant history and an outline of the current legislative regime are the subject of the next chapter.

3. History of Rail Safety Management

For reasons which will become clearer in later chapters of this report, it is not possible to divorce railway safety from general railway management. It is only by identifying what has happened in the past that recommendations for what needs to occur in the future can be placed in context.

The first feature of the New South Wales rail system which is significant is that it has, since 1855, been government owned. Although the first railways, no doubt modelled on what had occurred in the United Kingdom, were established as private companies both those companies, the Sydney Tram Road and Railway Company, which had been incorporated on 10 October 1848, and the Hunter River Railway Company, which was incorporated on 10 October 1853, found themselves in difficulties by 1854, resulting in a select committee of the Legislative Council reporting to Parliament that "private companies cannot succeed in constructing railways without government upon a scale which ought not to be conceded" and recommended that "these important works should be undertaken by the government".

The select committee of the Legislative Council recommended that the properties of both the Sydney Tram Road and Railway Company and the Hunter River Railway Company be purchased by the government and the Railways Act 1854 gave the government power to purchase that property. The companies passed the necessary resolutions and the property of the Hunter River Railway Company was transferred on 30 July 1855 and that of the Sydney Railway Company on 3 September 1855. From these dates, the railways became government property. They have remained so under different administrative structures to the present day.

The Railways Act 1854 provided for three Commissioners for Railways, one of whom was to be the Chief Commissioner, to constitute a body corporate known as The Commissioners for Railways. Only the Chief Commissioner drew a salary, the others serving in an honorary capacity. In January 1855 three Commissioners were appointed.

On 26 September 1855, the Sydney to Parramatta railway, which was the first railway in New South Wales, was opened. This was just 25 years after the first railway in England, from Liverpool to Manchester, was opened on 16 September 1830. The railway between Newcastle and East Maitland was opened on 11 April 1857.

The Government Railways Act 1858 substituted for the three Commissioners a single Commissioner for Railways and provided that the latter was to be a corporation sole known as The Commissioner for Railways. The Act commenced on 1 December 1858 and Captain Martindale became the first such Commissioner. The relevant legislation subjected him to "such regulations as shall from time to time be made by the Governor, with the advice of the [Executive] Council". For the next three decades railways were controlled by a single Commissioner for Railways.

In addition to the office of Chief Commissioner for Railways, Captain Martindale performed the duties of Commissioner for Roads and Superintendent of Electric Telegraphs and, in early 1859, the three positions were consolidated into one with the title Commissioner for Internal Communication.

Later, when the Department of Lands and Public Works was divided, in October 1859, Captain Martindale became Under-Secretary for Public Works and the office of Commissioner for Internal Communication was abolished. He continued as Commissioner for Railways, which office carried no separate remuneration, and the railways became located in the Department of Public Works, which was not to Captain Martindale's liking. He resigned by letter dated 20 October 1860, but remained in both offices until January 1861, when he returned to England.

Mr Charles Goodchap was appointed Commissioner for Railways in January 1878 when the offices of Under-Secretary for Public Works and Commissioner for Railways were separated. From *The History of Railways in New South Wales 1855-1955*, it appears that the next very significant reforms in the structure of the management of the rail network, which occurred in 1888, were precipitated by the events during the previous decade:

> It had become obvious during the administration of Mr Goodchap that politics were playing too dominant a part in the management of the railways. Goodchap, who had succeeded Rae as Commissioner in 1878, was baulked at every turn by political interference. The ordinary necessities of railway maintenance were denied him by irresponsible and incapable politicians, and it had become the practice to make alterations in the rates and train running times on political grounds rather than to meet legitimate traffic requirements. Any attempts at administrative reforms were thwarted by lack of finance and it was only too clear that there was urgent need for drastic overhaul of the Department.
>
> This untenable situation was recognised by Mr William Lyne, the Secretary for Public Works, who in August 1886 introduced a Bill in the Legislative Assembly providing for the appointment of three independent Railway Commissioners. However, he was accused by several Members of aspiring to the position of Chief Commissioner himself and he withdrew the Bill.
>
> Then, in January 1887, there was a change in the Government and the Premier, Sir Henry Parkes, fully recognised that unless the railway administration were made safe from political interference the whole system would collapse.
>
> Parkes was tired of the importunate demands of politicians soliciting jobs on the railways for relatives, and attempts to secure political interference with every petty act of administration. He realised that the problem could only be met if the Railway Commissioners enjoyed some measure of independence from interference in day-to-day management.
>
> He therefore introduced a Railway Bill which, after lengthy debates, was passed by both Houses of Parliament and came into operation on 22 October 1888.

The Government Railways Act 1888 established a new Department of Railways, independent of the Department of Public Works. The office of Commissioner was abolished and three Commissioners were appointed for a term of seven years, one of whom was the Chief Commissioner. Together, they constituted a body corporate known as The Railway Commissioners of New South Wales. Whilst responsibility for repair and maintenance of all

tracks and all decisions on the position, character and "suitableness" of all stations, station platforms, gate-houses, station-yards, sheds, piers, wharves and jetties was vested in the said Commissioners, the survey and construction of all new lines remained the responsibility of the Department of Public Works. This divided responsibility continued until January 1917, when all these functions were transferred to the Department of Railways. The Government Railways (Amendment) Act 1916 provided that the Commissioners were to be the Constructing Authority, within the meaning of the Public Works Act 1912, for all railway lines.

Mr E.M.G. Eddy held the office of Chief Commissioner from 1888 until his death, at the age of 46, in 1897. Early in that period, the Government increased its investment in the railways. The government granted the Commissioners the sum of £1,000,000, to be repaid in yearly instalments of £75,000 each, to enable them to carry out proposals for the reduction of gradients, the strengthening of the permanent way generally, the improvement of the rolling stock and the replacement of timber bridges by more permanent structures of steel, iron or brick.

Following the death of Mr Eddy and the appointment of one of his Assistant Commissioners as Chief Commissioner, relations between the three Commissioners deteriorated and a Royal Commission was established in 1905 to investigate and report. The report of the Royal Commission lead to the Railways Commissioners' Appointment Act 1906, which concentrated the authority to administer the railways in the Chief Commissioner, who was to be a body corporate with the name Chief Commissioner for Railways and Tramways. The Assistant Commissioner for Railways was to assist, and be under the control of, the Chief Commissioner.

The Government Railways (Amendment) Act 1916 provided for a Chief Railway Commissioner and three Assistant Railway Commissioners and for authority to administer the railways to be vested in all the Commissioners as a body corporate, which was known as The Railway Commissioners for New South Wales, and not in the Chief Commissioner alone. The Act also provided for the appointment of one of the Assistant Railway Commissioners as Deputy Chief Railway Commissioner. Whilst all Commissioners, including a Deputy Chief Railway Commissioner, were appointed in January 1917, when the person holding the office of Deputy Chief Railway Commissioner died in August 1918, the vacancy was not filled and three Commissioners continued to control the railways.

On 26 May 1924, Sir Sam Fay and Sir Vincent Raven were appointed pursuant to the provisions of the Royal Commissions Act 1923 "to enquire into the management, equipment, and general working including the finance, administration, control and economy of the Railway and Tramway Services in New South Wales, and more particularly:

> The organisation and running of the passenger and goods traffic, the services rendered, the scale of fares and freights operating, and the financial returns.
>
> Matters appertaining to the organisation and conduct of the Mechanical Section of the system in relation to the respective types of locomotives and rolling stock adopted, cost, economy of life and use, equipment, renewal and maintenance charges.

> Matters relating to the construction, renewal and maintenance of the permanent way, including station equipment and the systems of signalling and interlocking adopted.

The appointment of the Royal Commission was announced by the then Premier on 22 December 1923, as the result of discussions in the Legislative Assembly on railway administration generally, including the re-appointment or otherwise of the then Railway Commissioners. The Royal Commission recommended that there be a Chief Railway Commissioner, a Financial Assistant Commissioner, a Power Assistant Commissioner, a Tramway Assistant Commissioner and three Area Assistant Commissioners.

Following the report of the Fay-Raven Royal Commission, the Government Railways (Amendment) Act 1924, provided for the appointment of a Chief Railway Commissioner for New South Wales, two Assistant Railway Commissioners for New South Wales and four Area Commissioners. The Chief Commissioner and the two Assistant Commissioners were to be appointed by the Governor for a term of seven years. This form of administration commenced on 1 January 1925.

The Government Railways and Main Roads (Amendment) Act 1931 provided that, from 1 January 1932, the office of Assistant Commissioner was deemed to have been abolished and that the authority of the Railway Commissioners to administer the railways was to be exercised by the Chief Railway Commissioner for New South Wales.

This form of administration lasted only three months. The Ministry of Transport Act 1932 created the office of Minister of Transport and also created a Department of Transport. The Act provided for the division of the department into nine branches, including the Railway and Tramway Transportation Branch. The Act constituted a Board of Commissioners, being a body corporate named The Transport Commissioners of New South Wales, comprising a Chief Transport Commissioner and seven Transport Commissioners. Each branch of the Department of Transport was headed by a Transport Commissioner, one of whom was in charge of the Railway and Tramway Transportation Branch and responsible to the Chief Transport Commissioner.

The Railway and Tramway Transportation Branch controlled traffic operations of railways and tramways. The Power and Mechanical Branch controlled locomotive power, rolling stock, workshops, electrical, steam and other power operations. The Way and Works Branch controlled construction and maintenance of, among other things, railways, signalling equipment and buildings. The Commercial Branch controlled freight and passenger traffic, real estate interests and the sale of spirituous and other liquors. There were also Finance, Staff and Legal Branches and the Secretary to the Board of Commissioners who controlled, among other things, advertising, publicity and investigations.

This form of administration lasted only nine months. It was abolished by the Transport (Division of Functions) Act 1932 which created a Ministry of Transport, divided into three Departments including the Department of Railways administered by the Commissioner for Railways. The Commissioner for Railways was a body corporate and was appointed by the Governor to hold office for a period of seven years. The Act also contained power to appoint an Assistant Commissioner for Railways.

The next major structural change occurred some 40 years later when the Public Transport Commission Act 1972 constituted the Public Transport Commission of New South Wales as a corporation and dissolved the body corporate constituted under the name of the Commissioner for Railways. Five Commissioners were to be appointed by the Governor, two of whom were to be appointed on the nomination of the Minister. One of the full-time Commissioners was to be appointed as the Chief Commissioner. The full-time Commissioners were to hold office for a term not exceeding seven years and the nominated Commissioners were to hold office for a term not exceeding three years. The Act also provided that the Public Transport Commission was subject to the control and direction of the Minister.

The Transport Authorities Act 1980 constituted as corporations the State Rail Authority of New South Wales, the Urban Transport Authority of New South Wales (with functions relating to omnibus and ferry services, taxi-cabs and private hire cars) and the Railway Workshops Board of New South Wales, and dissolved the Public Transport Commission of New South Wales. The State Rail Authority of New South Wales was constituted as a corporation consisting of seven members, four of whom were to be ex officio members and three of whom were to be appointed. The ex officio members were to be the Chief Executive of the State Rail Authority, the two Deputy Chief Executives of the State Rail Authority and the Managing Director of the Urban Transport Authority. One of the Deputy Chief Executives was to be appointed Deputy Chief Executive (Industrial Relations). The appointed members were to be appointed by the Minister and, of them, one was to be appointed as Chairman of the State Rail Authority, one was to be elected as prescribed and one was to be appointed from a panel of not less than three persons nominated by the Labour Council of New South Wales.

The State Rail Authority had and could exercise the functions conferred or imposed on it by or under the Transport Authorities Act 1980, the Government Railways Act 1912 and any other Act. It also had and could exercise the functions other than ferry services, previously exercisable by the Public Transport Commission, except those conferred or imposed on the new Urban Transport Authority, created by the Transport Authorities Act 1980.

The Transport Administration Act 1988 reconstituted the State Rail Authority of New South Wales as a corporation to operate both railway passenger services and freight railway services. The Act constituted a State Rail Authority Board consisting of the Chief Executive of the State Rail Authority and not less than four and not more than seven members appointed by the Minister. The Minister was authorised to give the State Rail Authority Board written directions in relation to the exercise of its functions. The State Rail Authority was to supply the Minister with information relating to its activities as required by the Minister and to keep the Minister informed of the general conduct of its activities and of any significant development in its activities. Finally, the State Rail Authority was required to prepare and deliver to the Minister a draft corporate plan for each financial year and to consider the Minister's comments thereon.

Rail Safety Act 1993

The object of the Rail Safety Act 1993 was to promote the safe construction, operation and maintenance of railways. The 1993 Act, was the first attempt in any Australian jurisdiction to legislate comprehensively in relation to rail safety. Prior to this, the State Rail Authority had a general statutory duty under the Transport Administration Act for the safety of the rail

network. The Rail Safety Act provided for the safe construction, operation and maintenance of railways by at least three means. First, the Act provided for the establishment of a scheme for the accreditation of owners and operators of railways and for the certification of the competency of railway employees performing railway safety work. Secondly, the Act provided for the development and monitoring of safety performance standards for and with respect to the safe construction, operation and maintenance of railways. Thirdly, the Act provided for the carrying out of regular safety compliance inspections, the reporting of notifiable occurrences, the holding of inquiries into railway accidents and other incidents, and the adoption of other measures aimed at securing rail safety.

The Rail Safety Act 1993 provided to the effect that the purpose of accreditation was to attest, first, the fitness and competency of accredited owners to safely construct and maintain infrastructure and of accredited operators to safely operate railways and construct and maintain rolling stock; and secondly, that the standards proposed by accredited persons for such construction, operation and maintenance had been accepted by the Director General of the Department of Transport as regulator.

The 1993 Act also provided to the effect that applicants for accreditation were required to provide the Director General with the information necessary to enable their applications to be determined, to submit comprehensive safety management plans in relation to their proposed railway operations and, if they were accredited, to revise the plans annually. Applicants were also required to demonstrate their competency and capacity to safely construct, operate and maintain railways to the satisfaction of the Director General.

The Rail Safety Act 1993 also made it an offence for the owner or operator of a railway to employ, or enter into a contract with, a person to perform rail safety work who did not hold an appropriate certificate of competency. The purpose of certification was to attest, first, the health and fitness of the person certified to perform rail safety work; and secondly, that the person certified had sufficient responsibility and aptitude to perform the applicable railway safety work in accordance with standards submitted by the accredited owner or operator and accepted by the Director General.

Finally, the Rail Safety Act 1993 provided to the effect that the Director General was to cause safety compliance inspections to be carried out, not less than once every 12 months, of first, the track, other infrastructure and rolling stock; secondly, the construction, operation and maintenance of railways; and thirdly, the performance of railway employees, to ensure compliance with the terms of accreditations. The Director General could also require an accredited person to carry out remedial safety work. Accredited persons were required to provide the Director General with information, when requested, concerning measures taken by them to promote rail safety and to provide an annual safety report concerning their railway safety activities. In addition, accredited persons were required to report notifiable occurrences to the Director General in a specified manner and time. These included occurrences directly affecting persons and those affecting infrastructure or rolling stock.

Under the provisions of the Rail Safety Act 1993, accredited persons were required to inquire into, and report to the Director General on, any railway accident or other incident that may affect the safe construction, operation or maintenance of a railway. The Minister of Transport could also require the Director General or a person or body nominated by the Minister to inquire into and report on any such accident or incident.

Accredited persons were required by the Rail Safety Act 1993 to ensure that railway employees performing railway safety work were adequately trained for, and were of appropriate health and fitness to perform, the work for which they were certified. The Act also made it a condition of accreditation that an accredited person must ensure that all railway employees employed, or contracted, by the person to perform railway safety work are not under the influence of alcohol or other drugs when about to carry out, or while carrying out, railway safety work. The Director General was empowered to arrange, at any time, with accredited persons for the random testing of any person carrying out railway safety work on railways owned or operated by those persons for the presence of alcohol or any other drug, to ensure that accredited persons were complying with the terms of their accreditations. Provision was made in Schedule 2 to the Act for the testing of railway employees for the presence of alcohol and other drugs.

Finally, the Director General could direct accredited persons to install, within a specified time, protective or safety devices on infrastructure or rolling stock owned or operated by them. The Director General could also direct an accredited person to close any level crossing, bridge or other structure for crossing or passing over or under a railway.

The rail safety initiatives contained in the Rail Safety Act 1993 may have led to a much safer outcome on the New South Wales rail system had it not been for the changes that occurred in 1996. The restructuring of the railways which occurred in 1996 had a profound effect on both the safety and efficiency of the operation of railways in this State. For this reason it is worth identifying what occurred during that time and what effect this had.

Disaggregation and restructuring of the railways in 1996

Prior to 1 July 1996, the State Rail Authority was a vertically integrated rail organisation within one statutory authority that was divided into four divisions, all of which reported to a single Chief Executive Officer and Board. The divisions of the organisation were CityRail, CountryLink, FreightRail and a Property Division.

CityRail operated the suburban and intercity passenger train services throughout Sydney, as well as in Wollongong, Newcastle, the Southern Highlands and west across the Blue Mountains, as far as Lithgow. It maintained 1,700 kilometres of electrified track and its associated infrastructure and 60 kilometres of non-electrified track. It was responsible for train control and signalling functions covering the metropolitan area.

CountryLink operated long distance passenger services to intrastate and interstate destinations. FreightRail operated freight services. It maintained 7,469 kilometres of track and infrastructure outside the metropolitan area, as well as major freight terminals in metropolitan and country centres. FreightRail also managed the train control and signalling functions outside the metropolitan area.

The Property Division managed all property owned by the State Rail Authority. Safety responsibilities were undertaken by the different divisions but were still subject to centralised management and co-ordination.

On 11 April 1995, the New South Wales Government became a signatory to the National Competition Policy Agreement, which was designed to implement the recommendations of the Hilmer Report on microeconomic reform. Subsequently, New South Wales enacted the

Competition Policy Reform (New South Wales) Act 1995, which, among other things, applied certain laws of the Commonwealth relating to competition policy as laws of New South Wales.

Two elements of the National Competition Policy Agreement are of direct relevance to the restructure of the New South Wales Government railways. First, it required that public monopolies be stripped of any regulatory functions prior to being exposed to competition. Secondly, that a regime be established to enable third party access to significant government owned infrastructure facilities.

The first of these requirements had already been addressed in New South Wales by the passage of the Rail Safety Act 1993. This Act removed the general power of the State Rail Authority to regulate the safety of other operators on its track and established a safety regulatory regime administered by the Director General of the Department of Transport.

It was the second requirement of the National Competition Policy Agreement that provided the impetus for the major restructure of the State Rail Authority which was effected by the Transport Administration Amendment (Rail Corporatisation and Restructuring) Act 1996. In his second reading speech when introducing the Bill for this Act into Parliament, the then Minister for Transport, the Hon. B. Langton, said:

> Our reforms are the fullest response yet by an Australian State Government to the Competition Principles Agreement between the Commonwealth and the States.

The second reading speech and subsequent debate in the Legislative Assembly when the Transport Administration Amendment (Rail Corporatisation and Restructuring) Bill was introduced demonstrate that both the Government and the Opposition supported the restructure and provide an insight into the expectations that both sides of the Parliament had for the outcome.

The Minister for Transport commenced his second reading speech for the Bill with the following words:

> This Bill represents the most profound reform to rail system management ever undertaken in Australia. Indeed, it establishes principles which are the equal, and possibly in advance, of railway management practices anywhere in the world.

In his concluding remarks, Mr Langton said:

> In summary, this Bill introduces reforms which will revolutionise the service quality and the cost effectiveness of the New South Wales rail industry. Separating train operations from infrastructure management will dramatically improve the services of the State's passenger and freight operations, and put the management of the track on a fully commercial footing aimed at ensuring that rail infrastructure facilities meet the users' needs…

> This Bill will meet all of New South Wales' obligations in respect of the Competition Principles Agreement and will ensure a rail regime that is superior to other States on all counts.

There was bipartisan support for the Bill during the second reading debate. Mr M. Photios, the then Shadow Minister for Transport, spoke on behalf of the Opposition in the Legislative Assembly and made this clear in the following statement:

> There is bipartisan support in this State for this important legislative train work, which will facilitate better business practices, a commercialised approach to the provision of transport services and greater specialisation.

Mr Photios also made it clear that he considered the Bill to be a product of the policies of both sides of the Parliament. He stated:

> The Opposition generally supports the principles and the thrust of the Transport Administration Amendment (Rail Corporatisation and Restructuring) Bill. The Bill goes someway towards achieving the objectives of the former coalition Government and follows much of the work achieved by the previous Minister, Bruce Baird, the previous board of the State Rail Authority and government agencies generally.

He also later stated:

> In effect, the Baird-Egan model – a unique marriage from one government to the next – has come to pass in this Bill…
>
> Essentially the Bill will bring together coalition policy on a continuing basis, implemented by the current Government.

Neither the Government's nor the Opposition's expectations for a significantly improved railway industry was realised.

Under sections 19C and 19D of the Transport Administration Amendment (Rail Corporatisation and Restructuring) Act 1996, Rail Access Corporation (hereafter referred to as RAC) was constituted as a State owned corporation under the State Owned Corporations Act 1989, with power to hold, manage and establish efficient, safe and reliable infrastructure facilities, and to promote and facilitate access to the New South Wales rail network in accordance with the New South Wales Rail Access Regime. Rail infrastructure facilities were defined under section 19A(1)(a) to include railway track, associated track structures, cuttings, drainage works, track support earthworks, tunnels, bridges, level crossings, signalling systems, train control systems, communications systems and overhead power supplying systems.

FreightRail Corporation was constituted by section 19G as a State owned corporation. One of its principal objects under section 19H(1) was to operate efficient, safe and reliable freight rail services.

The Railway Services Authority was constituted by section 19U. The principal objectives of RSA included to be an efficient, safe and reliable supplier of goods and provider of services

to the rail industry in New South Wales. The RSA was later made a State owned corporation pursuant to the State Owned Corporations Act 1989 by the Transport Administration Amendment (Rail Services Authority Corporatisation) Act 1998, and became known as Rail Services Australia (hereafter referred to as RSA).

Section 4 of the 1996 Act constituted the State Rail Authority (hereafter referred to as SRA) and its principal objectives included to operate efficient, safe and reliable railway passenger services. Under section 7A of the 1996 Act, the operation of the railway service by the SRA was made subject to the requirements of the Rail Safety Act 1993.

The effect of the 1996 restructure was to alter the structure of the government rail industry from a single vertically integrated statutory authority, into a horizontal structure with the following features. First, RAC became the owner of the rail infrastructure with the objectives and functions above stated. Secondly, the former State Rail Authority was reconstituted as a passenger service organisation, by vesting the infrastructure assets previously owned by the former State Rail Authority in RAC and by transferring the maintenance responsibilities in respect of the track previously owned by the former State Rail Authority to RSA.

In other words, the first of the 1996 reforms was to create two State owned corporations, RAC and FreightCorp and two statutory authorities, the SRA and RSA. With the subsequent corporatisation of RSA in 1998, the SRA was the only part of the railway which was not corporatised. In outlining the anticipated benefits to be derived from the restructure in the second reading speech, the Hon. B. Langton stated:

> The State Rail Authority will retain its identity but will shed its infrastructure management, track maintenance and freight activities. It will become a specialist passenger train operator through its CityRail and CountryLink divisions. This means that the State Rail Authority will be able to concentrate on the delivery of high quality, efficient and value-for-money passenger services without having to concern itself with track maintenance, infrastructure, project management and other related issues. These will be matters for the Rail Access Corporation and the Railway Services Authority. From July, the State Rail Authority will be free to press for improvements to the system as a customer, rather than as an infrastructure provider which also has an obligation to run trains.

In relation to RAC the Minister said:

> To perform its functions effectively, the Rail Access Corporation will develop and maintain an informed customer capability: it will understand and specify its needs and verify that they are being adequately provided by its suppliers, but it will not undertake such works itself – to do so would be to distract the management of the corporation from the more important task of administering the open access regime.

Competition was to be introduced into the maintenance of the rail infrastructure. Initially, RSA would provide exclusive maintenance services, and subsequently, it would have to compete with other contractors for the work of maintaining the rail infrastructure. In the words of the then Minister for Transport:

> The Railway Services Authority will be made up of the State Rail Authority's existing railway services group, which operates rolling stock maintenance workshops as well as specialist trackwork services, together with track maintenance divisions of CityRail and Freight Rail, and the capital works project management group from the State Rail Authority's head office. It will commence operations with contracts for the main part of the Rail Access Corporation's infrastructure maintenance and construction work as well as a range of rolling stock overhaul and repair work for the State Rail Authority and the Freight Rail Corporation. Over a four year period, this business will progressively be made contestable. Railway services will carry out such work as it is contracted to do by its clients. For the Railway Services Authority to compete on an equal basis with the private sector, it will need the same freedom to pursue work beyond the New South Wales rail sector. Plus it will also be allowed to bid for work from outside New South Wales and from outside the rail industry.

None of the intended outcomes of the restructure eventuated for the RAC, the RSA or the SRA.

The Public Sector Management (Office of Co-ordinator General of Rail) Order 2000 was published in a special supplement to the Government Gazette on 9 June 2000. It provided for the establishment of the Office of Co-ordinator General of Rail, as a department of the Public Service responsible to the Minister for Transport. The same special supplement to the Government Gazette of 9 June 2000 appointed Ronald David Christie as the Co-ordinator General of Rail. The Government Gazette of 23 June 2000 contained notices under the State Owned Corporations Act 1989 by the then Minister for Transport confirming that on 7 June 2000 he gave directions to the Board of the Rail Access Corporation and Rail Services Australia. The directions required the respective Boards, in general terms, to both implement the decisions and instructions of Mr Christie as to the exercise of the functions of each respective rail entity under the Transport Administration Act 1988, and to specifically direct the Chief Executive Officer of each respective rail entity to implement the decisions and instructions of Mr Christie as to the exercise of the functions of each of the respective rail entities under the Transport Administration Act 1988, in the day-to-day management of their operation. Both the respective Boards were directed to provide Mr Christie with such information, resources and other assistance as he may require in reviewing the effectiveness of existing contractual arrangements between the RAC, the SRA and RSA in achieving reliable service standards for CityRail services and to specifically direct the Chief Executive Officer of each of the respective rail entities to do the same. Each direction was expressed to require such steps to be taken for a period of 12 months or until the Minister informed the relevant Board that the direction no longer applied, whichever first occurred.

Second interim report of the Special Commission of Inquiry into the Glenbrook Rail Accident

The second interim report of the Special Commission of Inquiry into the Glenbrook Rail Accident was delivered on 1 November 2000. It contained the following recommendations:

> 1. That the infrastructure owner RAC and the infrastructure maintainer RSA cease to be State owned corporations and that their property and

functions be merged into a single statutory authority, to be known as the Rail Infrastructure Authority, responsible to the Minister for Transport.

2. That savings and transitional provisions be included in the legislation to ensure that any existing contractual obligations of either RAC or RSA be performed.

3. That SRA be responsible for the control and management of timetabling and train movements and other functions of network control within the area of operation of the present CityRail network.

4. That the Rail Infrastructure Authority be responsible for network control in all areas of New South Wales other than those controlled by SRA.

5. To establish an Office of the Rail Regulator.

6. That if the Minister has an Advisory Board it would have a membership consisting of a range of representatives from users of the rail network, including passenger and freight operator representatives, to advise the Minister in relation to transitional issues and the efficiency and reliability of the rail system.

7. To formally establish the Office of the Co-ordinator General of Rail and to enable the Co-ordinator General of Rail to carry out the following functions:

   (i) examine and assess the ramifications of any structural change for all levels of operation of the New South Wales railways prior to any change being implemented and to manage those changes so that the level of safety is not reduced;

   (ii) manage required organisational changes to SRA to facilitate a proper customer focus; and

   (iii) manage the merger of RAC and RSA into the Rail Infrastructure Authority to facilitate improved asset management.

8. That the Office of the Co-ordinator General of Rail cease to exist at the end of [the] transitional period identified in recommendation 7 above and any relevant functions concerning the ongoing regulation of rail be transferred to the Office of the Rail Regulator, the Rail Safety Inspectorate and the Rail Accident Investigation Board respectively.

9. To establish a Rail Safety Inspectorate.

10. That responsibility for safety regulation in the rail industry be transferred from the Transport Safety Bureau within the Department of Transport to a Rail Safety Inspectorate.

11. To establish a Rail Accident Investigation Board.

12. That responsibility for rail accident investigation be transferred from the Transport Safety Bureau within the Department of Transport to a Rail Accident Investigation Board.

13. That the Department of Transport retain its function of transport policy development, co-ordination of public transport services of rail, bus and road transport and other functions related to ensuring that transportation needs meet the growing and changing needs of different geographical areas within New South Wales.

14. That pending the delivery of the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident, the safety regulatory function and accident investigation function should continue to be the responsibility of the Transport Safety Bureau within the Department of Transport.

15. That development of the legislation dealing with the establishment of a Rail Safety Inspectorate and a Rail Accident Investigation Board not be commenced until after the delivery of the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident.

Transport Administration Amendment (Rail Management) Act 2000

The final report of the Special Commission of Inquiry into the Glenbrook Rail Accident was delivered on 11 April 2001. Notwithstanding this and recommendation 15 above, the second reading speech for the Transport Administration Amendment (Rail Management) Bill was delivered on 15 November 2000 by the Minister for Transport, Mr C. Scully. The Transport Administration Amendment (Rail Management) Act 2000 was assented to on 6 December 2000.

Schedule 1 to the Transport Administration Amendment (Rail Management) Act 2000 confirmed and clarified the role of the Co-ordinator General of Rail until the establishment of a proposed Rail Regulator. The Co-ordinator General of Rail was given functions to manage and co-ordinate the exercise of the functions of the SRA, and RAC and RSA and, after their merger, Rail Infrastructure Corporation (hereafter referred to as RIC). Further, the Co-ordinator General of Rail was given the function to determine priorities for the exercise of functions by these rail entities in accordance with their approved financial outcomes. The Co-ordinator General of Rail was also given the function to manage and co-ordinate the merger of RAC and RSA and the implementation of structural reforms in connection with the management of the SRA. The Co-ordinator General of Rail was also given functions to develop rail performance standards in connection with the exercise of functions by the said rail entities and to conduct, with the Director General of the Department of Transport, a joint review and report on the effectiveness of the Transport Safety Bureau within the Department as a Rail Safety Regulator. The Co-ordinator General of Rail was given the power to give directions to the said rail entities, including a direction to provide information, resources or other assistance to the Co-ordinator General of rail.

The Transport Administration Amendment (Rail Management) Act 2000 also amalgamated RAC and RSA to form Rail Infrastructure Corporation, a State owned corporation. The principal objective of Rail Infrastructure Corporation was stated in the legislation to be to

ensure that the New South Wales rail network enables safe and reliable passenger and freight services to be provided in an efficient, effective and financially responsible manner. The other objectives of Rail Infrastructure Corporation included to be a successful business and, to that end, to operate at least as efficiently as any comparable businesses and to maximise the net worth of the State's investment in it.

The principal functions of Rail Infrastructure Corporation were stated in the Transport Administration Amendment (Rail Management) Act 2000 to be first, to hold, manage, maintain and establish rail infrastructure facilities on behalf of the State, and secondly, to provide persons with access to the New South Wales rail network under the New South Wales Rail Access Regime, including the development and maintenance of an excess pricing policy. The legislation empowered the Minister for Transport to give Rail Infrastructure Corporation directions in relation to the exercise of its functions. Rail Infrastructure Corporation was prohibited by the legislation from conducting any business outside the State that was not related to the New South Wales rail network without the approval of the Premier, Minister for Transport and Treasurer.

The Transport Administration Amendment (Rail Management) Act 2000 also provided to the effect that the Minister for Transport may, by order published in the Gazette, designate a rail operator as the body responsible for network control, or any specified aspect of network control, with respect to any specified part of the New South Wales rail network. Rail Infrastructure Corporation, the Act provided, was to be responsible for network control with respect to any part of the New South Wales rail network for which no rail operator was designated as the body responsible by such an order. Network control was defined to be both service planning, that is the timetabling of rolling stock, including standard working and daily timetables, and planning the occupation of railway track for maintenance and other service requirements; and real time control, that is the actual control of the movement of rolling stock, including train signalling and incident management.

The Transport Administration Amendment (Rail Management) Act 2000 also made changes to the management of the SRA. The principal objective of the State Rail Authority was stated to be to deliver safe and reliable railway passenger services in New South Wales in an efficient, effective and financially responsible manner. Its other objectives included to be a successful business and, to that end, operate at least as efficiently as any comparable businesses and to maximise the net worth of the State's investment in it.

The Transport Administration Amendment (Rail Management) Act 2000 also expressly provided that the SRA and its Board and Chief Executive were, in the exercise of their functions, subject to the control and direction of the Minister for Transport.

Finally, the Transport Administration Amendment (Rail Management) Act 2000 also provided for the constitution of a corporation with the corporate name of the Rail Regulator. None of the provisions relating to the Rail Regulator was ever proclaimed to commence and hence they did not come into force. Indeed, the whole Act, including the uncommenced provisions relating to the Rail Regulator, was ultimately repealed by the Transport Legislation Amendment (Safety and Reliability) Act 2003.

Final report of the Special Commission of Inquiry into the Glenbrook Rail Accident

The final report of the Special Commission of Inquiry into the Glenbrook Rail Accident was delivered on 11 April 2001. Among its recommendations were the following:

41. There should be random breath testing by authorised officers of the Rail Safety Inspectorate of railway employees engaged in safety critical work.

42. There should be drug testing of railway employees involved in an accident or incident.

…

46. The primary function of the Rail Safety Inspectorate should be the accreditation of rail organisations in New South Wales.

47. The Rail Safety Inspectorate should refuse accreditation to any organisation unless it is satisfied, in addition to any other matters, that:

    (i) It has a rigorous and robust safety management system which conforms to the highest international standards of safety management and practice.

    (ii) It has an effective safety management plan for the implementation, monitoring and ongoing improvement of its safety management systems.

    (iii) The members of the board, the Chief Executive Officer and all other officers holding senior managerial positions consider the safety of the organisation's activities as its first priority.

    (iv) It has an effective system for identifying safety risks in its operations and has effective mechanisms for controlling those risks, monitoring the effectiveness of the controls, and adjusting the controls accordingly.

    (v) It has an effective system for determining the priority of activities for removing, reducing or controlling particular risks.

    (vi) It has the resources, including sufficient numbers of employees, to ensure that the safety of rail operations can be maintained under any circumstance.

48. The Rail Safety Inspectorate should be required to make public all notices of accreditation issued by it.

49. The Rail Safety Inspectorate should have the responsibility to ensure that each accredited rail organisation complies with its accreditation and any conditions and restrictions specified in the accreditation.

50. The Rail Safety Inspectorate should be given the power to impose a range of sanctions, including prosecution of individual board members, chief executive officers and the accredited organisations, to enforce compliance with the accreditation and any conditions or restrictions specified in the accreditation.

51. The Rail Safety Inspectorate should be given the power to conduct safety audits of any accredited organisation.

52. The Rail Safety Inspectorate should be given the power to inspect any person or thing which might give rise to an unsafe activity or outcome on the rail network.

53. All safety audit reports of the Rail Safety Inspectorate should be made public.

54. The Minister for Transport should be given the power to direct the Rail Safety Inspectorate to conduct a safety audit or inspection of an accredited organisation.

55. The report of any audit or inspection directed by the Minister for Transport should be made public.

56. The Rail Safety Inspectorate should be given the power to serve any accredited organisation, or any person who appears to be employed by or otherwise associated with an accredited organisation, with a written notice requiring specified action to be taken or stopped, which an authorised officer of the Rail Safety Inspectorate has reasonable cause to believe may give rise to an unsafe activity or outcome on the rail network.

57. Legislation should be introduced to make it an offence, attracting substantial penalties, for failure to comply with such a notice.

58. The Rail Safety Inspectorate should be given the power to approve any variation to an accredited organisation's safety management system, including internal structural changes, provided that the Rail Safety Inspectorate first receives a disposition statement and is satisfied that a proper safety validation process has been conducted and that the variation will not reduce the level of safety of rail operations.

59. Legislation should be introduced to make it an offence for an accredited organisation to vary the safety management system with which it obtained accreditation without the prior written approval of the Rail Safety Inspectorate.

60. The Rail Safety Inspectorate should be given the power to examine proposed appointments and existing appointments to the board and senior management positions, including that of the chief executive officer, of an accredited organisation to enable it to satisfy itself that any

such appointee or proposed appointee has an appropriate level of understanding and commitment to the safety of the rail operations in which the organisation is, or is seeking to be, involved.

61. The Rail Safety Inspectorate should be given the power, if not so satisfied, to provide a written report to that effect to the person or persons responsible for making the appointment.

62. The Rail Safety Inspectorate should be given the power to reject a safety management plan of an accredited organisation if the plan is, in the opinion of the Rail Safety Inspectorate, inadequate in any respect.

63. The Rail Safety Inspectorate should be given the power to allocate or remove the responsibility for any particular safety matter to or from an accredited organisation.

64. Authorised officers of the Rail Safety Inspectorate should be given the powers to enter upon land, including premises and rolling stock, and to require an accredited organisation or any person who appears to be or to have been engaged in any rail activity, to produce any document, including a document in electronic form, or any thing which an authorised officer reasonably believes relates to a matter which does or could affect the safety of rail operations.

65. Authorised officers of the Rail Safety Inspectorate should be given the power to require any person to provide information orally, electronically, or in writing which the authorised officer reasonably believes does or may affect the safety of rail operations.

66. The legislation should make it an offence to fail to provide the document, thing or information requested.

67. The legislation should make it an offence to provide false or misleading information.

68. The Rail Safety Inspectorate should be given the power to monitor and ensure compliance by accredited rail organisations with the recommendations made in any report of the Rail Accident Investigation Board.

69. The legislation should provide that any accredited rail organisation that is affected by any recommendation made in a report of the Rail Accident Investigation Board, within 60 days of the release of the report, inform the Rail Safety Inspectorate in writing, as to each such recommendation, whether it accepts or rejects the recommendation in whole or in part and, if rejected in whole or in part, provide written reasons for such rejection.

70. The Rail Safety Inspectorate should be given the power to require an accredited organisation to inform it in writing how it proposes to

implement a recommendation made in a report of the Rail Accident Investigation Board and the proposed timetable for its implementation.

71. The legislation should provide that in the event that the Rail Safety Inspectorate does not agree with the reasons for the rejection in whole or in part of any such recommendation or alternatively, if any such recommendation is accepted in whole or in part by the accredited organisation, but the Rail Safety Inspectorate considers that the proposed remedial action is either not to be carried out in a timely manner or is inadequate, then the Rail Safety Inspectorate should have the power to direct that the remedial action be concluded within such time and in such manner as the Rail Safety Inspectorate may specify in writing and the accredited organisation should be required to comply with such direction.

72. The legislation should provide that the Minister for Transport may, by written notice to the accredited organisation, and the Rail Safety Inspectorate, extend the time for completion of the remedial action and, if such extension is granted, the Minister must provide written reasons for extending the time.

73. The legislation should provide that the Rail Safety Inspectorate give written reasons to the Minister for Transport for any action or failure to take action against an accredited rail organisation in relation to any non-compliance by that accredited rail organisation with the terms of its accreditation or with any recommendation contained in an investigation report of the Rail Accident Investigation Board.

74. The legislation should provide that all notices or correspondence passing between the Rail Safety Inspectorate, the Minister and an accredited rail organisation relating to any recommendation contained in a report of the Rail Accident Investigation Board be made public.

75. The Rail Safety Inspectorate should be provided with the necessary funding to retain experts, including specialists in engineering, organisational safety, statistical analysis and human factors, and to employ or retain legal officers and to otherwise finance its activities.

76. The Rail Safety Inspectorate should be within the Department of Transport.

77. The legislation whereby the Rail Safety Inspectorate is created should provide for its independence from ministerial control.

78. The legislation whereby the Rail Safety Inspectorate is created should provide for its independence from and paramountcy over the Office of the Rail Regulator created by the Transport Administration Amendment (Rail Management) 2000.

79. A project team should be established within the Rail Safety Inspectorate, over and above its normal staff establishment, for the specific purpose of

> ensuring that the recommendations in this final report are implemented by each relevant accredited organisation and that the Rail Safety Inspectorate should report in writing to the Minister for Transport at not less than six monthly intervals regarding the implementation of these recommendations and all such reports should be made public.

Rail Safety Act 2002

The then Minister for Transport, The Hon. C. Scully, in his second reading speech on 31 October 2002 for the Rail Safety Bill, said that the Bill "enacts the Government's response to Justice McInerney's report". There was bipartisan support for the Bill during the second reading debate. Mr P. Debnam, the then Shadow Minister for Transport, spoke on behalf of the Opposition in the Legislative Assembly. Mr Debnam proceeded to say:

> This month the Government introduced this long overdue, updated rail safety legislation. However, as I said at the outset, it does not provide real independence for the Rail Safety Regulator or for the rail accident investigation panel. A Coalition Government will amend the legislation immediately after the State election.

The Rail Safety Act 2002, which commenced on 8 February 2003, like the Rail Safety Act 1993 which it repealed, required operators of railways to be accredited. The Act stated the purpose of accreditation to be to attest, among other things, that the system submitted by the accredited person for the identification, management and control of the risks of carrying out railway operations had been accepted by the Director General of the Department of Transport and that the accredited person had demonstrated, to the degree and in the manner required by the Director General, the competency and capacity to implement the said systems. The system submitted by a person seeking accreditation was required to relate to: the identification and analysis of risks associated with the design of the railway and the carrying out of the railway operations for which the person was accredited; the design and implementation of controls to manage those risks; the monitoring of the controls for managing risks; and the modification of the systems in response to the monitoring of controls for managing risk.

An applicant for accreditation was also required to give to the Director General a comprehensive safety management plan. The safety management plan was required to identify any significant risks that had arisen or may arise from the carrying out of railway operations by the applicant; and to specify the controls, including audits, expertise, resources and staff, that were to be employed to manage the risks and to monitor safety outcomes in relation to those railway operations.

The Act also required an accredited person to provide an annual safety report to the Director General. The annual safety report was required to: describe and assess the safety performance of the railway operations during the preceding 12 months; to review any significant developments relating to their safety during that period; and to set out any safety initiatives proposed to be undertaken in the succeeding 12 months.

An applicant for accreditation was also required to: provide to the Director General information identifying safety interfaces between railway operations and the railway to which they related, for which the applicant was seeking accreditation and other railways or railway

operations; to give to the Director General particulars of agreements relating to the management of any such safety interfaces; and to demonstrate to the satisfaction of the Director General that appropriate safety interface agreements are or will be enforced in relation to any such safety interfaces.

An applicant for accreditation was further required to provide to the Director General, if otherwise relevant, a passenger security policy and plan. An applicant for accreditation was also required to demonstrate, to the satisfaction of the Director General, by the submission of appropriate systems, that the applicant possessed the competency and capacity to safely carry out the relevant railway operations. Applicants for accreditation were also required to demonstrate, again to the satisfaction of the Director General, that they possessed the competency and capacity to maintain in a safe condition the rolling stock used by them.

The Rail Safety Act 2002 also provided that an operator of a railway may issue certificates of competency to employees who carry out railway safety work. An operator of a railway who employs, or enters into a contract with, a person to perform railway safety work was guilty of an offence unless the person was the holder of an appropriate certificate of competency. The purpose of the issue of a certificate of competency was to attest that the person certified was considered to be of good health and fitness and in all other respects to be a fit and proper person to perform railway safety work, and was considered to have sufficient knowledge, skills, responsibility and aptitude to perform relevant railway safety work.

It was a condition of accreditation that an accredited person must ensure that all railway employees employed or contracted by the person to perform railway safety work were adequately trained to perform the functions for which they were certified. It was also a condition of accreditation that an accredited person must ensure that all railway employees employed or contracted by the person to perform railway safety work were of sufficient good health and fitness to perform the functions for which they were certified.

It was a further condition of accreditation that an accredited person must prepare and implement a drug and alcohol program for its railway employees and ensure that all those employed to perform railway safety work were not under the influence of alcohol or any other drug when about to carry out, or while on duty for the purpose of carrying out, whether or not actually carrying out, railway safety work. The program had to comply with guidelines issued by the Director General. The Director General could at any time arrange for the random testing of any person on duty for the purpose of carrying out railway safety work, for the presence of alcohol or any other drug, to ensure that the accredited person was complying with the terms of accreditation.

Finally, it was a condition of accreditation that an accredited person must prepare and implement a program for the management of fatigue, safe hours of work and periods between work for its railway employees. The program had to comply with the regulations and guidelines issued by the Director General.

The Director General could also cause inspections to be carried out to ensure that an accredited person was complying with the terms of the person's accreditation. The Director General could cause, among other things, the carrying out of railway operations by the accredited person and the performance of railway employees to be inspected. The inspections were to be carried out at such intervals as the Director General thought fit and, in the case of an accredited person who carried out railway operations principally relating to the carriage of

passengers, had to be carried out at least once every 12 months. The Director General had, if requested to do so by the Minister, to cause an inspection to be carried out.

An authorised officer could give an improvement notice to an accredited person or other person if the officer held certain specified opinions. An improvement notice could require the person to remedy the contravention and all the matters occasioning it and/or to undertake remedial safety work.

If an authorised officer was of the opinion that at any railway premises there was occurring or about to occur any activity that involved or would involve an immediate risk to the health or safety of any person, the authorised officer could give to the person who had, or may be reasonably presumed to have, control over the activity a notice prohibiting the carrying on of the activity until the matters that gave or would give rise to the risk were remedied.

The Rail Safety Act 2002 defined the expression "train safety record" to mean any or all of the following:

(a) all statements (whether oral or in writing) taken from persons by an authorised or other person for the purposes of a rail safety inquiry, including any record of any such statement;

(b) all communications (other than a train safety recording or a transcript of a train safety recording) between persons involved in the operation of a train;

(c) medical or private information regarding persons (including deceased persons) involved in an accident or incident the subject of a rail safety inquiry; and

(d) train safety recordings and transcripts of train safety recordings.

The same Act also defined the expression "train safety recording" to mean a recording consisting of, or mainly of, sounds or images or data, or any combination of sounds, images or data, produced by a device installed in a train, a signal box, a train control complex or other railway premises for the purpose of recording operational activities carried out by railway employees operating a train and other persons.

An accredited person was required to provide to the Director General information concerning measures taken by the person to promote rail safety or concerning other matters relating to rail safety that the Director General reasonably required. An accredited person was also required to submit a safety report to the Director General at such times as the Director General specified.

An accredited person was required to report to the Director General any notifiable occurrence that occurred on railway premises relating to a railway in respect of which the person was accredited. An occurrence was defined to be a notifiable occurrence if it:

(a) occurs in or on railway premises or with respect to a railway or the infrastructure of a railway; and

(b) results in or may potentially result in a derailment, a collision, a fatality, permanent or temporary incapacitating injury to any person, substantial damage to railway premises or any other property in or on railway premises or substantial damage to other property; and

(c) arises out of any of the following instances:

(i) an act or omission of a railway employee;

(ii) an act or omission by any other person;

(iii) a failure, defect or design fault in equipment on rolling stock;

(iv) a failure, defect or design fault in the infrastructure of a railway;

(v) a failure to comply with safe working procedures;

(vi) a fire or explosion;

(vii) inadequacy or failure of systems for the safe operation, construction or maintenance of a railway; or

(viii) environmental conditions.

The Director General could also require an accredited person to report to the Director General any incident of any other kind that endangered or could endanger the safe carrying on of railway operations. A condition could also be imposed on an accredited person's accreditation requiring the person to report specified incidents or kinds of incidents to the Director General.

An accredited person was required to inquire into, and report to the Director General on, any railway accident or incident that may effect the safe carrying out of railway operations for which the person was accredited.

The Director General or, at the request of the Director General, a rail investigation panel could inquire into any railway accident or incident that may affect the safe carrying out of railway operations. The Director General or Chairperson of rail investigation panels was required to provide to the Minister for Transport a report on such an inquiry. The Minister for Transport could also require the Director General or a rail investigation panel to inquire and report to the Minister on any railway accident or incident that may affect the safe carrying out of railway operations or the personal security of any railway employee or member of the public using a railway or in or on railway premises. The Chairperson of rail investigation panels could, of his or her own motion, refer a major railway accident to a rail investigation panel to inquire into and report to the Minister for Transport on the accident. The Director General was entitled to recover the reasonable costs of conducting such an inquiry as a debt due to the Crown.

The expression "major railway accident" was defined to mean a railway accident involving extensive property damage or one or more deaths, not being deaths resulting from suicide or of a trespasser. The costs were recoverable jointly or severally from any one or more

accredited persons in respect of the railway concerned. The Minister for Transport was required to lay such a report before both Houses of Parliament not later than 28 days after the Minister for Transport received the report.

The Director General and the Chairperson of rail investigation panels was each empowered to require persons to attend to answer questions or produce documents or other things. At a rail safety inquiry, the Director General or rail investigation panel conducting the inquiry was not bound by the rules of evidence, could conduct the inquiry without regard to legal forms and could inform himself or herself, itself in such manner as the person or panel thought fit.

The Rail Safety Act 2002 also contained provisions dealing with the disclosure of train safety records generally, train safety records other than train safety recordings, as well as train safety recordings. The Act provided that a train safety recording was not admissible in evidence in any civil or criminal proceedings against a railway employee. However, a party to civil proceedings could apply to the court in which the proceedings were instituted for an order that a train safety recording, or part of it, be admissible in evidence in the proceedings.

The Rail Safety Act 2002 gave to authorised officers powers of entry to, and inspection and investigations upon, railway premises, together with powers in relation to relevant documents found by an authorised officer in or on railway premises.

A person was not excused from a requirement to answer a question or produce a thing or a requirement to make a statement on the ground that the statement might tend to incriminate that person. However, the answer to the question, production of the thing, any information obtained as a direct result of the answer or production, or the statement, was not admissible in evidence against the person in criminal proceedings, if the person claimed before giving the answer, producing the thing or making the statement that it might tend to incriminate the person or unless the person's entitlement to make such a claim was drawn to the person's attention before the statement was made. Save as aforesaid, the Act provided that an answer to a question, production of a thing, any information obtained as a direct result of any such answer or production, or a statement made by a person, in compliance with a requirement under the Rail Safety Act 2002, could be used in evidence in any criminal or civil proceedings against the person.

The Rail Safety Act 2002 created a number of specific offences involving accreditation, certification and authorisation. It also provided that an accredited person who failed to install and maintain, or maintain, a system, device or appliance on a railway or rolling stock in accordance with the terms of the person's accreditation was guilty of an offence. Further, that an accredited person who failed to carry out a railway operation in accordance with any terms of the person's accreditation related to the person's safety management systems was guilty of an offence. The Act also created offences relating to the provision of false or misleading information to the Director General or any other person on behalf of the Director General for the purposes of an inquiry, or the provision in relation to an application for accreditation, or for variation of accreditation, of information, including a document, that the person knew was false or misleading in a material particular.

The Rail Safety Act 2002 also created specific offences that could be committed by directors or managers of corporations and corporations themselves.

Finally, the Rail Safety Act 2002 provided that the Minister for Transport was to review the Act to determine whether the policy objectives of the Act remained valid and whether the terms of the Act remained appropriate for securing those objectives. The Act provided that the review was to be undertaken as soon as possible after the period of five years from the date of assent to the Act and that a report of the outcome of the review was to be tabled in each House of Parliament within 12 months after the end of the period of five years.

Transport Administration Amendment (Rail Agencies) Act 2003

The long title of the Transport Administration Amendment (Rail Agencies) Act 2003 was:

> An Act with respect to the organisation of rail services in the State, the ownership of rail infrastructure facilities in the State and the constitution of new State rail agencies and the winding up and dissolution of others; and for other purposes.

Whilst the Act commenced in certain respects prior to 1 January 2004, the majority of its provisions commenced on that day, including in particular the constitution of Rail Corporation New South Wales (hereafter referred to as RailCorp), but excluding Schedule 2, which contained amendments relating to the dissolution of RIC.

The principal outcomes of the Transport Administration Amendment (Rail Agencies) Act 2003 were:

(a) to constitute RailCorp, a statutory State owned corporation, and to confer on it the rail passenger functions and other transport related functions of the SRA;

(b) to vest State rail infrastructure facilities situated within the metropolitan rail area in RailCorp instead of RIC, leaving RIC with ownership of those facilities within the country rail area;

(c) to constitute Transport Infrastructure Development Corporation (hereafter referred to as TIDC), a statutory State owned corporation, and to confer on it functions relating to the development of major railway and other major transport projects;

(d) to provide for the continuation of the SRA to exercise functions relating to its residual assets, rights and liabilities and for its dissolution at a later time;

(e) to provide for the dissolution of RIC at a later time; and

(f) to make consequential amendments and provisions of a savings and transitional nature consequent upon the Transport Administration Amendment (Rail Agencies) Act 2003.

The Minister for Transport Services, the Hon. Michael Costa, in his second reading speech on 2 December 2003 for the Transport Administration Amendment (Rail Agencies) Bill, said that under the Bill, SRA and RIC remain as entities to deal with surplus assets and liabilities,

prior to their eventual dissolution. There was bipartisan support for the Bill during the second reading debate.

The Transport Administration Amendment (Rail Agencies) Act 2003 provided that the principal objectives of RailCorp were:

(a) to deliver safe and reliable railway passenger services in New South Wales in an efficient, effective and financially responsible manner; and

(b) to ensure that the part of the NSW rail network vested in or owned by RailCorp enables safe and reliable railway passenger and freight services to be provided in an efficient, effective and financially responsible manner.

Other objectives of RailCorp included:

(c) to be a successful business and, to that end:

(i) to operate at least as efficiently as any comparable business, and

(ii) to maximise the net worth of the State's investment in the Corporation,

(d) to exhibit a sense of social responsibility by having regard to the interests of the community in which it operates.

The first function of RailCorp was stated to be to operate railway passenger services.

The board of directors of RailCorp was to consist of not fewer than three and not more than seven directors. The Chief Executive, from time to time, was to be a director. One director was to be a person recommended by a selection committee comprising two persons nominated by the Minister for Transport Services and two persons nominated by the Labour Council of New South Wales, being a person selected by the committee from a panel of three persons nominated by the Labour Council.

Under the Transport Administration Amendment (Rail Agencies) Act 2003, the Minister for Transport Services may, in addition to any power of the Minister to give directions under the State Owned Corporations Act 1989, give the board of RailCorp a written direction in relation to RailCorp's functions, if the Minister decides that this action is warranted on grounds involving urgency or public safety.

The principal objects of TIDC are to develop major railway systems and to develop other major transport projects in an efficient, effective and financially responsible manner. Its principal functions are also to develop major railway systems and to develop other major transport projects, including facilitating their development by other persons.

Transport Legislation Amendment (Safety and Reliability) Act 2003

In the second reading debate for the Transport Legislation Amendment (Safety and Reliability) Bill, the Leader of the Opposition in the Legislative Council, the Hon. Michael

Gallacher, indicated at the outset that the Coalition would not oppose what he described as "this important legislation", but would seek to amend it.

The Transport Legislation Amendment (Safety and Reliability) Act 2003 commenced on 1 January 2004. It abolished the Office of Co-ordinator General of Rail. The Act repealed the Transport Administration Amendment (Rail Management) Act 2000. The Transport Legislation Amendment (Safety and Reliability) Act 2003 was itself repealed by the Statute Law (Miscellaneous Provisions) Act 2004, however, none of the amendments it effected, relevantly, to the Transport Administration Act 1988 and the Rail Safety Act 2002 was affected by such repeal, by reason of the provisions of section 30(2) of the Interpretation Act 1987.

The principal outcomes relevant to railways of the Transport Legislation Amendment (Safety and Reliability) Act 2003 were:

(a) to constitute the Independent Transport Safety and Reliability Regulator (hereafter referred to as ITSRR) and the Independent Transport Safety and Reliability Advisory Board (hereafter referred to as the Advisory Board);

(b) to confer on ITSRR the function of accrediting railway operators and functions relating to the inspection, monitoring and auditing of the safety and reliability of train services;

(c) to confer on ITSRR the functions of reporting to and advising the Minister for Transport Services as to the safety and reliability of train services; and

(d) to confer on ITSRR and the Chairperson of the Advisory Board the function of holding enquiries into rail accidents and incidents and reporting on those enquiries.

The Transport Legislation Amendment (Safety and Reliability) Act 2003 constituted a corporation with the corporate name of the Independent Transport Safety and Reliability Regulator. The principal objective of ITSRR was stated in the legislation to be to facilitate the safe operation of transport services in the State. The legislation also provided that ITSRR also had the following objectives:

(a) to exhibit independence, rigour and excellence in carrying out its regulatory and investigative functions; and

(b) to promote safety and reliability as fundamental objectives in the delivery of transport services.

The principal functions of ITSRR were stated to be:

(a) to provide strategic co-ordination of safety regulation by transport authorities in relation to transport services and owners or operators of transport services;

(b) to reveal and evaluate any matter related to the safe operation of transport services and the functions of transport authorities in relation to the safe operation of transport services;

(c) to review and evaluate any matter related to the reliability of funded transport services and the functions of transport authorities in relation to the reliability of funded transport services;

(d) to advise the Minister for Transport Services, or make recommendations to the Minister, or both, about any matter related to the safe operation of transport services, including safety regulation by transport authorities in relation to transport services;

(e) to advise the Minister, or make recommendations to the Minister, or both, about any matter related to the reliability of funded transport services;

(f) to accredit operators of railways under the Rail Safety Act 2002;

(g) to investigate and report on accidents and incidents involving transport services; and

(h) to disseminate information to the public relating to the safety of transport services or the reliability of funded transport services, as ITSRR considers appropriate.

The expression "transport authority" was defined, relevantly, to mean the SRA, the RIC, the Director General of the Ministry of Transport or the Ministry of Transport. The expression "transport service" was defined, relevantly, to mean a railway operation within the meaning of the Rail Safety Act 2002. The expression "funded transport service" was defined to mean a transport service owned or operated by a statutory authority, including a State owned corporation, or any other transport service that receives a government subsidy or other government funding.

The ITSRR is subject to the direction and control of the Minister for Transport Services, save as to the following:

(a) the exercise of a function relating to the accreditation of a person under the Rail Safety Act 2002, including the variation, suspension or cancellation of an accreditation;

(b) any decision to take or not to take enforcement action under any Act;

(c) the exercise of a function relating to a rail safety inquiry or a transport safety inquiry or other inquiry under an Act into a transport accident or incident;

(d) the outcome of any monitoring or auditing of the safety or reliability of a transport service and any decision to carry out or not to carry out any such monitoring or auditing;

(e) the contents of any report or recommendation of ITSRR; and

(f) the giving of a direction to the Director General of the Ministry of Transport relating to the safe operation of transport services and associated matters.

The Transport Legislation Amendment (Safety and Reliability) Act 2003 required ITSRR to advise the Minister for Transport Services with respect to the performance of transport authorities in connection with the exercise of their functions relating to the safe operation of transport services and the reliability of funded transport services. The legislation also empowered ITSRR to monitor the following matters relating to the safe operation of transport services:

(a) the performance of transport authorities in connection with the exercise of their functions relating to the safe operation of transport services;

(b) the performance of owners or operators of transport services in connection with the safe operation of those services;

(c) the compliance by transport authorities with any recommendations relating to the safe operation of transport services contained in any report by ITSRR or the Chairperson of the Advisory Board; and

(d) the compliance by transport authorities with any safety management systems required to be implemented by them under any other Act or law or conditions of accreditation or other contracts or arrangements.

In relation to funded transport services, ITSRR was required to monitor the following matters relating to their reliability:

(a) the performance of transport authorities in connection with the exercise of their functions relating to the reliability of funded transport services; and

(b) the performance of owners or operators of funded transport services or other transport services in connection with the reliability of funded transport services.

The ITSRR was empowered to conduct audits of the compliance of transport authorities and owners or operators of transport services with requirements applicable to them under any Act or under any contractual or other arrangement entered into under any Act or with the Minister for Transport Services or the Director General of the Ministry of Transport.

The ITSRR was required by the legislation to report to the Minister for Transport Services each year on the performance of transport authorities and owners and operators of transport services in connection with the exercise of their functions relating to the safe operation and reliability of those services.

The ITSRR was also required, before publishing a report under any Act or giving a report to the Minister for Transport Services, to refer the report to the Advisory Board and consider any

advice of the Advisory Board relating to the report. This provision applied to a report despite the provisions of any other Act and applied, relevantly, to the following reports prepared by ITSRR:

(a) a report of a rail safety inquiry conducted by ITSRR;

(b) a report on an accident or incident relating to a transport service;

(c) a report on a transport authority or the operation of a transport service; and

(d) the annual report of ITSRR.

The ITSRR was also empowered, relevantly, to give directions to the Director General of the Ministry of Transport relating to the safe operation of transport services and associated matters.

The Director General, the Board and Chief Executive of a transport authority, and an owner or operator of a transport service, relevantly, must by virtue of the legislation:

(a) co-operate with ITSRR in exercising their functions;

(b) notify ITSRR of all matters of which they are aware that could reasonably be expected to affect the exercise of ITSRR's functions under any Act;

(c) provide ITSRR or the Chairperson of the Advisory Board with any information relating to their activities or any documents or other things requested by ITSRR or the Chairperson in the exercise of functions under any Act; and

(d) in the case of the Director General of the Ministry of Transport, comply with any direction of the kind referred to previously.

Finally, the ITSRR may, if it thinks it necessary for the safe operation of a transport service, disclose information acquired by it in the performance of its functions under any Act to any other person. It may, if it thinks it desirable for the promotion of the safe operation of a transport service, publish any information, including the report of a rail safety inquiry. Such publication must not identify a person by name.

The Transport Legislation Amendment (Safety and Reliability) Act 2003 also provided that ITSRR is to have a division called the Office of Transport Safety Investigations (hereafter referred to as OTSI), the head of which is to be the Chief Investigator. The Chief Investigator is to be appointed by ITSRR on a recommendation of the Chairperson of the Advisory Board. The employment of the Chief Investigator may be terminated by ITSRR only on the recommendation of the Chairperson of the Advisory Board. The Chief Investigator is not subject to the direction and control of ITSRR in respect of the exercise of any of the following:

(a) functions relating to a rail safety or transport safety inquiry; and

(b) any function delegated to the Chief Investigator by the Chairperson of the Advisory Board under any Act.

The Transport Legislation Amendment (Safety and Reliability) Act 2003 provided that the Chief Investigator might establish a system for the voluntary reporting by railway employees of matters that may affect the safe carrying out of railway operations. The Chief Investigator must not disclose to any other person, or to any court, any information that may identify an employee who provides information under any such voluntary reporting system, unless the employee consents to the disclosure, or the Chief Investigator or a court is of the opinion that it is necessary in the public interest that the information be disclosed. The Chief Investigator is permitted to disclose information so obtained to the Chief Executive or any member of staff of ITSRR.

The Advisory Board established by the Transport Legislation Amendment (Safety and Reliability) Act 2003 consists of five members, being a Chairperson appointed by the Governor on the recommendation of the Minister for Transport Services, three members appointed by the Minister and the Chief Executive of ITSRR. The members appointed by the Minister must have such experience in rail safety management systems, safety science, customer service, accident investigation and public administration, as the Minister considers necessary to enable the Advisory Board's functions to be carried out. The Chairperson of the Advisory Board must have experience in transport safety management systems, including rail safety management systems.

The principal functions of the Advisory Board are:

(a) to advise ITSRR, or make recommendations to ITSRR, or both, about any matter related to the objectives or functions of ITSRR; and

(b) without limiting the foregoing, to advise ITSRR about reports prepared by it and about any other matter referred to the Advisory Board by ITSRR.

The other functions of the Advisory Board include:

(a) advising ITSRR on matters relating to the accreditation or authorisation of persons;

(b) advising ITSRR on reports issued by it under the Rail Safety Act 2002 and other matters under that Act; and

(c) making recommendations to ITSRR and the Minister for Transport Services concerning rail safety generally.

The Advisory Board may also advise the Minister for Transport Services, or make recommendations to the Minister, or both, about any matter related to the safe operation of transport services, including safety regulation by transport authorities, or the reliability of funded transport services.

Before granting or refusing an accreditation, including a provisional accreditation, or granting an exemption, ITSRR must refer the matter to the Advisory Board and consider any advice

given by it. Similarly, before varying, suspending or cancelling an accreditation, ITSRR must refer the matter to the Advisory Board and consider any advice given by it.

The Chairperson may delegate to an authorised person, including the Chief Investigator, any of the functions of the Chairperson under any Act.

The Transport Legislation Amendment (Safety and Reliability) Act 2003 provided that the Governor, on the recommendation of the Minister for Transport Services, may appoint a Chief Executive of ITSRR. The Minister is first to consult with the Chairperson of the Advisory Board before making such a recommendation.

The Chairperson of the Advisory Board may conduct rail safety enquiries under the Rail Safety Act 2002 relating to accidents or incidents involving railways. Such enquiries may be initiated by the Chairperson or may be requested by the Minister for Transport Services. For the purposes of exercising functions relating to a rail safety inquiry, the Chairperson of the Advisory Board may arrange for the use of any staff or facilities of ITSRR. The procedure for the meetings of a rail safety inquiry is, subject to the Rail Safety Act 2002 and the regulations, to be as determined by the person conducting the inquiry. The person conducting a rail safety inquiry may, but is not required to, hold the inquiry in public.

The Transport Legislation Amendment (Safety and Reliability) Act 2003 provided that civil proceedings may not be brought against a person who has supplied information to a person conducting a rail safety inquiry, in respect of any matter contained in that information that is or is alleged to be defamatory or a breach of confidence. The Act, to avoid doubt, provided to the effect that it is not part of the purpose of a rail safety inquiry, or the function of a person conducting a rail safety inquiry, to provide evidence for the purposes of proceedings against any person or to determine the liability or otherwise of any person with respect to any matter the subject of the inquiry.

Section 42W of the Transport Administration Act 1988, as amended, as inserted by the Transport Legislation Amendment (Safety and Reliability) Act 2003, provides to the effect that the Minister for Transport Services is to review the operation of the amendments made by the Transport Legislation Amendment (Safety and Reliability) Act 2003, to determine whether the policy objectives of those amendments remain valid and whether the terms of the amendments remain appropriate for securing those objectives. The review is to be undertaken as soon as possible after the period of 12 months from the date of assent to the Transport Legislation Amendment (Safety and Reliability) Act 2003. A report of the outcome of the review is to tabled in each House of Parliament within three months after the end of the said 12 month period.

Conclusion

It is not surprising when one looks at the history of legislative and administrative changes to the New South Wales rail industry, particularly in recent years, that the major passenger train operator and the safety regulator have, within each, the safety deficiencies identified in the interim report, in the expert panel report and in this final report.

Unlike the events that transpired after the Glenbrook rail accident, where core recommendations such as the establishment of a separate and independent Rail Safety Inspectorate and a separate and independent Rail Accident Investigation Board were not

implemented, it is hoped that the recommendations of this final report will be implemented, so as to lift the standards of safety and therefore the efficiency of the rail system to the optimum level. That task will involve identification of the deficiencies that exist from an organisational safety perspective. Those deficiencies can best be identified by summarising in the next chapter the work and findings of the expert panel to which extensive reference has already been made in the introductory chapters of this report.

4. Safety Management System Review

The first term of reference required the Special Commission to inquire into and report on the causes of the Waterfall rail accident on 31 January 2003 and the factors which contributed to it. That term of reference was the subject of the interim report delivered on 14 January 2004. The second term of reference required the Special Commission to inquire into and report on the adequacy of the safety management systems applicable to the circumstances of the railway accident. The third term of reference required the Special Commission to inquire into and report on any safety improvements to rail operations which the Special Commission considers necessary as a result of findings made under the first and second terms of reference.

To enable the Special Commission to determine the adequacy of the safety management systems applicable to the circumstances of the railway accident, the SMSEP was appointed. A safety management review of RailCorp and ITSRR was conducted between 19 January and 19 March 2004. The resources applied to the review were substantial. The SMSEP comprised six people with extensive experience in safety management and the review team who conducted the safety auditing consisted of 11 people with extensive experience in safety auditing. In all, 3,836 man-hours were utilised in conducting this extensive examination of the safety management systems of the SRA, RailCorp and ITSRR. Associate Professor Glendon designed and supervised the safety climate survey of a cross-section of the employees of RailCorp.

These were being conducted at a time when the organisations involved were undergoing a process of transition discussed in the previous chapter. The SMSEP review was being conducted approximately 12 months after the Waterfall rail accident and considerable activity had been undertaken by the rail safety regulator attempting to remedy safety deficiencies revealed in the course of the evidence of the Special Commission and in the interim report.

The SMSEP identified 29 elements against which an assessment could be made for the purpose of determining the adequacy of what had become RailCorp's safety management system. This was based on 23 elements taken from the Qantas Airways Limited system, which contains elements indicative of an integrated approach to safety, quality and risk systems. The Qantas system focuses on the identification, modification and management of the safety data from multiple sources including incidents, accidents, audits, compliance inspections and observations. These are used as a means of proactively identifying emerging risks within the system. Management review, hazard identification, risk management, safety committee and analysis and monitoring are all key elements. The Qantas system focuses on capturing and continually reviewing safety information and is a data-driven approach to safety management. Such a focus, according to the SMSEP, did not appear to be a characteristic of SRA safety systems.

In addition to the 23 elements of the Qantas system, Mr Bahr, the Review Director, determined to add a further six elements specifically relating to railway operations. They were Management and Staff Recruitment, Medical Issues, Human Factors, Safety Organisation, Safety Awareness and Safety System Program Plan. These 29 elements were derived from features regarded by the SMSEP as essential for adequate safety management.

The review of ITSRR was based upon 11 elements derived from an analysis of other transport safety regulation frameworks. The elements were:

1. Regulatory Independence
2. Regulatory Mandate
3. Policy And Objectives
4. Organisation And Function
5. Data Analysis
6. Transition
7. Safety Enforcement Over Rail Authority
8. ITSRR Accident/Incident Investigation
9. ITSRR Audits
10. Safety Accreditation
11. Partnership with the Rail Authority

The review included an examination of approximately 1,000 safety management documents, of which 500 were reviewed in detail, and over 140 railway and ITSRR staff were interviewed by the safety review team, including interviews of the Chief Executives and Board members. Each interview was conducted by at least two review team members. At the end of each day, available review team members met to discuss the outcomes of material obtained during that day. This enabled observations and findings to be tested and conclusions validated. At the end of each week of the review, the SMSEP and the Review Director analysed the results.

To facilitate the provision of information to the SMSEP, the Review Director, Mr Bahr, and the Review Project Managers, Mr Olsen and Mr Neist, met with the Chief Executives of RailCorp and ITSRR and with representatives of the relevant trade unions to ensure access would be provided both to all individuals and all relevant information. The Chief Executives of RailCorp and ITSRR and leaders of the trade unions wrote letters to all staff and managers endorsing the audit process and requesting all individuals to participate. Confidentiality of those participating was assured. It was in everyone's interest that information flow freely during the audit and the interviews so that any deficiencies existing in safety management in RailCorp be identified, to enable appropriate steps to be taken to rectify those deficiencies.

The findings in respect to the 29 elements identified by the SMSEP are indicative of profound weaknesses in the management of safety by RailCorp and its predecessor, the SRA.

To ensure the SMSEP report was comprehensive and accurate, peer reviews were sought from Professor James Reason, Dr John Loy and Mr Terry Worrall. Professor Reason stated, in relation to the investigation of the RailCorp safety management system, that the SMSEP report "constitutes one of the most exhaustive, detailed and sophisticated examinations of an organisation's safety practices and thinking that I have yet seen". Later in his report he said of the review, "This will be a gold standard for future auditors".

Dr Loy said:

> I believe that the breadth and depth and appropriateness of the review of the SMS elements audited against RailCorp are outstanding in their range and detail.

Whilst Dr Loy had criticisms of the editing of the report he concluded that it was a "state of the art review that has been carried out by experts with (sic) appropriate range of expertise and using best practice methodology effectively. It should give the Special Commission a sound basis on which to respond to its relevant terms of reference".

Mr Worrall stated, "I believe the report to be a valuable piece of work" and in concluding he stated, "Much of the outcome from the SCOI (Special Commission of Inquiry) will be under public scrutiny and rightly so. It would be tragic for such a valuable contribution to rail safety to be diluted and even worse still left on the shelf". In an endeavour to avoid this occurring, the full contents of the SMSEP report and its attachments are volume 2 of this report. This chapter will summarise the most significant of its findings.

Brief comments on the relevance to safety management of the elements used as a yardstick are included, where necessary, in the summary of the SMSEP findings in each area.

Management commitment

The Glenbrook Inquiry report demonstrated that one of the fundamental features of an adequate safety management system is management commitment, and active participation by it in communicating and reinforcing the message that safe operations are fundamental to the conduct of the railway's activities. The SMSEP, however, found senior managers did not demonstrate how to drive and lead safety performance improvement.

The SMSEP concluded such managers did not demonstrate they had training in the operation of safety management systems, or that they participated in providing leadership roles for safety performance improvement or communicating to staff the importance of safety management.

The poor management commitment to safety was due to the fact that their safety responsibilities and accountabilities were either poorly defined or alternatively not defined. Management systems for holding managers accountable for such safety performance were either ineffective or non-existent.

Policies and objectives

The safety policies and objectives of the organisation should be clearly identified by its Board. It is then the responsibility of management to ensure the Board's policies are communicated and implemented throughout the organisation.

The SMSEP found that although both the SRA and RailCorp had a published safety policy and statement of objectives signed by the Chief Executive, there was no effective communication of this policy to staff, suppliers, contractors and visitors.

Safety representatives and personnel

The SMSEP pointed out that in complex, high hazard operations, like that of a railway, it is important that sufficient and competent staff resources be dedicated to the safety management function.

The SMSEP found that although there was a senior manager for overall safety, as well as managers in each division dedicated to safety, their roles were not as thoroughly defined as they should have been. Further, the organisational structure of safety management and responsibilities was not well documented and not communicated to the staff responsible.

Safety committee

In an adequate safety management system, safety committees at different levels of the organisation provide the means by which persons at those levels can meet and identify safety issues. These issues are then communicated within the particular division and adequately managed by those persons responsible for safety at the various levels of the organisation. Pacific National has set up safety committees throughout all levels of its organisation who in turn report upwards to senior management.

The SMSEP found that at the operational level, the safety committees that existed in the SRA and RailCorp had a strong focus on occupational health and safety and failed to identify broader system wide safety issues.

The SRA had a joint consultative committee, which provided a forum for the trade unions and their representatives to comment on and be informed on safety issues, but its focus was also on occupational health and safety. Further, the SMSEP found that it met too infrequently to be effective.

The SRA also had an executive safety committee of senior managers, including the safety managers. The SMSEP, however, came to the conclusion that the committee was not providing strong leadership or initiating critical reviews. At the level of the Board, the SMSEP found that although the SRA had a Board Safety Committee, RailCorp did not.

In addition to these weaknesses in the safety committee structure, the SMSEP found that even when safety committees made findings and recommended corrective action, there was no adequate system for communicating the findings and recommendations to the relevant senior management. The result was that the necessary remedial action was frequently not completed or alternatively ineffectively performed.

Management review

An adequate safety management system requires that auditing be done, that investigations be carried out and that reports be prepared, to enable a monitoring of the safety performance of the organisation. The SMSEP found that this process of management review, which should have been part of the safety management system, was incomplete, particularly with respect to implementation of remedial action and ensuring that the remedial action was effective. Although there were some systems in place to review safety issues, they also tended to focus on occupational health and safety and not broader system safety.

Training and education

Although the SRA, and now RailCorp, had a sophisticated training facility that was accredited by the New South Wales Vocational Education and Training Accreditation Board and thus satisfied the Vocational Education and Training Accreditation Act 1990, the SMSEP found that there was an unstructured and inconsistent approach to curriculum development, indicated by a failure to apply training needs analysis and task analysis to respective operations. The training policies and procedures provided little guidance on risk management and course evaluation. Safety training also was not aligned with the management of key system hazards identified in the operation of the rail system.

Hazard identification and risk management

The SMSEP stated that hazard identification and risk management are vital to ensuring system safety. The SRA, and now RailCorp, had a hazard identification and risk management process that identified the top prioritised hazards for the organisation. The SMSEP concluded that as the hazard identification and risk management process was inadequate, the hazards identified did not necessarily reflect the actual risk profile for the organisation. Although the SRA and RIC performed numerous safety analyses, they were overly focussed on occupational health and safety and not broader system safety issues. Almost no evidence could be found of a system safety engineering analysis. When analyses were carried out they were done reactively. There was no evidence, the SMSEP concluded, that hazard analysis was conducted proactively.

Document control

The SMSEP stated a strong document control process was necessary to clearly indicate the status, purpose and scope of a document in an organisation where new procedures, system modifications and new procurements can affect the safety outcome.

The SMSEP found that this was not present in the SRA or RailCorp. The safety critical operational documents in use were not adequately controlled and failed to include management review and approval processes, for example the network incident management plan.

Record control

The SMSEP found that there was an inadequate process of control of key safety records covering equipment, people and processes critical to ensuring the effectiveness of current and previous processes.

Internal audit

In a safety management system, internal audits provide the means by which the Board and management can obtain feedback on the safety performance of safety management systems. The use of internal audits should be carried out on a structured basis to address key safety hazards across the organisation and be conducted on a periodic basis.

The SMSEP found that although RailCorp had an internal audit process it was focussed on occupational health and safety and not the broader system safety considerations such as

organisation, people, processes and engineering. Further, the internal auditors undertaking the audits in some cases were not appropriately trained. The SMSEP found there were inadequate processes in place to ensure that the necessary corrective action was implemented.

Incident and accident reporting system

Clear and transparent safety incident reporting systems are important to promote continuous safety improvement. An adequate safety management system should not only have a reliable process for the reporting of incidents, it should also analyse and identify trends and monitor the effectiveness of controls in place to manage any hazards identified by incidents or accidents.

Although RailCorp had systems and formal processes for reporting and recording incidents and accidents, the SMSEP found that the feedback processes to staff who reported incidents were ineffective and did not adequately protect confidentiality.

Incident and accident investigation

Systemic safety investigation of accidents and incidents is a necessary part of a thorough safety management system. It enables an organisation to learn from incident investigations and thereby enhance its safety performance.

The SMSEP found that the investigation process was not sufficiently formalised and documented, that it did not adequately address causal analyses and risk assessment, and that follow-up corrective actions were not adequately tracked and finalised.

Analyses and monitoring

Understanding safety trends is an important measure of a safety management system's effectiveness. Although RailCorp monitored some hazards on a monthly basis, the weaknesses in hazard identification earlier identified meant that the validity of the judgments made about the monthly trend reports were questionable. Results indicated that the process for monitoring safety related trends were inadequate, in particular, in respect of safety critical activities and equipment and with respect to comparative analysis over a period of years.

Emergency response procedures

The importance of emergency response procedures in safety management systems was that if incidents occurred, early response minimised injury, loss of life and property damage. The SMSEP found that emergency response planning was ineffective, there was no planned periodic testing of the emergency response plan and the respective responsibilities were not clearly defined or effectively communicated. The plan in place did not sufficiently identify critical response personnel outside the rail organisation.

Change management

Change management policy and procedures ensure that safety is a necessary consideration when changes to processes, personnel and equipment are planned. Such policies and procedures require that the safety implications of any such changes are planned and managed.

The SMSEP found that neither the SRA nor RailCorp had a policy or process of safety validation of change in the organisation, its processes or engineering activities. Review results indicated there were few processes in place to manage change and the program for monitoring the effectiveness of change was inadequate. There was no indication of change leadership. Employees were not appropriately notified of changes or trained with regards to the consequence of change. Key safety processes, changes and deviations were not adequately assessed for risk or documented.

System for managing requirements and changes

Identifying and managing safety requirements and changes to requirements is important. It is important to ensure that key safety controls are kept in place and remain effective. The SMSEP found there was no policy or procedure in either the SRA or RailCorp requiring the identification of the safety requirements for the organisation, the people, processes or engineering. There were no processes for monitoring changes to requirements. Process, people, engineering and organisational changes were not safety validated. No process that sought a hierarchy of sign-offs and acceptance or transfer of hazards and risk was identified.

Customer feedback

The SMSEP found that neither the SRA nor RailCorp had any consistent or well documented process by which safety issues communicated by customers could be recorded and addressed.

Contracted goods and services

In an adequate safety management system, where outside persons provide goods or services to the organisation, any safety hazards introduced into the rail system need to be managed. The SMSEP found that there was no adequate process for requiring risk assessments to be undertaken when goods and services were acquired from outside the SRA or RailCorp, and that contractors were not made aware of the safety requirements for the organisations and were not closely monitored.

Traceability of goods and services

If goods or services are provided which may create risks, an adequate safety management system requires the identification of the source and supplier of the goods and services when safety critical equipment is involved. The SMSEP found that, when conducting passenger fleet maintenance site audits, there were insufficient identification and control of equipment and services being utilised through the component life cycle. The supplies of safety critical goods and services had not been adequately addressed.

Measuring equipment and calibration system

The SMSEP did not report upon this element because of time constraints.

Procurement of goods and services

Safety system requirements must be an integral part of the process of procuring goods and services. The SMSEP found that the processes in place were inadequate for ensuring

appropriate levels of quality identification and safety requirements and risk assessments of procurement.

Equipment maintenance

An adequate safety management system requires safety critical equipment to be identified, properly maintained and tested. The SMSEP found that although there were well documented equipment maintenance requirements, the maintenance schedules in place had not been effectively reviewed for some years.

Design and development

An adequate safety management system requires there be safety analysis and oversight processes as part of the design and development of equipment and systems, to ensure that safety requirements are considered effective. This was not done in relation to the deadman system. Little evidence was found of safety analysis performed during the design and development process.

Management and staff recruitment

The recruitment process of management staff must adequately assess the safety attitudes, qualifications, training and experience requirements for potential applicants. The SMSEP found that recruitment processes for senior management did not sufficiently identify safety requirements, such as qualifications, training and experience for the positions, and hence could not assess the suitability of applicants in this regard.

Medical issues

An adequate safety management system requires that persons performing safety critical tasks are not impaired in their performance by physical or mental disabilities. The inadequate medical assessments were the subject of discussion in the interim report and are dealt with in detail later in this report. The SMSEP found that although a high standard fatigue management program had been developed, it was not fully implemented. Random alcohol and drug testing programs, it was said, were not fully effective, whilst having improved since the Waterfall rail accident.

Human factors

In a safety management system assessments need to be made of areas where operators may make mistakes, or where the human/machine interface can create risks, and where fatigue or lack of concentration may lead to incidents or accidents. This is the area where persons with expertise in human factors form an important part of an adequate safety management system. At the time of the SMSEP review, the human factors staff position within RailCorp was vacant. Although there was an awareness of human factors issues, such as the design interface between the deadman system and the train driver, there was no system of adequate documentation of the deficiencies in that area or any adequate system in place for rectifying or minimising their impact.

Safety organisation

An adequate safety management system is achieved by identifying the responsibilities and accountabilities in all aspects of safety management, including engineering, people, processes or organisational management at all levels in the organisation. Persons holding positions which could have important safety outcomes are responsible and accountable for their performance. The SMSEP found that safety responsibilities and accountabilities for key safety outcomes were not defined or identified. Key personnel in safety management positions lacked qualifications, training and experience in organisational safety systems, human factors, risk management and system safety engineering. The SMSEP also found that there were insufficient safety experts with appropriate qualifications, training and experience to provide the necessary support to the organisation in that area. There was also no system safety program to define how safety management and operating management could be integrated to deliver the organisation's operation safely.

Safety awareness

The promotion of safety awareness on a continual basis is a necessary feature of an adequate safety management system. The SMSEP found that although employees had a good awareness of workplace hazards, they had little awareness of system safety hazards. The SMSEP found that the employees felt that there was a "blame culture" and it was difficult to communicate safety concerns to management.

System safety program plan

An adequate safety management system requires a documented, controlled and detailed safety program plan. Adequate resources are also required for communicating the elements of that plan to those who are required to implement it. The SMSEP found that the SRA and RailCorp had no such plan.

SMSEP conclusions

The analysis of the data collected, in relation to the 29 elements that an adequate safety system should contain, led the SMSEP to identify six particular areas where deficiencies in safety management were the most significant.

Safety management

Many of the senior managers interviewed displayed a lack of awareness of contemporary safety management principles and practice and had insufficient knowledge to implement safety principles. They lacked relevant technical safety qualifications in system safety, risk management or human factors and therefore did not have the capability to provide safety leadership within the areas for which they were accountable.

Risk management was conducted on a reactive basis, focussed on incident reporting to identify hazards, rather than a proactive risk management approach. There was a lack of an overall disciplined document control process to distribute safety critical information. There was no process to ensure that safety critical documents had been read and signed for by those responsible for dealing with any identified risks. The SMSEP also found that there was a lack of appreciation of the need to learn from incidents and accidents. Effective systems

were not in place for the SRA to allocate and hold managers at all levels accountable for safety performance.

The SMSEP analysis identified that frontline staff took safety seriously and understood the importance of following safeworking procedures and occupational health and safety rules. Their focus however was, not unnaturally, on occupational health and safety, not the broader system safety.

It was difficult for such staff to raise safety concerns with management because of a "blame culture" which focussed on disciplinary action for staff involved in safety incidents. Train drivers were induced to violate rules and procedures to meet on-time running requirements. This led to strained industrial relations between management and employees. The SMSEP believed this lack of a positive working relationship between management and operational staff resulted in the lack of open communication between them - an element so necessary to achieve a sustainable integrated safety management system.

Human factors

RailCorp and the SRA did not have a documented human factors policy. When an accident occurred, the SMSEP found that instead of undertaking an analysis of the limitations in human capabilities and behaviours that the accident might reveal, that the approach of RailCorp was governed by the traditional "blame and train" paradigm. It found that while RailCorp had introduced a "no blame" policy for safety investigations, there was no evidence that RailCorp personnel throughout the organisation were generally aware of the policy.

The SMSEP panel found, however, that RailCorp had made progress in the introduction of a fatigue management program which, although in draft form, the SMSEP considered to be comprehensive and equivalent to that used in the aviation industry.

Training systems

The SMSEP found that there was no formal structured and integrated process to identify training requirements for RailCorp and that, with the exception of minor variations in the content of the safety management systems training, there had been no significant changes in the way training was designed or delivered since the Waterfall rail accident.

In the area of safety management system training, training was strongly focussed on occupational health and safeworking procedures rather than system safety.

The observation of the SMSEP, about the absence of the capability of senior managers to provide safety leadership, was mirrored in the fact that there was no safety management system training or professional programs focussed on safety and risk management for management personnel.

Emergency preparedness

The SMSEP concluded that emergency response planning was inadequate. Although there were emergency response plans in existence, these were not tested. There was no co-ordination of emergency response plans with emergency services.

Asset management and maintenance

The SMSEP found that when new equipment was purchased or there were significant changes made to existing equipment, there was no comprehensive process to ensure the equipment's fitness for purpose or its design integrity. The findings in the interim report of the deficiency in the deadman foot pedal and what is said in the chapter about the methods by which new rolling stock is purchased, confirms the SMSEP conclusion.

In the area of maintenance, the fleet maintenance plans had not been revised since 1995 and the plans were theoretical in nature.

Of particular note in the SMSEP report was the observation that although RailCorp had introduced a new train management system called Advanced Train Running Information Control System (ATRICS), no safety analysis had been done of the operational and technical risks associated with the introduction of the system. The safety analyses that had been performed focussed on its internal integrity, but failed to consider rail operational risks.

Safety reform agenda

The SMSEP found that RailCorp had developed the safety reform agenda in recognition of the need for a major systemic change in the management of safety throughout the organisation. The agenda confirmed many of the findings identified by the Special Commission of Inquiry in the interim report. Chapter 21 is devoted to an analysis of the goals set out in the safety reform agenda and the time frames to achieve those goals. Set out in chapter 21 are reasons why it is unlikely that these goals will be achieved in the time frames allowed, or ever, in the light of the history of the SRA's failure to achieve safety reforms over a long period.

Safety climate review

The safety climate review was undertaken in an attempt to determine the organisation's safety culture. An important finding of the safety climate review was that there were no particular positive signs in any category of employee with regards to their perception of safety management.

The SMSEP found that notwithstanding the cross-section of groups interviewed, none expressed the view that they thought that rail operations were safe. The overall view was that rail operation safety had barely improved since the Waterfall rail accident.

ITSRR

The interim report found that the rail safety regulator at the time of the Waterfall rail accident was not aware of the deficiency in the deadman foot pedal. It also found that the SRA failed to disclose this safety risk. Furthermore, the rail safety regulator failed to discover practices such as deliberate circumvention of the deadman foot pedal by the use of flagsticks to fix it in the set position. An inspection of the underside of the driver's desk undertaken after the Waterfall rail accident revealed that this practice was widespread. The rail safety regulator failed to carry out such inspections.

A separate chapter of this final report deals with safety regulation. The SMSEP found that a lack of resources and lack of perceived independence were ongoing impediments to the Director General of the former Department of Transport, the former rail safety regulator.

Although ITSRR has more resources than the former rail safety regulator, it at present lacks the technical resources necessary to enable audits of rail operations to be carried out. The lack of perceived independence, particularly in the area of accident investigation, has continued. This topic is discussed in a later chapter of this final report.

General observations

The interim report identified the pervasive lack of safety awareness within the then SRA as being one of the underlying causes of the Waterfall rail accident.

The SMSEP review has demonstrated that there remains an ongoing lack of appreciation of the reasons why accidents such as the Glenbrook, Waterfall and Hexham rail accidents have occurred.

Organisational accidents do not simply happen. They occur because existing hazards creating risks have not been controlled and because the rail safety regulator does not identify the safety weaknesses in organisations it is required to regulate.

In an organisation where the activities are inherently hazardous, effective safety management requires that the organisation have the capacity to identify, assess and control risks and this requires effective and competent management. The task must be done on a planned and systematic basis. This involves identification of hazards, an analysis of the risks associated with the hazards and of the controls or defences put in place to prevent the risk from materialising into an incident or an accident. If the risk cannot be completely removed, then there must be efficient controls to reduce it to acceptable levels. The process of identifying hazards involves using safety data from the organisation and other similar organisations. It is also necessary to keep accurate and reliable documentation to provide a basis for review and validation of a safety management system.

The theory behind the safety case approach, which has been adopted in the United Kingdom, is that the safety case is supposed to demonstrate that an operator has a safety management system that is capable of systematically and continually identifying hazards, assessing them and eliminating, controlling or defending against the result and risks to persons or property that the hazards may create. The theory is that the safety regulator examines the safety case and, if accepted by the regulator, it becomes the basis of self-regulation. The safety regulator must have the resources to investigate the validity of the safety case and conduct field inspections and audits to ensure that the accredited organisation is implementing its safety management system.

The purpose of developing such management processes is to enable the organisation to anticipate and not merely react to hazards that have arisen.

The SMSEP identified many deficiencies in particular areas of safety management. These areas were identified in the interim report as being matters requiring consideration in the final report of the Special Commission of Inquiry and subsequent chapters deal with those specific matters. In addition, the SMSEP report identified some fundamental deficiencies in the

overall management of safety and in the performance of the rail safety regulator. In its conclusions, the SMSEP commented that the SRA, and now RailCorp, was unable to effectively implement integrated corrective actions, had a poor track record of effective project management, lacked organisational competence in contemporary safety management system practices, took an insular approach to learning, lacked formally defined management accountability, and had a poor appreciation of current practices in organisational development and change management.

Perhaps its greatest criticism of RailCorp, in view of the serious accidents that have occurred in New South Wales in the last few years, was what the SMSEP report described as an "unwillingness for critical self-examination" (sic).

By addressing the specific safety matters identified in subsequent chapters of this report and the management issues discussed in detail at the end of this report, RailCorp should be able to achieve a standard of safety management which is adequate. There will need to be vigorous ongoing involvement by ITSRR to ensure that this takes place.

The findings of the interim report, the SMSEP review and analysis, and the discussion and conclusions of this final report all point to the fact that the SRA had a grossly inadequate safety management system at the time of the Waterfall rail accident and this was a significant underlying cause of that accident. The fact that the former rail safety regulator accredited such an organisation indicates that the accreditation regime failed to achieve its purpose of ensuring rail safety.

Unless the specific deficiencies are addressed and an integrated safety management system developed by RailCorp and approved by ITSRR, it is likely further serious accidents will occur.

The following chapters of this report deal with several discrete areas where remedial action is required. The concluding chapters deal with what needs to be done to establish an integrated safety management system which will ensure that all risks are being properly controlled.

5. Emergency Response

The derailment occurred shortly after 7:14:27 am. At that moment the electrical system supplying power to the overhead wiring had short-circuited on both the up main and down main tracks. At approximately 7:15 am a track diagram at Waterfall railway station showed that the up track, that is the main track running in a northerly direction towards Sydney, was occupied. No train was scheduled to be on that track in that area at that time. The next train to Sydney was run number C412 which was some four kilometres south of where the derailment occurred.

At 7:16:10 am, Mr Leslie Thorpe, the train controller at the Rail Management Centre (hereafter referred to as RMC) who was responsible for managing trains through the area, was advised by the SRA Electrical Trouble section that the circuit breakers had been tripped and there had been an electrical failure on both the up and down tracks between Waterfall railway station and Cawley substation, south of Waterfall.

At 7:17:13 am, Mr Thorpe attempted to contact Mr Zeides using the Metronet radio. The Metronet radio enables direct and speedy contact with a train driver. That attempt at 7:17:13 am by Mr Thorpe to contact Mr Zeides was unsuccessful.

Approximately one minute later, Mr Thorpe spoke to Mr Aquilina who was the train driver of run C412. Mr Aquilina informed Mr Thorpe that his train had lost power and that he was not able to proceed further.

This narrative of events meant that by approximately 7:18 am, four minutes after the derailment, the officers at the RMC knew that the overhead power had been taken out in the section of track south of Waterfall and that the driver of G7 had not responded to a radio call that had been made to him.

Notwithstanding these facts, there was no realisation an emergency had arisen. It was not until 7:32 am, 14 minutes later, that a major incident response was initiated.

Mr Thorpe at 7:18:05 am requested the signaller at Waterfall railway station to make contact with the train guard on G7 via two-way radio. That attempt was unsuccessful.

Although each of these unsuccessful attempts at communication with the crew on G7 may individually be accounted for by explanations other than a derailment, the combination of them should have demonstrated to officers at the RMC that something was seriously amiss with G7.

While these communications between the RMC, Waterfall railway station and Mr Aquilina were occurring, some passengers had managed to extricate themselves from the wreckage. One passenger telephoned 000, the emergency number, at 7:20:20 am. That information was relayed to NSW Police and, at 7:22:40 am, a call was made over the police radio to which Senior Constable Butterfield, Constable Robinson and Probationary Constable Smede responded. At that time they were in a Sutherland police station vehicle. They were told that the derailment had occurred at Waterfall railway station.

The NSW Police then contacted the Ambulance Service and it in turn contacted Mr Glen Wise, an officer stationed at Engadine ambulance station, to inform him that there had been a rail accident approximately two kilometres south of Waterfall railway station. It is impossible to reconcile the information given to Mr Wise with the information given over the police radio at 7:22:40 am. It would appear that the location of the accident was somehow clarified before Mr Wise was contacted. Mr Wise left the ambulance station at 7:24:40 am in an ambulance accompanied by Mr Andrew Hall.

The ambulance took approximately three minutes to reach Waterfall railway station and it proceeded in a southerly direction along the Princes Highway to establish the location of the rail accident. They had set their vehicle's tripmeter at Waterfall railway station and, having travelled four kilometres in a southerly direction along the Princes Highway and realising they had gone beyond the area where the accident occurred, they returned towards Waterfall. On their way back they saw an SRA employee in uniform wearing a tabard, and a fire truck and a police car at an access gate about two kilometres south of Waterfall railway station. They drove through the access gate when it was opened and arrived at the accident site at approximately 7:45 am. This was approximately 31 minutes after the derailment and approximately 21 minutes after they were informed of the accident.

Mr Wise said it would have taken approximately four minutes to reach the access gate, had it been known which access gate provided access to the site of the derailment. He said it would take a further five minutes to reach the site of the accident from the access gate. This resulted in an unnecessary delay of approximately 12 minutes which is highly undesirable when a serious accident has occurred.

The RMC needs to be able to assess quickly and accurately that an emergency has occurred and to provide precise and reliable information to the Ambulance Service and to other emergency services about the location of an accident and the available access to the site.

The first call over the police radio was at 7:22:40 am to the effect there had been an alleged derailment at Waterfall railway station. Sergeant Albert Martin, then at Sutherland police station, heard the radio call and he and Superintendent Henry Karpik left Sutherland police station at 7:24:20 am.

At 7:24:37 am, a passenger on the train, Mr Gareth Redshaw, telephoned the 000 emergency number but that telephone call was regarded as suspicious, although an ambulance was dispatched at 7:24:40 am.

At 7:25:29 am, a police officer telephoned the RMC and said "I have just got a report of a derailment at Waterfall, are you aware of that?" The response was that it was not. The police operator then informed the RMC that the 000 emergency call service was receiving a number of telephone calls that "apparently a four car train has come off the track and rolled … it's 100 metres south of the railway station. They just left the station".

At about the same time as the police operator notified the RMC of reports of a derailment, the train guard on the derailed G7, Mr van Kessel, used his mobile telephone to contact Waterfall railway station. He had the telephone number stored in his mobile telephone. He made his first telephone call to Waterfall railway station at 7:25 am. He was not able to communicate much information in this call but he said to Mr Graeme Spargo, the relief duty

manager at Waterfall railway station, "We're in the dirt …". Whilst this may be railway parlance for a derailment it failed to mention the train had rolled off the track.

Mr Spargo received a further telephone call at 7:28 am from Mr van Kessel in which Mr van Kessel said, "Stop all trains. We are in the dirt …".

The mobile telephone connection dropped out on these occasions.

Between those two telephone conversations Mr Thorpe at the RMC, at 7:26:08 am, telephoned the SRA Train Crewing section and the Wollongong signal box rostering officer, to obtain the number, and then attempted to telephone Mr Zeides on his mobile telephone, which continued to ring without being answered, until it eventually went through to Mr Zeides' voice mail.

At 7:30 am Mr van Kessel managed, in a third attempt, to contact Mr Spargo when he said to Mr Spargo, "I am the guard of the train. Stop all trains". Mr Spargo asked, "What number is your train?" Mr van Kessel replied, "C311".

This communication from Mr van Kessel took place 16 minutes after the derailment and it convinced Mr Spargo that an emergency had arisen. Mr Spargo then immediately informed operations, "C311 has derailed. He is at approximately signal 770". In fact, G7 was at approximately signal 775. Mr Aquilina's train, run C412, was at signal 770.

Senior Constables Wicks and Mann also left Sutherland police station in a separate vehicle to Superintendent Karpik and Sergeant Martin in response to the police radio call that a derailment had occurred.

The information provided over the police radio was that the location of the accident was 100 metres south of Waterfall railway station and they travelled to Waterfall railway station.

Senior Constable Wicks, having local knowledge of the area, thought that the accident may have occurred at the first bend in the track south of Waterfall railway station. He went to a gate on the access track located approximately 200 metres south of the railway station.

When Superintendent Karpik and Sergeant Martin arrived at Waterfall railway station they were advised the accident site was located further south and told of the location of the access track approximately two kilometres south of Waterfall railway station.

When the police vehicle containing Senior Constable Butterfield, Constable Robinson and Probationary Constable Smede arrived at Waterfall railway station, Constable Robinson ran down to the railway station and returned with a railway employee, Mr McKenzie, who then guided the police officers to a fire trail providing access to the rail corridor approximately 500 metres south of Waterfall railway station. At the locked gate to this fire trail, the vehicle encountered another police vehicle containing Senior Constables Mann and Wicks.

At 7:37:18 am, a further call was received from NSW Police by the Operations Supervisor at the RMC, seeking advice regarding how far past Waterfall railway station the derailment had occurred. NSW Police was told it was around one kilometre south of the railway station.

At 7:39:27 am Mr Peter Moy, Network Operations Superintendent, Illawarra, advised the Illawarra Outer train controller that the derailment had occurred in the vicinity of signal 775 and G7 had derailed from the down line and was fouling the up line. At 7:41:27 am, the Illawarra Outer train controller contacted Waterfall railway station to ascertain the exact location of signal 775 and the closest access point to the derailment location. The duty manager at Waterfall railway station advised the location of the signal and indicated that he could not confirm the access road identified as Cawley Road was the closest road access point to the derailment.

At 7:43:10 am, police radio VKG activated the relevant disaster plan. Records from the police radio VKG indicate that the first emergency response vehicles arrived shortly before 7:43:10 am. By that time a number of passengers had escaped from G7, but a number remained trapped.

The passengers who were unable to escape had been trapped in G7 for approximately half an hour by the time the first emergency response personnel arrived. This observation is relevant to the SRA containment policy dealt with in a later chapter in this report. Fortunately, there was no fire in G7 during this 30 minute period, but passengers gave evidence during the first part of the Inquiry that they saw smoke inside the derailed carriages, which no doubt was a terrifying experience for the passengers. They were mistaken, it was not smoke they observed, it was dust resulting from the derailment.

Within approximately three minutes of the original emergency responders arriving, Superintendent Karpik and Sergeant Martin arrived. They passed through the access gate which had by then been unlocked.

In addition to police from Sutherland police station, Senior Constable Sheehan, Constable Muller and Probationary Constable Rutledge, on duty at Miranda police station, heard the call over the police radio and left there at 7:23:20 am. They drove to Waterfall railway station and parked at the road bridge passing over the railway line approximately 100 metres south of Waterfall railway station. They looked in both directions but could not see a derailed train. They then drove the police vehicle to an access track which they said was approximately 300 metres south of Waterfall railway station. Constables Sheehan, Muller and Rutledge then left on foot to follow the railway track in a southerly direction. They ran about 10 to 15 minutes, after which they could see the derailed train about 100 metres ahead. They observed passengers at the side of the track and some passengers trapped in the wrecked train. Constable Rutledge was then directed to find a ladder. He returned to the accident site shortly thereafter and observed several emergency response personnel using rocks in an attempt to break the windows on the second carriage of G7 to free the passengers trapped inside. Superintendent Karpik made similar observations on his arrival at the scene.

Each of the carriages of G7 was fitted with an external emergency door release. Figure 5.1 is a photograph of a Tangara train identical to G7, showing the location of the emergency door release. The external door release was not marked in any way on Tangara trains, prior to the Waterfall rail accident.

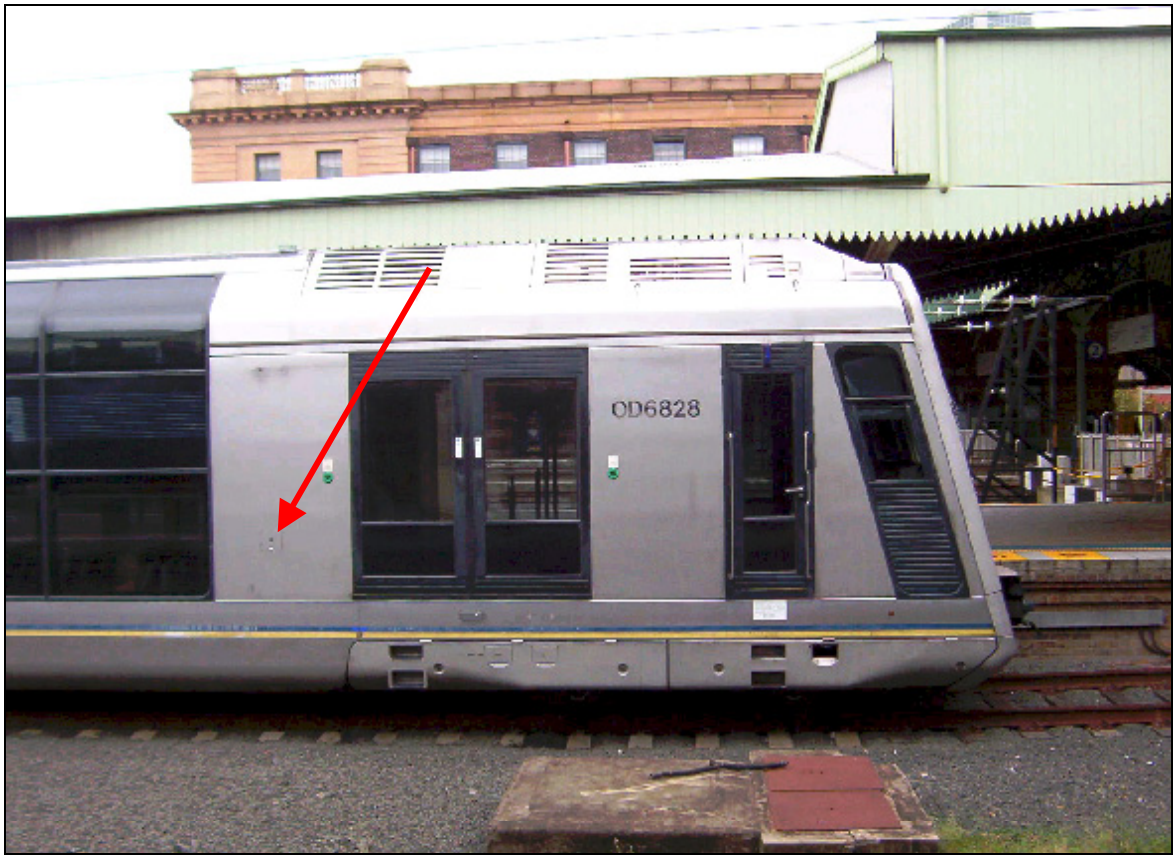


Figure 5.1 Tangara train identical to G7 showing location of emergency door release

Superintendent Karpik was shown this photograph when giving evidence and did not recognise the panel in Figure 5.1. It was apparent that none of the police officers, or any of the emergency services officers who attended the accident site knew of its existence. This resulted in them breaking windows in an attempt to release the trapped passengers.

From the narrative of events that has been set out above, it is clear that there was unnecessary and undesirable confusion as to the location of the accident site, resulting in substantial time being lost by emergency services personnel before they arrived at the scene of the accident. This is a most undesirable situation.

I have already observed that not only was there a delay in emergency response personnel reaching the accident scene but also, when they arrived, it was obvious that emergency services personnel had no knowledge or training in the means by which they could obtain access to the wrecked train, resulting in windows being broken.

Electricity

The next difficulty that arose in the emergency response related to the presence of the electrical wiring on the ground, as a result of the overhead stanchions being brought down by G7 during the course of the derailment. The circuit breakers tripped at 7:14:27 am and at approximately 7:18 am Mr Aquilina, the driver of train C412, then stationary at a signal approximately four kilometres south of the derailment site, informed the RMC that he had lost power to his train and could not proceed. Ambulance officer Wise, in his evidence, said:

> I believed that the power was off because of the fact that people were touching the train and there were wires hanging over the top of the train. However, I was concerned that in our training we had been told that bursts of electricity are often sent back down a line when it trips out, so I was concerned that power bursts may come back down the line and it may arc up. So I attempted to ask the [train] guard and other State Rail employees, who subsequently came onto the scene, as to whether the power had been isolated and as to whether it was off and as to whether there was any risk of charges of power coming back down the line.

He then gave the following evidence:

> Q: What were you told?
> A: I was told that they were not sure.
> Q: How many times did you ask and how many times were you told they were not sure?
> A: I asked – I'm guessing – somewhere around half a dozen times. I specifically remember asking the [train] guard. I specifically remember asking another State Rail employee. I also had a conversation with the senior rescue ambulance officer that arrived. I then witnessed him have a conversation with the State Rail employee about whether the power lines were safe, given that they were not earthed.

He was then asked how long it was before anyone was able to give him a categorical assurance that it was safe for him and other ambulance officers to undertake the rescue. He said that it was "somewhere around 8:45 am, 8:50 am it was still a matter of some concern to us".

It follows from that evidence that the ambulance officers in attendance had been there for approximately one hour and had still not received a categorical assurance that while they were conducting rescue activities there would not be a restoration of power which could result in their electrocution.

From the police perspective, evidence in relation to the safety of the area insofar as electrocution was concerned was relevantly given by Sergeant Martin. His evidence was:

> Q: When you arrived at the scene of the accident, did you recognise another officer, Senior Constable Wicks, standing on top of one of the overturned carriages?
> A: That's correct.
> Q: Did you observe overhead electricity wires?
> A: I did.
> Q: Were you concerned about Senior Constable Wicks' safety when you observed those two things?
> A: I was.
> Q: Did you, yourself, try to do anything to ascertain the status of the overhead wires?
> A: I did.
> Q: What did you do?

A: Each person that I saw that identified themselves as State Rail employees, I enquired as to the situation concerning the overhead wires.
Q: How many State Rail employees do you think you asked within the first minute or two of your arrival about whether the wires were live or not?
A: Within the first five minutes, it would have been about half a dozen.
Q: What answers did you get from these various rail employees to that question?
A: "That wasn't my department". That was the answer.
Q: Did you, in the circumstances, regard that as a satisfactory answer?
A: No.

Sergeant Martin then gave the following evidence:

Q: What were you then concerned about in terms of the presence of the wires if you were satisfied that the power had been tripped? Why was there continuing concern there?
A: Because of the State employee – the rail employee informing me that it had been tripped and not disconnected, and he wasn't prepared to tell me that it had been disconnected.
Q: What did they mean to you, when he said it had been tripped? What did you understand that to mean?
A: I was of the opinion that basically, looking at it from a layman's point of view, the fuse had been – an emergency fuse had been tripped by the – what do you call it – short circuit of the power lines and that sometime after that it had reset itself.
Q: Was your concern that if somebody re-energised the lines while there were rescue workers in the vicinity or contact with the powers lines that people could be injured or killed?
A: That's correct.

Other evidence disclosed that although the power failure occurred and circuit breakers opened at 7:14:27 am, at 7:15 am the circuit breakers automatically attempted to reset themselves into a closed position, but opened again immediately. At 7:17:50 am, an attempt was made by the Electrical Operations Centre to restore electrical supply, but again the circuit breakers opened immediately. There then followed the advice from the Electrical Operations Centre to Mr Thorpe at the RMC, to which reference has already been made, that there was no power supply on both the up and down tracks between Waterfall and Cawley.

Although, by approximately 7:18 am, the RMC knew that the power had been lost and that an attempt to contact the train driver of G7 on the Metronet radio had been unsuccessful, another attempt to restore power was made at 7:26:08 am. Again, the circuit breaker immediately opened.

By 7:29 am, the signaller at Waterfall railway station had informed the Electrical Operations Centre that there was a derailment and resulting track failure at Waterfall and no further attempts were made to restore power to the area.

It is apparent that attempts were made to re-energise the electrical circuitry after the accident. However, fortunately, the circuit breakers immediately opened on each occasion and no rescue workers were exposed to electrocution.

Evidence tendered through Ms Guy, an expert consultant in emergency response procedures retained by OTSI, demonstrated that the disconnection of the power did not in fact occur until 8:06 am. That was done by isolating the power to the section of track between the two relevant circuit breakers, with the result that the area was then safe. It therefore took over 45 minutes to isolate the electrical supply to the area where the rescue workers were engaged. During that time the police officers and other emergency services personnel attending knew there was a risk of electrocution.

There was confusion within the SRA as to the status of the power supply in the area. Mr Noel Barber, a Network Operations Manager who was the nominated representative on the on-call list to attend major accidents, attempted to ascertain the status of the electrical supply on a number of occasions. He stated that at 7:53 am or 7:55 am he understood that the electricity was earthed. He said that at 7:56 am he was told by a Mr Munro from Fluor Daniels Electrical that the power was off. Ms Lowson, who appeared for the relatives of the deceased and the injured passengers, asked Mr Barber a number of questions in relation to what he then did:

Q: When you were told the power had been positively earthed at, I think you said, 7:56 am or 7:45 am …
A: Something around there, yes.
Q: Did you communicate that immediately to the Rail Centre?
A: Yes I rang them, or via my relay system I spoke to them and the answer that I got back was, "Yes we know".

When Mr Thorpe, the Illawarra train controller at the RMC, was asked his knowledge of the position in relation to the power supply and the source of that knowledge, he said that he received confirmation that the power had been disconnected at 7:53 am. This is consistent with the answer which he gave to Mr Barber.

However, tendered in evidence were the audio recordings of the communications between Mr Thorpe and an officer at the Electrical Operations Centre, which is also known as "elec trouble". Mr Thorpe's evidence in relation to those audio files was as follows:

Q: Can you identify who the parties were to that conversation?
A: Myself and the electrical trouble officer.
Q: And that was at 7:59:39 am?
A: Yes.
Q: And still, even at that stage, no confirmation that the power had been isolated?
A: That's what I was asking him to confirm, yes.

Although the power had not in fact been confirmed as disconnected until 8:06 am, SRA officers were informed that it had been disconnected without that confirmation being received. It is apparent from the audio recording of the conversation between Mr Thorpe and the Electrical Operations Centre that, at least as at 8:00 am, he was still attempting to clarify the situation. The reason for Mr Thorpe seeking such clarification is apparent from the audio recording, which was tendered in evidence. It contains the conversation between Mr Thorpe and Wollongong signal box and an officer of the Electrical Operations Centre. The audio recording includes the following conversation:

Thorpe:	He's removed supply from Helensburgh substation to Heathcote substation. But they cannot guarantee that the supply is free from the overhead. He's going to let me know as soon as he knows that they've got their field staff out there. Hang on a minute mate. Waterfall?
Waterfall station:	Yeah, I've got the assurance in from elec servicing in Hurstville. It's all clear to go on the line down there at Helensburgh?
Thorpe:	Hang on a minute, mate, let me confirm that with elec. Just a minute. Elec, I've got Waterfall on the phone. He says he has one of your representatives there that has given the clearance that the supply is now removed. Have you got that confirmation?
EOC officer:	Supply is removed?
Thorpe:	Yes.
EOC officer:	Still in the process of removing that supply, mate. Everything has still got to be treated as alive.

As observed above in relation to the evidence of ambulance officer Wise, he was still attempting to find out between 8:45 am and 8:50 am whether or not an assurance could be given that the power had been disconnected, and could receive no such confirmation even though the power had been isolated by 8:06 am.

This narrative in relation to the isolation of the power supply is instructive not only in relation to the inefficiency with which power disconnection occurred, it also demonstrates a lack of co-ordination between the rail industry on the one hand and the Ambulance Service and NSW Police on the other hand.

The confusion related not only to whether or not the power had in fact been isolated, but whether the expressions being used to determine whether or not people were exposed to electrocution were the same for different personnel. Words such as "tripped", "power off", "disconnected" and "isolated" appeared to have different meanings to different personnel. What was necessary was clear and unequivocal evidence that it was safe for the emergency personnel to undertake their work without risk of electrocution.
Mr Barber was asked about this confusion:

Q:	Why was confusing information conveyed about whether the power was on or the power was off? What is your explanation for the inconsistent information that you heard on the tapes that were played?
A:	Well, it could be because of some people's interpretation of power on or power off. Some people interpret power as being off as being safe. Other people interpret power as being off as being off but not safe: in other words, not earth to rail; that's the difference.

That answer demonstrates the kind of confusion which needs to be removed from the emergency response vocabulary when rescue activities are being conducted in the vicinity of power lines.

Communications

The next difficulties that were experienced by emergency response staff related to communications. The train guard on G7, Mr van Kessel, attempted to contact Waterfall railway station using his mobile telephone. As previously indicated, the calls that he made were unsuccessful or became disconnected, because the line kept dropping out, and he was unable to convey information as to the location of G7 and what had occurred. There was a Metronet radio in the guard's compartment but Mr van Kessel was not authorised to use the radio, even though it could have given virtually instantaneous contact with the RMC. Importantly, the Metronet radio was fitted with an emergency call button for use by train drivers.

There is no reason why train guards should not be trained and authorised to use the Metronet radio in emergency circumstances. This would enable identification of the train from which communication is being made and thus relieve confusion.

The language used by Mr van Kessel when he made contact on his mobile telephone did not immediately identify that an emergency had arisen. He said G7 was "in the dirt". I have referred to the fact that that no doubt indicated a derailment, but failed to convey the serious nature of the derailment. If train crew were trained that in circumstances where there has been a derailment and a situation of danger has arisen, all such communication should start with the words "Emergency, emergency, emergency", the lack of realisation of the seriousness of the situation would have been avoided. Instead of saying "We're in the dirt", what should have been said was, "Emergency, emergency, emergency, this is the guard on train C311. The train has rolled and there are serious injuries. Our location is signal 775".

There were many other illustrations of inappropriate communication, in evidence played from audio tapes during the public hearings of the Special Commission of Inquiry. On several occasions recordings demonstrated various rail employees talking over the top of one another. Others used slang and coarse language. For example, an attempt was made to obtain the mobile telephone numbers of the train driver and the guard on G7. The recorded conversation was:

Thorpe:	Can I have their names and/or phone numbers for one of them or both of them or whatever?
Wollongong rostering officer:	C311? What do you want that for?
Thorpe:	Because I have got the prick of a thing standing at Helensburgh and they won't talk to me. I've got everything standing on the Illawarra at present.

In a subsequent conversation Mr Thorpe was communicating with Waterfall signal box about the fact that a train had lost overhead power as it was coming into the platform. That recorded conversation was as follows:

Waterfall signaller:	Yeah, the driver this one that's come in, 6B, said he lost the overhead as he was coming into the platform.
Thorpe:	It's just someone's having trouble down there and no-one's fucking – no-one's doing what they should.
Waterfall signaller:	Yeah.

Recommendation 33 in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident was that "all communications protocols should be strictly enforced by accredited rail organisations". The reason why that recommendation was made was to avoid both confused and misunderstood communications and also to remind personnel involved in the transportation of members of the public that they operate in an area where safe and efficient operations can only be achieved by the use of clear and accurate communications protocols. These are not casual communications on a social occasion, they involve the communication of information about train movements which, if misunderstood or inaccurate, could result in injury or death.

The deficiencies in the equipment available for communication was not restricted to SRA employees. Senior Constable Wicks, shortly after arriving at the scene of the accident, assessed the seriousness of the situation and made several unsuccessful attempts to communicate with the police operations centre using his portable police radio.

Ambulance officers who arrived at the scene also had difficulties communicating the seriousness of the incident, to enable the necessary resources to be speedily provided. It was not until 11:30 am that a satellite telephone was provided. Superintendent Karpik gave evidence that by the time the satellite telephones had arrived, the rescue phase of the operation was virtually over.

In all remote areas sufficient satellite telephones should be available for immediate use by all emergency services. The rail organisations should have satellite telephones available for their officers on duty to deal with any major incident that may arise in any outer urban area.

Another communications deficiency following the accident related to the signal telephone system. As the Glenbrook Inquiry demonstrated, all signals are fitted with a signal telephone which has a landline to the signaller responsible for the operation of that signalling area. There was a signal telephone at signal 775, located approximately 176 metres from the area where G7 derailed. Mr Barber attempted to use that signal telephone, but it was not working. There is not much point in having signal telephones if they are not in working order. More importantly, of the emergency personnel who attended the scene of the accident, none was aware of the presence of signal telephones. This is another illustration of inadequate communication and co-ordination between the rail industry and emergency responders.

Chief Superintendent Roger Bucholtz of the New South Wales Fire Brigades gave evidence that initial information was very sketchy and there were delays in getting the necessary resources where they were needed. He was of the opinion that to reduce delays it was desirable that there be a direct line of communication between the Fire Brigades operations centre and the RMC. He also regarded as desirable that there be a tie line, which is a line of communication which is open to the emergency services and, when necessary, the RMC, so that the various agencies can talk to one another at the same time when the need arises.

A further communications deficiency that occurred was that when communication was made with the RMC, different people received the communication and relayed information. There was no single dedicated person at the RMC responsible for managing communications between the centre and outside agencies.

Site control

The next matter with which I shall deal relating to the emergency response is concerned with control of the accident site.

Under the Incident Management Protocol dated February 2000 between State Rail Authority and the NSW Police Service for the Management of Responses to Incidents on or near Railway Tracks in the Sydney Metropolitan Area, NSW Police is the lead agency for incidents where there has been a derailment followed by loss of life or serious injury. Thus it is the agency responsible for control and co-ordination of rescue activities. This memorandum of understanding was prepared specifically for the Olympic Games in 2000 and has not been revised.

The senior officer present and in control of the site was Superintendent Karpik. As such, under the memorandum of understanding, he was the site controller. However, he wore a tabard with the words "police commander" on it. Sergeant Martin, who was carrying out the duties of the police commander, wore the tabard with the words "site controller". The distinction between these two positions is that under the incident management plan, the site controller is the most senior police officer present and is responsible for the whole of the management of the site, whereas the police commander is responsible for the management of the police resources present at the site.

Two problems presented themselves as being significant immediately after the arrival of Superintendent Karpik and Sergeant Martin. The first was that, by the time they arrived at approximately 7:43 am, a number of persons had already started to converge on the site. Superintendent Karpik was asked how many people were there by the time he arrived and he said:

> I estimate there would have been about 50 other people, made up from Ambulance, SES [State Emergency Services], Rural Fire Service, NSW Fire Brigade and Police, if not more than 50.

It is unlikely that Superintendent Karpik is correct in his recollection of the number of persons present at the time he arrived, as he was one of the first to arrive. His estimation is likely to be correct as to the number of people who attended the accident site shortly after his arrival. He said, "On this occasion, everybody has just rushed straight to the scene, blocked the access routes and made it difficult, until we could clear that, and there was no site control as such".

Of those persons present, Sergeant Martin estimated that approximately 30 of them were railway personnel and did not observe them taking part in the co-ordinated rescue.

Ms Guy, in her report, stated:

> Some rail staff accessed the site in the rescue phase and one staff member entered the train and pulled circuit breakers inside the train without being requested to do so. Another staff member was peering into the driver's compartment and another entered the guard's compartment.

Later in her report she made the observation:

> Some rail staff self-responded and went to the site to see if they could assist. Although they may have had the best intentions this does lead to further congestion. Only staff who have a defined role should be on site. Staff involved in the restoration or recovery operation should not be on site until completion of the rescue phase.

A large number of railway employees self-responded, most of whom had no role to perform. Ms Guy stated in her evidence "convergence at emergency sites can cause great problems". She later continued:

> The staff who are responsible for the recovery and restoration of that area of the track are not needed immediately and, therefore, there is no requirement for them to be on site immediately. So their arrival at the site can be delayed until such time as they are needed. Because convergence is such a problem, so it's trying to keep people back who aren't needed until such time as they are.

She later stated:

> If they get in the way they can impede the emergency services and the rescue. It is a dangerous area for people to be traipsing around in. The more people traipsing around, the more evidence that's going to be destroyed for the subsequent investigation.

Superintendent Karpik, shortly after his arrival at the accident site, attempted to establish site control in accordance with the usual practice. He stated:

> I first of all spoke to the most senior ambulance officer that was down at the scene, at the crash site, and I asked him to wait at a certain point so that we could start getting site control going. I then went and got another Inspector from the New South Wales Fire Brigades and brought him over to where the ambulance person was supposed to be. That ambulance person was called away. I asked him to wait so we could get site control going and went and got the Rural Fire Service person to come back, and while I was doing that, that officer got called away. So to try and establish site control was virtually, in that situation, impossible.

Superintendent Karpik then reassessed the position. He said in his evidence:

> I had to make a decision, do I go formally and call everybody back and risk injured people most probably being more seriously ill, killed, dying as a result of that, or let things go as they were going and then establish site control after the rescue process was over, and that's what I decided to do.

Given the lack of training of the rail service personnel who self-responded, and the failure of the Ambulance Service, Fire Brigades and Rural Fire Service personnel in charge of their respective officers to follow any set procedure, it is understandable that Superintendent Karpik took the view that in the circumstances it was better to let the disorganised process

continue. If the various agencies who responded did not act in accordance with a clearly defined pre-existing plan, it was impossible to attempt to establish one at the scene.

Superintendent Karpik stated the purpose of site control clearly in his evidence:

> The purpose of site control is to make sure that the tasks are allocated appropriately, that they are prioritised which ones have to be done and at what time level so that you have ultimate control. If there is death and injuries, as in this case, it becomes a crime scene: numerous investigations, thorough investigations, have to be undertaken. So, therefore, it is important that we get control – co-ordination and control in place as soon as possible.

In fact, Superintendent Karpik said that the first such site control meeting was held after 11:00 am, "once the rescue phase was completed".

The way in which Superintendent Karpik then obtained site control was that he ensured that everyone was informed that "the rescue process is now completed. This is now a crime scene. Everybody leave the area, please".

The congestion during the rescue phase was not confined to personnel. Superintendent Karpik described what had happened with the vehicles that had been driven to the accident site. Rescue personnel did not adopt the accepted practice in these circumstances, that is leaving the keys in the vehicle or alternatively having someone remain with the vehicle. It appears personnel arriving in vehicles got out of them, taking the keys with them, thereby blocking the access track and preventing ambulances from entering the access track.

It was apparent to me from the evidence given by Superintendent Karpik and others that there was a lack of any standardised procedure for emergency response from the various emergency services and the railway representatives who attended. Superintendent Karpik stated:

> All the emergency services know that in an incident like that we have got to have site control and each agency has to allocate liaison officers to it. That didn't happen, as much as I tried to get that to happen, and it is a reflection back again on each of the emergency services, they should have known that had to happen, but it didn't happen at that location.

One aspect of the absence of site control and co-ordination which this incident revealed, and which was noted in the evidence of Superintendent Karpik quoted immediately above, was the lack of any appropriate system for liaison. This was a very serious rail accident where specialised knowledge in relation to rail-related matters was required.

The SRA incident management plan designates an individual as a rail commander whose purpose is to liaise with the police. It also required him to be available at all times to the police site controller to assist in any necessary railway related information required by the site controller, such as whether the electrical wires are live, the location of the nearest access tracks, the location of signal telephones, how to open the doors on the train, and to arrange specialised railway equipment and matters of that nature. It is important such a person be present to support the police in any major rail accident.

The person who was designated as rail commander on that morning was Mr Noel Barber. It appears he arrived at the accident site at around about 8:15 am and he said he introduced himself to Sergeant Martin somewhere between 8:30 am and 8:40 am, approximately 45 minutes after Sergeant Martin's arrival and approximately 15 to 25 minutes after he arrived. It appears he did this because Sergeant Martin was wearing the site controller's tabard, even though he was not the site controller. The site controller was in fact Superintendent Karpik and he did not meet Mr Barber until sometime in the afternoon. Mr Barber said of his meeting with Sergeant Martin:

> I just said I was in charge of the rail response and I indicated to him that I believed he was in charge of the site because he had the vest on and I was of the understanding it was a crime scene and I offered my assistance.

Although the rail commander, Mr Barber, was the person who was supposed to be working with the site controller, Superintendent Karpik, it transpired that Superintendent Karpik had no dealings with Mr Barber during the rescue phase of the operation, but he did have dealings with another railway employee, Mr Errol Wilson, who appears to have been employed in a managerial capacity in the area of passenger fleet maintenance. Superintendent Karpik said of him:

> I don't know whether he was a foreman or what he was, but he seemed to be in control of the railway workers that were there, and he was the person I was communicating with, wanting to know what had to be done, and how things had to be done, what police and rescue people were going to do, what the procedures were going to be first. He was the main person and the majority of my meetings were with him.

Superintendent Karpik was asked why he identified Mr Wilson as the point of contact in relation to rail related matters and he replied:

> He seemed to know what he was talking about, sort of thing, and he was very helpful, you know, identifying that the lines – the tension wires were down, "This has to be done. We have got to be careful of these issues", and things like that. He would organise – at a later time he would be organising the cranes to come down, he would be organising the people to come down to cut the tension lines, the power lines, to make sure that things were right.

Although Superintendent Karpik identified Mr Wilson as a person who appeared to know what he was doing, he did not, as required by the incident management plan, work in tandem with a rail commander. Superintendent Karpik stated that neither he nor his officers asked for the rail commander or the forward commander to be identified.

Mr Barber was asked for his explanation as to why, in effect, the incident management plan that the railways should have been following was not followed on this occasion in relation to the role which he should have played as rail commander, liaising with the police and assisting the police and other emergency personnel. His response was:

> Ideally that is the situation we would like, but given the confusion on this morning and the number of people who were there, it was a very difficult site in the first instance to manage and it wasn't until later in the morning that we

> gained some sort of control over the area and we set up our perimeters and set up our induction process.

Ms Guy in her report made a number of observations as to what she thought was deficient in the way in which this incident was managed, from an emergency response point of view. She observed that although there is a position described as "rail commander", there are no details as to what that person is supposed to do, whether it was to provide support for emergency services or limited to the restoration of the rail services as soon as possible.

Ms Guy also observed that it is necessary to identify the authority of the rail commander. There was a large number of railway personnel on the site who did not have any role to play in the rescue and who could have impeded the rescue operation and been a danger to themselves. It is not clear whether the rail commander had the authority to exclude those people from the site. It does not appear that unnecessary personnel were excluded from the site until 11:00 am, when Superintendent Karpik advised those present that the site was a crime scene and they must leave. When Mr Barber was asked about these railway employees and his relationship to them his response was, "They weren't my staff but they were rail employees, yes".

The role of the rail commander needs to be clearly defined. If it is a liaison role with police and other emergency services, then this should be made clear. Likewise, if it is a role of supervision over railway employees as well, then this should also be made clear and should include authority to direct rail personnel, particularly those not involved in the rescue, to leave the site.

The adequacy of the emergency response plan

As this narrative has shown, the emergency management systems for responding to serious rail accidents were inadequate on this occasion. It is necessary therefore to consider why this has occurred and what recommendations should be made to improve this aspect of rail operations. There appear to be two main reasons for the deficiencies that have been identified in the emergency response.

The first is that the SRA had an incident management plan which was lengthy, convoluted and difficult to understand. The second is that the different emergency responders were operating under different procedures. The Fire Brigades were using a standard procedure based upon what is known as the ICS, or incident command system. The police were operating under a memorandum of understanding with the SRA and in accordance with their own practices, and the ambulance officers were following the procedures utilised by them as part of the standard Ambulance Service response. Although there was a number of similarities between the responses of the different emergency services to this accident, there was a lack of co-ordination between the various response organisations.

Ms Guy reviewed the procedures under which the SRA personnel were supposed to have acted, as contained in the 2002 version of the State Rail Network Incident Management Plan. This was a document some 46 pages in length. The first matter which Ms Guy identified as being relevant is that it was produced in December 2002, approximately two months before this accident. She made the point that staff had not received training in its operation.

According to the submission ultimately made by Mr Garling on behalf of the SRA, the plan was prepared to accommodate the fact that a new RMC had been established and that this centre had not been operating for a very long period before the Waterfall rail accident. The quality of the plan does not depend upon whether or not the RMC had been in existence for a short period of time. The quality of the plan must be assessed against its usefulness for its purpose regardless of when it came into operation.

Ms Guy's observations about the Network Incident Management Plan were:

> I found it a bit confusing to read and I found it didn't clearly lay out the roles and responsibilities of the different departments within the organisation and/or some of the key personnel who would have to respond. And as a result, there's a lot of text in there and, because there's a lot of text, some of the important points aren't highlighted. I would have preferred to see something that clearly lays out roles and responsibilities, so from that people can draw clear procedures.

It would appear the deficiencies in the 2002 document were recognised because the Special Commission of Inquiry was provided with a further document described as the Network Incident Management Plan, Final Draft Issue 1.0 dated November 2003. In addition, there was another document provided which was titled "RailCorp Incident Response Plan (Response to Rail Incidents), Draft Issue 1.1, dated December 2003". Dr Edkins noted that a number of rail personnel were using the most recent document, Draft Issue 1.1, as if it had been accepted as the final version that should be followed, whilst it was in draft form.

Ms Guy was asked about the last draft, dated December 2003, which was intended to be an improvement upon the 2002 document, and she said of it:

> I really found it very difficult to decipher, as I say, all the roles and responsibilities of a department. I found they'd been scattered throughout the plan. Throughout the plan there might be a description of different functions that had to be carried out and under those functions it might describe some of the roles and responsibilities of a department, but that would be scattered throughout the plan under different functions. As a result, it's very difficult to piece together what the roles and responsibilities of one department might be. From a plan, you've got to be able to write your checklists. To do that effectively you've got to know very concisely what your roles and responsibilities are.

It would appear that it was almost inevitable that there would be little improvement in the various versions of the incident management plans that the SRA has been developing between 2002 and 2003, because the officer responsible for that process, Mr Doak, had no formal training or education in that process. Mr Doak, who prepared the revisions of the plan, stated that he based his revisions upon other railway incident response plans from Australia and overseas and upon State legislation relating to emergency plans in use in New South Wales. When Mr Doak was questioned about the absence of any checklists in the draft that he prepared. His response was:

> We have to understand the framework of our incident management plans that we are currently finalising. The current two plans in draft format are not – are

> high level plans and are available – the intention is to be available for reference by all operating classifications. However, the detail of those plans is not intended to be conveyed and expected to be understood in the full detail by the likes of train drivers, train guards, infrastructure workers, signallers etc. They will have more specific detailed information providing [sic] to their specific classification. However, management need to understand the principles of the network incident management plans, both from a functional response point of view and a network response perspective.

Having read the plans to which Ms Guy referred, like her, I found them confusing and verbose. Ms Guy is an expert in incident management. If she found them confusing and verbose it is difficult to understand how a manager, let alone "all operating classifications", could have any chance of actually understanding what they need to do when an emergency arises.

I agree with Ms Guy's observation that what is necessary are checklists. It seems to be little more than common sense that under the stress of an emergency situation, where a train has derailed and persons are injured or killed, that long and convoluted documents are of no assistance. Ms Guy stated that checklists enable persons responsible for the tasks set out in the checklist to determine which of the items suit the particular circumstances. By this means important matters are not omitted and the checklist provides the opportunity to consider all relevant procedures that need to be considered and the order of performance. Having a plan, which is clear and concise, where roles and responsibilities are defined is only one part of what needs to be done.

Exercises

Ms Guy emphasised that it is essential that there be training in the way in which the plan is to be implemented. This should be done through practical exercises.

It was apparent that Ms Guy did not believe, in the context of the rail industry, that rail organisations such as the SRA should themselves have total responsibility for ensuring that necessary exercises are carried out. She expressed the view that the regulator had an important role in ensuring that that occurred. In her report she said:

> The Rail Safety Regulator should consider imposing a standard with regard to the regularity of the conduct of exercises involving a train accident. Various exercise scenarios should be planned and should test a "worst case". This would involve a full train load of passengers and could include factors such as poor weather, an accident in a tunnel and other difficult access conditions. The Rail Safety Regulator would have to attend these exercises and follow-up to ensure recommendations are put in place.

In her evidence Ms Guy identified two reasons why exercises were important:

> First of all, obviously it is very beneficial for training the staff, but also importantly it is a way of testing if your plan's workable or not. It's one thing to write a plan, but you don't really know if it works until it has been tested, and one of the best ways to test it is through exercises. That's often how you find out problems, things you've omitted in your plan or things you've done

wrongly, and find out it doesn't make sense. It's a way to ensure that you've got a plan that actually works – find the mistakes out in an exercise rather than finding them out on the day of an emergency.

Tendered in evidence were the results of exercises carried out by the SRA. On 23 May 1997, the SRA carried out an exercise, "Blue Rattler", to test the adequacy of its emergency response arrangements to determine ways to cope with a major emergency in the Sydney underground tunnel system. In the final exercise debrief report the results of the exercise were encapsulated:

> The following summarises the major critical issues identified by the Directing Staff and Umpires during the conduct of exercise "Blue Rattler":
>
> 1. It was the unanimous view of all combat agencies involved that had the incident been a real emergency it is probable that all train passengers would die from smoke or fire either on the train or in the tunnel.
>
> 2. In this exercise the train carried only 40 passengers, but at peak times the train would have carried over 1500 passengers. At any given time during peak hours in excess of 30,000 passengers are carried on trains within the Sydney rail underground system. This is not including those waiting at railway stations.
>
> 3. Combat agency/emergency services personnel would be exposed to serious injury, if not death, in attempting rescue in the tunnel because of the hazardous conditions.
>
> 4. The existing communication system in the tunnel and trains is seriously deficient. In fact, there is currently no communication means available on the train for the guard or driver on the train to pass advice of an emergency to the nearest Stationmaster, State Rail Control Centre or the State-wide emergency 000 telephone number.
>
> 5. Failure of telephone systems within the tunnel.
>
> 6. It was also extremely difficult for emergency services and rail authority personnel to maintain reliable electronic communications with their own organisations in the tunnel.
>
> 7. During the exercise it was found that with no smoke extraction system in place that all passengers on the train would have been asphyxiated. There is currently no ventilation system in place in the tunnel. [The w]hole of [the] tunnel relies on the movement of trains within the tunnel to provide air. If no movement of trains no air. In the event of another train(s) being halted the occupants of the train(s) would also face a serious hazard.
>
> 8. There are no smoke, fire detection or fire suppression systems installed in the tunnel. Passengers aboard the train were unable to self evacuate from the train due to the fact that the systems to enable passengers to

escape from the train have been withdrawn because of vandal problems. Access to, and operation of, train outside door releases by emergency service agencies in the event of an emergency were matters noted and of concern to the Exercise Working Group.

9. The difficulty of Fire Brigade personnel to gain immediate access to the front or rear of trains (Tangara train) in the event of an emergency in the tunnel. Keys to the train front and rear doors being held by limited SRA personnel.

10. Inappropriateness of current train ladders. These ladders being difficult to manhandle and place. Passengers, particularly those suffering from even minor disabilities, would experience great problems in being able to alight from train carriages under conditions of dense smoke in the tunnel.

The same summary contained a number of recommendations. These were:

1. CBD underground fire and life saving systems need to be completed at all stations. Installation of smoke extraction/exhaust systems required, but such installation must be done in consultation with council and other relevant authorities. Prior to the exercise two systems were tested at St James and Museum Stations. The tests of these systems showed them totally unsatisfactory for a fire of medium intensity in the underground rail tunnel system.

2. Improved access for emergency agencies to the incident site and trains under smoke and other hazardous situations.

3. Overhaul of all means of communication in tunnel system and aboard trains to enable:

   (a) train crews to communicate with emergency management agencies and rail authority staff;

   (b) emergency management agencies to communicate with other combat agencies and personnel within their own organisations.

4. Review of emergency ladders currently used by State Rail.

5. Review of liaison arrangements between combat agencies and SRA.

6. Review of arrangements for the evacuation of persons from trains.

7. The agreement of the Minister for Transport to the appointment of one Rail Authority Emergency Management Co-ordinator who is able to commit and control the resources of all Rail Authorities if they are requested to do so by either a Combat Agency Commander or Emergency Management Controller during a rail emergency.

8. Review of training of:

   (a) rail industry and operator personnel to enable staff of these agencies to provide a more effective response to all types of rail incident in the future. Groups especially identified are drivers, guards and station personnel within the Sydney underground railway tunnel system. In conjunction with this training simple Standing Operating Procedures (SOPS) must be developed by rail authorities/operators for their personnel;

   (b) emergency management personnel in responding to rail emergencies.

9. Research of methods used overseas to deal with fire or other emergencies in railway tunnels.

10. Need for further specific tests on matters not covered in the exercise – e.g., smoke propagation tests both on trains and in tunnel system. These tests to be conducted in consultation with the Exercise Working Group.

11. Keys to trains to be provided in a glass-fronted box in station emergency control rooms.

In her evidence in relation to exercise Blue Rattler, Ms Guy said:

> You must take the lessons learnt from that exercise and take action to correct any problems that occurred. Exercises are no use unless you learn from them and act upon the recommendations.

From what have already been identified as deficiencies that occurred in the aftermath of the Waterfall rail accident, it would appear the lessons that should have been learned about communications between emergency services and railway staff, communications among emergency services, arrangements for the evacuation of persons from trains, the need for the appointment of one Rail Emergency Management Co-ordinator to control the resources of all rail entities, and a review of the training of rail industry personnel to enable staff of these entities to provide a more effective response to all types of rail incident, did not take place. Exercise Blue Rattler did not achieve the desired aim of either enabling better procedures to be developed or recommendations to be implemented so as to overcome the deficiencies the exercise demonstrated.

Given the identified deficiencies one would have expected that, as suggested by Ms Guy, exercises would regularly be carried out for the purposes of overcoming the deficiencies exercise Blue Rattler revealed. However, it would appear from the evidence that no further exercises were conducted until 1999. The 1999 exercise did not have as its purpose the saving of the lives of passengers and it did not involve co-ordination of emergency services. It was carried out in preparation for the Olympic Games. It was described by Mr Bernard Hudson, Regional Network Operations Manager for the North West/CBD Region, as being an exercise which was "internal only". He said that:

> It was revolving on how we would cope with a derailed train in the western corridor for the – during the Olympic Games period.

He agreed the object of the exercise was to determine how the rail system could cope with such a derailment, so as not to disrupt train services due to the very heavy demands on the rail service created by the Olympic Games.

There was at least one exercise, "Quick Flash", involving railway station staff, who conducted an evacuation of a railway station. Very little information about this exercise was made available.

An exercise about which some detail was given was an exercise conducted on 7 September 2001 and known as "Wombat". It had as its purpose the testing of the arrangements contained in the airport line site emergency management plan. The scenario used was a train coming to a standstill between stations, with a fire in the roof compartment. A debrief was conducted on 21 September 2001, with all agencies involved in the exercise represented. A number of issues was raised that needed to be reviewed in the light of the outcomes from that exercise. According to the report, dated 7 November 2001, to the Director General of the Department of Transport and the Co-ordinator General of Rail, the main issues arising from that exercise were:

1. A lack of understanding and/or knowledge of the protocols contained in the airport line site emergency management plan.

2. There was no-one present at the exercise to act as Rail Commander (Incident Management Co-ordinator) who is the single point of contact between the rail agencies and emergency services.

3. There was confusion as to when or if the overhead power was made safe, the definition between power off to power isolated [sic] and the process that needs to be followed.

4. The GRN [government radio network] system failed to handle the amount of radio communications required.

5. There was conflict between emergency services for control of operational staff at the incident site.

6. There was confusion of when the site controller (police) should hand the site back to the rail after all passengers were evacuated; and

7. The exercise directing staff indicated that they experienced problems in obtaining State Rail input into the planning stage of the exercise.

That report was written by Mr Alan Lidbetter, Transport Safety Officer, Department of Transport to the Director General of the Department of Transport and the Co-ordinator General of Rail. Mr Lidbetter observed:

> It should be noted that the majority of issues that have been identified in this exercise have been raised in past exercises.

After the Waterfall rail accident, there continued to be a lack of understanding or knowledge of protocols that should be followed in emergency response plans; there was no rail commander who acted as a single point of contact between rail agencies and emergency services; there was confusion as to when, or if the overhead power was made safe; confusion about the meanings of the expressions "power off" and "power isolated", and what processes needed to be followed to isolate power supplies; and that the radio communications were inefficient.

Although the deficiencies identified in exercise Wombat, and the emergency response to the Waterfall rail accident, demonstrated less than adequate emergency response procedures, nothing appears to have been done to improve the performance of the rail industry or the emergency services in response to serious rail accidents. There has only been, on the evidence before me, one other exercise since the Waterfall rail accident. That was exercise "Shield" and, again on the evidence before me, that did not involve a train accident.

The level of preparation and the deficiencies that have been identified in this chapter in relation to emergency response issues are a matter of serious concern. It is not only because incidents occur accidentally on the rail network. Events over recent years have demonstrated that railways are often a target for deliberate activity by persons wishing to use violence as a means of highlighting or influencing political or social ends. The terrorist bombings on the commuter train system in Madrid, Spain, on the morning of 11 March 2004, in which 191 people were killed and more than 1,800 people injured, is a tragic example of just such an attack.

On 18 February 2003 an arson attack occurred south east of Seoul, South Korea on a train in an underground railway station and at least 133 passengers were burnt to death. Most of the passengers who died were in a second train where the doors remained locked for 20 minutes after the fire started.

On 20 March 1995, a terrorist attack using poison gas in the Tokyo subway occurred, resulting in the death of 12 people and injuries to thousands of passengers.

As recently as 6 February 2004, a bomb was exploded during the morning rush hour in the Moscow metro system, killing 39 people and wounding 129 others.

It is notorious that mass transportation systems are targets for deliberate conduct of this nature. Fortunately, so far in Australia, such an event has not occurred. However, emergency response on the railway system by and between police, ambulance and fire services and the rail industry needs to be fast and efficient, not only to minimise the loss and damage from incidents on the rail network, but also the consequences of deliberate conduct. However an incident is caused, there is a need for an efficient response.

Conclusions

It is possible to readily identify the kind of emergency response that needs to be instituted in these circumstances. Overseas, particularly in the United States of America, considerable attention has been given to emergency response procedures in circumstances where there is the risk of terrorist activity or other criminal conduct on the rail network, causing injury or death to passengers.

Considerable investigations have been conducted in this area by the various rail inquiries conducted into a number of serious rail accidents in the United Kingdom. The European Commission, as part of its review of railways for the purpose of standardising safety procedures, has also given attention to methods by which the optimum emergency response practices can be put in place.

Before dealing with what should be done to improve the emergency response, it is desirable to summarise the particular areas where deficiencies can be identified.

First, there was a failure in the RMC to contemplate that a serious rail accident had occurred. The major incident management response was not triggered until 7:32 am. At 7:18 am, 14 minutes earlier, the necessary information was available which should have resulted in the declaration of an emergency and triggered the incident management response.

The reasons for the delay in identification of the emergency were, first, that there was a lack of awareness of the possibility of such an event occurring, including refusal to accept that an emergency had occurred when the RMC was informed by emergency services personnel that there was a report of a derailment. Secondly, the area where the accident occurred was not mimicked at the RMC. There was a mimic board at Waterfall railway station, which showed at 7:15 am that a train was occupying the up main track, even though there was no train scheduled to be on that track, but the RMC did not have any technological means by which it could determine that G7 occupied the up main track. There is no evidence to suggest that that deficiency has since been rectified.

The RMC was established in response to the findings and recommendations of the Glenbrook Inquiry. One of the purposes of such a centre is to facilitate a speedy emergency response. To do this it must have available to it all relevant information and not have to attempt to obtain it from several different sources or, worse still, speculate.

Secondly, power to the area was not immediately isolated. A train was heading in the opposite direction on the adjacent track and, although it was brought to a stop by a red signal and by loss of power, several attempts were made to restore power.

Thirdly, some emergency response personnel were given inaccurate information as to the location of the accident.

Fourthly, as a result of the lack of accurate information as to the location of the accident and a lack of knowledge of means whereby access could be obtained to the track at different points, valuable time was lost by officers of NSW Police, New South Wales Fire Brigades, and importantly, the Ambulance Service of New South Wales. This could have produced unnecessary loss of life or more serious injuries.

Fifthly, the gate leading down to the accident site was locked and emergency services personnel did not have a key. It was necessary for railway employees to unlock the gate.

Sixthly, when emergency response personnel arrived, passengers were trapped in G7. More is said in relation to this aspect of the aftermath of the accident in the section of this report dealing specifically with matters to do with emergency access and egress.

Seventhly, emergency response personnel were not aware of the features of G7 which would have enabled passengers to be promptly evacuated. Accordingly, various emergency response personnel attempted to break windows when, if they had known, they could have opened the doors by the external door release.

Eighthly, communication with the RMC could not be undertaken in the most efficient manner, which was by the train guard using the Metronet radio, because the guard was not permitted to use it. Had he been able to do so then, he could have quickly communicated the critical details to the RMC using the Metronet radio.

Ninthly, the inability to use the Metronet radio was not the only communications equipment deficiency in the events as they unfolded. Mobile telephone reception in the area was weak and spasmodic. The signal telephone which was located a few hundred metres from the accident site did not work. In any event, emergency response personnel did not know of its existence as an alternative means of communication with the nearest signal box. Finally, it was necessary in order for adequate communications to occur that satellite telephones be used. However, these were not immediately available to all emergency response personnel that needed them.

Tenthly, there was a number of deficiencies in the communications procedures that were in place. There was no single nominated contact person at the RMC with overall responsibility for the management of the incident. Evidence was given that in the 43 minutes immediately after the accident there were 71 minutes of recorded conversations. This meant that many conversations must have been occurring at the same time. It also follows that different information was being provided at the same time by different people to different callers, a process which could only generate confusion and a less than efficient response to the emergency. In addition, there was no compliance with any language communication protocol at a number of different levels. The train guard, by his use of expressions such as "in the dirt", although indicating a derailment, did not identify that a serious emergency had in fact occurred. There was no provision by the train guard in his conversations of critical information such as the precise location of G7, the location of the nearest signal or the number of passengers being carried by G7.

Eleventhly, the procedure for identifying a site controller from the emergency services, in charge of the accident site, was not followed. The lead agency was NSW Police, but the actual site controller was wearing the police commander's tabard, and not wearing the site controller's tabard, indicating a different responsibility. Fortunately, this did not create serious difficulties because none of the emergency response personnel who attended the site were proceeding under any particular co-ordinated response plan. However, Mr Barber, the rail commander, introduced himself and spoke to Sergeant Martin in the belief that he, and not Superintendent Karpik, was the site controller.

Twelfthly, there was no proper site control. As is described later in this chapter, there are recommended procedures by which cordons are established. The cordons enable access to the accident site by the appropriate response personnel when needed. There was congestion of unauthorised personnel at the accident site, including on G7. There was also congestion on the access track because persons responding had left their vehicles and taken their keys, thus blocking the track. This lack of site control did not, in the circumstances of this accident, produce any death or aggravation of injuries, but could have done so in different circumstances and must therefore be avoided. Not only does there need to be an inner and

outer perimeter, there also needs to be a means by which any emergency response personnel can determine where to go to best facilitate the emergency response. Police evidence was that in earlier times, they carried a flashing light to identify the location of the site controller, but that practice has been discontinued. It is desirable that that practice be reinstated so that people know to whom they should go to obtain information.

Thirteenthly, the rail commander who attended, although designated as a rail commander, failed to perform the emergency response function that should have been carried out in that position. The purpose of a rail commander is to provide support for the lead agency, NSW Police. The rail commander, Mr Barber, not only failed to identify himself to Sergeant Martin, who was wearing the site controller's tabard, for approximately 45 minutes after he arrived, but also did not remain in the vicinity of Sergeant Martin, whom he believed to be the site controller, to provide the necessary support to ensure that the emergency response was as efficient as possible.

In making these findings and observations, I wish to make it clear I am not criticising any individual. The police and other emergency personnel acted with great courage, and dedication, but the absence of proper planning, co-ordination and training meant that they were exposed to unnecessary risks. The risk of injury from breaking windows with rocks or electrocution from overhead electrical wiring that may have been re-energised are but two examples. It is very important when tragic events like this occur to identify deficiencies in the emergency response, to better prepare for any future catastrophe.

Having identified, in summary, what went wrong in the emergency response, it is helpful to identify some of the reasons why it went wrong. These too may be summarised.

First, there was no designated emergency response line to the RMC. Such a line should have existed and should have been used for an incident such as this.

Secondly, there was no nominated officer at the RMC to immediately take control of events at the RMC as soon as it was apparent that a serious accident had occurred. All the relevant information necessary for such a decision and response was available within four minutes of the accident, but it took 18 minutes for the major incident management process to be implemented.

Thirdly, there was no single means of communication between the RMC and the emergency services. Telephone calls were being received on a number of different telephones by different people. There should have been an immediate link up between the RMC and a central communication point in each of the emergency services, so that efficient communications could be established immediately and continue during the emergency response phase.

Fourthly, there was no system for immediately disconnecting the relevant power supply. On some rail systems there is a means whereby any person can pull a clearly identified trackside lever and disconnect the power supply and it will remain disconnected for three minutes unless a telephone call is made to provide the reason why this was done. If such a telephone call is made, then the power can be kept off. If no such call is made, then power is automatically re-established. In the United States, a number of railways have a so-called "blue light" system. A blue light indicates the presence of a trackside lever. A rail employee or a member of the public can pull the lever, and by doing so immediately disconnect the

power supply to the area, making it safe for persons to enter upon the track and preventing power being supplied to any other trains in the vicinity. In those railways, all employees are trained in the location and operation of the blue light system because they are the persons expected to initiate the removal of power if an emergency requiring that precaution were to occur.

Fifthly, emergency personnel did not have knowledge of maps showing access points to the track and, even when the access points were identified to them, they did not have keys to open the gates. It is desirable there be a master key for access and this should be available to all police stations to enable quick access to such areas.

Sixthly, there has not been developed a railway disaster plan or "displan". There is a New South Wales State emergency management displan and within that plan there are sub-plans dealing with emergency situations such as an aviation accident, bush fire, flood, a hazardous material incident and a major structural collapse, but there is none to deal with rail emergencies. This is obviously desirable and should be developed.

Seventhly, the various emergency services that responded were not responding in accordance with an ICS or incident command system, which informed each response agency what it should do and how its activities formed part of an overall response.

In many countries, and in some emergency response agencies within Australia, the ICS procedure has been adopted and mandated. This is an incident command system whereby particular behaviours are implemented immediately upon emergency personnel attending the site of a disaster such as this. Some of the elements of the ICS: are perimeters are established around the accident site, so as to control access to the site and the orderly evacuation of the site; and a staging area remote from the site is established, so as to better martial resources that need to be sent in for the purposes of the rescue operation. In this case a staging area was located on the Princes Highway, but there was no proper control of the area immediately around the accident site, resulting in congestion of both people and vehicles, thus impeding rescue efforts and having the potential to destroy important evidence.

There was no unified command structure. Superintendent Karpik attempted to establish a command structure, but other persons were unaware of its existence. A unified command structure is important to enable strategic decisions to be taken, in particular as to what resources should be available and in what order, and to engage in other operational planning and the co-ordination of various response agencies.

Common terminology needs to be developed. As previously noted, various ambiguous descriptions were given as to the status of the electrification of the wires in the area. It needs to be made clear to emergency personnel that a particular expression cannot be misunderstood.

The ICS should be capable of being implemented immediately so that all response agencies are following the same system. It should also be capable of expanding or contracting as circumstances demand. For example, if an emergency is declared then the ICS should immediately become the method by which response is to occur. If it is determined to be a relatively minor incident, then the strategic planning phase and determination of the amount of resources can be quickly completed. If it is a major incident with deaths and injuries, then the ICS needs to have the means whereby the response can be expanded to meet the ongoing

demands of the situation. Obviously, inherent within this needs to be the ability to access all available information and to communicate accurate information to those that need to respond or not respond, as the case may be, depending upon the size and nature of the incident. The communications equipment to do this must be available immediately.

Also inherent in that process of communication is the need for integrated communications both within response agencies and between agencies involved in an incident. This means having compatible equipment and uniform communication protocols.

The ICS requires that there be an action plan by which individual persons within the system know what they are required to do. The agencies should know their own responsibilities and be aware of those of the other agencies involved.

The rail industry needs to develop checklists for its staff to follow in the event of a particular kind of incident, such as a derailment. For example, the train driver should have a simple checklist identifying the information which he should immediately communicate to the RMC. Similarly, the checklist for a derailment should include:

(a) train identification number;

(b) location by milepost or track designation;

(c) whether or not there is a fire on the train;

(d) the number of passengers;

(e) the identification numbers of the cars that are derailed or damaged;

(f) the number and location of passengers who are disabled or injured.

This is the type of checklist for train drivers which is used by the San Francisco Bay Area Rapid Transit, known as BART, and by many other railways within the United States.

Other railway personnel need to have checklists identifying clearly and precisely what they are required to do in the case of an emergency and the order in which things are to be done. For example, in the United Kingdom, the Association of Train Operating Companies, also known as ATOC, distributes guidance notes from time to time which set out the procedures to be followed by various railway crew in the event of an accident. The checklist for the train driver requires the driver to:

(a) immediately switch on the tail lamp in the front of the train;

(b) immediately switch on the hazard warning indication;

(c) check the exact location of the train;

(d) check whether any other lines are obstructed (if in doubt, treat them as obstructed) and decide the quickest way to stop any approaching trains;

(e) contact the signaller using the quickest way possible, either a cab radio emergency call or any available telephone or any radio system;

(f) then the train driver must do these things in the following order:

(i) state, “this is an emergency call”;

(ii) identify the driver and the train reporting number;

(iii) identify where the driver is speaking from;

(iv) state what has happened, clearly;

(v) state the exact location of the train accident;

(vi) state which lines are obstructed;

(vii) state whether traction current needs to be switched off; and

(viii) state whether emergency services are needed.

Once the signaller receives such a communication, the signaller’s checklist requires him to:

(a) immediately protect each obstructed line by placing signals to danger or arranging for this to be done;

(b) take any other action that is needed to prevent trains approaching the accident site;

(c) make a general emergency broadcast by radio to trains in the area concerned or arrange for this to be done;

(d) if possible, tell the driver involved that signal protection has been provided; and

(e) call emergency services if they are needed.

Similar straightforward checklists have been prepared for other persons who will be involved in such an emergency situation. Such checklists should be provided as part of the ICS, which itself should form part of a railway displan. They should be on a sheet in the driver’s cabin, guard’s compartment or signaller’s or train controller’s work station.

There should be a single person at the RMC with dedicated telephone lines between that person and each of the emergency services. He should manage the incident at the RMC by constant communication with a rail commander on site, who remains in the vicinity of, and provides support to, the site controller.

These are the characteristics that a railway displan should have. It needs to be developed through consultation between the rail industry and the emergency response agencies. The emergency response agencies need to have the same command structure. The ICS model is a very good starting point for the development of such a plan. Once developed, exercises need

to be conducted for each area within the rail network to enable an understanding of and to test the emergency plan.

Emergency services personnel need to be trained in railway network operations so they understand the environment in which they will be working. Such training should include, for both rail personnel and emergency services personnel, the establishment of emergency voice communications protocols and agreed terminology. For example, if the overhead power has been disconnected, but not isolated, then the difference needs to be understood by all involved.

The final observations which an analysis of the emergency response to the accident invites relate to debriefing and training. Mr Doak, who redrafted the SRA Incident Management Plan, did not himself attend any SRA debrief following the Waterfall rail accident. Likewise, the Rail Commander, Mr Barber, did not attend one. The inter-agency debrief which occurred after this incident did not address all the deficiencies identified. Nor is there any evidence of any exercise, since the last of those identified above, which has had as its purpose the improvement of the rail response and emergency services response to a serious rail accident. Such exercises are essential for the training of all staff involved. They need to be practical exercises and not desktop exercises.

There need to be facilities available for the training of emergency personnel in situations as close to reality as can be achieved. Counsel Assisting attended the Washington Metropolitan Transit Authority training centre at Landover, Virginia. In that centre, a replica of a tunnel has been built inside a former factory warehouse and previously damaged rail carriages have been used to create a scene similar to what would occur if there were an accident in a tunnel. The tunnel can to be pumped full of smoke and emergency personnel are then sent to rescue "passengers", who are dummies with various kinds of injuries. The whole process is videotaped and played so that the participants can learn from the experience in as close to a real situation as can be created. The centre trains approximately 3,300 personnel per year in emergency response. It is obvious, in view of what has been observed earlier about exercise Blue Rattler, that such training centres are desirable in this State. It may be that the cost of the training on a State level would better be borne by agreement between the States to establish some national centre for the training of emergency response personnel from other States as well. That is a matter initially for the New South Wales Government and then for the Council of Australian Governments to decide, but it is obvious that such a training centre is highly desirable to better equip emergency response personnel to deal with emergencies of all kinds.

6. Design and Procurement of Rolling Stock

One matter of importance in this Inquiry is to examine the circumstances in which G7, comprising four Tangara cars built in 1995, was placed in revenue service on the New South Wales rail system with the inherently deficient driver safety system identified in the interim report.

Although it is not part of this Inquiry to examine the pre-contractual arrangements relating to the manufacture of Tangara trains, there are a number of features of the way in which the project was undertaken that are a matter of concern and that indirectly contributed to the accident.

It appears that the first concept for a Tangara train arose in about 1983, when the research and development group within the mechanical branch of the SRA began working on a new concept for a double deck rail car. Prior to this, double deck intercity trains had been built and these were regarded as being an efficient way of transporting passengers because they could carry more passengers than single deck trains. The concept specification for a double deck Tangara train was circulated to industry and a small group of SRA employees went on a study tour to Asia, Europe and Canada to better inform themselves about the latest trends in commuter train design. It appears the concept of the deadman foot pedal system, which ultimately became a feature of the Tangara train, was based upon a foot pedal design observed by this group, after examining the high speed trains in use in the United Kingdom.

Following that overseas trip, tenders were invited from three companies for the construction of the Tangara trains. Clyde Engineering, Commonwealth Engineering and A. Goninan & Company Limited (hereafter referred to as Goninan) were issued with tender documents in May 1985 and, following the closure of tenders in November 1985, an assessment was made of the tenders by the SRA. In July 1986, Goninan was identified as the preferred tenderer and a contract was signed in November 1986.

Under the contract the first four car set was required to be delivered by 29 September 1987, only 11 months after the contract was entered into. It should be pointed out that authorisation had been given for some preliminary work to be done by Goninan following its selection in July 1986 as the preferred tenderer.

The contract recognised the necessity for a quality control system in clause 3.7.1.1:

> The contractor shall establish and maintain a Quality Control System which complies with the requirements of Australian Standard "AS.1821-1985 Suppliers' Quality Systems" and provide effective control of the total scope of work under the Contract including design, project planning, procurement, manufacture, inspection and testing, commissioning and delivery, technical documentation, training and spare parts, and any other support required.

The operative words in that contractual obligation are "shall establish and maintain". In other words, at the time of the contract there was no operative quality control system in place for these trains, despite being built using what was then a new concept design and being required to commence service within 11 months of the date of the contract.

It is worth noting that the quality assurance section of the contract contained some detail as to the documentation that the contractor was required to have. Clause 3.7.1.2 relevantly provided:

> The Contractor's Quality Control Documents shall include but not be limited to the following categories of documents:
>
> 3.7.1.2.1 Quality Control Manual
> 3.7.1.2.2 Company Operating Procedures
> 3.7.1.2.3 Quality Control Procedures
> 3.7.1.2.4 Project Quality Control Plan which includes the following:
>
> 3.7.1.2.4.1 Implementation Sub-Plan
> 3.7.1.2.4.2 Design Sub-Plan
> 3.7.1.2.4.3 Procurement Sub-Plan
> 3.7.1.2.4.4 Manufacturing Sub-Plan
> 3.7.1.2.4.5 Inspection Sub-Plan
> 3.7.1.2.4.6 Testing Sub-Plan
> 3.7.1.2.4.7 Logistics Support Sub-Plan
> 3.7.1.2.4.8 Project Documentation Sub-Plan for Management of Drawings, Specifications, Standards, and Documentation.

Had these quality assurance processes been in place prior to the commencement of construction of the trains, the deficiencies of the driver safety system which ultimately contributed to the Waterfall rail accident should have been detected and rectified at an early stage. Instead, production of these train cars commenced and, predictably enough, many problems arose once they entered into service.

The interim report identified that, as early as 30 November 1988, the then project manager of the Tangara project was alerted to the inherent deficiency in the deadman foot pedal system, namely that the static weight of a train driver's legs was sufficient to keep the foot pedal in the set position while the train was motoring. The project manager did not accept the accuracy of this report but did not test the train while it was motoring.

This was only one of a large number of problems that had arisen in relation to the Tangara train. Ongoing contractual disputes between the SRA and the manufacturer, Goninan led to a mediation in 1992, in which the outstanding problems numbered 49. A number of the outstanding problems were not insignificant. They included bogie failures, which required carriages to be taken out of service, continuing failures of auto couplers, which are the connecting pieces between carriages, and the ergonomic defects in the driver's cabin design which were discussed in the interim report.

The principle defects of the driver's cabin design which required rectification included the fact that the rotation of the master controller as part of the deadman handle system was ergonomically defective because it required train drivers to hold the master controller handle, against tension, at an angle of approximately 30 degrees. In relation to the foot pedal, some lighter train drivers suffered from repetitive strain injury to their ankles and legs by having to keep downward pressure on the foot pedal for lengthy periods. The opposite was the case

with heavier train drivers, such as Mr Zeides, who could keep the deadman foot pedal in the set position by the static weight of his legs alone.

The 49 items dealt with in the mediation did not include those matters about which there was no dispute as to the need for rectification or its cost. Nor did it include items already found to be defective and repaired. For example, the operation of the doors on the carriages manufactured from 1987 to 1991 was defective, because they did not fully close. This unsatisfactory state of affairs was rectified apparently in about 1991.

In other words, the deficiencies in the driver safety system on the Tangara train were but an example of a larger number of deficiencies that existed in relation to this rolling stock. The fundamental cause for these deficiencies was a lack of careful and rigorous planning and testing before the trains were built. The starting point should have been the clear and concise identification of how the trains were required to perform, from an engineering perspective and from the perspective of the safe and efficient transportation of passengers.

It was then necessary for the two contracting parties to validate that the components, systems or subsystems being used met the requirements identified. For example, in the case of a driver safety system designed to deal with the situation where a train driver becomes incapacitated or falls asleep, by automatically applying the train's braking system, an analysis and testing should have been carried out to see whether it worked. If the driver safety system designed did not produce this result because, for example, the static weight of some train drivers' legs kept the deadman foot pedal in the set position then, obviously, there needed to be some redesign of the deadman foot pedal system or, alternatively, it was necessary to add another layer of protection such as a vigilance device.

The analysis undertaken by Dr McIntosh in relation to the deadman foot pedal, as part of the first stage of this Inquiry, should have been undertaken prior to the manufacture of any Tangara train. The reason why this approach of analysis and testing did not occur was that the time taken for design, documentation and performance verification processes before production commenced was not long enough to enable the necessary steps to be taken. To do this properly required an analysis of the design of each of the systems on the Tangara trains by a careful and rigorous design review.

If there had been an adequate design review of the driver safety systems, the deficiencies in the design concept for the driver safety subsystem would have been identified before the Tangara trains were put into service.

The next stage of the project should have been to integrate the subsystems into a complete train. The next stage was to build a prototype then test it to see whether or not it functioned as intended.

These are the conventional processes followed in other industries in any reasonably complicated engineering project involving a new design. They mitigate the risk of unforseen problems materialising after the equipment has been put into service.

In addition to planning and testing before production commenced, good engineering practice required a quality control system to be in place. The contract recognised the need for this but it did not occur, because it was probably impossible for it to be established and the trains built in accordance with the time frame identified earlier.

As the interim report demonstrated, once the deficiencies in the driver safety system began to materialise in the Tangara trains, it was very difficult to redesign the trains once they were in use. This point was bluntly made by Goninan in its letter dated 21 August 1992 to the SRA which related to ongoing complaints by the SRA about some features of the Tangara train which the SRA then wanted changed. Mr Janik, the Tangara Project Manager for Goninan stated in the letter:

> Surely with over half the ordered fleet of Tangaras already running around in Sydney this does accept Goninan Specifications.

In other words, deficiencies need to be identified early and addressed before the trains are permitted to enter service.

Although there were specifications which required the usual engineering procedures to be followed, there was not the time for Goninan to do those things. In those circumstances the SRA did not require it to discharge its contractual obligations and it accepted the Tangara trains in the condition that they were in, regardless of whatever contractual arrangement had preceded the dispute that led to the mediation.

The reasons why the Tangara trains, with the inherently deficient driver safety system, were permitted to remain on the tracks until after the Waterfall rail accident in January 2003 was discussed at length in the interim report.

I have used the word "deficient", rather than the word "defective", to make the distinction between a design which was carried into effect, but which had the inherent deficiency that it would not achieve the purpose, compared with a design which would have worked from a functional point of view if the train driver became incapacitated, but did not work because of defective workmanship. In this case, the SRA received what it ultimately agreed to receive, a deadman foot pedal which was deficient for its purpose, but not otherwise defective. There was no defective workmanship in what Goninan built. It built what it was required to build, and it was accepted with the deficiency, which SRA officers did not believe would manifest itself for reasons set out in the interim report.

What should have occurred was:

1. When a decision was made that it was necessary to build a new double deck new train which had certain functional requirements that would work on the New South Wales rail network, the SRA should have informed itself of the requirements through persons or organisations who could have provided input into the project or who may have been affected by the design.

   Although there was some input into the process from the relevant trade union in relation to ergonomic matters and the design of the driver's desk, there was no input by representatives of the travelling public in relation to seating and ingress and egress, or by experts in areas of safety devices, crashworthiness, fire resistance and other relevant safety related matters, nor was there consultation with the rolling stock manufacturing industry to better determine feasibility.

2. Having assessed and analysed this information, a functional performance specification should have been prepared, so as to identify the various sub-

systems, such as the traction system, passenger seating, the driver's cabin and controls, braking, driver safety systems and power systems.

Unlike what was done in the Tangara design, where an enormous amount of detail was provided in the specification and nobody ever determined whether the design would work before the manufacturer was contracted to build the train, the functional performance specification needed to identify the means by which the satisfaction of the functional requirements would be verified. For example, if the driver safety system required that in the event of train driver incapacitation the train would be brought to a stop by an automatic application of the brakes, the specification should have set out how the contractor was expected to prove that that result would occur under all operating circumstances.

3. There should have been a quality assurance program for the construction phase. The quality assurance program that has been referred to above in relation to the contract with Goninan would have satisfied this requirement, had it been in existence before design commenced.

4. During the process of design which the contractor was undertaking, there needed to be a system of regular review to determine whether the contractor was satisfying the original requirements. Alternatively, whether some of those requirements were impractical and needed to be changed. For example, if the driver safety system had as its only feature either a deadman foot pedal or a deadman spring-loaded master controller handle, then such a review would determine whether the device would bring the train to a stop if the train driver became incapacitated. If not, this would have resulted in a design change, for example, to add a vigilance device to bring the level of safety to the level expected in the specification.

5. There should have been a process of auditing at the end of the design phase. This was necessary to prove that the design, as completed, fully satisfied the functional and performance requirements. The functional and performance requirements may have been varied or amended during the processes earlier identified. However, in each case the specification would then be appropriately amended to reflect such agreed amendments or variations.

None of these practices, which were and are regarded as conventional, occurred with the Tangara train. Instead, as noted above, a very complex and detailed specification was provided to Goninan and it built what it was asked to build, with the results that have been identified in this Inquiry.

Unfortunately, this deficiency in project management must be regarded as an indirect cause of the tragedy which occurred on 31 January 2003. The same mistakes should not be repeated in the design of future rolling stock.

I have identified, to the extent that it is necessary for me to do so in a report of this kind, the type of deficiencies in the project design and management of the Tangara train. Railways overseas have reduced these requirements to standards.

Counsel Assisting met with representatives of the Railway Safety and Standards Boards in the United Kingdom and were provided with several standards which are used there to ensure that the kind of deficiencies that I have identified in the way in which the Tangara trains were procured and commissioned do not occur. The names of some of these standards identify the content. There is one called "Engineering Acceptance of Rail Vehicles". The process of acceptance is one by which confirmation is achieved that the rolling stock produced meets the design specification. A second standard, called "Rail Vehicles – Overall Design, Risk Assessment and Certification", ensures that the specification and the resulting equipment is fit for its purpose. There are several other standards that form part of the process. For example, manufacturers of safety critical components in trains must prove that they have quality assurance systems in place which will demonstrate that the product is fit for the purpose for which it is being produced.

In the United Kingdom, not only must the company which is purchasing the rolling stock undertake the processes which I have identified, but, separately and independently from it, the owner of the infrastructure must satisfy itself that the train is fit for purpose to run on its tracks. This is for the obvious reason that the owner of the infrastructure has a duty to other users of the infrastructure to ensure that no rolling stock which is capable of causing the kind of disastrous outcome that occurred at Waterfall on 31 January 2003 enters upon the infrastructure.

Counsel Assisting also met with representatives of Virgin Trains in London. The processes involving an approach of the kind that I have outlined, for trains recently purchased by Virgin Trains for use in the United Kingdom, took a period of approximately two years before building commenced. After building commenced, the ongoing process of verification continued to ensure that at each stage of the project development the specifications were being met.

In my view, not only should the company ordering the new rolling stock comply with the processes that I have identified, but the safety regulator should be involved at a number of stages in ensuring that this occurs. The rail safety regulator should ensure as part of the accreditation requirements that any railway organisation seeking accreditation has adequate systems in place for commissioning rolling stock in accordance with the procedures outlined in this chapter. The responsibility for the safety of the rolling stock must remain with the railway that commissions the rolling stock, but the regulator should be involved to the extent of ensuring that the procedures being followed are adequate and effective to ensure the safety of rolling stock before it can be used for public passenger transport.

7. Driver Safety Systems

The interim report came to two important conclusions in relation to driver safety systems. The first was that the accident occurred because of a failure of the deadman system on G7 and the second was that the accident could have been avoided had a vigilance device been fitted to G7. One of the significant deficiencies in the management of safety by the SRA was that on its Outer Suburban Tangara trains, if the train driver fell asleep or became incapacitated in an automatic signalling area, the only mechanical protection was the deficient deadman system. Although train stops were fitted to the signals in the area, south to Helensburgh, these would not operate unless there was a train in the section ahead.

When the Tangara contract was varied to provide for modification of the last 80 cars for use in outer suburban areas, the specification was changed to include toilets, luggage racks and bicycle storage. No changes were made to the driver safety systems. This aspect should have been considered. The outer suburban environment did not, at that time, have train stops and the longer journey times made train drivers more susceptible to lack of concentration. If an effective risk analysis had been conducted as part of the change of specifications, such an important issue would have been identified and driver safety systems subject to appropriate review.

When Counsel Assisting conducted investigations in the United Kingdom, Europe and the United States, it was found vigilance devices were a normal feature of driver safety systems in passenger trains.

Vigilance devices should have been installed on Tangara trains when the deficiencies associated with the deadman system were first identified by a driver trainer, Mr Wilkinson, in 1988. Expert consultant reports obtained by the SRA, in 1992, 1994 and 1999, expressly drew attention to the public safety risk inherent in the deficient Tangara deadman foot pedal. The SRA focussed on the issue of signals passed at danger (hereafter referred to as SPADs) and the associated risk of collision, and did nothing about controlling the risks to passengers from a rollover accident occurring in an area where the signals were green.

Train stops were favoured over vigilance devices as a mechanical defence. Risks that could result from a deadman system failure remained uncontrolled, except in areas where signal stops were fitted to prevent a train passing a red signal. Because the density of traffic in the outer suburban areas is considerably less than that in suburban areas, an outer suburban train was unlikely to confront a red signal.

The train stop arm operates in conjunction with the signal. If a red signal is passed, an arm comes up on the track adjacent to the signal and catches a trip valve on the underside of the train, opening the brake pipe on the train, resulting in an emergency brake application. This protection was of no assistance at the time of the Waterfall rail accident because the signals between Waterfall railway station and the site of the derailment were green, a circumstance that does not appear to have been envisaged by the management of the SRA.

In the United Kingdom, from where the SRA obtained the idea of the deadman foot pedal for Tangara trains, trains at the time were fitted with vigilance devices as a further level of mechanical protection for the safety of passengers in the event that the deadman foot pedal system failed to operate. That additional level of protection was not provided in Outer

Suburban Tangara trains, although it was added to double deck intercity (hereafter referred to as DDIC) trains when driver cabin refurbishment was commenced in mid-November 1999.

Vigilance control systems are designed to apply the brakes of a train if a train driver fails to carry out certain tasks or acknowledge the system within a particular period of time. Modern vigilance devices are task-linked and speed sensitive, which means the faster the train is travelling, the shorter the cycle. If there is a flashing light or audible noise that alerts a train driver at the end of the cycle, then it is necessary for him to perform a task to reset the cycle. If the train driver fails to respond, then an emergency brake application is initiated.

The urgent need for the installation of vigilance devices in Tangara trains was belatedly recognised in the immediate aftermath of the Waterfall rail accident. A project to fit such devices to Tangara trains was commenced in February 2003. Mr Paul Gilbertson, the Director Capital Works, SRA, gave evidence before the Special Commission, in August 2003, that it was expected vigilance devices would be fitted and operational in all Tangara trains by the end of March 2004. In September 2003, the SRA embarked upon a program named the Train Services Safety Improvement Program, which included the continuation of the project to install vigilance devices in all Outer Suburban Tangara trains. The program also included an examination of the deadman system in all trains.

The result, insofar as vigilance devices are concerned, was that it was intended that they be fitted to all Tangara trains by September 2004 and to the remainder of the suburban and inter urban fleet by the end of 2004. In relation to the operation of the deadman foot pedal, Mr Gilbertson said no changes had been made at that point of time, but investigations were continuing.

An examination of the summary reports for the various programs within the Train Services Safety Improvement Program would not give rise to any cause for optimism.

The improvement program required the writing, in relation to driver safety systems, of what was described as a "functional brief covering philosophy, business drivers, timing of implementation, inter-relationships with other safety systems, inter-relationships between in-cab systems". That aspect was intended to be completed by 10 October 2003. RailCorp documents dated 1 April 2004 included the comment:

> Issue paper/draft functional brief circulated for comment. This relates to Recommendation No. 10 of the ITSRR from Waterfall. RailCorp draft to be provided to ITSRR for comment in April.

Recommendation No. 10 from the then Department of Transport's investigation into the Waterfall rail accident was as follows:

> That the Rail Safety Regulator commissions an appropriately funded project to research options available to integrate contemporary technology with existing and developing deadman, vigilance and speed envelope systems. The research should include risk assessments of each option. In particular, the research should examine tamper-proof processes in which driver alertness and/or vigilance and incapacitation can be continuously monitored and managed.

Although the Train Services Safety Improvement Program was intended to have produced a "functional brief" in relation to the Driver Safety Systems by 10 October 2003, all that had occurred by April 2004 was completion of 60 per cent progress toward drafting a brief identifying what needed to be done.

While RailCorp was preparing what it described as a "functional brief", Dr McIntosh, Senior Lecturer in Biomechanics and Ergonomics, School of Safety Science, University of New South Wales, and a consultant to the Special Commission, was asked to conduct some investigations in relation to deadman systems on trains other than the Tangara. His investigation of the Millennium train demonstrated its deadman foot pedal system had the same inherent deficiency as the deadman foot pedal in the Tangara and DDIC trains. Indeed, he found the Millennium deadman foot pedal had inherent defects that did not exist in the Tangara foot pedal. Unlike the Tangara train, the deadman foot pedal in the Millennium train does not have a cover or shroud and it is therefore easier for objects such as small stones to be deliberately or inadvertently jammed in a position keeping the foot pedal in one position and thereby permanently setting the deadman system.

Dr McIntosh summarised the results of his more extensive investigations as follows:

1. Testing and evaluation of deadman pedals on DDIC and Millennium trains indicates that there is a potential for the pedal to remain "set" for a period if a driver were to become incapacitated. This problem reflects that observed with the Tangara, although the DDIC and Millennium pedals are more sensitive.

2. The vigilance units in the DDIC and Millennium trains offer an added level of safety above the deadman system and train/trip stop combination. The task linked vigilance units do not appear to create additional driver tasks.

3. The limitations of the vigilance system are that: there is no direct overspeed protection; drivers could operate the train inappropriately but continue to provide task linked inputs; the vigilance cycle could be restarted by an incapacitated driver knocking the master controller with the deadman pedal held "set".

4. Track based protection remains important and could be enhanced by transponders linked to the vigilance system. Consideration for transponders located at "black spots" is required.

5. Data loggers can be very important tools for the evaluation of driver and network safety systems. However, this requires a planned long-term program.

6. Consideration for overspeed protection and methods to prevent knocking the master controller is required.

7. A new standard for the design and evaluation of driver-train interfaces, and any other safety critical systems, is required. Evaluations should

involve substantial and in-depth ergonomic and human factors assessments.

Although vigilance devices provide an additional level of mechanical protection, the limitations identified in paragraph 3 of Dr McIntosh's summary demonstrate that circumstances could exist where the existence of a vigilance device will not avoid an accident of the kind that occurred at Waterfall. This matter was mentioned in the interim report and was also brought to the attention of the SRA in a report dated 9 May 2003 by Qest Consulting Engineering Pty Ltd, titled "Risk Assessment of Driver Vigilance Systems on Tangara Intercity Trains". The authors of that report also concluded that vigilance devices, in addition to a deadman foot pedal system, would provide a secondary and therefore higher level of safety protection, but still had the inherent limitation that the vigilance device could be inadvertently set by a train driver who was incapacitated or asleep, by performing an involuntary action which would be recognised by the train as the train driver performing a task, resulting in the resetting of the vigilance cycle.

The combined vigilance system and deadman system would thus enhance driver safety systems significantly, but there would remain ongoing uncontrolled risks because of the inherent deficiencies in both the deadman foot pedal system and the vigilance system. Consequently, there remains a clear need for RailCorp to evaluate all available options relating to driver safety systems and to implement sustainable developments in the driver safety systems utilised throughout their fleet, to establish an acceptable level of risk.

The final report of the Special Commission of Inquiry into the Glenbrook Rail Accident contained a discussion of various means whereby automatic train protection (hereafter referred to as ATP) could be used to overcome the deficiencies that have been identified in the driver safety systems currently used. That report did not recommend the introduction of ATP, and the reasons for that were stated at pages 155 and 156 of the report. Those reasons were:

(i) There is no system yet developed which could reliably be used on the complex Sydney rail network.

(ii) The major impediment to increasing the number of trains on the Sydney network and the frequency of peak hour services is the dwell time at busy city stations. ATP does not improve dwell times.

(iii) The cost of somewhere between $1 billion and $1.5 billion for technology which cannot be demonstrated to be reliable, would not be justified. In the last decade there has been a vast amount of public money wasted on less than satisfactory communications systems (Countrynet and Metronet) and train control systems (the Queen Street project). Embracing level 2 or level 3 ATP technology is likely to produce the same outcome.

(iv) Safety would be improved by expenditure of a much lesser amount of money on what have been referred to as the soft issues of training, supervision, auditing and better rail safety management, rather than technological devices. However, if the government, for whatever reasons, were to reject the recommendations of the Special Commission

> of Inquiry for a Rail Safety Inspectorate and a Rail Accident Investigation Board then it would then be essential to spend a large sum of money on improving the technology to attempt to achieve the same safety outcomes by other means.

Investigations by Counsel Assisting established that, since the Glenbrook final report, substantial developments have been made with ATP overseas. In the European Union, these have been driven by requirements for interoperability between different member states. Considerable standardisation for the use of various levels of ATP has been achieved on various high speed lines in the European Union, and the process is ongoing.

The Glenbrook final report included the following observations:

> It may be inevitable that advances in technology will produce means by which trains can be operated and controlled which will minimise the extent of human involvement and provide technical barriers to accidents occurring. The technological advances should be monitored and a careful evaluation made if a stage is reached where the level of efficiency of the CityRail network can be improved to enable it to cope with the demands created by an increase in passenger numbers from the current 900,000 passengers per weekday to the predicted figure of up to 1.6 million passengers per weekday in ten years time. Together with an examination of the reliability of any system developed, a rigorous process of analysis of the safety implications should also be undertaken by the Rail Safety Inspectorate before a decision on implementation is made.

Unfortunately, the recommendation in the second interim and final reports of the Glenbrook Inquiry, that a truly independent Rail Safety Inspectorate be established, has not been implemented. Nor does it appear, from the evidence, that any attempt has been made to take advantage of the developments in the European Union in relation to ATP to determine their suitability for use in New South Wales. It is not difficult to analyse developments that have occurred overseas and in other States of Australia, to identify the progress that could be made and to identify where ATP should be installed.

The present level of sophistication of driver safety systems in New South Wales is, assuming vigilance devices are fitted, that trains will have vigilance devices, a deadman foot pedal and master controller system and train stops which will stop trains passing a signal at stop. The shortcoming of these, as made apparent in the Waterfall rail accident, is the lack of overspeed protection, such as ATP, available to trains.

Following several derailment incidents resulting from overspeed through low speed turn-outs, the SRA investigated and implemented speed limiting train stops in high risk areas, where feasible. A speed limiting train stop operates in a similar fashion to a train stop, with the additional function that by use of track circuits it determines the speed of the train. If it is in excess of the speed which is considered safe for the particular area being approached, for example a low speed turn-out, the speed limiting train stop will initiate an emergency brake application. Similar to train stops, speed limiting train stops are a reactive measure and only operate after a train has exceeded the speed at which it should be travelling. The Waterfall rail accident has shown excessive speed is unacceptable and hazardous and should be controlled. Low speed turn-outs are not the only place that a high speed derailment and

rollover are possible. A wider application of speed limiting train stops should be investigated as an interim measure until more satisfactory driver safety systems can be installed.

Progressively, rolling stock and the infrastructure on which it operates needs to move incrementally towards systems which are not only safer, but more efficient and therefore better able to cope with future increased demand for passenger services. This necessitates a move away from reactive systems, described above, towards systems with a more predictive capacity. When considering new developments in driver safety or train protection systems, it is helpful to consider them in terms of the way they function. There are two main categories: in-cab and trackside. These relate to the location of the equipment that detects the train movement and initiates responses. There are also two levels of action or authority enforcement that can be applied. One is based on speed enforcements, the other is based on authority to travel to a particular point on the track. The latter is used where a train is likely to overrun a signal at stop or some other marker or infrastructure that represents the end of permission to move on the network. Speed enforcement is used to slow or stop a train where it is likely to exceed infrastructure or rolling stock speed limits. Finally, the systems can be considered in terms of their sophistication and level of automation.

The use of ATP involves the application of in-cab computer technology that communicates with trackside or centralised equipment to ensure that the train travels within its authority. The authority of a given train's movement encompasses details such as how far and how fast the train may travel on a specific section of track. The system also considers the performance characteristics of the train, taking into account such matters as the train speed, loading and braking characteristics.

If one considers Level 0 to be the lowest level of sophistication and automation and Level 2 to be the highest level currently supported by proven technologies, there are already several systems in operation in Australia and internationally that can provide a significant improvement in the safety and efficiency of Sydney's passenger services. These were not fully developed and proven at the time of the Glenbrook Inquiry.

Level 0, the first level of ATP, involves the use of train stops. These are mainly used to deal with trains passing a signal at danger and hence exceeding an authority. Their function is similar to the train stops mentioned previously but, instead of a mechanical interface, an electromagnetic field is used to interact with an in-cab vigilance system to warn the train driver that action is required to prevent a SPAD incident. The system warns that a limitation on authority is approaching, and it may also consider the train's speed before taking enforcement action. Although the train driver retains control of the train, if the driver continues to ignore the warning and does not decrease speed, an emergency brake application is made. This system ensures that the train has been slowed to the extent that the train will not pass the red signal. In other words, it is providing predictive control, not reactive control after the train has gone past a red signal and activated the train stop. If the driver responds appropriately to the warnings and uses the normal braking system to bring the train speed within the braking curve for the red signal, no emergency brake application will occur.

There are different technologies available by which this first level of ATP may be achieved. One is known as Automatic Warning Systems (hereafter referred to as AWS). The AWS system used in the United Kingdom operates by a set of magnets on the track, which are detected by the vigilance system on the train, warning the train driver of the state of the signals. The first is a permanent magnet which arms a brake trigger on the train. If the signal

is green, the second magnet, an electromagnet, is energised and the brake trigger is disarmed. If the signal is at caution or stop, the second magnet is de-energised and the brake trigger remains armed. An audible warning is sent to the train driver. If the driver does not acknowledge the warning, an emergency brake application occurs. The AWS system is a reactive system because it applies an emergency brake application if the limits of authority are exceeded. If the train is travelling at excessive speed as well, it may still pass the red signal, creating an incident. This is because it depends upon the train driver taking the appropriate action in response to the warning.

Train Protection Warning System (hereafter referred to as TPWS) is another system that provides the first level of ATP. TPWS differs from AWS in that if the train approaches a signal at danger at too high a speed to be stopped the train will be forced to stop, without warning and regardless of any action or inaction taken by the train driver. If the train is not speeding, a second detection and trigger will still initiate an emergency brake application if the train passes the limit of its authority. Victoria is planning to use TPWS for its high speed regional commuter services. Instead of magnets, TPWS uses a set of induction loops. Like AWS, it initiates action via the in-cab vigilance system.

Level 1 ATP uses in-cab computers to determine, either continuously or at regular intervals, both the speed and location of the train, to compare it against an authority held by the train's computerised system. All systems provide warnings with respect to both speed and authorities, but not all systems provide speed enforcement. Where there is no speed enforcement, if the train driver ignores or does not respond to a warning, an emergency brake application is used to bring the train to a stop. Where speed enforcement is available, if the train driver ignores or does not respond to a warning, the in-cab system will use service brakes to slow the train to within acceptable limits. Emergency brakes are only applied if the authority will be exceeded. At Level 1, this system still operates using fixed blocks for authority and trackside signals.

The implications of this level of ATP in regard to the circumstances surrounding the Waterfall rail accident are self-evident. The train driver would have received a warning as soon as G7 started to speed and when he did not respond, the system would have stopped G7.

Level 2 ATP uses both authorities and speed enforcement parameters, and includes an additional level of sophistication in that trackside signalling is replaced by in-cab signalling on the train. This removes the need for fixed reference points for marking the start and end of an authority. They are replaced by virtual block lengths which can be scaled to suit traffic conditions and train characteristics.

Level 2 systems are being used successfully in Europe, Japan and the United States. The differences in the systems are mainly related to the location and speed determination technology and whether or not the known state of the train is regularly updated. The train's state is advised to train control via various communication mediums, depending on the design.

A Level 2 system allows trains to be spaced on a network at safe braking distances. This allows for a more efficient use of the available infrastructure, whilst ensuring high levels of safety. This type of technology is currently being used in Perth, Western Australia. It is the type of technology that should be used for reasons of both safety and efficiency on the RailCorp network.

The Australian Rail Track Corporation (hereafter referred to as ARTC) is developing an Advanced Train Management System (hereafter referred to as ATMS) for use on the interstate rail network. The ATMS will provide Level 2 ATP in that it will employ in-cab signalling and authority enforcement.

Whilst there may be differences in the technology used to locate and determine the speed of the train and the system used to identify and advise the authority, the level of train protection for passenger and freight operations should be similar across Australia. It is obviously in the interest of rail passengers in New South Wales that RailCorp and the rail safety regulator consider the changes necessary to provide the required level of train protection on the RailCorp network.

As indicated in the title of the ARTC program, it is not just train enforcement systems that need to be considered, the overall train management concept must also be integrated to ensure the highest possible level of safety. Train management systems also include the traffic management part of railway operations.

Evidence was given in the public hearings of the Special Commission of Inquiry about RailCorp's new metropolitan traffic management system, the Advanced Train Running Information Control System (hereafter referred to as ATRICS). ATRICS will be implemented across the entire metropolitan train control area. It includes a train location system, and signal and switch control through existing interlockings and warning systems. In a control centre, ATRICS replaces the older technology control panels with computer based workstations.

Whilst systems such as ATRICS allow for efficiency in train control, they can also provide a train controller with considerably more information than current older technology systems. Unless carefully planned and implemented through focused training and education, this can result in controller overload. Dr Edkins also raised the point that ATRICS may result in signallers developing an over reliance on the system, resulting in a lack of decision-making and responsibility, and a degradation of cognitive skills. The importance of the human factors issues associated with monitoring and responding to alarms cannot be underestimated, as the Ladbroke Grove Inquiry report demonstrated. In that accident, the train passed through a red signal which was not fitted with any mechanical device, such as a train stop, and travelled for a considerable distance into the path of the other train without recognition of the emergency situation.

ATRICS introduces new accountabilities and different work conditions for signallers. Because of their safety critical status in the railway, such changes must undergo appropriate risk assessment and adequate planning to ensure the safety of the network during transition and initial operations.

It should also be noted that even where the most sophisticated level of ATP is employed, there will still be occasions where train drivers will need to respond to adverse or unusual conditions since these cannot be fully programmed into the control systems. This occurs even on very sophisticated systems, such as the Washington Metro system, for example, if there is heavy snow or ice and the automatic system needs to be overridden manually. This is not likely in New South Wales. Such responses will also be required if the ATP systems break down, requiring train management to revert to a manual form of authority issue and train control. Even with the use of the best available technology, there will remain human

performance issues, errors and violations that must be dealt with through training and by ensuring an appropriate culture of accountability and safety exists in a railway.

All new rolling stock procurement should be designed to be compatible with Level 2 ATP. This is clearly the future direction of driver safety systems and traffic management. Furthermore, it is clear that there should be a program for the analysis, functional specification and staged implementation of Level 2 ATP for the RailCorp network. It would appear that ATRICS already provides at least one of the essential building blocks for such a system. Such a program must involve contemporary systems engineering and risk management practices to ensure all aspects of the system, especially the human aspects, have been adequately considered and integrated to provide an acceptable level of safety assurance.

8. Risk Assessments and Risk Control Procedures

The final report of the Special Commission of Inquiry into the Glenbrook Rail Accident reviewed the processes that were in place for the management of safety in hazardous industries and discussed the attempt to incorporate those more modern processes of safety management into safety management of the New South Wales rail network. The report said:

> Developments in safety management overseas point to the importance of human factors, organisational and managerial issues and the development and maintenance of a strong safety culture as being matters of fundamental importance to the proper management of safety in any large organisation. The Rail Safety Act 1993 does not reflect those developments and requires amendment to ensure that safety management **is not limited to a mechanical exercise of formal hazard assessment and implementation of appropriate controls**. In practical terms the best way of dealing with that deficiency in the Rail Safety Act 1993 is by amending the Act to provide a new Rail Safety Inspectorate with the necessary functions, powers and sanctions to properly regulate the safety of the rail industry. (Emphasis added)

The recommendation to establish a Rail Safety Inspectorate was not implemented. In fact, nothing was done in relation to that recommendation other than the creation, after the Waterfall rail accident, of the so-called independent ITSRR, with the deficiencies of that particular body discussed in chapter 16.

Modern management techniques in the rail industry have been adapted from other hazardous industries such as the petrochemical industry, the airline industry, and the offshore mining industry. These industries all utilise an integrated safety management system approach to their overall management of safety. An integrated safety management system is one that does not stand apart from other management systems within the organisation. It is part of the core business of the organisation. A successful safety management system involves using a systematic process for managing risks and reducing them to an acceptable level.

The Australian Civil Aviation Safety Authority (hereafter referred to as CASA) was the first aviation authority to mandate the adoption of safety management systems for all passenger carrying operations and provided the definition, "A safety management system is an explicit element of a corporate management responsibility that sets out an operator's safety policy and defines how it intends to manage safety as an integral part of its overall business". A safety management system is an integrated set of work practices, beliefs and procedures for monitoring and improving the safety and health of all aspects of the operation of an organisation. It recognises the potential for human error and violations and establishes effective measures to reduce the probabilities of errors and violations. It also provides effective defences to ensure that when these errors and violations occur, they do not result in incidents or accidents. A good safety management system involves goal setting, planning, documentation and measuring performance against goals. It should become part of the organisation's culture and a routine characteristic of the way businesses go about conducting their work. It should not be an "add on" component to the business process but should be an integral part of it. As Mr Edwards and Mr O'Donnell of Pacific National both made clear, safety was vitally important for Pacific National to stay in business. In order for an organisation such as Pacific National to run profitably, it is necessary for it to avoid

catastrophic accidents, which can cost millions of dollars. Therefore, safety in an organisation is not only important from the point of view of preventing death and injury, it is also important to avoid catastrophic damage to rolling stock and infrastructure. It is an important part of the business of running an organisation.

A non-integrated or fragmented safety management system, as was the case with the SRA prior to the Waterfall rail accident, functions separately to other management systems. The result is that hazards, errors and violations and safety deficiencies can be easily overlooked. Similarly, they may be detected in one section of the system but what might be critical safety information is not communicated to the other areas of the system or to senior management of the organisation. A classic example of the latter is the deadman system.

It is not disputed by RailCorp or ITSRR that the SRA and RIC, at the time of the Waterfall rail accident, did not have an integrated safety management system in the terms set out above. Mr Bunyon, the Chairman of the RailCorp Board, agreed in evidence that RailCorp did not have an integrated safety management system.

When the safety management system is integrated into the overall operation of an organisation, the culture of the organisation changes to reflect that influence. By that means safety of operations becomes part of the culture of the organisation.

The dominant culture of the SRA was not a culture of safety, but a culture of on-time running. Whilst on-time running is an essential objective of a rail system, it is more likely to be achieved if the rail system is operating safely. Unsafe practices cause disruption to the rail system. What needs to be achieved is a safe and therefore reliable rail system. This can only be achieved by first identifying the matters which can cause disruption and then properly controlling them. Any incident can have implications for safety and on-time running. To achieve both safety and on-time running, there must be an ability first to identify hazards that have the capacity to disrupt services and compromise safety, and then efficiently manage the risks that those hazards create. In the area of risk perception and analysis, there was a failure to fully appreciate the hazardous nature of the activities being carried out at the time of the Glenbrook and Waterfall accidents. The same lack of risk perception and analysis influences the culture of the organisation so that, at an organisational level, a weak safety culture exists.

There appears to be a perception among many staff of the New South Wales government owned railways that since trains have been running on a daily basis without serious accidents that, therefore, in the area of safety management, there is nothing to be worried about. When that mindset exists, as soon as there is a degraded mode of operation, for example the signal failure at Glenbrook or the heart attack suffered by the train driver, Mr Zeides, at Waterfall, then catastrophic results, including deaths, occur. These are then perceived as being akin to "bad luck", without an understanding that what they reflect is a deep-seated underlying failure to properly manage the risks in the system. Failure to properly manage the risks in the system is just as detrimental to on-time running as it is to safety, except that in the case of low probability, high consequence risks such as were involved in the Glenbrook and Waterfall rail accidents, the results are catastrophic.

Inadequate periodic medical examinations, inadequate train guards' training and a deficient deadman system occur because of bad management of risks. When risks such as the deficient deadman foot pedal are well known to persons in managerial positions and nothing is done to investigate, let alone eliminate the known risk, the inference that must be drawn is that those

persons in management positions do not know how to determine what risks are acceptable and what risks are not acceptable and need to be eliminated or controlled, to reduce the likelihood of them occurring to a level that is acceptable.

It is an inescapable fact that rail operations are complex and inherently hazardous. Trains weighing approximately 200 tonnes, travelling at speeds up to 115 km/h, with up to 1,000 passengers on board, using overhead electrical current, passing through tunnels, and with a high frequency of traffic, create obvious dangers if there is any malfunction of the equipment or errors are made by the operators.

That lack of risk awareness is likely to be historical and probably has its origins in a time when there were many fewer opportunities for a combination of uncontrolled events that can occur in a complex system to lead to a serious accident. The more complex the system, the more attention is required in properly managing all the risks in that system. This is particularly so with major hazards, because they occur so infrequently they are not recognised as possibilities in the day-to-day running of the railway.

Hazard analysis and risk assessment in complex high risk industries is not a matter of simple analysis of past incidents and historical hazard data. Reference is often made among safety professionals to Professor James Reason's Swiss cheese illustration of the way in which accidents occur in complex situations. If that illustration is applied to the risk of train driver incapacitation causing a catastrophic accident such as the Waterfall rail accident, a simple diagram demonstrates how the defences that were supposed to prevent it failed.

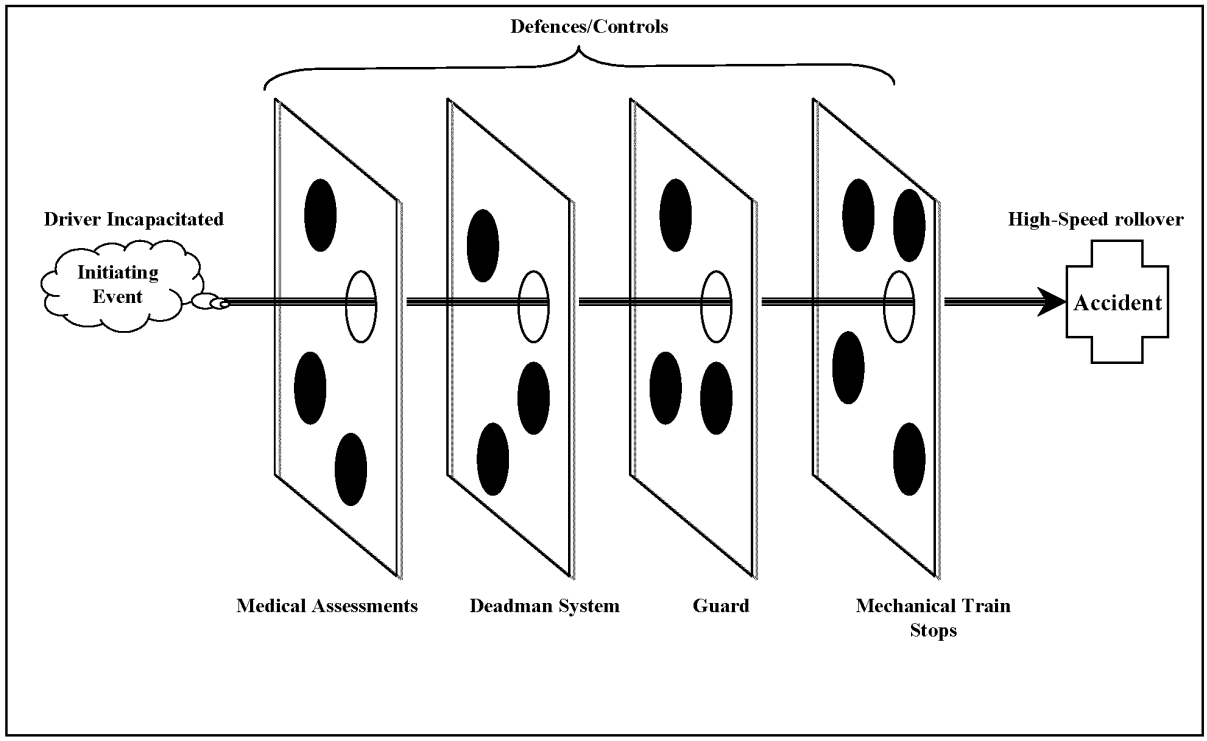


Figure 8.1 Swiss cheese illustration of Waterfall rail accident

Professor Reason's organisational risk model considers the known and identified hazards and the defences and controls implemented to mitigate or manage the risks of those hazards occurring. His model then considers the possible flaws in those defences, the holes in the

Swiss cheese, that can occur due to latent or unidentified hazards and because of deficiencies in the defences. When the holes or deficiencies in various defences are aligned by means of a particular sequence of events, the chain of hazards and deficiencies then are permitted to pass through culminating in a catastrophic outcome. This is precisely what occurred at Glenbrook and Waterfall.

The first defence in the Waterfall sequence should have been the medical examination of Mr Zeides. However, this failed to detect the latent condition that led to his heart attack. The second defence was the deadman system. The deadman foot pedal design was deficient and allowed G7 to continue after the train driver became incapacitated. The third defence was the train guard. Ineffective training, authority gradients and a lack of relevant information, including that the train driver was incapacitated and the deadman system deficient, prevented the train guard from responding. The fourth defence was the train stop system, which was only effective if the train was passing a signal at stop. G7 had green signals all the way, so this was not going to stop a runaway train. The result was that all the defences were penetrated and a catastrophic accident occurred. The scenario was predictable and avoidable by proper risk analysis of the hazards sought to be managed. The relevant hazard to be managed was train driver incapacitation in an outer suburban area leading to a high speed rollover accident.

The time at which that hazard should have been managed for Outer Suburban Tangara trains was when contract 10/86 was varied to provide for modification to the last 80 cars for outer suburban services. The specification was changed to include toilets, luggage racks and bicycle storage, however, no one revisited the driver safety systems. This is important given the outer suburban environment did not at that time have train stops and the longer journey times made train drivers more susceptible to loss of concentration. Had an effective analysis been conducted as part of the change management program, such an important issue would have been identified and the driver safety systems subjected to appropriate review. One obvious measure, which could have reduced the risk of train driver incapacitation causing a catastrophic accident, was to fit the additional protection of vigilance devices. This was done after the Waterfall rail accident.

Mr Bahr stated in his report:

> A comprehensive safety management system and institutionalised risk management processes could have identified the critical conditions that led to the Waterfall accident.

During the course of the Inquiry, RailCorp represented that in fact it was using modern risk assessment techniques to manage the safety of its operations. The falsity of that assertion can be clearly seen with the milestones imposed on RailCorp as conditions of its accreditation. These milestones are examined in detail in a later chapter. The process of risk analysis requires at the outset that there must be an understanding of the particular features of the whole system and the activities that are to be managed. This requires appreciation of what makes the system work, in terms of the human factors, equipment, infrastructure and relationships between them.

The next part of the analysis is to identify hazards that may exist within the particular system. Hazard identification is a crucial part of this system safety process. It is necessary to be clear

about what a hazard is, before the exercise of risk assessment can progress. A hazard is any circumstance which can cause injury or death, damage to or loss of equipment or property.

Risk is the probability or chance that the hazard will eventuate, combined with the severity of the consequences if that were to occur. It can be seen that all risk management can then be analysed in terms of the hazard and risk paradigm. It is impossible to control risks adequately without first identifying them. Mr Bahr stated that an all too frequent mistake in safety engineering is to omit this step or not give it adequate attention. He stated the hazard identification process is a kind of safety brainstorming. The purpose is to identify as many hazards as possible and develop a preliminary hazard list.

Once hazards have been identified, analysis of the controls to prevent their occurrence, or mitigate their effect, needs to be undertaken. This is done by evaluating the risks. Is it likely to occur and, if it does, is it likely to be serious? The hazards are then ranked in order of priority. Once the hazards are identified and ranked in a priority order, the controls fall into two broad categories: engineering controls and management controls. Engineering controls are changes in the hardware that either eliminate the hazard or mitigate the risk. Management controls are changes made to the organisation itself. Developing and implementing a plant safety plan is a good method of applying management controls to hazards. Some examples are: using production line employees as safety representatives for their areas; requiring middle management reviews and approvals of any plant or system modifications, to consider safety implications; or assigning signature authority to safety engineers for all engineering changes.

Once controls are in place, verification must be undertaken to ensure that the controls actually control the hazards or mitigate the risks to an acceptable level.

In summary, the process of risk management involves understanding the nature of the system or activities to be managed, identifying the hazards that exist in the system and putting in place controls to eliminate the hazard or, if the hazard cannot be eliminated, then to minimise its effect. The causes of the Waterfall rail accident provide examples of the way in which the process of risk management works.

One of the hazards to be managed was incapacitation of a train driver due to poor health. The defence was periodic medical examinations. The latent hazard was that the medical examination was deficient in that it did not detect Mr Zeides' critical condition.

Another latent hazard was that the systems put in place to stop G7 in the event of train driver incapacitation were deficient, in that the dead weight of the train driver's legs was sufficient to keep the system active. The third latent hazard was that the train guard was neither trained nor provided with appropriate information to act as G7 gathered speed and exceeded the allowable track speed.

If appropriate medical standards had been applied the risk presented by the train driver's heart condition could have been controlled. Had the known deficiencies in the deadman foot pedal been acted upon, secondary controls such as vigilance systems would have been installed, thus controlling the risk of the dead weight of the train driver's legs maintaining the deadman system in the set position.

The control represented by train stops was ineffective and unsuitable in the instance of a train proceeding with authority, but at too high a speed. Finally, if appropriate crew resource management training had been implemented, there is a high probability that the train guard would have been aware of the state of the train driver and, if provided with an appropriate communications system, would have been able to confirm this.

None of these processes of analysis took place. A closer examination therefore needs to be undertaken to determine what it was about the way in which the SRA approached the hazard analysis that it undertook that did not enable it to correctly identify the risks associated with train driver incapacitation.

The SMSEP review identified a number of reasons for the failure of the SRA's safety management procedures to identify the risks of an accident of the type that occurred at Waterfall. The primary reason was the risk analysis was conducted in a reactive way. Only hazards that had been previously identified were risk assessed. There was no process to identify hazards existing in the system which had not yet led to an incident or accident.

Since there had been no experience of a high speed rollover accident in an outer urban area resulting from train driver incapacitation, a reactive approach to risk assessment was never going to identify that particular situation. Mr Bahr identified a number of specific consequences that resulted from this approach to risk assessment:

> The safety analysis could only evaluate current identified hazards and left unanalysed a significant number of credible hazard scenarios. Of particular concern was that material changes to equipment design, procurement of new equipment, or modifications to train operations were not adequately or routinely reviewed for safety impact.

Mr Bahr's reference to "modifications to train operations" is the very type of safety analysis that was not undertaken by the SRA when the decision was made to use the suburban trains on outer suburban routes. The report from Lloyd's Register Rail, which was commissioned by RailCorp during this Inquiry, stated:

> RailCorp has in the past adopted a predominantly reactive approach in hazard identification and risk assessment based on in-service incidents and failures. This was conducted through recording and analysing incidents that has [sic] occurred on the railway network.

An organisation which conducts systematic analysis of hazards, thus enabling them to be assessed and controlled proactively, is to be preferred to one which merely reacts to incidents by implementing controls after the event.

If potential hazards are not identified, then there are obviously no controls in place. Unfortunately, near misses were not identified as precursor events which could give rise to a catastrophic accident, because complete attention was directed to incidents that had produced an accident. There appears to be a concentration on recent incidents. That has a tendency to restrict analysis of events that have occurred months or years ago, but which have significance in terms of the need to manage a particular type of risk. It is for this reason that the low probability high consequence accidents of the kind that occurred at Glenbrook and Waterfall have continued to plague the New South Wales rail system.

One of the accidents that was investigated during the Glenbrook Inquiry was an accident on 18 August 1998 at Kerrabee in the Hunter Valley, where a breakdown in communications led a freight train to collide with a vehicle occupied by track workers which was on the track because they had been led to believe that there would be no train in the vicinity. The communications failures that occurred at Kerrabee were, in essence, no different from those that occurred on 2 December 1999 in the Glenbrook rail accident. Nor were they different, in essence, from the communications breakdown which occurred at the time of the Hexham accident. The Kerrabee accident was a precursor to the Glenbrook accident. Both were precursors to the Hexham accident. In each case there was a failure to communicate a dangerous situation caused by the presence of other trains on the track.

The persistent failure of the SRA, and now RailCorp, to manage risks associated with inadequate communications has been a feature of their inadequate safety management for several years.

Another undesirable feature of the way in which risk analysis has been undertaken by the SRA, and now RailCorp, is that there has been a failure to have regard to incidents outside their own network. Had the SRA reacted to the Footscray accident on 5 June 2001, which identified inadequacy of medical controls and the susceptibility of the same type of foot pedal as in the Tangara to inadvertent circumvention, this should have alerted it to the two risks that actually eventuated at Waterfall. It should also have been aware of the high speed rollover accident on 24 June 1984 at Morpeth, in the United Kingdom, which should have led to a consideration of the risk of high speed rollover accidents on the New South Wales system.

It is for these reasons that there were several recommendations in the Glenbrook Inquiry final report relating to the need for rail organisations, including the regulator and the rail accident investigation body, to avail themselves of information from interstate and overseas rail accidents which would better assist in the identification of risks on the New South Wales rail system.

Adequate risk assessment requires an organisation to be reactive in terms of information to be gained from the rail network's own operations. This applies not only to recent events, but also knowledge obtained over a period of time resulting from incidents that have occurred. In addition, the knowledge of incidents occurring outside the network can be used as a check to determine whether adequate controls are in place in local rail operations, to adequately manage the risks.

A reactive approach to incidents or accidents is obviously necessary in any risk management system, but it must not be the only approach. Such an approach will not capture low probability high consequence events of the kind that materialised at Waterfall. That is why a rigorous process of overall risk assessment must be carried out by RailCorp. If not, there could continue to be serious rail accidents caused by latent deficiencies, such as the deadman foot pedal on G7. These may remain latent for many years until such time as they combine with other causes to produce catastrophic results.

Verification must be undertaken to determine the extent to which controls put in place have prevented the risk from materialising, or minimised the consequences, if it does occur. If the controls have not minimised the risks to an acceptable level, then further analysis must take place to determine what further controls are necessary to reduce the risk to an acceptable level. What is acceptable or unacceptable becomes a value judgment based usually on a cost-

benefit analysis. The example of ATP is one way of demonstrating the method of analysis that should be used. Automatic train protection offers a far lower risk of collision or derailment due to a train driver falling asleep or becoming incapacitated.

Automatic train protection is a relatively expensive means of controlling such risks. Although recommended for the United Kingdom rail system by several accident investigation reports, the decision was made that the risk was tolerable, with other less expensive options put in place. Tolerable risks are described as those which are as low as reasonably practicable (hereafter referred to as ALARP). This somewhat indefinite phrase appears to have created a comfort zone for those responsible for managing risks. What should be considered is whether the risks are tolerable. It involves a value judgment by those making the decision, who should accept responsibility for any such decision and advise those exposed to the risk of their decision and of the risk which they regard as tolerable.

The response of RailCorp to the Waterfall rail accident has been to add an additional level of protection against train driver incapacitation by the addition of vigilance devices. There will remain some residual risk. The additional protection from vigilance devices though not foolproof carries a greater degree of safety. If an appropriate vigilance device had been installed on G7, the Waterfall rail accident would probably not have occurred.

What should have happened in relation to the deadman foot pedal is that an appropriately thorough examination should have been carried out to determine the extent to which that control was going to be effective to provide the level of protection that was required to control the risk of a runaway train to an acceptable level.

The kind of examination carried out by Dr McIntosh would have soon disclosed that the risk was not controlled because around 40 per cent of Tangara train drivers have a moderate to high ability, due to their body mass, to hold the deadman foot pedal in the set position, when incapacitated. In the case of Tangara train drivers with a body mass of 105 kg or greater, 50 per cent were able to hold it in the set position, without effort. This is clearly an unacceptable risk.

One very good illustration of the failure of RailCorp to properly assess risk is that the vigilance system that was installed in the Tangara trains initially made the same sound as the bell signal given by the train guard to inform the train driver that it was safe to proceed from the platform. In other words, if the train had been stationary at the platform for the length of the vigilance device cycle, then a bell warning would be given which the train driver could easily mistake for a bell signal from the train guard to the effect that it was safe to proceed, and drive the train away from the platform while passengers were still getting on or off the train. That risk was recognised as a hazard by RailCorp and referred to in a crew briefing document which was provided to the Special Commission of Inquiry. The crew briefing document described the risk introduced by the vigilance bell sounding similar to the train guard's bell in the following terms:

> With the introduction of the Vigilance System a risk is introduced whereby, the first "ding" of the Vigilance Bell could be confused with the "single ding" of the All Right Bell. This creates a hazard that a train driver might depart a platform on the wrong bell.

There are a number of significant issues associated with the above quotation. The first is that in designing the vigilance system, the warning device made the same sound as used for a train guard to communicate to a train driver that it is safe to proceed. In those circumstances the train driver may be uncertain what the bell sound indicated. It is obvious that with the introduction of such vigilance devices, there had been no hazard analysis of the danger of the train driver mistaking the sound of the vigilance device when stationary at a platform. The risk introduced was the danger of serious injury or death to passengers attempting to board the train. The risk of dragging passengers along platforms was recognised in RailCorp's own safety documentation as one of its major hazards.

These processes for the installation of vigilance devices were occurring during the course of the Inquiry. The Inquiry was not informed of any risk assessment and this episode demonstrates that, to the present time, the capacity of RailCorp to conduct even the most elementary of risk assessments is severely limited. What RailCorp did was to increase the risk of a high probability hazard which involved passengers attempting to board or leave a train, whilst trying to control a low probability high consequence hazard as occurred at Waterfall.

In addition to careful analysis of the systems and activities, identification of all the relevant hazards, adequate risk assessment and adequate risk treatment on an overall basis will not work unless the persons engaged in those processes diligently carry out their work. One of the means by which such diligence can be ensured is by identifying the person or persons who are accountable for the control of the particular risk.

Given the observations made about the capacity of RailCorp to carry out adequately overall risk assessment, it is essential that it retain the services of an independent consultant, so that when risks which could result in a catastrophic or major accident are being considered that consultant is called upon to certify that the risk has either been eliminated or controlled to the extent identified. The process should then be ratified by the Board of RailCorp satisfying itself that the work that has been performed has either eliminated the risk or reduced it to a level that the Board regards as tolerable. The Board must also be accountable for any such decision. The processes of hazard identification, risk assessment and control, and independent verification and approval by the Board in respect of all potentially catastrophic or major hazards should be fully documented and kept in a registry. In addition, that information should be provided to the rail safety regulator which, if considered necessary, should overrule the Board's decisions.

9. Data Loggers

Chapter 2 of this report summarised the findings and conclusions of the interim report. It observed that the task of the Special Commission of Inquiry was made much more difficult because the recommendation to fit data loggers to SRA trains made in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident had not been implemented.

The information that had been obtained from the data logger records on the Indian Pacific enabled a considerable amount of time and cost to be saved in the investigation of the accident during the course of the Glenbrook Inquiry.

If the data logger which had been fitted to G7 had been working at the time of this accident it would have been possible to readily determine a number of important facts: such as that the train driver, Mr Zeides, did not operate the controls of G7 from shortly after G7 left Waterfall railway station; that there was no defect in the way in which G7 was operating from the time it left Waterfall railway station until the derailment; that Mr Zeides had not applied the brakes; that the train guard had not attempted to apply the brakes; that the traction system and braking systems on G7 were working correctly; and that there had been no emergency brake application as a result of the deadman system being activated. In addition, data logger records would have indicated the manner in which Mr Zeides drove G7 from Central railway station to Waterfall railway station. The data logger records would have also identified the precise time of the accident; would have shown the acceleration rate of G7; and the speed of G7 at the time of the derailment.

The determination of these facts from other sources took months of public hearings and evidence, and many hundreds of hours of engineering and other investigation. One of the main reasons why this Inquiry has taken the time it has is that the recommendation in the Glenbrook report that data loggers be fitted was not implemented. The time lost, and money wasted, as a result of the failure to implement that recommendation has been considerable.

What is even more ironic is that G7 was fitted with a data logger, albeit that it was not in use. It transpired that G7 was one of a number of trains that had been fitted with a data logger for testing purposes. When the testing of the G7 data logger was to commence in early January 2003, it was noted that the data logger had in fact been operating and recording information. This was in breach of a protocol that had been agreed between the then SRA and the relevant trade union, the Australian Rail, Tram and Bus Union, New South Wales Branch (hereafter referred to as the RTBU).

Thus, the testing scheduled to take place on the data logger in early January 2003 was cancelled and it was re-programmed for mid-January. This testing did not proceed because no rostering arrangements for staff had been put in place to allow participation in the testing. Thus, although G7 had a data logger which could have been operational, it was not turned on as at 31 January 2003. This sequence of events is an example of poor project management and poor industrial relations by the SRA.

The cost, inconvenience and delay occasioned by the failure to implement the Glenbrook Inquiry recommendation to fit data loggers before the Waterfall rail accident occurred, led me to inquire into the reasons for the delay. When material relating to the installation of data loggers was examined, it became apparent that, as early as 1993, the SRA had identified the

installation of data loggers as a project. Data loggers and event recorders had been a normal feature of railway rolling stock equipment for decades before then. Nevertheless, the fitting of data loggers was not completed until 2003, seven years after a decision to install and trial them was made on 29 June, 1996, and then probably only because of the criticisms voiced during the course of this Inquiry.

When the Special Commission of Inquiry came to examine the events that occurred between 1993 and the installation of data loggers in 2003, there were a number of features of the way in which safety was managed in that period by the SRA, apart from the failure to install data loggers, which require comment.

The Glenbrook rail accident occurred on 2 December 1999 and, in the Inquiry into that accident, the precise time of the collision and other matters relevant to the movement of the Indian Pacific train were readily ascertainable. When evidence during that Inquiry revealed the existence of the proposal as far back as 1993 that data loggers be fitted to all SRA trains, attempts were made to determine why, as of 1999 this had not occurred. The only explanation seemed to be that the project was overlooked in the 1996 disaggregation of the monolithic New South Wales government owned railway.

Mr Gilbertson, the General Manager Capital Works, RailCorp was asked about the reason for the delay after 1996 and he said that the period between 1996 and 1998 "was a period when the railways were broken up and it is a matter of factual record that there was some confusion at this stage over the management of the data logger project". It would be expected that when an integrated railway was disaggregated, one of the processes would be to identify what outstanding projects needed to be completed and then to determine which of the disaggregated organisations was responsible for the completion of each project. I would have thought that since it was a project in relation to the installation of data loggers on rolling stock, the only obvious organisation responsible for the completion of that project would be the SRA, the owner of the relevant rolling stock.

No step appears to have occurred after 1996 in relation to the installation of data loggers until the final report of the Glenbrook Inquiry was delivered in April 2001. On the evidence before the Special Commission, the contractual arrangements for the installation of data loggers were finalised a month after the delivery of the Glenbrook Inquiry final report. The events that thereafter unfolded are illustrative of a number of deficiencies in the safety management systems of the SRA.

When one considers data loggers are vitally important pieces of equipment for identifying what happens in the course of incidents and accidents and for monitoring the way in which trains and train crew perform, it is surprising that industrial relations concerning data loggers took the course they did.

Two factors appear to have impeded the progress of the project. The RBTU was legitimately concerned about the reliability of the information being obtained from the data loggers, particularly if it was to be used for the monitoring or disciplining of train drivers. The RBTU officers believed they needed to be certain of the reliability of the information that was to be recorded, because they did not trust that the management of the then SRA would not use the material to the disadvantage of RBTU members. This was an eminently reasonable approach.

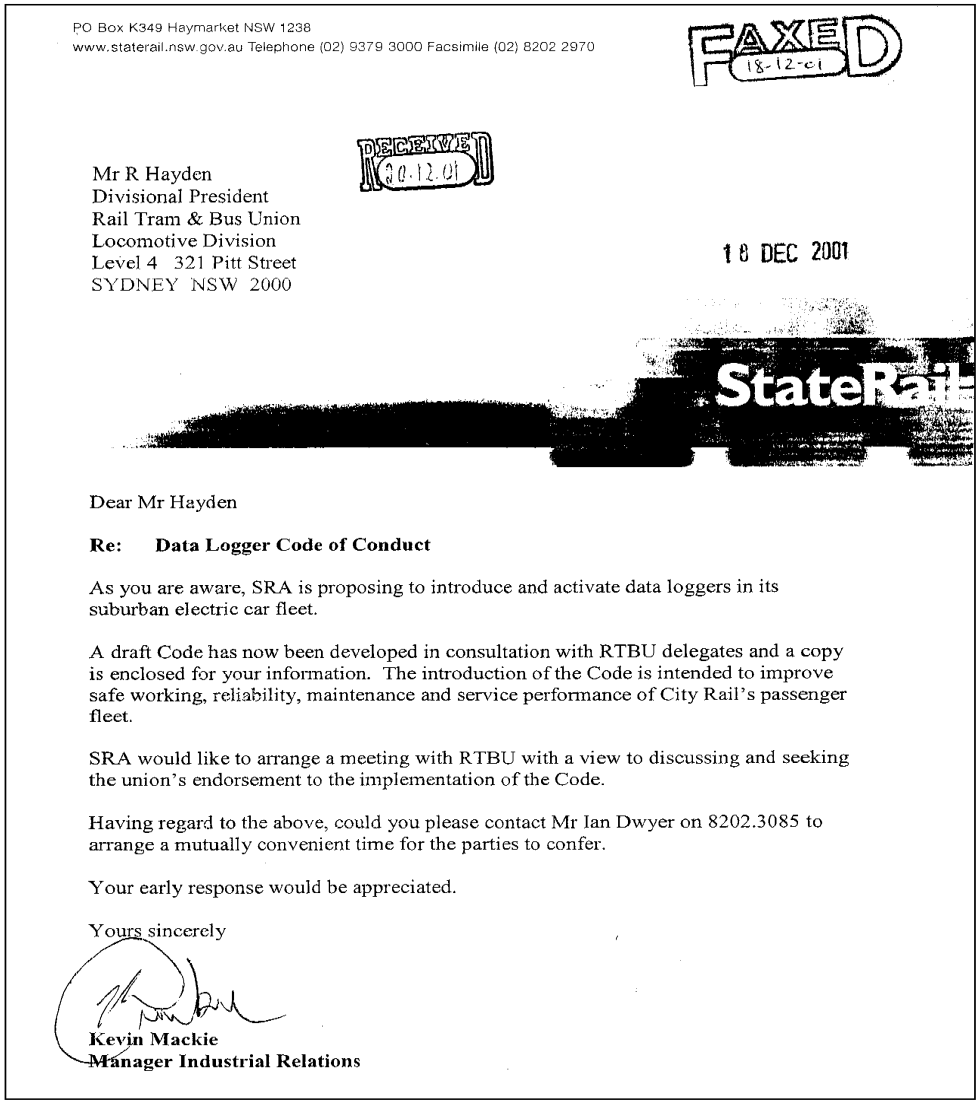
A good illustration of this relationship can be found in the evidence Mr Robert Hayden, President of the RTBU, who stated:

> … in the work environment of SRA at the time, and now RailCorp, there was a perception that our members felt that the drivers were always wrong. If an incident occurred, the drivers were always wrong and unless there was proof of such, that punishment was handed out to our members.
>
> We felt – and we had to make sure that the information being received by the data logger was accurate, correct and was transparent to our rank and file so they had confidence that if that – if and when that information was used against them, it was accurate.

Such a level of distrust between employees and management is not a very good foundation upon which to develop the kind of safety culture which is essential to ensure the optimum safety of the travelling public.

The SRA and the RTBU agreed to establish a committee for the purpose of attempting to resolve the outstanding issues surrounding the use of data loggers. In the meantime, the program of installation of data loggers in SRA trains had commenced. The RTBU was then asked by the SRA to endorse the installation program, before a code of conduct relating to how the information downloaded from the data loggers was to be used was agreed between the parties.

The program of installation of data loggers was suspended shortly after 18 December 2001 due to RBTU opposition. On 18 December 2001, the Manager, Industrial Relations, of the SRA wrote to Mr Hayden. The letter is Figure 9.1.



PO Box K349 Haymarket NSW 1238
www.staterail.nsw.gov.au Telephone (02) 9379 3000 Facsimile (02) 8202 2970

FAXED 18-12-01

RECEIVED 20.12.01

Mr R Hayden
Divisional President
Rail Tram & Bus Union
Locomotive Division
Level 4 321 Pitt Street
SYDNEY NSW 2000

18 DEC 2001

StateRail

Dear Mr Hayden

Re: Data Logger Code of Conduct

As you are aware, SRA is proposing to introduce and activate data loggers in its suburban electric car fleet.

A draft Code has now been developed in consultation with RTBU delegates and a copy is enclosed for your information. The introduction of the Code is intended to improve safe working, reliability, maintenance and service performance of City Rail's passenger fleet.

SRA would like to arrange a meeting with RTBU with a view to discussing and seeking the union's endorsement to the implementation of the Code.

Having regard to the above, could you please contact Mr Ian Dwyer on 8202.3085 to arrange a mutually convenient time for the parties to confer.

Your early response would be appreciated.

Yours sincerely

Kevin Mackie
Manager Industrial Relations

Figure 9.1 Letter dated 16 December 2001 from SRA Manager Industrial Relations to RTBU President re data loggers code of conduct

The attachment was a draft code titled "Data Logger Code of Practice" and it included paragraphs such as:

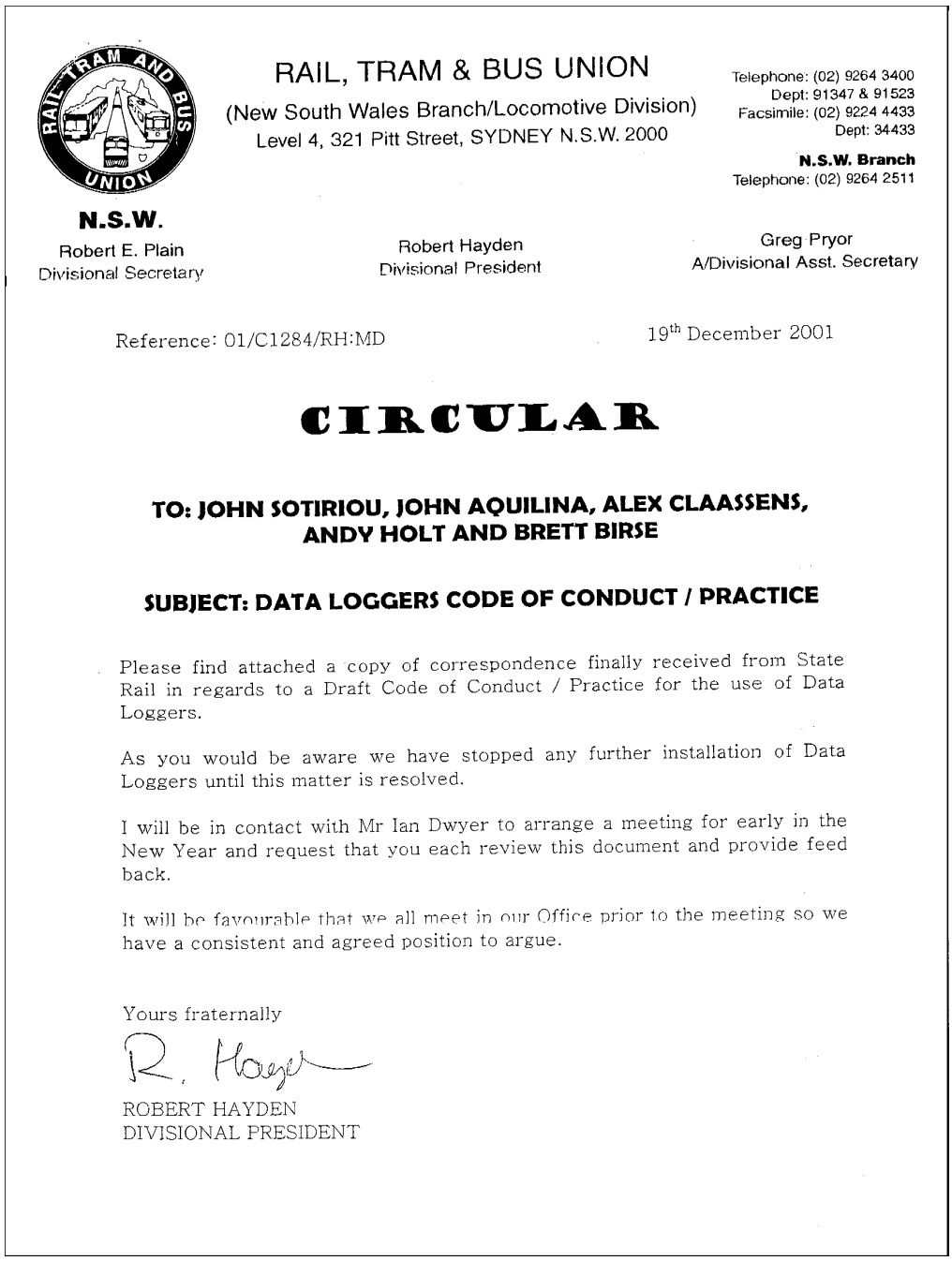
> Information collected by the data loggers may be utilised in monitoring safeworking practices and procedures, the investigation of major incidents, as well as in the analysis of train operation and in service performance with the objective of planned improvements in maintenance scheduling, reduced breakdowns and cost efficiencies.
>
> … [A]ccess and use of data will take place to assist in compliance monitoring of safeworking practice and procedures, incidents investigations including safeworking breaches, and if necessary for the purpose of legal proceedings arising out of such investigation.

Mr Hayden, in a statement provided to the Special Commission of Inquiry, recorded his response to that communication as follows:

It was a document inconsistent with what I expected to receive from State Rail. The document did not, in my opinion, provide proper protection to members whilst equipment was operating in test trial mode.

During the period from 19 December 2001 until 9 April 2002 installation of data loggers, as far as I am aware, did not continue. Testing of data loggers that had been installed in numerous trains did however continue.

Figure 9.2 is the circular Mr Hayden sent to the RBTU representatives on the data logger committee that had been established to agree on the code for the use of data loggers.



RAIL, TRAM & BUS UNION
(New South Wales Branch/Locomotive Division)
Level 4, 321 Pitt Street, SYDNEY N.S.W. 2000

Telephone: (02) 9264 3400
Dept: 91347 & 91523
Facsimile: (02) 9224 4433
Dept: 34433
N.S.W. Branch
Telephone: (02) 9264 2511

N.S.W.
Robert E. Plain
Divisional Secretary

Robert Hayden
Divisional President

Greg Pryor
A/Divisional Asst. Secretary

Reference: 01/C1284/RH:MD

19th December 2001

CIRCULAR

TO: JOHN SOTIRIOU, JOHN AQUILINA, ALEX CLAASSENS, ANDY HOLT AND BRETT BIRSE

SUBJECT: DATA LOGGERS CODE OF CONDUCT / PRACTICE

Please find attached a copy of correspondence finally received from State Rail in regards to a Draft Code of Conduct / Practice for the use of Data Loggers.

As you would be aware we have stopped any further installation of Data Loggers until this matter is resolved.

I will be in contact with Mr Ian Dwyer to arrange a meeting for early in the New Year and request that you each review this document and provide feed back.

It will be favourable that we all meet in our Office prior to the meeting so we have a consistent and agreed position to argue.

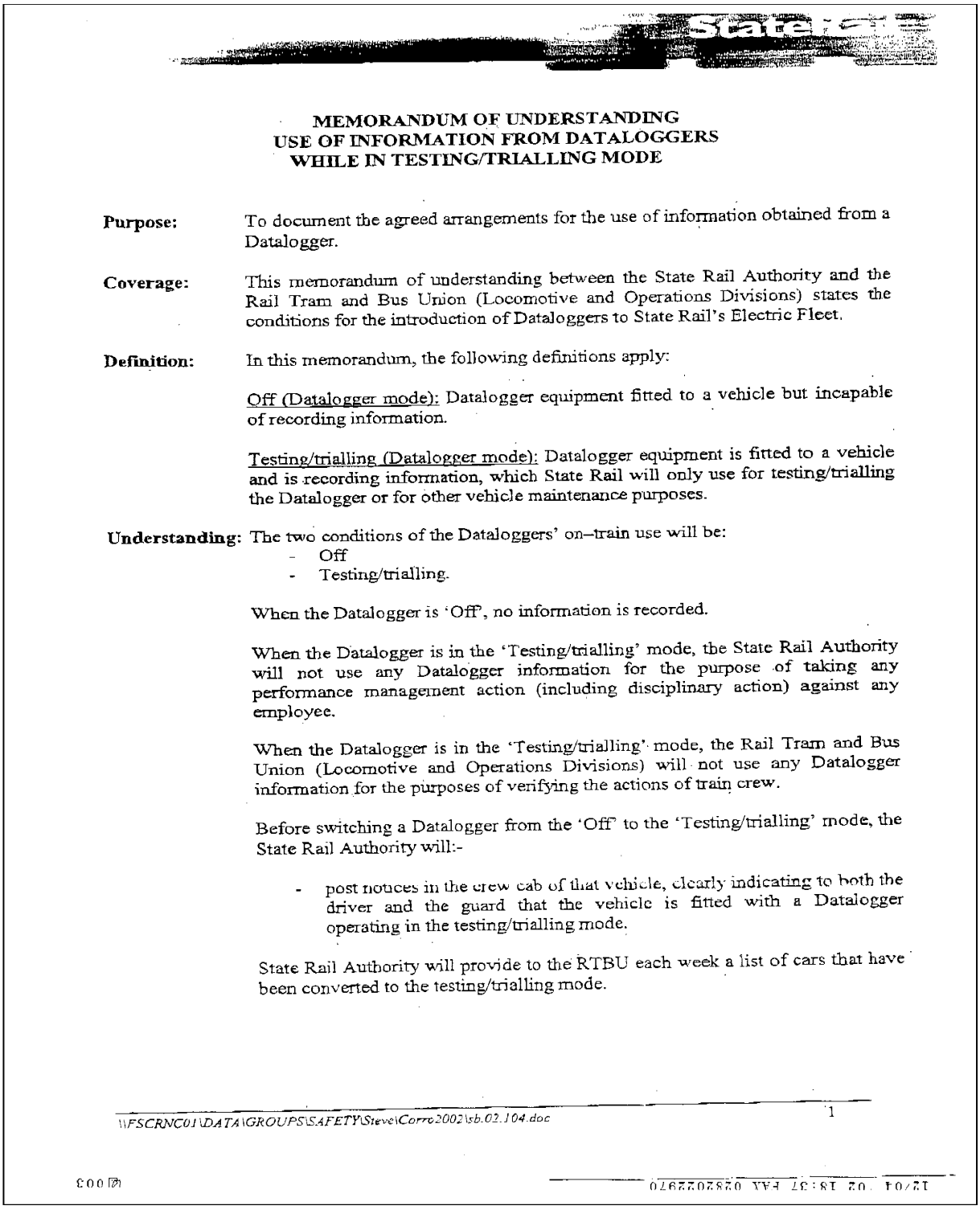
Yours fraternally

R. Hayden

ROBERT HAYDEN
DIVISIONAL PRESIDENT

Figure 9.2 Circular dated 19 December 2001 from RTBU President re data loggers code of conduct/practice

From 19 December 2001 to 9 April 2002, meetings and correspondence between the SRA and the RTBU continued until eventually, on 9 April 2002, an agreement as to the formal code of conduct was reached. The agreement reached resulted in considerable compromise by the SRA as to the uses to be made of data loggers. The agreement reached on that date was reduced to a memorandum of understanding. The relevant sections of the memorandum of understanding are Figures 9.3 to 9.4.



MEMORANDUM OF UNDERSTANDING
USE OF INFORMATION FROM DATALOGGERS
WHILE IN TESTING/TRIALLING MODE

Purpose: To document the agreed arrangements for the use of information obtained from a Datalogger.

Coverage: This memorandum of understanding between the State Rail Authority and the Rail Tram and Bus Union (Locomotive and Operations Divisions) states the conditions for the introduction of Dataloggers to State Rail's Electric Fleet.

Definition: In this memorandum, the following definitions apply:

Off (Datalogger mode): Datalogger equipment fitted to a vehicle but incapable of recording information.

Testing/trialling (Datalogger mode): Datalogger equipment is fitted to a vehicle and is recording information, which State Rail will only use for testing/trialling the Datalogger or for other vehicle maintenance purposes.

Understanding: The two conditions of the Dataloggers' on–train use will be:

- Off
- Testing/trialling.

When the Datalogger is 'Off', no information is recorded.

When the Datalogger is in the 'Testing/trialling' mode, the State Rail Authority will not use any Datalogger information for the purpose of taking any performance management action (including disciplinary action) against any employee.

When the Datalogger is in the 'Testing/trialling' mode, the Rail Tram and Bus Union (Locomotive and Operations Divisions) will not use any Datalogger information for the purposes of verifying the actions of train crew.

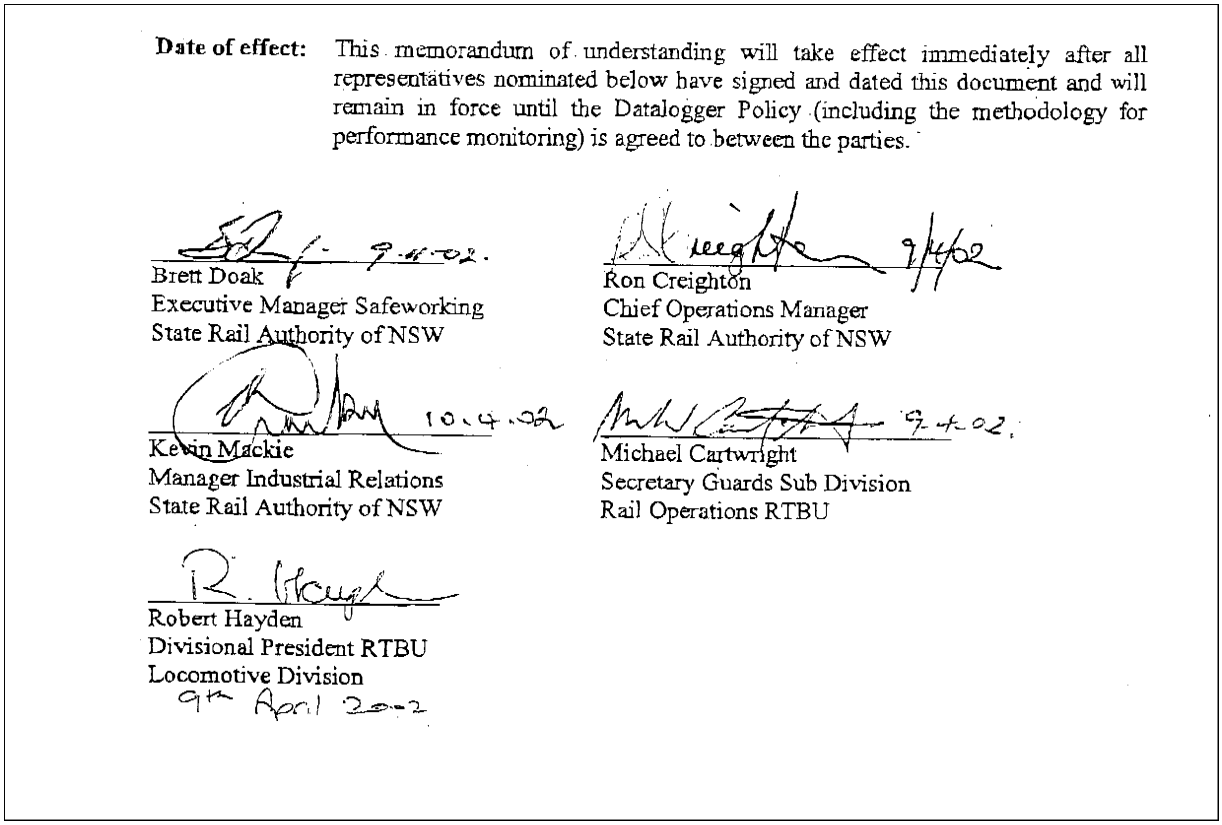
Before switching a Datalogger from the 'Off' to the 'Testing/trialling' mode, the State Rail Authority will:-

- post notices in the crew cab of that vehicle, clearly indicating to both the driver and the guard that the vehicle is fitted with a Datalogger operating in the testing/trialling mode.

State Rail Authority will provide to the RTBU each week a list of cars that have been converted to the testing/trialling mode.

\\FSCRNC01\DATA\GROUPS\SAFETY\Steve\Corro2002\sb.02.104.doc 1

Figure 9.3 Memorandum of understanding dated 9 April 2002 re use of information from data loggers while in testing/trialling mode (page 1)



Date of effect: This memorandum of understanding will take effect immediately after all representatives nominated below have signed and dated this document and will remain in force until the Datalogger Policy (including the methodology for performance monitoring) is agreed to between the parties.

9.4.02.
Brett Doak
Executive Manager Safeworking
State Rail Authority of NSW

9/4/02
Ron Creighton
Chief Operations Manager
State Rail Authority of NSW

10.4.02
Kevin Mackie
Manager Industrial Relations
State Rail Authority of NSW

9.4.02.
Michael Cartwright
Secretary Guards Sub Division
Rail Operations RTBU

Robert Hayden
Divisional President RTBU
Locomotive Division
9th April 2002

Figure 9.4 Memorandum of understanding dated 9 April 2002 re use of information from data loggers while in testing/trialling mode (page 2)

Data loggers were only to be used in a "testing/trialling" mode and information obtained would only be used by the SRA "for testing/trialling the data logger or for other vehicle maintenance purposes". The second feature of this memorandum of understanding was that, before a data logger could be switched on, the SRA was required to "post notices in the crew cab of that vehicle, clearly indicating to both the driver and the guard that the vehicle is fitted with a data logger operating in the testing/trialling mode".

Following the 9 April 2002 memorandum of agreement, the installation program recommenced. In relation to the data loggers already installed, technical difficulties in their operation led the RBTU to oppose the information recorded prior to the testing period, being used against any of its members.

There were technical difficulties associated with the reliability of the data being collected from the data loggers. For example, there was evidence that some data loggers were incorrectly recording train speed.

The RTBU opposition to the proposals by the SRA to use data logger information led Counsel Assisting to question trade union officials as to whether they genuinely supported the installation of data loggers or whether this industrial action was motivated by a concern that the real purpose of the installation of data loggers was to monitor train crew performance. Those propositions were rejected by the RTBU officers to whom they were put. The following question and answer appears in the evidence of Mr Hayden:

> Q: What I want to suggest to you is the documents you've been shown on the data logger issue this morning, looked at overall, don't support the

proposition that your union wholeheartedly supported the installation, trialling and availability of data loggers as a safety device on the various parts of the fleet?

A: No, I don't agree. As I said yesterday, there were industrial issues in regards to protection of the information, how that's used against our members, and that's what a union does, but it was not – it was not and has never been to purposely hold up or delay the installation of data loggers on the State Rail fleet, never.

One way of testing whether there was any deliberate attempt to prevent the installation of data loggers was to establish whether or not the kind of problems that Mr Hayden claimed the RTBU was concerned about had in fact occurred in relation to the installation of data loggers. When this issue was examined, it was obvious that the program for the installation of data loggers had been handled inefficiently by the SRA. The original program provided for the use of outside contractors to install the data loggers, but under industrial agreements the work had to be done by members of the Australian Manufacturing Workers' Union. Mr Garry Hingle, the Secretary of the Vehicle Division of that trade union, said that the members of his trade union who were given the task of installing the data loggers did not have "enough knowledge about what was required, engineering instructions were not always available, correct protocols were not available and all the training had not been completed for the fitters to understand how the system correctly worked".

Added to that was the fact that the program for the installation of the data loggers was to be accommodated within the general routine inspections of the trains. Thus, trains were not taken out of service for data loggers to be fitted by properly trained and equipped employees and the work had to be accommodated within the routine maintenance inspection of trains. Mr Gilbertson said:

> The plan was, and this is a plan that was adhered to for most of the program, that each train would have the data loggers installed over a period of three general inspections and that simply reflected the amount of work to be done to install the data logger or its associated wiring. From time to time the amount of work that needed to be done to a particular train during a particular general inspection sometimes precluded that but, as I said, that was the exception rather than the rule and most trains did in fact have their data loggers installed over a period of three general inspections.

Mr Gilbertson went on to state that the period of a general inspection for a double deck train was 120 days and for a Tangara train it was 90 days. He gave the following evidence:

Q: So the range was between 270 days and 360 days – that was the range over which, at least in relation to some trains, the installation of the data loggers occurred?

A: That's correct.

Q: And that, of course, relates to the question of installation, not in relation to calibrating them and then turning them on?

A: That's correct.

Q: That, itself, took a further period of time in relation to the project to install data loggers, and that was the time during which there were discussions with the union about the way in which they were to be used?

A: That's correct.

It transpired that a final memorandum of understanding between the RTBU and the SRA about the uses that could be made of the information downloaded from the data loggers was not reached until 30 May 2003, and that agreement did not permit the use of data in relation to train crew performance. It was not until December 2003 that the RTBU agreed that data loggers could also be used for that purpose.

The installation of data loggers on all trains was not completed until 16 June 2003 and it is probable that, had it not been for this Special Commission of Inquiry and the criticism expressed during the public hearings of this Inquiry about the failure to implement the recommendation made in April 2001 in the final report of the Glenbrook Inquiry, this would have been further delayed.

The history of the installation of data loggers speaks eloquently of poor industrial relations, deficient planning of projects and deficient processes for the implementation of projects, each of which is as critically important to the management of safety on the New South Wales railway system as the data logger project itself.

I am satisfied that one of the main reasons for the delay was the technical difficulties encountered by those responsible for installing the data loggers, and that the RTBU was properly concerned that inaccurate information could be used adversely against its membership. Its concern was fuelled by the "us and them" culture that existed within the railway.

These deficiencies will be addressed in later chapters of this report, but they include defective project management, poor industrial relations, and a weak safety culture. For these reasons the data logger project took ten years from its inception to completion.

The data loggers, and the data they provide, are crucial to the monitoring and improvement of the reliability of rolling stock, because of the data obtained relating to the performance and maintenance of the rolling stock. They are also critical to the auditing of the performance of train crew. They are an essential piece of equipment for the determining of the causes of incidents and accidents of the kind that occurred at Glenbrook and Waterfall.

Data loggers are such an important piece of equipment that, in my opinion, it should be mandatory for all trains to be fitted with them and rail organisations should not be accredited to operate on the New South Wales rail network unless each train is fitted with an operational data logger. This requirement should be a condition of accreditation for any organisation seeking to operate on the New South Wales rail network. The requirement should be specified in a similar form to that required in the United Kingdom, where the Rail Standards and Safety Board has prescribed certain requirements in relation to data loggers. The relevant Railway Group Standard is Figure 9.5.

Data Recorders on Trains – Operating Requirements

Traction unit
Any railway vehicle which has the capacity for self-propulsion (whether or not the power by which it operates is derived from a source external to the vehicle).

B4 Requirements

B4.1 Extraction of data
Train operators shall have processes in place for the extraction, validation and analysis of data from data recorders to meet the requirements of this document.

B4.2 Use of data
Train operators shall extract data from data recorders to provide information for the purpose of:

a) meeting the requirements of GO/RT3251 to monitor performance and assess the competence of their drivers

b) accident and incident investigation, to assist in the identification of causes.

B4.2.1 Data for performance monitoring and competence assessment
Train operators shall have documented processes for the extraction and use of data for performance monitoring and competence assessment. Such processes shall define the arrangements for using extracted data for:

a) monitoring the driving performance of every driver at a frequency determined by the level of risk attributed to each driver

b) additional monitoring of drivers within a specially monitored driver system

c) assessment of the competence of drivers

d) feedback to individual drivers on their performance.

B4.2.2 Data for accident and incident investigation
The train operator shall ensure that data is extracted and analysed for use and provided to the person responsible for leading the investigation after an accident or incident where the operation or technical performance of the train may have been a contributory factor [including signals passed at danger (SPAD)].

B4.3 Retention of data
B4.3.1 Retention period for data
Train operators shall retain data used for performance monitoring and competence assessment of train drivers for a minimum of seven years, to allow comparisons to be made over time for an individual driver's performance.

B4.3.2 Special requirements for retention of data
Retention of data by train operators shall be longer than seven years if it is necessary to show the effectiveness of remedial action, such as special monitoring, taken as a result of performance monitoring, competence assessment or the investigation of an accident or incident.

B4.3.3 Retention of data for accident and incident investigation
Data extracted by train operators for use in the investigation of accidents and incidents shall be retained for a minimum of seven years from the date of the accident or incident.

B4.4 Competence
Train operators shall have processes in place to ensure that persons required to extract, validate and analyse data on their behalf are competent to do so. Sufficient resources shall be provided to ensure the availability of persons competent to download data as soon as is reasonably practicable following accidents and incidents.

Figure 9.5 RSSB railway group standard: data recorders on trains – operating requirements

The reasons why the Railway Group Standard in Figure 9.5 imposes those requirements are conveniently expressed in the guidelines issued by the United Kingdom Association of Train Operating Companies to assist its members in complying with those standards. The relevant sections of the guidance note for the use of data recorders are Figures 9.6 to 9.10:

Guidance Note – Use of Data Recorders

ATOC Guidance Note
ATOC/GN001
Issue One
Date January 2001

Part B

1. Purpose

This document provides guidance on the use of Data Recorders.

2. Scope

This Guidance Note applies to all ATOC Members.

3. Definitions

Data Recorder
For the purpose of this document, equipment provided on a train to record data about the operation of its controls and performance in response to those controls and other train control systems.

A Data Recorder is also referred to elsewhere as a Data Logger, Event Recorder and On-Train Monitoring and Recording (OTMR) equipment

Competent Person
A person with the necessary skills and experience to undertake the extraction of and/or the analysis and validation of the recorded data from a Data Recorder.

4. General

4.1

Train Operators must comply with Railway Group Standard GO/RT3272 with regard to the fitment and functions of Data Recorders.

4.2

Data Recorders provide factual data about the performance of trains and traincrew. This enables operating incidents and accidents to be more effectively investigated and train and traincrew performance to be more effectively monitored. To ensure effective use of Data Recorders, it is important that

- the equipment records the most appropriate data, taking account of the equipment's technical capabilities and the risks associated with the various recordable events
- the equipment is reliable
- the integrity of the data is beyond question

Figure 9.6 ATOC guidance note – use of data recorders (page 1)

4.3

Although traincrew are generally aware that Data Recorders are installed on certain fleets, they are sometimes unaware of what data is recorded and what it can be used for. It is recommended that traincrew are given suitable briefing on both what data is recorded and what it can be used for.

5. Procedures and Documentation

5.1

Train Operators should have documented procedures covering:

- criteria for data extraction
- traincrew performance monitoring
- training and competence assessment
- operating instructions
- data extraction
- data analysis
- data validation
- records and data storage
- audit

6. Criteria for Data Extraction

6.1

Data extraction should normally be carried out for the following events and incidents for the purpose of analysing and controlling risk:

Operating incidents	Collisions, Derailments, Cat. B, C and D SPADs, Divided Trains, Door Irregularities, Suicides etc.
Cat A SPAD	After a reported Cat. A SPAD
Station overrun / Failure to stop	After receiving a report of a train overrunning or failing to stop at a booked station

Figure 9.7 ATOC guidance note – use of data recorders (page 2)

Reported speeding	After receiving a report that a train may have infringed the line permissible speed or maximum train speed.
Radar speed check	To check the recorded speed after an infringement and to review driver performance over the whole journey.
TPWS, ATP, Speed and Tilt Control System Interventions, Mechanical Trainstop Systems	Intervention by these systems on the approach to and over speed restrictions and tilt prohibited sections, and at a signal displaying a danger signal
Isolation of Train safety systems	When these have been isolated in the wrong circumstances.
Customer complaints	Insufficient station dwell time applied, speeding, doors opened on the wrong side etc.
Competence assessment	As a part of the competence assessment procedure or where additional post incident assessments have been implemented by the incident or SMD Procedure.
Training / Post Training Assessments	Trainee and New Drivers during and in the period following initial training.
Traincrew Monitoring	For the unannounced monitoring of the performance traincrewl.

7. Traincrew Performance Monitoring

7.1

Data Recorders provide factual records of events and therefore can be used to monitor the actions of traincrew. As the factual record of events is obtained continuously and without the presence of a supervisor, the actions of the traincrew are likely to be typical of their day to day performance. Furthermore, if the traincrew are aware that their actions *may* be monitored, it is likely that they will comply with rules and procedures more assiduously than would otherwise be the case.

Figure 9.8 ATOC guidance note – use of data recorders (page 3)

7.2

Although performance monitoring in this way is mostly relevant to assessing the Driver, operations such as door release and closure under control of the Guard can be similarly assessed.

7.3

It is recommended that monitoring using recorded data is undertaken at least once in a two-year period for each Driver

7.4

It is recommended that data should be obtained and retained of the 'optimum driving profile' for principal routes. This may be obtained by special test run or on an observed normal service run. Once obtained, this data can be used as reference data which, once output as hard copy, can be suitably marked with route data to aid later use. Different hard copy outputs may be referenced for different actions such as braking technique, speed regulation, energy conservation (traction power control and speed), door control etc.

7.5

Subsequent data extractions for performance monitoring should be compared to the optimum driving profile reference data to assess the driving technique and identify where further monitoring or training may be required.

7.6

It is recognised that an 'optimum driving profile' may be of limited value where train formations are variable.

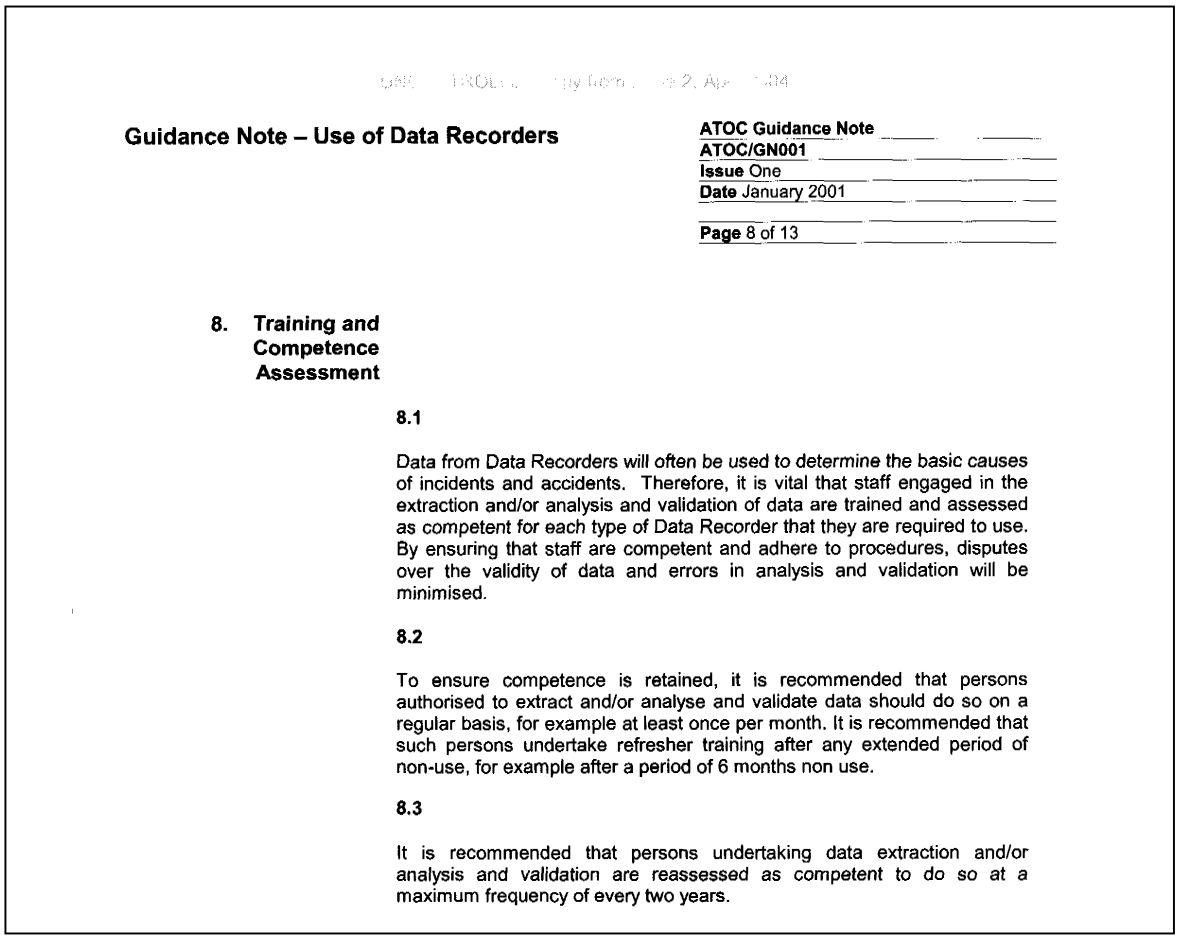
7.7

Monitoring, using recorded data, should be carried out at a minimum frequency which is in accordance with the company policy on performance monitoring. Any deficiencies with driving techniques or operation of train systems must be assessed and mapped across to the competency record file of the person and any shortfalls discussed and appropriate corrective action plans implemented.

7.8

A hard copy of the data extracted for the purpose should be retained on the Driver's or Guard's personal record to assist in identifying trends.

Figure 9.9 ATOC guidance note – use of data recorders (page 4)



Guidance Note – Use of Data Recorders

ATOC Guidance Note
ATOC/GN001
Issue One
Date January 2001

Page 8 of 13

8. Training and Competence Assessment

8.1

Data from Data Recorders will often be used to determine the basic causes of incidents and accidents. Therefore, it is vital that staff engaged in the extraction and/or analysis and validation of data are trained and assessed as competent for each type of Data Recorder that they are required to use. By ensuring that staff are competent and adhere to procedures, disputes over the validity of data and errors in analysis and validation will be minimised.

8.2

To ensure competence is retained, it is recommended that persons authorised to extract and/or analyse and validate data should do so on a regular basis, for example at least once per month. It is recommended that such persons undertake refresher training after any extended period of non-use, for example after a period of 6 months non use.

8.3

It is recommended that persons undertaking data extraction and/or analysis and validation are reassessed as competent to do so at a maximum frequency of every two years.

Figure 9.10 ATOC guidance note – use of data recorders (page 5)

In my opinion, ITSRR should impose similar requirements by means of a standard or regulation in relation to the collection and uses to be made of data from data loggers.

10. Communications

The interim report identified a number of deficiencies in communications that occurred immediately after the Waterfall rail accident. After the interim report was delivered, evidence was tendered of other communications failures, in particular, a report by the Department of Transport into a serious rail accident on 12 July 2002 at Hexham in the Hunter Valley. Evidence was also received of an exchange on 23 February 2004, between a train driver and a train controller, where a suicidal trespasser was on the tracks and the train controller, against the eyewitness assessment of the train driver, directed the train driver to proceed.

Although the Waterfall rail accident was not caused by a communications failure as such, the evidence that caused concern was that there were deficiencies in the communications procedures after the accident, which could have had the effect of causing greater casualties. Those deficiencies are identified in the chapter dealing with the emergency response.

What is of greater concern is that, in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident, deficiencies in communications were identified as being one of the major causes of that accident, and many of the recommendations made in the final report of that Inquiry relating to communications deficiencies appear to have been ignored. In the Glenbrook rail accident the Penrith signaller, by the use of casual and informal language, authorised an inter urban train to pass a signal at stop. The train driver on approaching the red signal asked the signaller, "I'm right to go past it, am I mate?" And received the reply, "Yeah, mate, you certainly are". This exchange led the driver of that inter urban train to believe that there was nothing on the track in front of him. In fact, the Indian Pacific train was located around a bend, the inter urban train was unable to stop in time and in the ensuing collision, seven passengers were killed and 51 were seriously injured. The combination of inadequate communications technology and casual and informal methods of communication were major causes of the Glenbrook rail accident.

The Glenbrook Inquiry was required to consider reports relating to the circumstances of eight additional rail accidents, of which three involved communications failures.

On 18 August 1998, at 7:02 am, an empty coal train collided with a road vehicle traversing a cutting in the Hunter Valley. A communications failure led the ganger in charge of the particular work group to believe that it was safe for him to enter upon the track, in the belief there was no train in the vicinity. An empty coal train collided with the vehicle in which they were travelling, killing both employees.

On 15 October 1998, the driver of a V-set inter urban train, on a journey from Central railway station to Lithgow, was not informed of the presence of track workers carrying out work on the track ahead. The result was that he was not alerted to the fact that track workers were working in a particular location. He did not observe two workers between the tracks and his train struck and killed one of them.

On 9 July 1999, the driver of a train heading north from Hornsby was not informed that the route that he was expecting to take had changed, with the result that the train derailed. Fortunately, no deaths or serious injuries resulted, but there was considerable damage to rolling stock and infrastructure.

As a result of the conclusions reached by the Glenbrook Inquiry about communications deficiencies being causally related to the deaths of the seven passengers in the Glenbrook rail accident, and what was ascertained as to other communications deficiencies in the other accidents considered during the course of that Inquiry, the final report made a series of recommendations relevant to communications issues. They were recommendations 26 to 37 of the Glenbrook final report. They were:

26. The Rail Safety Inspectorate should instigate and develop a standard for railway communications within twelve months of its establishment.

27. The Rail Safety Inspectorate should ensure that the standard for railway communications, once developed, is fully implemented.

28. Until a uniform and integrated communications system is implemented in accordance with the standard, all types of communications equipment should be permitted for the communication of safety critical information.

29. No train is to be operated without being equipped with operative radio communications equipment.

30. The existing communications protocols should be reviewed and redeveloped following consultation with other relevant organisations.

31. The revised communications protocols should incorporate a requirement that drivers be informed of route changes.

32. The revised communications protocols should incorporate a requirement that drivers be informed of the likely location of any trackside workers they may encounter.

33. All communications protocols should be strictly enforced by accredited rail organisations.

34. It should be a condition of accreditation that rail organisations strictly control the use of any private audio or visual device in areas where safety critical communications occur.

35. The Rail Safety Inspectorate should conduct random audits of compliance by accredited rail organisations with the communications protocols.

36. The Rail Safety Inspectorate should supervise a trial of train to train communications to evaluate their advantages and disadvantages.

37. If the trial satisfies the Rail Safety Inspectorate that train to train communications should be introduced, then they should be implemented as soon as possible.

The failure to establish an independent Rail Safety Inspectorate may partly explain why a number of these communications recommendations have not been fully implemented, because there has been no independent body to oversee their implementation.

No standard for railway communications between various rail operators has been established. Likewise, uniform or integrated communications systems between them have not been implemented. Most importantly, in terms of recommendation 33, communications protocols have not been strictly enforced by accredited rail organisations.

Mr Ron Creighton, the Chief Operations Officer, RailCorp, was asked about the lack of progress in the area of communications. He claimed that progress had been achieved in a number of areas as a result of increased training and auditing. He was asked the following:

> Q: Can you explain why, with all this so called training and auditing, that we still have on every occasion that I have been able to have in evidence – obviously there has been no improvement since Glenbrook?
> A: In some areas that's certainly correct.
> Q: I can only conclude that this training is either not taking place or has no effect - one or the other - isn't that right?
> A: In some areas, that's correct.

It was then put to him by Counsel Assisting that there could be but only one explanation and that was ineffective management, to which he replied, "That's certainly one answer".

Mr Brett Doak, the Executive Manager, Safeworking, RailCorp, gave evidence about ongoing deficiencies in communications. When asked questions about a recorded exchange between the train driver and train controller in the incident on 23 February 2004 involving the suicidal trespasser he agreed, after hearing the tape recording, that it appeared that not very much had been learned, either in terms of communications protocols or safety management at the operational level, since the Glenbrook rail accident.

He was also asked about the incident on 12 July 2002 at Hexham and gave the following evidence:

> Commissioner: I have been told ad nauseam that training has been instituted to ensure that there are proper and adequate communications and auditing is going on, yet every time we hear a tape none of the protocols are adhered to. Can you give me an explanation as to why that is?
> A: There has been a lot of work done in implementing improved protocols.
> Q: But, you see, you tell me a lot of work is being done, but yet when one reads a tape or looks at an incident like the Hexham incident, the radio communication protocols are completely ignored.
> A: Yes.
> Q: Sorry?
> A: Yes, I acknowledge that, Sir.
> Q: But if you tell me that this training and auditing is going on, why, then, has there been no improvement in what we see?

What is the answer to that?

A: There is no doubt, yes, we have got considerable improvement to be made and more work to be done.

Q: But, you see, I suggest that no improvement seems to have been made in those two instances?

A: Yes. I would have to agree in that sense.

Q: Well I can't understand, you know – I have been told about all this training, all this auditing. Why, then, has there been no improvement? Might I suggest that is there is no training going on, or no insistence that those protocols be followed? Might that be a conclusion I could come to, do you think?

A: Sir, I think we have to – I think we have to accept that training and auditing is one thing, and then continuing to reinforce results and take appropriate action if required to – if those results are not achieved.

Q: When do you think there is likely to be any improvement, if ever?

A: There will be improvement, and I can – the continual review and work on this issue is something that is getting a lot of attention within the organisation at the moment.

Communications failures were a major cause of the accident on 18 August 1998 at Karrabee. Communications failures were also a major cause of the accident on 15 October 1998 at Bell, the Glenbrook rail accident on 2 December 1999 and the Hexham rail accident on 12 July 2002. The conclusion to which I am forced to come to is that no real progress has been made in improvement of railway communications, so vital for the safe operation of railways. There has certainly been very little progress in the implementation of the communications recommendations made in the final report of the Glenbrook Inquiry.

The report by Transport New South Wales into the Hexham accident highlights a number of areas where very serious ongoing communications deficiencies exist on the New South Wales rail network. The accident at Hexham occurred when an empty coal train, travelling on designated coal train lines, derailed as a result of poor infrastructure maintenance, and the empty wagons of the coal train fouled adjacent main lines used by passenger trains. Approximately eight minutes after the train derailed, a passenger train collided with one of the derailed coal train wagons, fouling the main down line and causing the passenger train to derail. The train driver, the guard and ten passengers were injured. Fortunately, there were no fatalities.

There were a number of remarkable features about this accident. The first is that the coal train had been derailed with part of it fouling the main running line for eight minutes, while passenger trains were approaching the area from both directions, without either of the train drivers being warned of the derailment of the coal train or that it was fouling the main line. The passenger train travelling in an easterly direction was stopped by a red signal, but the passenger train travelling in a westerly direction was not stopped by the signalling system. No one communicated with the train driver of this train to inform him of the situation. This was an incredible oversight, to allow a train carrying passengers to continue without warning the train driver that the line was fouled. An examination of why there was no communication with this train revealed grave deficiencies in both the equipment used for communications purposes and in the procedures that were followed.

The report into this accident reveals there were three different kinds of communications facilities available to the various trains, train controllers and signallers involved. The CountryNet Train Radio System (hereafter referred to as CTRS) is a communications system that offers special features to its users, including an emergency broadcast function that allows all CTRS users in the vicinity to be informed of an emergency. Another mode of communication was the 450.050MHz open channel local radio system. Its open channel function allows all radio traffic to be heard by all users, but consequently it is prone to being cluttered with so much radio traffic that it is difficult for users to communicate clearly and discreetly. Radio traffic occurring on CTRS cannot be heard on the local radio system, and vice versa. Finally, mobile telephones offered the third option for communication.

The crew of the coal train had access to all three modes of communication, the CTRS, the open channel local radio system and mobile telephones. The passenger trains, however, only had access to the open channel local radio system.

The movement of trains was controlled by signallers who were located in various areas and the overall control of train operations in that area was carried out by the train controller at Broadmeadow. The train controller at Broadmeadow had access to the local radio, the CTRS and mobile telephones. However, the signallers who operated in the local area only had access to the local radio and landline and mobile telephones. The signallers did not have access to the CTRS.

The result was that when the coal train derailed and its crew informed the train controller of the accident via the CTRS network, the surrounding train signallers and the drivers of nearby passenger trains did not hear or receive the transmission. No attempt was made by either the crew of the coal train or the train controller to contact train drivers or signallers on the local radio or by any other means.

Another disturbing feature arising from the Transport New South Wales report into the Hexham accident was that although the coal train driver had contacted the train controller using the CTRS system in its emergency mode, which gave it a broadcast function to all other trains on the CTRS system in the vicinity, the train controller at Broadmeadow was not sufficiently trained in the operation of the CTRS system to recognise the significance of the call and inadvertently cancelled the emergency call. The train controller then reinitiated contact with the driver of the coal train using the normal non-emergency mode of operation.

The train controller's action in cancelling the emergency call did not, in the circumstances, cause or contribute to the occurrence of this accident, because the passenger trains did not have the CTRS system of communication in any event. However, if all trains had been on the same radio system and an emergency transmission had been broadcast, then each of the train drivers in the vicinity within the eight minutes between the time of the initial derailment and the collision are almost certain to have become aware of the existence of that derailment, and the collision between the passenger train and the derailed coal wagon would not have occurred.

The deficiencies in the communications equipment were confounded by the fact that, although the open channel local radio was available to all of the parties involved, it was an inefficient method of communicating urgent safety information. Even where the local radio was used in this case, it was clear that it was not a reliable mode of communication.

The Transport New South Wales report identified a number of other disturbing communications failures. For instance, the voice transmissions for a period of 30 minutes immediately after the derailment were recorded and analysed. Of the entire 28 voice transmissions that were recorded, 12 of them did not receive a response. In addition, the deficiencies in the communications equipment available were further compounded by inadequacies in the communications protocols and procedure. The report identified a number of respects in which communications protocols were deficient. These included:

1. Abbreviated and/or poorly structured messages were used;

2. Wrong roads [railway tracks] were named;

3. Roads [railway tracks] were not properly identified;

4. Callers did not identify themselves; and

5. Messages were either not repeated or closed out to the satisfaction of all parties.

The Transport New South Wales report also concluded that, in relation to the collision between the passenger train and the derailed coal wagon, the contributing factors included among other things:

1. The significance of emergency communications was not fully comprehended by network control.

2. An inadequate communication process in arranging protection for the derailed train resulting from the following:

   (a) three types of communication systems; and

   (b) multiple and ineffective interfaces between train crews, train controllers and signallers, resulting in difficulties in the transfer and comprehension of vital information.

3. Inappropriateness of response to emergency radio calls.

4. Failure to close all adjacent roads [railway tracks] until the full extent of the derailment was ascertained.

5. Communication to the driver of 715 [the passenger train] was not attempted prior to the collision.

The fact that the communications recommendations in the Glenbrook Inquiry final report were not fully implemented and that communications failures of the kind identified in the Hexham accident have continued to occur is disgraceful.

The evidence during the course of the Special Commission of Inquiry into the Waterfall Rail Accident demonstrated that although communications failures did not cause the accident, the effectiveness of the emergency response was impeded by continuing deficiencies in communications procedures and equipment.

Ms Guy, whose evidence has been discussed in the emergency response chapter of this report, was asked questions relating to a comparison of the communications protocols which she had observed following the Waterfall rail accident with those in the airline industry. Her evidence was:

> Q: How does that compare with what you observed in the airline industry, in terms of the way in which people communicate with each other?
> A: It did appear to be more casual, and I believe what you mentioned before about having a code word at the start of your conversation should get rid of the casualness of that conversation. Immediately reply to the person you've called "This is an emergency situation. Listen up. Pay attention." It would promote a more professional means of communication.
> Q: Why is that desirable?
> A: To speed up the process of communication, to stop unnecessary conversation.
> Q: What's the problem with unnecessary conversation?
> A: Time. What we're talking about here is time. Time in this situation is absolutely critical.
> Q: And, again, does that involve proper training and proper monitoring of people to ensure that they are doing what they are supposed to be doing – that is communicating in accordance with a clear protocol?
> A: Training and exercising and monitoring.

She was asked what would occur if such a casual approach to safety communications occurred in the airline industry and her response was:

> It's treated so seriously that people would not want to take it in a casual fashion, and if they did they wouldn't be appropriate for the job.

Although difficulties in communications equipment have been identified in the emergency response chapter of this report, it is worth repeating here that at the time of the Waterfall rail accident, as with the Hexham rail accident, there were several incompatible systems of communication available. G7 was fitted with a Metronet radio, but the train guard was not permitted to have access to the Metronet radio and not trained in its use. As observed in the emergency response chapter, there is no reason why train guards should not be able to use any available method of communication, including the Metronet radio, if an emergency occurs. If the train guard had been able to use the Metronet radio in the guard's compartment he would have been able immediately to communicate that the emergency had occurred.

Secondly, there were signal telephones fitted to the signals, but the particular one fitted to the signal nearest to the accident was broken. Even if it had been in working order, emergency response personnel did not know of its existence.

Thirdly, although passengers and train crew had mobile telephones, they did not work efficiently in this area and it was not until satellite telephones were brought in after the accident that reliable and effective communications could be established.

Finally, the Metronet radio allowed communication between the train driver and the RMC and would have allowed communication between the train guard, had he known how to use

it, and Wollongong signal box, but not Waterfall signal box. For Waterfall signal box to attempt to contact the train driver, it was necessary for that signal box to request Wollongong signal box to make the necessary attempt to contact him because the train had entered the Wollongong signalling area.

The Waterfall, Hexham and Glenbrook rail accidents, and the other accidents considered during the course of the Glenbrook Inquiry which identified serious communications deficiencies, all point strongly to the need for compatibility of communications systems throughout the rail network. It is essential that train drivers, train controllers, signallers, guards and supervisors of trackside work gangs be able to communicate using the same technology. The failure to have that degree of compatibility and interoperability causes miscommunication and delay in communications, which the above accidents have demonstrated can have fatal catastrophic consequences. Accuracy and speed of communications is an absolute necessity in a complex operation such as the New South Wales rail system.

The Glenbrook Inquiry reports established that, if the driver of the inter urban train had been able to hear the communication between the driver of the Indian Pacific train ahead of him and the Penrith signaller, he would have known its position and thus avoided the collision.

Similarly, if the drivers of the passenger trains at Hexham had heard the communications between the driver of the derailed coal train and the train controller, then they would have been aware that there had been a derailment of a coal train and would have been able to avoid the collision.

The need for compatibility of communications equipment will increase as new and more operators operate on the New South Wales rail network. In the area where the Hexham accident occurred, new operators have commenced operations with apparently incompatible communications equipment. Compatibility needs to exist, not only between trains operated by the New South Wales government owned instrumentalities, but also between other operators and them.

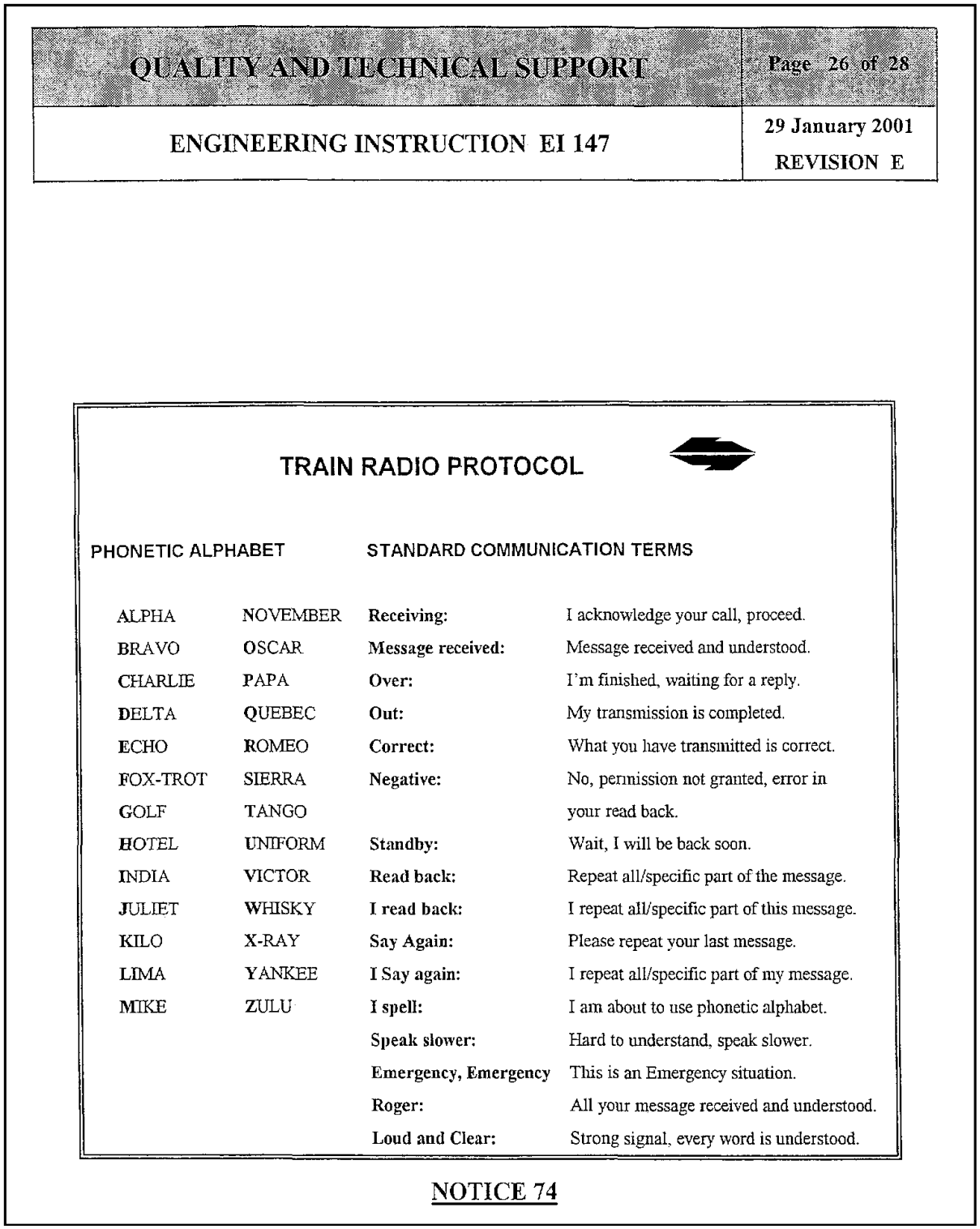
Even when compatible and interoperable equipment is available and used, there is no point in having the equipment available to be used by different persons unless the procedures are standardised. The only effective way for communicating information about train movements and train operations is to adopt clear and standardised procedures by which everyone involved describes the same subject matter in the same way.

A good illustration of imprecise communication protocols from the Waterfall rail accident was discussed in the evidence of Mr Donaldson, the Executive Director, Transport Safety and Rail Safety Regulation in ITSRR. He said of some of the communications that he heard:

> It gets to the laughable stage where people talk about, “I’m in the dirt, mate”. You don’t know how to escalate an emergency situation if there is a break down in those standard call signs and phonetic alphabet, and it is actually in a code that both RIC and State Rail and all the operators are supposed to adhere to.

The former SRA had produced a protocol which on the face of it addressed some of the deficiencies of lack of clarity and conciseness of communications to which reference has

already been made. Figure 10.1 is the train radio protocol which contains the phonetic alphabet and the standard communication terms which are supposed to be used.



QUALITY AND TECHNICAL SUPPORT | Page 26 of 28

ENGINEERING INSTRUCTION EI 147 | 29 January 2001 REVISION E

TRAIN RADIO PROTOCOL

PHONETIC ALPHABET		STANDARD COMMUNICATION TERMS	
ALPHA	NOVEMBER	**Receiving:**	I acknowledge your call, proceed.
BRAVO	OSCAR	**Message received:**	Message received and understood.
CHARLIE	PAPA	**Over:**	I'm finished, waiting for a reply.
DELTA	QUEBEC	**Out:**	My transmission is completed.
ECHO	ROMEO	**Correct:**	What you have transmitted is correct.
FOX-TROT	SIERRA	**Negative:**	No, permission not granted, error in
GOLF	TANGO		your read back.
HOTEL	UNIFORM	**Standby:**	Wait, I will be back soon.
INDIA	VICTOR	**Read back:**	Repeat all/specific part of the message.
JULIET	WHISKY	**I read back:**	I repeat all/specific part of this message.
KILO	X-RAY	**Say Again:**	Please repeat your last message.
LIMA	YANKEE	**I Say again:**	I repeat all/specific part of my message.
MIKE	ZULU	**I spell:**	I am about to use phonetic alphabet.
		Speak slower:	Hard to understand, speak slower.
		Emergency, Emergency	This is an Emergency situation.
		Roger:	All your message received and understood.
		Loud and Clear:	Strong signal, every word is understood.

NOTICE 74

Figure 10.1 Train radio protocol

Counsel Assisting, when in the United States of America, obtained the relevant sections of the Federal Register relating to radio and wireless communications. These are reproduced in Figures 10.2 to 10.4 to provide guidance and assistance as to the type of communications

procedures that should be mandatory throughout New South Wales, if not Australia. The use of the phonetic alphabet, protocols for receiving and ending transmissions and the clarity with which numbers are to be pronounced should be part of communications procedures for all trains operating in New South Wales. A national set of procedures has obvious benefits for both safety and efficiency.

Subpart B—Radio and Wireless Communication Procedures

§ 220.21 Railroad operating rules; radio communications; recordkeeping.

(a) The operating rules of each railroad with respect to radio communications shall conform to the requirements of this part.

(b) Thirty days before commencing to use radio communications in connection with railroad operations each railroad shall retain one copy of its current operating rules with respect to radio communications at the locations prescribed in paragraphs (b) (1) and (b)(2) of this section. Each amendment to these operating rules shall be filed at such locations within 30 days after it is issued. These records shall be made available to representatives of the Federal Railroad Administration for inspection and photocopying during normal business hours.

(1) Each Class I railroad, each Class II railroad, each railroad providing intercity rail passenger service, and each railroad providing commuter service in a metropolitan or suburban area shall retain such rules at each of its division headquarters and at its system headquarters; and (2) Each Class III railroad and any other railroad subject to this part but not subject to paragraph (b)(1) of this section shall retain such rules at the system headquarters of the railroad.

(c) For purposes of this section, the terms Class I railroad, Class II railroad, and Class III railroad have the meaning given these terms in 49 CFR Part 1201.

§ 220.23 Publication of radio information.

Each railroad shall designate where radio base stations are installed, where wayside stations may be contacted, and the appropriate radio channels used by these stations in connection with railroad operations by publishing them in a timetable or special instruction. The publication shall indicate the periods during which base and wayside radio stations are operational.

§ 220.25 Instruction and operational testing of employees.

Each employee who a railroad authorizes to use a radio in connection with a railroad operation, shall be:

(a) Provided with a copy of the railroad's operating rules governing the use of radio communication in a railroad operation;

(b) Instructed in the proper use of radio communication as part of the program of instruction prescribed in § 217.11 of this chapter; and

(c) Periodically tested under the operational testing requirements in § 217.9 of this chapter.

§ 220.27 Identification.

(a) Except as provided in paragraph (c) of this section, the identification of each wayside, base or yard station shall include at least the following minimum elements, stated in the order listed:

(1) Name of railroad. An abbreviated name or initial letters of the railroad may be used where the name or initials are in general usage and are understood in the railroad industry; and

(2) Name and location of office or other unique designation.

(b) Except as provided in paragraph (c) of this section, the identification of each mobile station shall consist of the following elements, stated in the order listed:

(1) Name of railroad. An abbreviated name or initial letters of the railroad may be used where the name or initial letters are in general usage and are understood in the railroad industry;

(2) Train name (number), if one has been assigned, or other appropriate unit designation; and

(3) When necessary, the word ''locomotive'', ''motorcar'', or other unique identifier which indicates to the listener the precise mobile transmitting station.

(c) If positive identification is achieved in connection with switching, classification, and similar operations wholly within a yard, fixed and mobile units may use short identification after the initial transmission and acknowledgment consistent with applicable Federal Communications Commission regulations governing ''Station Identification''.

§ 220.29 Statement of letters and numbers in radio communications.

(a) If necessary for clarity, a phonetic alphabet shall be used to pronounce any letter used as an initial, except initial letters of railroads. See appendix A of this part for the recommended phonetic alphabet.

(b) A word which needs to be spelled for clarity, such as a station name, shall first be pronounced, and then spelled. If necessary, the word shall be spelled again, using a phonetic alphabet.

(c) Numbers shall be spoken by digit, except that exact multiples of hundreds and thousands may be stated as such. A decimal point shall be indicated by the words ''decimal,'' ''dot,'' or ''point.'' (See appendix B to this part, for a recommended guide to the pronunciation of numbers.)

§ 220.31 Initiating a radio transmission.

Before transmitting by radio, an employee shall:

(a) Listen to ensure that the channel on which the employee intends to transmit is not already in use;

(b) Identify the employee's station in accordance with the requirements of § 220.27; and

(c) Verify that the employee has made radio contact with the person or station with whom the employee intends to communicate by listening for an acknowledgment. If the station acknowledging the employee's transmission fails to identify itself properly, the employee shall require a proper identification before proceeding with the transmission.

§ 220.33 Receiving a radio transmission.

(a) Upon receiving a radio call, an employee shall promptly acknowledge the call, identifying the employee's station in accordance with the requirements of § 220.27 and stand by to receive. An employee need not attend the radio during the time that this would interfere with other immediate duties relating to the safety of railroad operations.

(b) An employee who receives a transmission shall repeat it to the transmitting party unless the communication:

(1) Relates to yard switching operations;

(2) Is a recorded message from an automatic alarm device; or

(3) Is general in nature and does not contain any information, instruction or advice which could affect the safety of a railroad operation.

§ 220.35 Ending a radio transmission.

(a) Except for transmissions relating to yard switching operations, at the close of each transmission to which a response is expected, the transmitting employee shall say ''over'' to indicate to the receiving employee that the transmission is ended.

(b) Except for transmissions relating to yard switching operations, at the close of each transmission to which no response is expected, the transmitting employee shall state the employee's identification followed by the word ''out'' to indicate to the receiving employee that the exchange of transmissions is complete.

§ 220.37 Testing radio and wireless communication equipment.

(a) Each radio, and all primary and redundant wireless communication equipment used under §§ 220.9 and 220.11, shall be tested as soon as practicable to ensure that the equipment

Figure 10.2 Radio and wireless communication procedures (page 1)

functions as intended prior to the commencement of the work assignment.

(b) The test of a radio shall consist of an exchange of voice transmissions with another radio. The employee receiving the transmission shall advise the employee conducting the test of the clarity of the transmission.

§ 220.38 Communication equipment failure.

(a) Any radio or wireless communication device found not to be functioning as intended when tested pursuant to § 220.37 shall be removed from service and the dispatcher or other employee designated by the railroad shall be so notified as soon as practicable.

(b) If a radio or wireless communication device fails on the controlling locomotive en route, the train may continue until the earlier of—

(1) The next calendar day inspection, or

(2) The nearest forward point where the radio or wireless communication device can be repaired or replaced.

§ 220.39 Continuous radio monitoring.

Each radio used in a railroad operation shall be turned on to the appropriate channel as designated in § 220.23 and adjusted to receive communications.

§ 220.41 [Reserved]

§ 220.43 Radio communications consistent with federal regulations and railroad operating rules.

Radio communication shall not be used in connection with a railroad operation in a manner which conflicts with the requirements of this part, Federal Communication Commission regulations, or the railroad's operating rules. The use of citizen band radios for railroad operating purposes is prohibited.

§ 220.45 Radio communication shall be complete.

Any radio communication which is not fully understood or completed in accordance with the requirements of this part and the operating rules of the railroad, shall not be acted upon and shall be treated as though not sent.

§ 220.47 Emergency radio transmissions.

An initial emergency radio transmission shall be preceded by the word "emergency," repeated three times. An emergency transmission shall have priority over all other transmissions and the frequency or channel shall be kept clear of non-emergency traffic for the duration of the emergency communication.

§ 220.49 Radio communication used in shoving, backing or pushing movements.

When radio communication is used in connection with the shoving, backing or pushing of a train, locomotive, car, or on-track equipment, the employee directing the movement shall specify the distance of the movement, and the movement shall stop in one-half the remaining distance unless additional instructions are received. If the instructions are not understood, the movement shall be stopped immediately and may not be resumed until the misunderstanding has been resolved, radio contact has been restored, or communication has been achieved by hand signals or other procedures in accordance with the operating rules of the railroad.

§ 220.51 Radio communications and signal indications.

(a) No information may be given by radio to a train or engine crew about the position or aspect displayed by a fixed signal. However, a radio may be used by a train crew member to communicate information about the position or aspect displayed by a fixed signal to other members of the same crew.

(b) Except as provided in the railroad's operating rules, radio communication shall not be used to convey instructions which would have the effect of overriding the indication of a fixed signal.

§ 220.61 Radio transmission of mandatory directives.

(a) Each mandatory directive may be transmitted by radio only when authorized by the railroad's operating rules. The directive shall be transmitted in accordance with the railroad's operating rules and the requirements of this part.

(b) The procedure for transmission of a mandatory directive is as follows:

(1) The train dispatcher or operator shall call the addressees of the mandatory directive and state the intention to transmit the mandatory directive.

(2) Before the mandatory directive is transmitted, the employee to receive and copy shall state the employee's name, identification, location, and readiness to receive and copy. An employee operating the controls of moving equipment shall not receive and copy mandatory directives. A mandatory directive shall not be transmitted to employees on moving equipment, if such directive cannot be received and copied without impairing safe operation of the equipment.

(3) A mandatory directive shall be copied in writing by the receiving employee in the format prescribed in the railroad's operating rules.

(4) After the mandatory directive has been received and copied, it shall be immediately repeated in its entirety. After verifying the accuracy of the repeated mandatory directive, the train dispatcher or operator shall then state the time and name of the employee designated by the railroad who is authorized to issue mandatory directives. An employee copying a mandatory directive shall then acknowledge by repeating the time and name of the employee so designated by the railroad.

(5)(i) For train crews, before a mandatory directive is acted upon, the conductor and engineer shall each have a written copy of the mandatory directive and make certain that the mandatory directive is read and understood by all members of the crew who are responsible for the operation of the train. Mandatory directives which have been fulfilled or canceled shall be marked with an "X" or in accordance with the railroad's operating rules, and retained for the duration of the train crew's work assignment.

(ii) For on-track equipment, before a mandatory directive is acted upon, the employee responsible for on-track safety shall have a written copy of the mandatory directive, and make certain that the mandatory directive is acknowledged by all employees who are responsible for executing that mandatory directive. The employee responsible for on-track safety shall retain a copy of the mandatory directive while it is in effect.

(6) A mandatory directive which has not been completed or which does not comply with the requirements of the railroad's operating rules and this part, may not be acted upon and shall be treated as though not sent. Information contained in a mandatory directive may not be acted upon by persons other than those to whom the mandatory directive is addressed.

Appendix A to Part 220—Recommended Phonetic Alphabet

A—ALFA
B—BRAVO
C—CHARLIE
D—DELTA
E—ECHO
F—FOXTROT
G—GOLF
H—HOTEL
I—INDIA
J—JULIET
K—KILO
L—LIMA
M—MIKE
N—NOVEMBER
O—OSCAR
P—PAPA

Figure 10.3 Radio and wireless communication procedures (page 2)

Q—QUEBEC
R—ROMEO
S—SIERRA
T—TANGO
U—UNIFORM
V—VICTOR
W—WHISKEY
X—XRAY
Y—YANKEE
Z—ZULU

The letter "ZULU" should be written as "Z" to distinguish it from the numeral "2".

Appendix B to Part 220—Recommended Pronunciation of Numerals

To distinguish numbers from similar sounding words, the word "figures" should be used preceding such numbers. Numbers should be pronounced as follows:

Number	Spoken
0	ZERO.
1	WUN.
2	TOO.
3	THUH-REE-.
4	FO-WER.
5	FI-YIV.
6	SIX.
7	SEVEN.
8	ATE.
9	NINER.

(The figure ZERO should be written as "0" to distinguish it from the letter "O". The figure ONE should be underlined to distinguish it from the letter "I". When railroad rules require that numbers be spelled, these principles do not apply.)

The following examples illustrate the recommended pronunciation of numerals:

Number	Spoken
44	FO-WER FO-WER.
500	FI-YIV HUN-DRED.
1000	WUN THOU-SAND.
1600	WUN SIX HUN-DRED.
14899	WUN FO-WER ATE NINER NINER.
20.3	TOO ZERO DECIMAL THUH-REE.

Appendix C to Part 220—Schedule of Civil Penalties [1]

Section	Violation	Willful violation
220.9 Requirements for trains	$5,000	$7,500
220.11 Requirements for roadway workers	5,000	7,500
220.21 Railroad Operating rules; radio communications.		
(a)	5,000	7,500
(b)	2,500	5,000
220.23 Publication of radio information	2,500	5,000
220.25 Instruction of employees	5,000	7,500
220.27 Identification	1,000	2,000
220.29 Statement of letters and numbers	1,000	2,000
220.31 Initiating a transmission	1,000	2,000
220.33 Receiving a transmission	1,000	2,000
220.35 Ending a transmission	1,000	2,000
220.37 Voice test	5,000	7,500
220.39 Continuous monitoring	2,500	5,000
220.41 [Reserved]		
220.43 Communication consistent with the rules	2,500	5,000
220.45 Complete communications	2,500	5,000
220.47 Emergencies	2,500	5,000
220.49 Switching, backing or pushing	5,000	7,500
220.51 Signal indications	5,000	7,500
220.61 Radio transmission of mandatory directives	5,000	7,500

[1] A penalty may be assessed against and only for a willful violation. The Administrator reserves the right to assess a penalty of up to $22,000 for any violation where circumstances warrant. See 49 CFR part 209, appendix A.

Issued in Washington, D.C. on August 28, 1998.

Jolene M. Molitoris,

Federal Railroad Administrator.

[FR Doc. 98–23697 Filed 9–3–98; 8:45 am]

BILLING CODE 4910–06–P

Figure 10.4 Radio and wireless communication procedures (page 3)

The means by which such procedures can be mandated is by regulations making them a condition of accreditation and ensuring that a properly resourced and independent rail safety regulator insists upon compliance with such procedures and conducts audits to ensure that that occurs.

In addition to the procedures, staff need to be properly selected and trained. In the United Kingdom, the process of recruitment and selection of staff has as its purpose identifying people with appropriate personal qualities to convey information clearly, accurately and concisely. Once selected, they are given basic training and their performance is continually evaluated. In addition, assessments are conducted on a structured basis, usually twice a year, and there is monitoring of their adherence to protocols during the course of regular operations and, in particular, in the post-incident phase, where the best testing of the effectiveness of selection, training and assessment occurs. Where deficiencies are identified in the performance of particular staff, then remedial measures by way of further training occur. This type of practice should be adopted in New South Wales.

Mr Donaldson, who had had extensive experience in both the rail and airline industries, gave this evidence:

Q: The aviation industry never had those problems with communications protocols, did it?
A: Oh, you would be taken out of the air as a pilot or air traffic controller within minutes.
Q: If you didn't comply with the communications?
A: If you didn't comply with those communication protocols.

There is little difference between transportation of passengers in the air and transportation of passengers by rail, when it comes to requirements of compliance with communications protocols. The sanctions for non-compliance should be the same.

Obviously, if there are some railway organisations which properly train and supervise and monitor the communications protocols performance of their employees and others which do not, the ones that do not will cause disruption and create safety risks for themselves and other users of the rail infrastructure. The safety of any system is only as strong as its weakest link.

The Australasian Railways Association has embarked upon a process for the standardisation of the interoperability of equipment used throughout Australia. This aim was strongly supported in the final report of the Glenbrook Inquiry and is still supported, but it must be accompanied by effective programs for the standardisation of communications protocols. The United States regulations in Figure 10.2 provide a useful guide in this regard.

Even compatible communications systems must be capable of working in all areas to be effective. Whether by the use of repeaters or otherwise, there must not be any dark spots where communications cannot occur.

Train controllers, signallers, train drivers and guards need to be properly trained in the use of the equipment. The training should not only be in the classroom, but the emphasis should be focussed on the practical use of the equipment in real life situations. The effectiveness of the training should then be measured by random auditing to ensure that it has produced the outcome that the training is intended to produce.

The very serious rail accidents mentioned and discussed in this chapter have highlighted the urgent need to address the deficiencies in communications in the New South Wales rail industry. In summary, equipment should be compatible and accessible to all train crews; there should be interoperability of communications equipment for all trains entering New

South Wales from other States; staff involved in controlling train movements should be carefully selected to ensure they have the correct personal qualities and communication skills; procedures and protocols should be standardised and mandated by regulations making them a condition of accreditation; and the rail safety regulator in New South Wales should ensure that, as a condition of accreditation, all of these matters are carried out and should audit against them to enforce compliance. By these means the kind of tragic accidents that have been identified during the course of this and the Glenbrook Inquiry can be avoided.

11. Train Maintenance

The interim report dealt with the maintenance history of G7. This was necessary to determine whether any defect in G7 may have caused or contributed to the accident. In the course of the technical investigation done for that purpose during the first stage of this Inquiry, a number of deficiencies were identified in relation to the maintenance of trains and the means whereby the repair of defects was carried out. The interim report concluded that, in relation to G7, the deficiencies in the maintenance records did not enable a finding to be made as to whether or not lack of maintenance of G7 caused or contributed to the accident. From other material before the Special Commission of Inquiry, I was able to infer that G7 was functioning correctly on the morning of the accident.

Nevertheless, from the matters investigated in relation to the first term of reference, a number of deficiencies in relation to maintenance and defect reporting were identified and these require consideration and recommendations for improvement. It is convenient to divide the regime for maintenance and defects reporting into two separate categories, planned and unplanned maintenance and repairs.

The system for planned maintenance and the identification of matters requiring repair is done in four ways. First, as part of train preparation, the first train driver allocated to take a train out to commence service goes through a checklist of items on the train, for the purpose of determining whether the systems and equipment are working satisfactorily. Such train preparation includes checking the braking system, the traction control system, and the deadman foot pedal. If a defect is identified which prevents or delays the train from entering into service, the supervisor, mechanical control office or operations control must be notified immediately. In addition to the train crew preparation at the start of the day, a similar check is required to be carried out by the train driver between the morning and afternoon peak hour periods. The criteria for making a report are not safety criteria as such, but criteria which relate to whether or not the train will be able to enter into or continue in service.

Evidence was given that when defects are identified by a train driver in the course of the preparation of a train and the train driver follows the correct procedure of notifying the supervisor and reporting the fault, the response frequently is not to take the train out of service or take immediate steps to rectify the defect, but to reprimand the train driver for making the report.

On 4 March 2004, the Special Commission of Inquiry wrote to ITSRR requesting it to identify to the Special Commission of Inquiry issues arising under terms 2 and 3 of the Terms of Reference. On 4 April 2004, a reply was received under the hand of Ms Carolyn Walsh, the Chief Executive of ITSRR, providing answers to that request. Ms Walsh in her evidence confirmed and verified the material contained in the answers. The answers set out the extensive problems that SRA had and RailCorp now has. Under a heading "(f) Inappropriate prioritisation and conflicting goals", the comment included matters such as the dominance of on-time running over safety and the desire to keep trains running rather than taking immediate action to resolve the safety problems.

Mr Paul Foster, who had been driving electric trains for six years, said he had attempted to follow the procedure for reporting to the supervisor a defect that he found on a train during the course of a morning inspection. His evidence was:

> I have been told, "What are you reporting that defect for? You are going to make the train late now. You have walked all the way over." And it is not worth the hassle so a lot of crews won't do it.

There is no point in having a system whereby train drivers are required to report defects to a supervisor if they are discouraged from reporting defects. If the discouragement produces the result that it is "not worth the hassle" and trains are taken into service with defects, then from time to time it is inevitable that train services will be disrupted and this has implications for both safety and reliability.

It has implications for safety in a number of respects. First, it means that when the defects materialise during the course of train operations, the timetable is disrupted and train drivers may be tempted, or may have pressure exerted upon them, to operate the defective train in a way which is inherently unsafe. There were many examples given of train drivers having had pressure exerted on them to operate a train in service when a defect existed in the train.

Mr Simon Highley, a train driver, said that on 26 January 2004 he was driving a train and was not aware that it had a broken window until he was required to swap ends at Macarthur railway station. He noticed that the first set of doors on the second carriage had a broken glass pane. Mr Highley's description of the appearance of the glass was "the glass was bulging out – it was all shattered but still intact." Mr Highley stated that he contacted the Campbelltown signal box and informed it of the defective window, the carriage number and the set number and advised that he would be running at reduced speed at platforms on that side of the train. He was informed that an attempt would be made to try to fix the window on arrival at Central railway station. He was told that it could not be fixed sooner because there were too many trains at Campbelltown railway station. When he arrived at platform 16 at Central railway station, he observed his supervisor and a station assistant examining the train. He said:

> I then proceeded down to inspect the window and noticed that the glass was still protruding between 10 and 20 millimetres from the edge of the rubber. I then informed his supervisor that the train would run at reduced speed until fixed properly. I then noticed that there was an Inspector in the background listening to the conversation. He didn't say anything to me then. I then proceeded back on the train and proceeded around the City Circle at reduced speed. … On arrival at platform 22 at Central station he came up to me and produced a General Order, dated around 2002, saying that we can run at track speed with the rubber still intact in the window and that I was to run at normal track speed.

Mr Highley's evidence as to what then occurred was:

> Q: What did you say?
> A: I then said after doing my risk assessment, the glass was still protruding from the glass in an unsafe manner and running at track speed the glass fragments could fly out, hitting people in the face, or people could fall into the window and cut themselves. I said, "I'll still run at reduced speeds or go to the nearest maintenance centre".
> Q: What did the Inspector say to you?

A: "I'm ordering you to take it at track speed." And I replied that, "I will still be running at reduced speed". The Inspector replied that he would be putting me in for refusing duty and he walked off.
Q: Were you refusing to do your duty?
A: No, I was doing something that was in a safe manner.
Q: Were you reported for any kind of disciplinary procedure as a result of the decision you made on the basis of the risk assessment that you undertook?
A: Yes, I was. At this stage, mediation has been ordered but I have not attended at this stage.

It is obvious that if there was any risk that the glass could become dislodged from the train as it was entering a platform with passengers on it, that the flying glass could then be thrown toward the passengers and could cause serious injury.

Mr Johnson took charge of a train on 9 May 2003 at approximately 1:10 pm. When he took possession of the train he checked with the train guard that the braking system was working satisfactorily and that the bell signalling system between him and the train guard was working. Within one minute of commencing the run, he noticed that the train radio appeared not to be changing from one signalling area to another and he concluded that the radio was defective. At 1:50 pm, as he was approaching Sydenham railway station, he contacted Operations Control to advise that there was a problem with the train radio and he was instructed by Operations Control to take the train to Central railway station.

His journey into the city required him to go through Bankstown and, again, the train radio did not pick up the signal areas that it was designed to, as it entered each area. He again contacted Operations Control and his evidence as to what occurred was:

> I told him that I had now missed about seven transponders and that the train radio was definitely defective, and that I would require it to return to Mortdale maintenance centre. He said to me that he would get an equipment examiner to meet the train when I arrived in town, which is Central, and if the equipment examiner could not fix the train, he would swing it around into Mortdale.

Mr Johnson said that he understood by the expression "swing it around into Mortdale" that he would be given instructions to proceed to Mortdale maintenance centre for the necessary repairs to be carried out. His evidence continued:

Q: When you arrived at Central station platform, what happened?
A: I was met by Operations Inspector Bob Murray and an equipment examiner, and there was an argument between myself and them as to whether, in fact, the train radio was defective. In their opinion the train radio was fit for service and could continue, and they were totally ignoring the rules set out in special general order 7 of 2002 and network rule NTR 410.
Q: What do those rules say?
A: Special general order 7/2002 states that a defective – once a train radio has been declared defective, it must be removed from service before the second change of ends; and network rule NTR 410 is a little bit different.

It says that the train may continue to the end of its run and then must proceed empty to a maintenance centre.

Q: Who was it that makes the declaration as to whether or not the train radio is defective – the driver or some other person?

A: It is hard to say. I can declare the radio defective, but they will then argue the point. For instance, I had a problem last week as well where I told them that the radio was defective and they said, "Well, we performed a test from here and it was working fine". Promptly, the train radio dropped out and lost the call; but according to them it was working fine.

Mr Johnson was asked:

Q: Is it your view that a working train radio is an essential safety feature on a train?

A: I think it is one of our main safety features. If I press the emergency push button on a train radio, within five seconds every train in that area knows that there is an emergency in progress.

Q: When the Operations Control officer at Central station had what you described as the dispute with you as to whether or not the train radio was or was not working, what did you do?

A: I quoted the rule NTR 410 and told him that it was defective and that, as the train had now changed ends twice already and it had completed three runs, that it should be going to a maintenance centre for repairs. He told me that it was right – as long as I could keep entering the area numbers manually it was right to continue in service indefinitely, and I said that that was not the case and I would not be taking the train to Glenfield, I would be taking it to Mortdale sheds.

Q: What did he say?

A: He disagreed. He said that there was nothing wrong with the radio apart from the fact that I could enter the area numbers manually. I said no. He then asked me if I had an operational working WB radio, which is the open channel local radio. I said yes. The equipment examiner then said, "Well, the train is okay to run then." And I said, "No, the local radio is not a safety device like the Metronet radio – I have no emergency function and probably 99 per cent of the other CityRail trains do not have a working WB radio in the cab either".

Had he complied with the Operations Control officer to punch the numbers in manually he would have to know what the numbers were, or look them up, with the likelihood of being distracted from his driving duties. His evidence proceeded:

Q: What did you do then?

A: At that stage I basically told him that the only place that I was taking the train was Mortdale. He then got on his mobile phone to Operations Control and spoke to Brian McGregor and had some nasty things to say about me to Brian McGregor.

Q: Use the actual words he said. What …

Commissioner: As best you can recollect.

A: He swore, Mr Commissioner. Is that OK that I repeat those words?

Commissioner: Repeat the words that he used.

A: His exact words were, "This cunt is not going to take the train".

Q: That was said about you in your presence?

A: That was said. He was standing on the platform, I was in the cab, and that was said so that I could hear it in the cab and I would imagine all the passengers in the front car and all the passengers standing on the platform also heard it.

During the first stage of this Inquiry, Mr Peter de Bruyn, a mechanical engineer and a consultant to the Special Commission of Inquiry, inspected the records of the daily crew preparation sheets for G7 and other trains and frequently noted maintenance sheets missing.

If defects are not reported or recorded, then the chance of them being rectified is nil. If reported, and a direction is given that the train be taken out in a defective condition, then from time to time it is to be expected that the train will break down, with consequent disruption to scheduled train services. If the train is being operated in a degraded mode of operation, safety risks are increased for both passengers and crew.

The first reason why the daily train crew preparation process is defective is because it takes place prior to the train being taken into service. If such inspections were carried out after the train had finished its service for the day this would provide an opportunity to rectify any defects at that time, rather than confronting them just before the train is due to commence service. It would still be necessary to routinely check the train before it is taken out the next day, but the possibility of the train crew then being confronted by any defects should be minimal.

The second reason why the train preparation procedure is defective is the absence of records. If records are not kept, obviously it follows that the defects cannot be tracked. There is no reason why records of all defects cannot be kept and the relevant sheets, referred to as "stabling sheets", entered into a database for the purpose of tracking the defect until it has been rectified. Without the stabling sheets being completed, there is no record of any defect, and no record that there has been an examination of the train to determine whether there is any defect. In my opinion, this should be done as part of the daily crew preparation. In other words, the examination of the train should be conducted when it is stabled, for the purpose of establishing any defects, and proper records should then be entered into a computer database so the defect can be tracked.

The next planned inspection regime is an intermediate inspection, which is done on a 30 day cycle. G7 inspections prior to the Waterfall rail accident were done on 16 December 2002 and 14 January 2003. G7 was therefore up-to-date in these inspections.

The purpose of the intermediate inspection is to check certain systems on the train, such as the braking system, the pantograph, which is the mechanism that engages the overhead electrified catenary wire, and passenger and crew amenities, such as the seats and the driver's cabin. It is also part of this inspection to check the records to determine if there are any outstanding defects reported as a result of train crew preparation, or in the course of operation. There is a computerised system, METRE which is an acronym for "making

electric trains run easier", but the METRE record will not contain information if the status sheets are not completed when a defect is found. In the absence of any reliable system for the recording of defects, they are unlikely to be picked up during the 30 day intermediate inspection, unless they relate to one of the matters due to be checked at that inspection.

The next planned regime of maintenance and inspection is on a 90 day cycle. Each 90 days, different routine inspections are performed on different parts of the train. For example, on one of the 90 day cycle inspections the roof equipment, including the pantograph, high tension wiring and roof catches, is inspected. The second 90 day inspection relates to the driver's cabin and the interior of the train, including the crew cabin, safety equipment, windows, doors, gangways, air conditioning, lights, seats, communication, electrical equipment and internal fittings, water and toilet systems. The third 90 day cycle inspection each year relates to the undergear and exterior. The undergear includes couplers, brakes, bogies, wheels and axles, the train radios and the external body of the train. The fourth of the 90 day cycle inspections appears to include the couplers and all the electrical equipment.

There were no maintenance records in relation to G7 for the period prior to 24 October 2003, to determine whether or not the 90 day inspections had identified any defects. This is not to say that there were not any unattended defects. In fact, there was a record of one of the windows being cracked and not yet rectified. However, there was no evidence that any defects other than the deadman system had contributed to the accident.

The final planned inspection relates to the wheels of the train. This is a wheel turning inspection, which has as its purpose the examination of the profile of the wheel to check the wheel to rail interface. The wheel turning inspection is separate and apart from the 90 day and 30 day periodic inspections. The timing of this inspection appears to depend upon a visual examination of the condition of the wheels of the trains.

In addition to planned maintenance there are regular changeouts of components in trains. There is a six year changeout based upon changing certain specified components and other components are examined, to determine whether or not those components reach pre-defined limits and if they are required to be replaced.

In addition, there is a 12 yearly changeout of other components, and an inspection of components not automatically changed out, to determine whether or not their condition fits within pre-defined limits. If it does not, they are changed. In addition, and usually on the basis that it is to coincide with either the six yearly or 12 yearly changeout, there is a bogie changeout which involves the removal and disassembly, examination and reassembly of the bogies. In relation to G7, this was last carried out on 18 October 2000. The most recent six yearly changeout of G7 prior to the accident was on 29 June 2001.

Provided the maintenance plans are regularly revised, the staff are properly trained and the effectiveness of the plans are audited by checking that the same defects are not continuing to occur, the system of periodic maintenance appears to be satisfactory.

Unfortunately, the same cannot be said for unplanned defects reporting and rectification in the course of daily operations. This system depends upon train drivers reporting a defect in a train by one of two means. The first is using the Metronet radio to make a call to the defects officer. The second method is by the train driver filling out a train status report, which is handed in at the nearest railway station, to be faxed through to the defects unit of the RMC.

If a train driver uses the Metronet radio to report a defect, he is nevertheless required to complete a train status report identifying such things as the train number and the nature of the defect.

There were a number of deficiencies identified in relation to the systems for reporting of defects. The first was that when a train driver sought to report a defect to the defects officer, the experience of many train drivers was that no one answered the telephone. Apparently, some steps have already been taken to rectify that weakness. Secondly, if someone did answer the telephone, whether or not a record was kept of the defect depended upon whether or not the defects officer could by discussion with the train driver overcome the alleged defect. If it could be overcome, then no record was kept that a report was made.

A number of train drivers gave evidence that they reported a defect and then, some time later, drove the same train again and noticed the same defect. It may well be that the defect was an intermittent fault. In the absence of any record it could not be known whether or not the fault was intermittent.

If the defects officer cannot give a train driver advice as to how the problem can be overcome, arrangements are made for an equipment examiner to meet the train to attempt to rectify the problem. If the equipment examiner believes he has rectified the problem then no record is kept. If the fault is of an intermittent nature, the equipment examiner may believe he has rectified it, no record will be kept and the same fault may reoccur with another train driver. The absence of any proper recording prevents any tracking of the progress of reported defects and it prevents the recognition of any trends which might be indicative of a need for more extensive investigation.

If the equipment examiner cannot identify or rectify the problem, it is then entered into the METRE system. At that stage, one of two things will happen. The train will either be taken out of service, if it is a safety critical matter, or if it is perceived to be less critical, it will remain in service.

As the two illustrations that I have given earlier in this chapter demonstrate, there are obvious differences of opinion as to whether or not a particular defect is safety critical. The two train drivers each believed a defective train radio and a shattered window pane were safety critical, but supervisors took a different view. There needs to be a clear definition of what constitutes a safety critical defect.

The only sensible way of identifying a safety critical defect is to do so on the basis of a risk assessment. If someone were to ask, what if the window dislodges as I am entering a railway platform at high speed and shattered glass is thrown from the train, then it is obviously a safety critical matter which requires immediate attention. Similarly, if someone were to ask what if an emergency occurred on this train and I could not get access to the emergency communications facility. In such circumstances, the risk to passengers on that train and other trains would obviously lead the person to conclude that that was a safety critical matter. However, there appears to be no universally accepted practice by either train drivers or their supervisors as to the criteria which require a train be taken out of service.

If the defects report is written and handed to station staff for faxing to the defects unit at the RMC, the effectiveness of the system depends upon the document being faxed. An audit conducted in 2002 by the Department of Transport demonstrated that, on a number of

occasions, railway station staff failed to fax the defects report to the defects section, and in those circumstances nothing was done to repair the defect.

The manner in which defects were reported also led to a breakdown in the defects reporting and rectification system. According to Mr Creighton, Chief Operations Manager, SRA, and now RailCorp, auditing has been carried out on a sample basis for the purpose of improving the way communication of defects occurs. The improvements are intended to overcome the casual nature of the communications and also the way in which the defects officers treat train drivers who report defects. Evidence was given that the response of defects officers to train drivers reporting defects was such as to discourage train drivers from reporting defects.

Mr Foster said:

> Then what happens is you are seen to be – if you keep reporting faults, you are seen to be a bit of an obstructionist. What happens is crews won't – generally won't report the fault because they don't feel like it is worth the abuse or to be belittled again, so they let it go for another driver to report it.

If train drivers are belittled following a defects report, or if they believe the process is a waste of time, obviously this is a discouragement to them in reporting defects. This will probably inevitably result in a disruption to train services at some time point of time.

The obvious way of remedying that deficiency is by training and supervision. This would involve supervision of the defects officers to ensure they answer the telephones and properly record reported defects. There should also be adequate supervision of their work to ensure that reported defects are recorded, tracked and attended to.

As was observed in relation to the system of train drivers entering defects found during the course of train preparation, all complaints of unplanned defects should be reported whether or not it is believed that an equipment examiner can rectify the defect while the train is in service. It is only by having comprehensive records that trends in defects, which may be indicative of some significant underlying defect in the trains, will be discovered.

Some effort has been made to encourage train drivers to report defects by allowing access to the computer database from certain locations. This has been done by so called "kiosks" at Central railway station and other locations. Obviously enough, if the defect reported is not entered in the METRE system, then the kiosk will not enable a train driver to determine what has become of the reported fault.

Problems in relation to the kiosks have been identified. The first is that train drivers who wish to follow up defects they have reported, need to have the time to access the computer in the kiosk. This can be a time consuming task because the way in which defects are recorded does not place them in any particular order or priority. If the set number and the carriage number are entered, the computer lists every defect that has ever been reported in relation to that particular carriage. The train driver then needs to go through the list to identify the one which he reported, to see whether it is described as "outstanding" or "acknowledged".

For the kiosk system to work efficiently, there needs to be a method of more readily identifying the particular matter that the train driver wants information about. This could

mean entering the driver status report or the date or approximate date of the report or the nature of the defect reported.

Another way in which train drivers could receive feedback on their reports would be by adopting the practice used by Virgin Trains in the United Kingdom, where the train drivers can ask a driver team manager to enquire what happened in relation to a reported defect. There is a driver team manager for every 25 drivers within Virgin Trains. They appear to occupy a function similar to what I recommended in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident. That recommendation was as follows:

> 14. The position of team leader be created to be responsible for a group of approximately 30 drivers to act as a mentor and to instruct them individually or collectively on any safety related matter.

As with many of the other recommendations of the Glenbrook Inquiry report, this was not implemented.

The fundamental deficiency in the way in which defects reporting and rectification and maintenance is carried out, in my opinion, is that there is a lack of any overall integrated system for dealing with both defects and maintenance matters. As has been observed, many matters do not find their way into any documented record.

These problems are compounded because there are two separate organisations involved in defects reporting and maintenance, and the relationship between them depends upon the availability of accurate records. The defects unit is part of the Network Control Division, whereas Passenger Fleet Maintenance is a division of its own. Passenger Fleet Maintenance practices depend upon the following of maintenance manuals supplemented by the METRE system.

A Passenger Fleet Maintenance major issues paper provided to the Board of the SRA was tendered in evidence. It identified as one of the reasons for deficiencies in the maintenance system that it was theoretical in content, unable to be fully implemented in practice at the depots and did not contain any system for verification of tasks performed. It transpired that the maintenance plans had not been revised since 1995. If the depot staff do not know what they are required to do to implement the plan, there is little prospect that maintenance plans are going to be successful.

The maintenance plan should be regularly revised and it should incorporate procedures for the computerised recording of all work that needs to be done on trains, as part of the daily preparation, the 30 day inspection, the 90 day inspection and the wheel turning inspection. In relation to the train crew preparation, there should be an inspection of the train at the time it is stabled, to identify any defect that can be rectified so the train is fit for service when required. Train crew preparation would then only have as its purpose the final checking of the train prior to going into service.

The integration of the data recording should include the recording of all defects, whether or not a defects officer believes that it has been fixed, or an equipment examiner claims that the defect has been rectified. By this means, the kind of intermittent faults which may explain

some of the train drivers' complaints, about having made a complaint and then finding that the train had the same defect the next time they drove it, might be rectified.

In the revision of the plan there should be a proper procedure for confirming that the reported defect has been investigated and certification that it has been rectified. This would mean that, in addition to establishing the necessary database, there would need to be employed officers who have sufficient computer skills to immediately record the defect as it is being reported, so that it can then be tracked through to finality.

The practice adopted of writing defects on a loose piece of paper has been replaced with the practice of writing the defects in a log book which are then entered in METRE. The evidence suggests they are entered when there is time to do so. If the staff receiving the necessary information followed appropriate communications protocols for the recording of defects and were sufficiently computer literate to enter the defect straight in the database, then there would little risk of defects not being recorded.

Some random auditing has occurred to check whether the entries in the log books have been entered in METRE. Similarly, the checking of radio communications to ensure that accurate information is being provided and received is also only done on a random basis. Both these tasks should be carried out to ensure the system of capturing defects is working effectively.

Once the new plan is developed, it should be straightforward, practical and easy to understand. It should then be distributed to the fleet management section, the train crewing section, the defects section and railway station staff, so that everyone knows the processes to be followed in relation to defects reporting and maintenance.

By developing such an integrated and co-ordinated means of dealing with maintenance and defects, the kinds of deficiencies which have led to the unreliability and lack of safety in rail operations caused by the deficiencies in the existing systems should be able to be overcome.

12. Alcohol and Drug Testing

In the course of investigating the possible causes of, and contributing factors to, the Waterfall rail accident, the possibility of alcohol or drugs being involved in relation to the behaviour of either the train driver or the guard needed to be considered. Although these were discarded as causes of the Waterfall rail accident, the processes for determining the fitness for duty of train crew became relevant. Drug and alcohol testing are an important part of that process.

At the time of the delivery of the final report of the Glenbrook Inquiry on 11 April 2001, the SRA did not have a process for random breath testing of staff. Such testing was only done, as permitted by the Rail Safety Act 1993, after an accident.

During the course of the Special Commission of Inquiry into the Glenbrook Rail Accident, one of the accidents which the Special Commission of Inquiry was asked to consider related to a rail accident that occurred on 14 November 1999 at Olympic Park. In that accident, an eight car Tangara train passed a red signal and was derailed. The train driver was subjected to a breath test with negative results. He was, however, observed to be nervous and sweating, which aroused the suspicion of the train crewing officer investigating the accident that the train driver may have been under the influence of drugs. He requested the train driver to undergo a blood and urine test for the existence of any other substances. The train driver agreed to undergo the test, but while the nursing sister who was to conduct the test left the room to telephone the nearest police station to request a blood and urine kit, the train driver left the hospital without warning and no testing took place.

The suspicion, from his behaviour, of the presence of substances other than alcohol which may have contributed to the accident, identified the necessity of having mandatory drug testing of railway employees involved in an accident or incident.

There is no doubt that random breath testing for alcohol should form part of the safety management of the railways. If motorists are subject to random breath testing for alcohol as a matter of public safety, it is impossible to deny that persons involved in the driving of public passenger vehicles which can carry up to 1,000 passengers, should not be subjected to similar scrutiny.

The final report of the Glenbrook Inquiry recommended the introduction of random breath testing of railway employees engaged in safety critical work. That recommendation was made on 11 April 2001 but was not implemented until October 2003. There was little evidence as to the cause of the delay in the implementation of that recommendation. The only explanation provided in evidence was the necessity to have consultation with relevant trade unions about the introduction of random breath testing. It appears those consultations were protracted. Random breath testing was eventually introduced, according to Mr Donaldson, because the rail safety regulator "stuck by our guns". It is extraordinary that there should have been any contention about this issue.

The Glenbrook report did not recommend the introduction of random drug testing, but only drug testing limited to employees involved in an accident or incident. RailCorp, however, introduced random drug testing in February 2004.

The Glenbrook Inquiry final report also recommended an examination of the advantages and disadvantages of introducing a system which enables the immediate and reliable assessment of the fitness to commence duties of safety critical employees. There is no evidence before me that any such investigation was carried out. I did, however, receive evidence about the introduction of a program before employees start work, which was called the "Are you OK?" program. This consisted of the signing-on officer of the employer making an enquiry of the employee whether he was fit to commence work.

The evidence in relation to the success of this program was scant. No material was made available relating to the number of persons who respond in the negative to the question whether they were fit to perform work. It would be surprising if an employee who had made the effort to go to work, would then declare himself unfit to commence work on being asked this question. In addition, such programs will be ineffective if employees exercise what are called "joiner rights". Joiner rights were exercised by Mr Zeides on the day of the Waterfall rail accident, permitting him to join his train at a railway station without any observation of his fitness for work being made. Normally, he would be expected to present himself at the depot where he was rostered to commence work, where observations could be made as to his fitness to perform work. The result of him exercising joiner rights was that no assessment was made of Mr Zeides either on the day of the accident or the previous day.

The Special Commission considered the standards and procedures used for random alcohol and drug testing as implemented by the SRA, and now RailCorp. In relation to alcohol, the standard that is used is that a safety critical employee must not have in his or her blood a blood alcohol concentration in excess of .02 mg of alcohol per 100 ml of blood. Any review of this limit can be undertaken by ITSRR.

In relation to drug testing, this is done by urine testing and is done in accordance with Australian/New Zealand Standard 4308 which is titled "Procedures for the Collection, Detection and Quantitation of Drugs of Abuse in Urine".

13. Medical Examinations

The interim report concluded that Mr Zeides had a heart attack and the static weight of his legs was alone sufficient to keep the deadman foot pedal in the set position, with the result that G7 continued down the tracks until it reached the bend where it rolled over. One of the matters of importance in this Inquiry was to determine what deficiencies existed in the periodic medical examinations of train drivers which resulted in Mr Zeides driving a train with a level of coronary artery disease which exposed him to the risk of a sudden heart attack.

The last periodic medical examination of Mr Zeides was in accordance with the medical standards of the SRA as they had existed since 1995. The interim report identified six particular areas which required attention. These were:

1. The absence of any predictive element in the periodical medical assessments which assist in determining whether a particular train driver or other safety critical employee was in a high risk category for sudden incapacitation.

2. The qualifications of the medical practitioners conducting the periodical medical examinations. These were general practitioners who did not have any particular skill in occupational medicine and who were not instructed in the nature of the work that the person being examined performed.

3. The examinations were not done with the examiners having access to medical histories.

4. There was no system for follow-up or referral of patients where the medical examinations revealed the possibility of some significant health risk which required referral, for example, to a cardiologist.

5. The SRA had no system for reviewing the reports from the medical examinations by an appropriately qualified occupational physician.

6. There was no monitoring of the medical histories of employees to identify trends, and in particular, trends that may indicate a deteriorating state of health as the employees aged.

Although the program for reviewing the medical standards of the SRA had commenced before the interim report was delivered on 15 January 2004, the particular matters identified in it as requiring remedial action had not been the subject of specific attention by the SRA.

The responsibility for the ongoing improvement of medical examination standards within the SRA, and now RailCorp, was given to Mr John Dawes, the Project Manager, Health Standards, Corporate Safety Division. Mr Dawes stated in evidence that the medical assessments now contain a predictive element. The cardiac risk score is used as a screening method. It is based upon a system for allocating a score to what are recognised as particular risk factors. Figure 13.1 is a table used to calculate cardiac risk.

Coronary Heart Disease

Risk Factor Prediction Chart

1. Find Points for each Risk Factor

Age (if Female)				Age (if Male)				HDL Cholesterol		Total Cholesterol		Systolic Blood Pres		Other	
Age	Pts	Age	Pts	Age	Pts	Age	Pts	HDL-C	Pts	Total-C	Pts	SPB	Pts	Others	Pts
30	-12	47-48	5	30	-2	57-59	13	0.65-0.68	7	3.60-3.99	-3	98-104	-2	Cigarettes	4
31	-11	49-50	6	31	-1	60-61	14	0.69-0.76	6	4.00-4.30	-2	105-112	-1	Diabetic (M)	3
32	-9	51-52	7	32-33	0	62-64	15	0.77-0.84	5	4.31-4.69	-1	113-120	0	Diabetic (F)	6
33	-8	53-55	8	34	1	65-67	16	0.85-0.90	4	4.70-5.19	0	121-129	1	ECG-LVH	9
34	-6	56-60	9	35-36	2	68-70	17	0.91-0.99	3	5.20-5.69	1	130-139	2		
35	-5	61-67	10	37-38	3	71-73	18	1.00-1.09	2	5.70-6.19	2	140-149	3	(0 pts for	
36	-4	68-74	11	39	4	74	19	1.10-1.19	1	6.20-6.79	3	150-160	4	each NO	
37	-3			40-41	5			1.20-1.30	0	6.80-7.49	4	161-172	5		
38	-2			42-43	6			1.31-1.43	-1	7.50-8.19	5	173-185	6		
39	-1			44-45	7			1.44-1.56	-2	8.20-8.55	6				
40	0			46-47	8			1.57-1.70	-3						
41	1			48-49	9			1.71-1.89	-4						
42-43	2			50-51	10			1.90-2.07	-5						
44	3			52-54	11			2.08-2.25	-6						
45-46	4			55-56	12			2.26-2.49	-7						

2. Sum Points for all Risk Factors

Age ( ) + (HDL-C ( ) = Total-C ( ) + SBP ( ) + Smoker ( ) + Diabetes ( ) + ECG-LVH ( ) Point Total

NOTE: Minus points subtract from total

3. Look up risk corresponding to point total

Probability (%)			Probability (%)			Probability (%)			Probability (%)			**4. Compare to ave 10 year risk** Probability (%)		
Pts	5yrs	10yrs	Pts	5yrs	10yrs	Pts	5yrs	10yrs	Pts	5yrs	10yrs	Age	Women	Men
<1	<1	<2	10	2	6	19	8	16	28	19	33	30-34	<1	3
2	1	2	11	3	6	20	8	18	29	20	36	35-39	<1	5
3	1	2	12	3	7	21	9	19	30	22	38	40-44	2	6
4	1	2	13	3	8	22	11	21	31	24	40	45-49	5	10
5	1	3	14	4	9	23	12	23	32	25	42	50-54	8	14
6	1	3	15	5	10	24	13	25				55-59	12	16
7	1	4	16	5	12	25	14	27				60-64	13	21
8	2	4	17	6	13	26	16	29				65-69	9	30
9	2	5	18	7	14	27	17	31				70-74	12	24

Modified from Chart by the American Heart Association, April 2002

Figure 13.1 Table used by RailCorp to calculate cardiac risk

It has been decided by RailCorp that the cardiac risk score that will result in an employee being referred for a stress ECG is 22. Mr Zeides' cardiac risk score was only 20.

Mr Dawes' attention was drawn to this fact and he indicated that RailCorp was contemplating an approach which did not involve a purely mathematical approach to predictive medical assessments, but the score is used as a guide. If a particular employee scores between 15 and 21, that means that the examining medical officer would have the discretion to consider other matters that may point to a possible future cardiac problem, in determining whether further investigations are required.

That appears to be an appropriate compromise, if implemented. A purely mathematical approach based on the cardiac risk score is, at best, only one indication of possible future problems. It is up to the medical examiners to determine in all the circumstances, having regard to all relevant medical history and their findings on examination, whether further investigations are called for.

Mr Dawes indicated that if an employee failed the medical examination, then that employee would be declared temporarily unfit and subject to review, which meant that his or her employment status and salary continued, but he or she was removed from train driving or other safety critical duties until such time as it could be demonstrated that he or she was fit for work.

New and more rigorous medical examinations commenced on 2 February 2004. At the time that Mr Dawes gave evidence, there had been a total of 236 train drivers subject to this new type of medical examination. Of the 236 train drivers, 52 were found to be temporarily unfit

and subject to review. These results may seem alarming, in that they suggest that something in the order of one fifth of train drivers were in a state of health that should have prevented them from driving trains. It needs to be observed, however, that the selection included only 30 train drivers who were due for their periodical medical examinations. The remaining 206 train drivers were selected because they fitted within categories which put them at the higher risk of future cardiac problems, such as being over 50 years of age, with a body mass index over 35, and who had not had a periodical medical examination for 12 months. In addition, some had other medical conditions which may have affected their ability to perform their work safely. Accordingly, that sample was biased towards a class of train drivers more likely to have underlying cardiac conditions compared with the general train driving population.

Mr Dawes was asked to compare the results from the new periodical medical assessments with what occurred using the previous standards and he said:

> I think it was fairly rare to fail or be classified as temporarily unfit under the previous standards.

As pointed out in the interim report, the previous type of medical examinations conducted by the SRA did not include a predictive element.

The loss of 52 train drivers was obviously disruptive to the provision of rail services, but it should be noted in respect of these train drivers that their classification was temporarily unfit and subject to review. The evidence does not disclose how many of them were permanently removed from train driving duties. No doubt they were subject to further medical examinations and decisions made as to their future employment.

It is obviously in the public interest and their own interest that train drivers who are at risk of a sudden heart attack not be driving passenger trains. As Dr Stephen Rainer, a Senior Staff Specialist in Pathology, St Vincent's Hospital stated in evidence during the first part of the Inquiry, having examined the nature of the blockage that Mr Zeides had to his left anterior descending coronary artery as it appeared from pathology slides, Mr Zeides would have been an excellent candidate for coronary bypass surgery, with the likely result that he may well be alive today. It should be said therefore that such medical examinations are likely to be of considerable benefit to each particular driver as well as protecting the travelling public from the situation that occurred with Mr Zeides.

The president of the RBTU, Mr Robert Hayden, was asked about the trade union's position in relation to the new periodical medical assessments. His evidence was:

> … the RTBU in the loco division - and certainly I've been involved in that - we have supported the introduction of the new medical standards. One of our officers, the vice-president, has been involved in the development from stage one of the new national health standards from the Victorian model and to be brought up here and there has been no, actually, no campaign by the RTBU New South Wales to delay them or stop them. It is supported by our members, and I have to say where RailCorp is concerned, they have seemed - they have handled the introduction of the national medical standards introduction quite well, and they're supported by the rank and file.

It would seem, accordingly, that the introduction of these new medical standards is beneficial to the safety of the travelling public and beneficial to the health of rail employees. Needless to say, most people who have an underlying heart condition which could be successfully treated, would welcome that information.

The second matter identified as a deficiency in the interim report was the lack of formal medical qualifications in occupational health and safety of the medical examiners, together with no understanding of the nature of railway related duties. Mr Dawes said that a medical service provider has been retained to recruit the general practitioners to conduct the periodical medical examinations. These general practitioners do not need to be qualified in occupational health and medicine, as some evidence suggested was necessary. They are nevertheless required to have skills and experience in occupational health beyond that of the average general practitioner.

RailCorp has introduced its own system of training of the medical practitioners to enable them to have an understanding of the duties required of the particular employee they are examining. Mr Dawes described the nature of that training as follows:

> That would typically involve taking the doctor out on the train, in the driver's cabin, with the driver, to observe the nature of the driver's work. We would then take the doctor to a railway yard to be able to observe other aspects, for example, of the driver's work, such as the need to walk on rough ground, the need to be able to climb steep steps to get into the cabin, the need for train crew staff at times to get between carriages to couple and uncouple them. After that, we take the doctors back to a classroom environment where there would be, I suppose, a theory session where we would talk about requirements of the standard and typically we would have someone like Dr Bruce Hocking, who has done this for us before, present to deliver the theoretical component of the training.

The medical services provider has also agreed to provide to RailCorp the services of an occupational physician, who it is intended would review the general practitioners' medical assessments and ensure an appropriate standard of practical medical examinations.

These procedures, if fully implemented, are a vast improvement on the system of periodic medical examinations existing before the Waterfall rail accident.

The third area in which the interim report criticised the quality of periodic medical examinations related to information that was provided to medical practitioners conducting the periodic medical examinations. That deficiency has been addressed, according to Mr Dawes, by RailCorp providing its medical records relating to the particular employee to the medical practitioner conducting each periodic medical examination, prior to it being conducted. Further, medical practitioners are encouraged, if it is thought necessary, to contact the employee's general practitioner to obtain a more detailed medical history. Such contact can only be made with the consent of the employee. If the employee does not consent, and the medical practitioner has concerns, then the employee can be referred for a specialist assessment and declared temporarily unfit until such assessment has taken place.

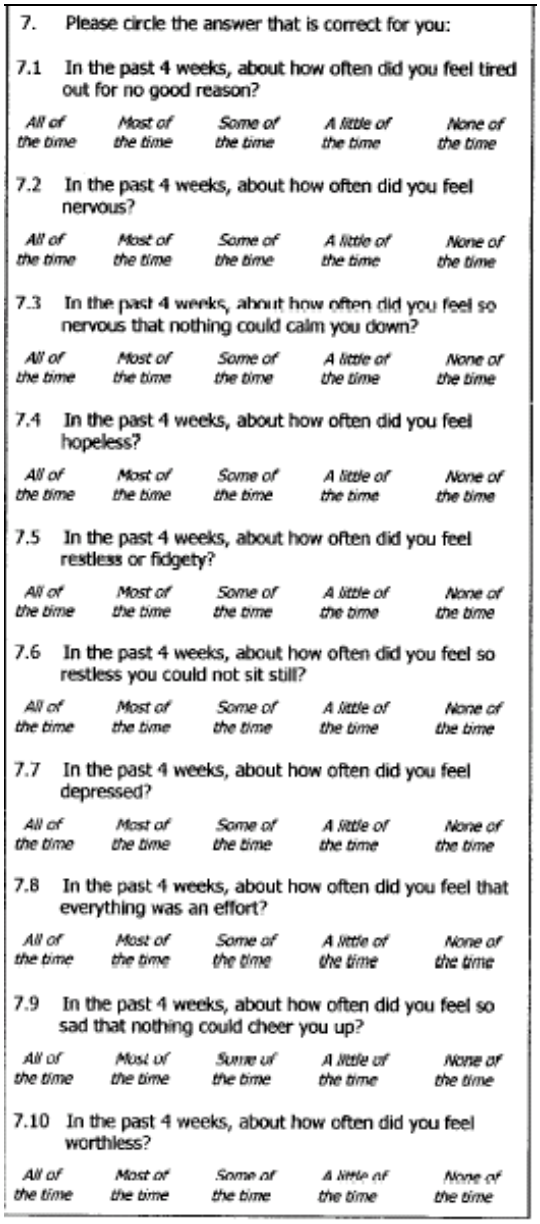
The fourth criticism that was made in the interim report related to the absence of any procedures for follow-up on identified areas of concern. As has been indicated above, this

deficiency is now addressed by a procedure under which employees may be referred to a specialist medical practitioner, such as a cardiologist, or referred for the carrying out of a stress ECG, in an attempt to exclude such conditions as advanced coronary artery disease.

The fifth deficiency identified in the interim report related to what happened to the information obtained from the periodic medical assessments when it was received by the SRA. Under the previous regime, clerks received that information and were responsible for filing it. This system had not proved infallible. Mr Dawes said that attempts had been made by RailCorp to recruit a chief health officer, whose duties would include independently reviewing the medical reports coming from the service provider and providing some overview of the entire process. The chief medical officer is to be an occupational health physician. It is hard to understand the need for a second occupational health physician when the service provider is supposed to be providing this service.

The sixth deficiency identified in the interim report is the need for ongoing monitoring of the health generally of RailCorp employees. One of the findings made by Dr McIntosh was that in the ten years prior to 2003, the average weight of train drivers had increased by ten kilograms. It is obvious that with aging and such a significant increase in weight, the risk to the overall health of train drivers has increased over that period. It is necessary, therefore, not only to review the pattern in relation to any particular individual over time, but to be mindful of the overall risk of deterioration of the state of health of the train driving population and to update, monitor and review the medical standards that are put in place, to accord with the overall trends that are able to be identified.

In the interim report there was some discussion of the mental health of the train guard and of the absence of any routine periodic psychological assessment. Evidence was given by Ms Michelle Small, organisational psychologist for RailCorp that the K10 screening test is now used as part of the periodical medical examinations. Figure 13.2 is the K10 questionnaire.



7. Please circle the answer that is correct for you:

7.1 In the past 4 weeks, about how often did you feel tired out for no good reason?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.2 In the past 4 weeks, about how often did you feel nervous?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.3 In the past 4 weeks, about how often did you feel so nervous that nothing could calm you down?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.4 In the past 4 weeks, about how often did you feel hopeless?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.5 In the past 4 weeks, about how often did you feel restless or fidgety?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.6 In the past 4 weeks, about how often did you feel so restless you could not sit still?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.7 In the past 4 weeks, about how often did you feel depressed?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.8 In the past 4 weeks, about how often did you feel that everything was an effort?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.9 In the past 4 weeks, about how often did you feel so sad that nothing could cheer you up?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

7.10 In the past 4 weeks, about how often did you feel worthless?

All of the time | *Most of the time* | *Some of the time* | *A little of the time* | *None of the time*

Figure 13.2 K10 questionnaire

The questionnaire is no more than a screening method which depends, fundamentally, upon self-reporting by individuals of circumstances which should alert the medical examiner to the possibility of the need for further investigation. It is not possible to make a finding that if Mr van Kessel had been subject to a K10 questionnaire any psychological impairment would have been detected.

The final observation to be made in relation to this topic are that the safety regulator, ITSRR, has indicated that it proposes to make mandatory the medical standards that have been discussed in this chapter. That proposal is supported.

There is, at present, a national review of railway medical standards and it is obviously desirable, since trains travel from one State to another, that the same high medical standards exist in all parts of Australia.

During the course of overseas investigations, Counsel Assisting reviewed medical standards in the United Kingdom, Europe and the United States. The standards of the medical examinations that either have been introduced or are proposed to be introduced by RailCorp are of a higher standard than exists in any of the overseas rail systems that were investigated. Provided RailCorp continues with the program of implementation of the periodic medical examination systems envisaged, this is one area where appropriate initiatives have been put in place to better ensure the safety of the travelling public. The efficiency with which RailCorp appears to have dealt with the deficiencies in periodic medical assessments identified in the interim report, by implementing necessary changes, is a welcome improvement to this area of safety management.

This does not mean, however, that periodical reviews of the standards should not occur. Medical standards should be reviewed at least every five years to ensure that advances in medical knowledge and technology can be utilised on an ongoing basis.

14. Safety Document Control

The interim report reproduced a large number of documents recording the history of the deficiencies in the deadman foot pedal system, which was one of the main causes of the Waterfall rail accident. One of the issues that therefore requires consideration is the adequacy of the systems in place for the management of safety documentation.

Having examined the documentation available in relation to the deadman foot pedal, it is clear there was an inadequate system for the documentation of safety hazards and a deficient system for communication of safety information within the SRA. The deficiencies that existed in the deadman foot pedal system were not notified to the Department of Transport in the annual safety reports of the SRA or in its applications for accreditation. The result was there was no organised system for identifying important safety issues relating to significant hazards and tracking the processes for addressing those hazards to remove them or ameliorate their effects.

The Inquiry's Lead Investigator, Mr Lauby, gave evidence as to the failure of the SRA to recognise the significance of the documents in its possession which identified the deficiencies in the deadman foot pedal. His evidence was:

> Q: You are aware of the evidence that has been led in this hearing as to the advice that has been tendered over time about the deadman control issue. Has that been material in the course of your examination that you have had regard to in ultimately formulating the observations you have in this report on the safety issues, both systemic and otherwise?
>
> A: Yes, it has, because the handling of the deadman issue I find very disturbing. The deadman issue was discovered long ago, back in the 90s. It was brought to the attention of the SRA. SRA was given enough information that I would have expected that they would have made the deadman issue a critical item that was brought to the attention of everyone in the organisation, and that rapid steps should have been taken to address this problem.
>
> The fact that they weren't, and that here we are in 2003 discovering – rediscovering that there is a problem with the deadman system, of course at this point after a tragic accident has taken place, I find that quite disturbing.
>
> My conclusion is that the SRA needs to go beyond just deciding how they are going to change the deadman system, what other systems - whether they are alerter systems, or vigilance systems – that they are going to use, but they are also going to have to address the more fundamental question, and that question is why didn't SRA management react to the information on this critical safety system? There are reasons that that may have happened – maybe the information was not on safety, maybe there was not an adequate understanding of the criticality of that system – but, again, the SRA is responsible for the safety of the public that rides these trains and it is their business to know what the issues are and it is their business to address them when they are aware of them.

> And so I want them to go beyond just solving the technical problem and find out what the systemic problem was in the organisation that would allow someone who knew of a critical safety issue not to respond to it.

Mr Vince Graham, the Chief Executive of the SRA, and now RailCorp, was asked about the adequacy of information control systems within the SRA. The relevant evidence was:

> Q: It was plain, was it not, just during the course of the hearings last year, if it wasn't certainly after the Commissioner delivered his report, that information control systems within State Rail were inadequate?
> A: Yes, along with a number of other matters.
> …
> Q: That, of itself, is vital in an effective rail organisation with a complex organisation, isn't it, that there be state-of-the-art, properly controlled information systems?
> A: In a safety management system, yes.

Mr Graham was not the Chief Executive of the SRA at the time of the Waterfall rail accident. Mr Howard Lacy was the Chief Executive from 3 December 2001 to 8 April 2003, when he was removed from office and replaced by Mr Graham. Mr Lacy gave evidence about what he tried to do in relation to the document management system shortly after he was appointed Chief Executive. He stated:

> The document management and control procedures in the organisation had been a source of some concern since fairly early in my time there, and part of the brief that I had given to the chief information officer, who I had to recruit in the first months of joining the organisation, was to address his mind to a more rigorous document management system.

Mr Kent Donaldson, the Executive Director, Transport Safety and Rail Safety Regulation Division, New South Wales Department of Transport, was asked about his attempts to ascertain whether anyone within the Department of Transport was aware of the 1994 report by TMG which identified the inherent deficiency in the deadman foot pedal. His evidence was:

> Q: To the best of your knowledge, do you say that no one within the Department of Transport, as it was then known, was aware of the existence of the 1994 TMG report that identified potential risk on the Tangara train so far as the deadman foot pedal device was concerned?
> A: I've interviewed each individual person reporting to me and the delegated people, and not one them, going back as far as 1994, had any idea of the TMG report, including the manager of accreditation, Mr Holliday.

Ms Catherine Herriman, the then Executive Director Safety, of the SRA, was also questioned about the failure of the SRA to identify and act upon the information available to it in expert reports commissioned by it from consultants such as TMG, and why it was only after the Waterfall rail accident that the deficiencies were identified. She stated:

Q: What you are saying to the Commissioner, as I understand it, is it was, in effect, purely accidental that the TMG reports came to light, in the sense that it was the man reporting the heater problem that triggered the line of inquiry which revealed the TMG reports. Is that right?

A: That is how those events unfolded, yes. That's not to say that our continued process of document search and investigation would not have turned up those documents.

Q: Indeed, but what it does suggest is, if the fact be as you've just stated, it shows, in itself, doesn't it, something seriously wrong with the management of data, information within SRA, that it took a coincidental event, such as the heater problem, to bring those reports to light, even if the Waterfall accident, in due course, might have brought about the same result?

A: Yes, it shows that the document control systems failed to pick up these previous reports.

Q: And that, of itself, would you agree, would have to rank as one of the most serious matters that have emerged in the course of this Inquiry, that the absence of document control is responsible for failing to bring to light the existence of these TMG reports before the Waterfall accident in time to have action taken to rectify perceived problem?

A: The – yes, the absence of document control to pick up those documents has become apparent. The processes in the organisation for documentation and identification of risk, nevertheless, exists and continue to exist. I think in the instance of State Rail, there has been, through the 15 or more years of history associated with this deadman foot pedal, a number of changes of organisational structure, a split of the organisation into other rail entities, and the process of ensuring that all documentation is kept strictly controlled is a very difficult one. Nevertheless, the documents did not – were not brought to light in the hazard logs that are kept by the divisions.

Q: You would agree that that's a serious omission in the system?

A: Yes.

There were a number of reports between 1988 and 1999 referred to in the interim report identifying the deficiencies in the deadman foot pedal. None of these reports led to proper investigation of the identified risks. Nor were they brought to the attention of the rail safety regulator, the Director General of the Department of Transport.

The then Deputy Chief Executive, Operations and Infrastructure, of the SRA, Mr Arthur Smith, was asked to explain why the SRA did not include references to the knowledge that it had of the deficiencies in the deadman foot pedal in the annual report about any safety issues it had identified which it was required to prepare and submit to the Department of Transport. His explanation was:

> Can I say that that report prepared for June-July in the year 2000 made mention of the task force that has been put together to investigate SPADs [Signals passed at danger] and get the SPAD situation under control. In that first six months of that calendar year, 2000, we were derailing catastrophically on a regular basis. … We were derailing, the system was in crisis and every other week we had a derailment. It was of particular concern to the organisation. It

> was very, very public, and leading up both to the Olympic Games and from a fundamental safety point of view, the organisation was desperate to get control of the circumstance of trains derailing because they have gone through a red signal. So there was a huge effort on behalf of RAC [Rail Access Corporation] then RSA [Rail Services Australia] and State Rail to get that circumstance under control.

In other words, the explanation for the failure of senior management to deal with the identified latent risk of the deadman foot pedal causing a serious accident was that there were so many other derailments occurring because of train drivers passing red signals, that this precluded any systematic analysis of the potential for other types of accident. This is an unsatisfactory explanation, particularly when Mr Smith was specifically put on notice by Mr May in a memorandum dated 9 November 1998, in which Mr May pointed out that accidental circumvention is a particular problem with foot pedal devices. A copy of this memorandum was sent to Mr Ron Creighton, General Manager, Passenger Fleet Maintenance, Mr Stan Lai, Acting Manager, Technical Support and Supply, Mr Barry Lovat, Manager, Fleet Projects and Assets, and Mr Phil McColl, Acting Fleet Manager, Flemington Maintenance Centre.

Even after the SRA had the opportunity to deal with the safety issues associated with signals passed at danger, including the opportunity to implement the recommendations of the Glenbrook Inquiry final report, delivered on 11 April 2001, subsequent documentation prepared by that organisation still failed to identify the deadman foot pedal risk.

The 2002 application by it for accreditation under the Rail Safety Act 1993 made no mention of the risks identified in the TMG reports. The application was prepared by Mr Ken Prestwidge, the Manager, Audit and Accreditation. He said he was not told about the problem with the deadman foot pedal.

Document control deficiencies were confirmed by the investigation conducted by the SMSEP. The conclusion of the SMSEP in relation to the document control procedures of the SRA was:

> Whilst document control procedures exist in some local areas, there was no effective, integrated document control policy for State Rail and document control was not practised within the organisation at any disciplined level.

The purpose of a safety document control process is: to facilitate communication of issues and risks within the organisation, to and from lower levels of the organisation to higher levels of the organisation; to identify trends; to enable failures to be reported and corrective action to be taken and recorded; to enable the recording of incidents and hazards and to share information; and to record decisions and track the management of any matter requiring attention within the organisation. One of the main purposes of a safety document control process is to identify the individual or individuals who are responsible for taking the corrective action required.

It is not difficult to identify the way in which a system for controlling safety documents should operate. The first step is to identify any documents which may have safety implications for the organisation. These may be documents which are generated within the organisation, such as Mr Wilkinson's memorandum in 1988 or Mr May’s memorandum in

1998, or they may come from some external source, such as the TMG reports in 1994 and 1999, or as a result of a report of a safety incident occurring on railways outside the New South Wales rail system, such as the Footscray accident in 2001.

Having obtained the relevant documents, an analysis then needs to be undertaken as to what information can be gleaned from them and a plan prepared to deal with whatever issues arise. The SRA at no stage properly analysed the available documentary material or prepared any plan to deal with all the risks identified in those documents.

If the action plan involves the development of procedures to be implemented to manage a risk which has been identified, it is essential the documentation be received by the persons required to take that action. If developing the plan of action requires a number of versions of the plan, then there needs to be a proper system in place for tracking each of those versions. Each version of a plan should be identified by a number.

Part of this process will involve the preparation of documents which require fairly urgent action. It is necessary to put the tasks in an order of priority, according to their safety importance. Procedures need to be put in place to ensure that the persons who are to be made accountable for the implementation of the final plan have signed an acknowledgment that they have received and understood the final document and confirming that they understand what is required of them to implement the plan set out in the document.

One of the glaring deficiencies in relation to the control of safety documentation related to the methods by which versions, usually described as drafts, were prepared. The SMSEP report found that there were two different versions of the SRA Network Incident Management Plan available at the RMC. They also found a large number of policy documents which were described as "draft".

Dr Edkins gave evidence about what was found during the safety audit, concerning the use being made of the incident management plan. He said:

> What is of concern is that what the auditors discovered during their discussions with managers and from interviews that they conducted, is that some people are using this draft document as the current incident management plan, where it is clearly marked "draft". So again it illustrates the point I wanted to make which is if you had a document control process in place, you shouldn't have these copies out there with some managers using these documents which are clearly draft documents and not final documents that should be used and implemented as such.

The SMSEP came to a conclusion with which I agree, namely:

> It is only when a document is in its final format that it should be authorised, distributed and implemented throughout the organisation.

In respect of some important documents there even seemed to be some confusion about which version of the document or draft document it was. Evidence was given about the SRA Safety Plan 2002 – 2005, which was supposed to contain its three year plan. Dr Edkins said of that document:

> Again, not to rehash the point, this is an example of a document where there appears to be no document control. The version number is unclear. If you actually flick through the pages, on the copy that I've got it has on the front page a date of 15 February 01 or 02. I think the two has been crossed out and there's a one there. I don't know what that means. Does that mean that's a page number or a date?

Dr Edkins went on to make some further observations about that document:

> It doesn't appear to be signed off by an accountable manager. Certainly the document that we have – that has been obtained, doesn't have a sign-off, an apparent sign-off process that was observed. There's no clear date, as we mentioned, no apparent revision, and no version number. So, again, it illustrates lack of a disciplined document control process.

The SRA had a published safety policy which contained some of the necessary elements for an overall management system for safety documentation, but the SMSEP findings in relation to it included:

> State Rail and RailCorp did have a published safety policy and a statement of objectives signed by the CEO. However, there was little evidence of an effective process to communicate this policy to all staff, suppliers, contractors and visitors.

It need hardly be said there is not much point in developing policies, whether of a general or specific nature, unless there is communication of the content of those policies to staff, suppliers, contractors and visitors who need to know the policy in a particular area and how to apply it.

An attempt was made to identify what, if anything, had been done to remedy these deficiencies. Mr Vince Graham, the Chief Executive of RailCorp, was asked what the organisation was doing to remedy the deficiencies in RailCorp's safety document control processes. He stated:

> … RailCorp is only five months old and the total safety management system, the information flows, the validations in their final form, are still in transition.

He concluded his evidence in chief, on 28 May 2004, by stating:

> … If I can say, as part of the safety management systems, because the information element is one of the key elements of the safety management system. Yes, it is inadequate and, yes, we are moving to ensure that we make it adequate.

During February and March 2004 RailCorp commissioned a consultant, SAI Global, to conduct a desktop review of a number of documents presented by RailCorp. SAI Global reported that:

> Some documents listed have been noted as "uncontrolled document".

The significance of this was that these documents did not have version control, issue number or date of issue. That was consistent with the review that was conducted by the SMSEP.

The deficiencies in the management of safety documentation identified in the SMSEP report were not challenged in any way. There is an absence of any evidence of the way in which RailCorp intends to establish the comprehensive safety document management system which is an essential part of any overall safety management system. There must be concerns about its ability to achieve that result in the future.

In the area of accreditation, the earlier failure to record essential safety information has been noted. Mr Prestwidge, who was involved in the drafting of the application for provisional accreditation by RailCorp for 2004, gave this evidence:

> Q: Do you know whether there has been any investigation to date made for the purposes of tightening up the accreditation process by ensuring that information that comes from different divisions or units within RailCorp is cross-checked, validated, before it was relied upon for accreditation purposes in the 2003 provisional application?
> A: No, I'm not aware that that's taken place.

As Ms Carolyn Walsh, the Chief Executive of ITSRR acknowledged, if RailCorp does not have control over its own documents the safety regulator would be unable to assure the public when granting accreditation that it is based on reliable and credible data. She added:

> One of our aims as a regulator is to ensure that is not allowed to continue into the future with the rail industry but, rather, those issues are addressed in far greater detail in applications for accreditation.

Not only is the safety regulator dependent upon the organisation to keep adequate safety documentation for the purpose of applications for accreditation, but the Board of RailCorp, which is responsible for the strategic direction of the organisation, also needs to have that information. According to the Chairman of the RailCorp Board, Mr Bunyon, the only way it can have an acceptable level of confidence in the information that is being passed to it by the senior management of RailCorp is "by enquiry, personal observation, and audit".

Modern information technology enables the accurate recording, collating and dissemination of safety documentation. Indeed, there was evidence that RailCorp had an electronic data control system. What is unknown is whether or not it had been used to overcome the deficiencies which have been identified.

Obviously, in an organisation the size of RailCorp, a large volume of material is generated. There must be persons whose function it is to develop the information technology processes which enable that documentation to be collated and disseminated. Mr Donaldson, in his evidence, referred to the need for the position of a Chief Information Officer. Mr Donaldson described the role of such a person as follows:

> In an organisation such as RailCorp, or any of the accredited operators of any size, a person responsible for the information flows, to integrate those information flows, and that's what I think is probably lacking in the accreditation model at the moment.

> So you would be looking at doing a series of licensing across those areas and making people accountable for integrating them into the Board and the total safety management system, and I think modern IT technology can enable that to be done through project management.

Further, he said:

> In my opinion, Commissioner, most big organisations now, where safety is involved, there is so much complexity in each of the elements, such as engineering, flight operations, train operations, you need a person in that organisation to make – where there is (sic) critical elements identified, you need a person that brings all of those projects together and can push it right up to the top level, and also, put the finger (sic) and point the finger at the particular elements in the organisation, such as fleet maintenance or train operations, that is falling behind, because a safety management system is only as good as the weakest link the chain.

It is obviously a big task to create the safety documentation system that an organisation the size of RailCorp needs, but it is no bigger task than has been carried out in other large organisations and is therefore achievable. Dr Edkins in his evidence gave some examples of where that has occurred:

> There are various models and, if you like, applications around within aviation and within mining. Of note is a system developed by BHP Billiton called "first priority" which is a system that enables the capture from various mining facility sites around Australia and internationally on the part of BHP Billiton to a central source, where the organisation collects electronically information from incident reports, injury reports, audit information, compliance-type issues that come out as well. So it, again – multiple data sources, a variety of incident – a variety of organisational sites, and, in some cases, international, and there is a basic interface arrangement between a central source, if you like, and very – in some cases, remote sites around the world and within Australia.

Dr Edkins went on to observe that not only can collection of such data in a computerised system aid in the management of risks within the rail organisation that uses it, but it can also enable better safety management by other organisations, because of the capacity provided to communicate information to outside organisations and receive information from them. Dr Edkins said:

> I think that is one of the outcomes of having a good database. I think at the start you need to have a good database that has multiple data sources, so that you can inform not only your own industry but – or your own State, in this case – but other regulators and operators that may operate the same sorts of equipment and potentially have, therefore, the same problems.

Not only does it appear from the evidence that the aviation industry has achieved success in the creation of the kind of database which it is necessary for RailCorp to have, but that there was also evidence that Pacific National had itself achieved success as a rail organisation in this area. Evidence was given by its Chief Executive Officer, Mr O'Donnell, as to the way in which its system worked:

> … if we had an incident, this would be reported, we would have an investigation. As part of that investigation we may then decide that we want some sort of external advice or expertise to help us fully understand the issues. That would then result in a report. That report would then be attached to the investigation and become part of the material. That safety – if it deemed to be safety critical, and really that's where David Edwards' group come in, they would then keep a record of that. They have a document control process. That would then be captured in that. For any main change that occurs within the organisation there is a change control process, again, to ensure that appropriate people have signed off and we have got the best opportunity to take full advantage of the intellectual knowledge contained within the organisation.

Mr Edwards of Pacific National also gave evidence as to how that system worked:

> Every one of our employees, Australia wide, has access to our Pacific National intranet site. The control document is maintained on the intranet site. Any document printed off our controlled internet site system is an uncontrolled document, so it is a quality-based document control and data process. We deliberately try to avoid having masses of paper around so that people can get the information they need in bite-sized chunks and not necessarily have telephone book-sized manuals sitting on tables unread.

Apart from the obvious advantage of the ability to obtain up-to-date and relevant information for the particular area with which the employee is concerned, the use of computer technology will avoid the circulation of large amounts of paper which is often unread.

The SMSEP report, when dealing with document control related to information provided to railway station employees, came to this conclusion:

> There was a lack of document control, particularly in regard to information being sent to stations by corporate RailCorp. Consequently, station staff felt that they were swamped with unnecessary paper. This means that station staff could fail to pay proper attention to key documents and thereby not be aware of important safety related information.

It follows that, in the modern age of information technology, RailCorp should avail itself of that technology and should do so in a disciplined manner. There needs to be careful screening of documentation to ensure that information goes on its intranet site and that this information is as concise as it can be and is provided in such a way that the persons who need to access it can readily identify what is relevant to them. It would not be difficult to enable staff to use a computer terminal in which, for example, the word "driver" is entered and any updated information relevant to the position of train drivers, which might affect either the route that they are required to travel on or any other aspect of the work they are engaged in performing, is displayed.

In addition, information technology can enable the entry into the computer database of any defect reported by any train driver, which can then be tracked through to completion. I have discussed and recommended the necessary procedures in the chapter of this report dealing with train maintenance.

The same facility can be used to report incidents and identify who is the accountable officer responsible for ensuring that the particular matter is properly investigated and the necessary remedial action has been carried out.

Staff at a senior executive level could then readily and efficiently obtain access to the same information, which would then enable them to better manage operations on their railway and check that outstanding matters are being attended to and satisfactorily completed. Needless to say, without senior managers having quick access to reliable information that can be obtained from a computer database, they will be impeded in their capacity to manage the safety of the organisation.

It is not difficult to imagine how easy it would have been to manage the relevant information in relation to the deficiencies in the deadman foot pedal, had computer technology, which has been available and used in many other industries for a long time been used efficiently and effectively by the SRA.

There is no doubt that it is in this direction that RailCorp should be going. This may mean that it needs to train its staff to be able to effectively use computers for this purpose.

The rail safety regulator, ITSRR, should also have immediate access to the same database, so it can readily and efficiently determine whether any identified hazard is being properly managed and identify the officers responsible for managing the hazard.

These uses of modern information technology should vastly improve the safety management carried out by RailCorp, and also enable the rail safety regulator to properly discharge its responsibilities to regulate safety.

I have identified the numerous deficiencies in safety document management within RailCorp. The SMSEP report also investigated the way in which the rail safety regulator, ITSRR, was managing its own safety documentation. The SMSEP found:

> At the time of the Waterfall accident record keeping by the regulator was ad hoc and inadequate to provide a system for proving due diligence or appropriately analysing the safety health of the railway. Establishing a valid data and information management system should be a very high priority for ITSRR.
>
> At present there is no document control procedure in place in ITSRR. An "interim" manual filing system has been put in place to catalogue "inherited" documents. A system called PRISM (Performance Reliability Investigation Safety Management) is under development, but is not planned to be fully operational until late 2004. Among other things, this system is expected to manage documents and data. It has not been possible for the safety review to make an adequate assessment of PRISM due to it only being a "concept" at this stage. ITSRR will need to ensure that whatever system is implemented, it provides an effective knowledge management framework for trend analysis, record keeping and decision support.

It is difficult to see how a rail safety regulator could possibly discharge its functions without the use of available computer technology.

Both the Glenbrook final report and this report have emphasised the importance of the communication of safety information between rail organisations, as well as within each rail organisation.

Counsel Assisting met with officers of the Australian Transport Safety Bureau (hereafter referred to as ATSB) were informed that a program is in place for the development of standard processes for identification of the records that should be kept in relation to any incidents on a railway, the manner in which the material should be collected and collated, and the manner in which this should be disseminated. The collection, collation, trend analysis and dissemination of safety critical information on an Australia-wide basis would not only improve the safety of rail operations within New South Wales, but it would also improve safety procedures for operators from other States who enter New South Wales in the course of their rail transport activities.

It is necessary, as pointed out in the SMSEP report, that RailCorp develop an integrated safety information system which includes:

1. Capture of all hazards, OH&S incidents, audit results, non-compliance findings, near miss reports and so on;

2. The system should be capable of systematic analysis to focus finite resources in priority areas;

3. Decisions should be supported by data and trend analysis; and

4. The system should be capable of sharing with other safety information systems.

Inherent in those proposals is the need for development of a system for managing that information, using information technology which is currently available and which should be used for that purpose. Obviously enough, not only will the system need to be developed, but considerable resources will need to be allocated to ensure that all staff are properly trained in its use, so as to maximise its effectiveness in the management of information.

As previously indicated, as far as ITSRR is concerned, I regard the development of a computerised method of collating, collecting and disseminating information as an essential priority for that organisation to undertake.

15. Train Guard and Driver Training

Both the interim report and the Glenbrook final report recognised the importance of training in a safety management system. The interim report noted that although the train guard, Mr van Kessel, was said to have been trained to deal with the situation that arose at the time of the Waterfall rail accident, the only conclusion is that if he had received any training in how to react to such an emergency, it was ineffective. Deficiencies in training were highlighted, and recommendations were made to improve training, in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident, delivered on 11 April 2001.

Mr Kent Donaldson, Executive Director, Transport Safety Regulation of ITSRR, was questioned about what had been done to improve training as a result of the Glenbrook recommendations. The first training recommendation of the Glenbrook Inquiry report related to the need for psychometric testing as part of the initial selection process. Mr Donaldson said, "I do believe that is now being implemented after a long period". It appears from the evidence of Mr Iaen Hodges, Crew Area Manager, Wollongong, who had served on a committee from July 2001 until 16 December 2002, established to co-ordinate the implementation of the recommendations of the Glenbrook Inquiry, confirmed Mr Donaldson's evidence and stated that that recommendation had been "implemented through the establishment of the Recruitment and Selection Centre within State Rail".

The Glenbrook Inquiry final report made a number of specific recommendations about the delivery of training. The first was that the development of safe behaviour should be the principle objective of training. This recommendation relates to what has been said elsewhere in this report about safety culture. It is clear from Mr Donaldson's evidence that he recognised the relationship between the development of safe behaviour as the principle object of training and the development of a culture in which safe behaviour is paramount. Mr Donaldson said:

> I think that hasn't been taken up as fully as we would like at this stage; I would say it was in the bottom 25 per cent.

That statement is consistent with the conclusions set out in chapter 17 dealing with safety culture. One of the ways of establishing an appropriate safety culture is to effectively use the opportunity that training gives, both in the initial stages and throughout the employment of safety critical workers, to enforce and reinforce that message. The ranking of the implementation of that recommendation in the bottom 25 per cent is far short of what is required in this regard.

The next recommendation related to the teaching of the safety rationale behind rules and procedures. Staff will have a better understanding of the reason for the rules if they understand what the safety rationale for each rule is. This in turn will increase their own safety awareness and understanding of their duties, which will obviously improve the overall safety culture of the organisation. Mr Donaldson accepted there had been "a significant improvement in terms of the network rules", but he said:

> I still think it has a long way to go, albeit I think the rules that have been put in, which we administer and signed off last year, are a vast improvement on the previous rules, in plain, simple English.

Mr Hodges stated that the way in which that recommendation has been implemented is by the safety management system training which has also been introduced. The effectiveness of this training will be discussed later in this chapter.

The next training recommendation was that training of railway employees should include:

> Practical examples drawn from Australia and overseas experience to demonstrate the consequences of failure to apply operational rules and procedures correctly or in a thoughtful manner.

That recommendation was made because it is obvious that persons would better understand the safety rationale for rules if practical examples are given to them in the course of their training, demonstrating the consequences of failing to apply the appropriate rule or procedure. Mr Donaldson said that recommendation had not been implemented.

Mr Donaldson correctly pointed out, and as I have observed in the chapter on risk management, one of the problems with the RailCorp organisation is that because, nearly all the time, activities are conducted without any particularly serious mishap, this creates a sense of complacency in the employees which can be dangerous. As Mr Donaldson correctly pointed out, the use of examples of particular incidents or accidents can produce the result that:

> You also break that cycle of complacency in a normal day's operations, I think we can all become complacent in our everyday jobs.

The next recommendation was that the training of railway employees should include "an appropriate balance between practical work experience and classroom components of any training program". According to Mr Hodges, that recommendation had been implemented, however, Mr Donaldson disagreed. Mr Donaldson said that the practical side of that process had not "gone anywhere near the extent that it could be". He added that:

> People to be certified both from a theoretical classroom assessment and then on-the-job application.

The next recommendation was that the training of employees should involve "the use of modern, interactive simulators as a core component of training programs". As a result of that recommendation, the rail training centre at Petersham was provided with two virtual reality simulators and two upgraded driver training simulators. I have viewed the use of these simulators at the Petersham training centre. Their use, however, fails to recognise the fact that they need to simulate situations where conditions are abnormal or degraded. This is where catastrophic consequences can result. Mr Donaldson explained:

> Where I think the training probably lacks, in my opinion, is the fact that the training is orientated to the normal day's operation, as opposed to the abnormal operation. So I think the training needs to have a lot more emphasis on when a train is in trouble or it has a lack – has a loss of power, has a communication breakdown, what other protocols a crew should follow when there is an abnormal operation, and trained for the worst rather than a normal day's operations.

In the training of airline pilots it is well known simulators are used extensively to simulate abnormal situations, to train pilots to deal with emergencies. The same use should be made of simulators in the training of train drivers and guards.

Mr Donaldson referred to the incident that had occurred on 23 September 1999 at Bangkok airport, when a Boeing B747-400 aircraft aquaplaned on landing and overran the runway by 220 metres. He said:

> I bring your attention to QF1 that ran off the runway in Bangkok some years ago. Theoretically, 401 lives could have been lost out of that but the simulated exercises with the crew, I think, probably saved many lives. You can't underestimate the practicalities.

The use of simulation as an effective tool to train operational staff in emergency response has not been confined to the aviation industry. In the SMSEP report the authors said:

> Research and operational experience within aviation and other industries has established that during an emergency people react best in a manner that has been practised or rehearsed. This is one reason why high risk industries such as nuclear, petrochemical and aviation invest heavily in simulated emergency training. This training includes onsite activation actions, site shutdowns and the use of simulators.

Dr Edkins expressed the view that the simulators have not been used as effectively as they could have been. He believed what was needed was a greater degree of interactivity between the equipment and the staff. They should be used as a means by which the authority gradients could be broken down, and they should be used to equip train crew with the ability to manage emergency situations. Dr Edkins said, "You could achieve the same thing by showing a video". In other words, the simulators have the capacity to train staff better because of the interactive features that they have, whereas they are currently being used in the same way as a videotape is used for passive viewing. The evidence of Dr Edkins was that the failure to increase the effectiveness of the simulators as a training tool was related to the absence of any training needs analysis. Training needs analysis is necessary to identify the areas of particular occupations where training was required. Having identified these particular areas, the simulators could be adapted to deal with those particular issues of training.

The next recommendation from the Glenbrook Inquiry final report was that the training of railway employees should include "emphasis on the importance of teamwork in rail operations including ensuring that operational employees have a clear understanding of the duties, roles and pressures involved in the work of other operational occupational groups". Mr Donaldson said of this recommendation:

> I still think there is a long way to go with crew resource management, for example, the interrelationship and the communication and the safeworking understanding between people such as guards, drivers, signallers and train controllers, and I think that's been borne out by a number of inquiries I have been involved with – not only this one, but Hexham – and I think that's due to the fact that there's been a lack of on-job application training as opposed to classroom training.

The importance of maximising the resources available to ensure public safety by requiring train crew to work together is obvious. The interim report highlighted problems to do with the authority gradient between train drivers and guards and the adverse effect that train crew carrying out their respective duties in isolation from one another can have on passenger safety.

Mr Lauby gave evidence in relation to the practice in the United States, which illustrates the opposite view in relation to the responsibilities of both train drivers and guards. Mr Lauby said:

> All members – but the approach is that all members of the train crew that represent the company are there to make sure that the train and the customers are kept safe, and I think that that maybe what is missing from the relationships that we have seen between the guard and the driver on SRA and other operations in Australia.
>
> The responsibility for safety of the train is spread among all employees of the company, and it reminds me of – when travelling on airlines, of some of the staff there will tell you their main function is your safety, and that's the way it has to be on the railroads also. That is very common in the US – if a train is caught speeding in the US and there are two people in the cabin, both are taken out of service. They are both equally responsible for that train speeding; it is not the – the problem does not lie just on the shoulders of the driver, it lies also on the conductor or brakeman or other people involved in the operation of the train.

The authority relationship between train drivers and guards in New South Wales is different to that in the United States, where the train guard has the authority to take the train driver out of service if the guard believes that the train driver is affected by alcohol, or is in some other way impaired. The guard has complete authority to stand the train driver aside and his decision to do so will be supported by management, if he has acted reasonably in all the circumstances.

Mr Donaldson expressed himself in terms of there being "a long way to go" in the encouragement of teamwork. In other words, some efforts to encourage teamwork among train crew have been undertaken. Ms Fiona Love, Director of Training and Development for the SRA, and now RailCorp, was asked about this particular recommendation and her assessment of the effectiveness of its implementation in view of the Waterfall rail accident and the train guard's lack of response to the emergency. Her evidence was:

> Q: You're aware from the recommendations of the Glenbrook Inquiry that in relation to various people on the railways working together there were recommendations to the effect that people should be encouraged to work as a team?
> A: Yes.
> Q: Were efforts made to try to achieve that objective by the training centre at Petersham?
> A: They have been, yes.

Q: Would you agree that on what occurred during the course of the evidence in relation to the first part of this inquiry, it would appear that those efforts were not successful?
A: Yes, I would agree.

The next recommendation was that the "trainers of safety critical staff should have and maintain operational experience". There appears to have been some progress in relation to that recommendation. Mr Donaldson said:

> I think this goes back to a balance between the theoretical classroom teaching and on-the-job training, both in simulators and out on the track. I think there needs to be a lot more assessment, both by the regulator of driver compliance and train control compliance and signaller compliance, in addition to an assessment by specialist drivers and specialist train controllers of adhering to the network rules and procedures.

The next recommendation was that "trainers of safety critical staff should develop and maintain their training skills". Mr Donaldson's evidence was that there had been some improvement in that area. He said:

> I think there is a number of drivers now that work both in the classroom and on the track, but I think it needs to have a lot more emphasis on the practical training. To answer your question specifically, I don't think that is fully implemented, no.

The next recommendation was:

> The performance of training organisations and individual trainers be regularly assessed by accredited rail organisations and audited by the Rail Safety Inspectorate.

As has been frequently observed, the recommendation to establish an independent Rail Safety Inspectorate with the specific powers and functions identified in the Glenbrook final report has not been implemented. Accordingly, it is of no surprise that the important function of regularly assessing and accrediting rail organisations and auditing their training performance has not been carried out. Between the Glenbrook rail accident and the Waterfall rail accident, that is to say from December 1999 to January 2003, there was no change in the regulatory procedures for oversight of the SRA.

The next recommendation was that "the process and techniques used for assessment of the competency of safety critical staff be upgraded and strengthened to ensure effectiveness". Mr Donaldson stated that until the creation of ITSRR this had not occurred. He pointed out there is now the power in the safety regulator to require this to be done, pursuant to a regulation under the Rail Safety Act 2002 which requires that as part of a rail organisation's accreditation "they (sic) will have to demonstrate certificates of competency by particular workers in their (sic) industry – safety critical workers".

The final recommendation was that "there should be random auditing by the Rail Safety Inspectorate of the assessments of the competence of safety critical employees". No Rail

Safety Inspectorate has been conducting such audits because none was established. It would appear that some auditing has been done by ITSRR. Mr Donaldson said:

> We've done a number of audits over the last six months and questioned a number of competencies of a number of individuals.

He was then asked to summarise what these audits had found. He said:

> Lack of adherence to train communication protocols; understanding of how to the train communication functions; different standards in different depots, for instance, in installing or maintaining safety equipment; in other words the way things are done in different depots, there is not a standardised methodology; and in the case of safeworking rules, some different interpretations by safety critical workers of those rules.

In other words, it would appear from the limited auditing that has been done during the six months prior to Mr Donaldson giving evidence, that there were very significant deficiencies in the way in which the assessment of the competence of safety critical employees had been carried out by the SRA, and now RailCorp.

It can be seen from this review that except for psychometric testing for selection of safety critical staff, none of the specific recommendations of the Glenbrook Inquiry report has been fully implemented. In part, this is due to the failure to establish the recommended independent Rail Safety Inspectorate with the specific task of ensuring that these necessary reforms took place.

The rule or procedure that the train guard was obliged to follow in the circumstances of the Waterfall rail accident was safeworking unit 141. That rule provided "the guard is responsible for the safety of all passengers on the train and must be prepared to stop the train immediately if an emergency situation arises". A person required to follow that rule, who had been imbued with the ethos that safe behaviour is paramount, is more likely to apply the emergency brake than someone who has not had safe behaviour emphasised in that way and who has been regularly exposed to train drivers speeding. If safe behaviour is the dominant ethos, then a train guard should have no hesitation in "pulling the tail" in the circumstances that G7 was after leaving Waterfall railway station.

Similarly, the safety rationale for that rule is the immediate stopping of a train in circumstances where an emergency arises. If the rationale for that rule were emphasised as part of training, then the probability is that the train guard, Mr van Kessel, would have responded to the developing emergency situation, rather than done nothing.

The audit review that was conducted and the SMSEP analysis came to a number of conclusions in relation to the deficiencies that existed in the area of training. The first significant finding of the SMSEP was that there had been no significant changes in the design or delivery of training since the Waterfall rail accident. This conclusion is hardly surprising, given the material identified above relating to the failure to fully implement the recommendations in relation to training made in the final report of the Glenbrook Inquiry.

The SMSEP came to a number of other conclusions in relation to the way training was designed and delivered by RailCorp. In summary, the deficiencies identified in the design

and delivery of training resulted from the absence of any systematic approach to training. For there to be a systematic approach to training, it is necessary for an analysis to be undertaken of the training needs of the organisation at an organisational level. In the area of training, the process of developing a training needs analysis is fundamental to both the design and delivery of training.

Dr Edkins stated that a training needs analysis has as its objective the identification of the "types of skills and abilities people need to operate in this environment to conduct that process, those safe, efficient transport operations". He continued:

> One of the core aspects of a training needs analysis is conducting a tasks analysis. Could I just explain it? Basically a task analysis is done to look at specific tasks, if you like, that may be conducted by various, or required by various, individuals – say, for example, a guard or driver – within a particular operation, for which you develop tailored training programs. The training needs analysis is of the overall organisation, their capability in terms of their training needs, whereas a task analysis is the specific skills and responsibilities of particular individuals or groups of individuals, if you like, like a group of guards or a group of drivers.
>
> Again you would be expecting most, if not all of the training that had been developed to go through a fairly rigorous task analysis. But if we have a look at some of the training that the auditors viewed, there were cases where this task analysis, this basic concept that you would be expecting, had not been done in a satisfactory manner.

He was then asked to illustrate that point with specific examples:

> One of the issues in terms of the training courses which was a case where an incomplete, if you like, inadequate task analysis had been conducted, was training of station operations staff as supplementary crew members. I think this was an issue that I raised on Thursday in regard to a lack of material change process by the organisation in the proposal to have a supplementary crew member such as a guard, a driver or, more importantly, a station operations staff member sitting in the cab with a driver to supposedly ensure that the driver is alert and maintaining operations. Part of that process, of course, was to train station operations staff to identify situations where the driver is perhaps fatigued or potentially not alert, those sorts of issues, and take appropriate action.
>
> The training of station operations staff as a supplementary crew member was done to apply emergency braking if a driver becomes incapacitated, and the assessment form for this particular type of training that was viewed by the auditors showed a complete lack of task analysis in regard to that particular development training, so it doesn't contain any guidelines, including what you would expect in categories of observable measures of behaviour for these supplementary crew members to identify, that would indicate to the assessor, that is the person assessing these supplementary crew members, that the student understands when he or she is to intervene, precisely what actions need to occur to halt the train in terms of operation of the emergency brake valve, and so forth.

> So there was a lack of task analysis conducted to identify the particular procedures and processes that a supplementary crew member would have to follow, that's the first issue, and also how you would evaluate whether those particular crew members are competent enough to carry out those tasks. The task analysis, had that been done correctly, should have been able to identify those two aspects.

Superimposed on the existing unsystematic approach to training was the safety management system training which was introduced in late 2000. It appears that the introduction of this type of training was intended to improve the level of safety awareness and improve the safety culture of the organisation.

When the audit review was conducted, the finding that the SMSEP came to was:

> The train crew had very little understanding of what constituted a safety management system and were only capable of assessing risks relative to their understanding of tasks.

Although it is obviously desirable to train staff in how to manage the safety of the operations in which they are engaged, there is little point in training operational staff in matters to do with organisational management, since skills in that area are unlikely to make them safer operational staff.

The train controller, in the exchange with the train driver quoted in the communications section of this report, where the train controller directed the train driver to proceed into the possible path of a suicidal trespasser, was the subject of questions asked of Ms Love relating to the effectiveness of the safety management system training that staff had been provided with. The following evidence in relation to that matter was given by Ms Love:

> Q: Do you tell train controllers when you train them that it is the driver's call and the driver's call only as to whether or not the driver thinks that it is safe for him to proceed, because, after all, he is there in charge of the train and responsible for the passengers, not the train controller? Do you tell train controllers that message?
> A: That has been conveyed in the SMS training, yes.
> Q: It does not seem to have got through to that particular train controller does it?
> A: No it hasn't.
> Q: Can you explain why?
> A: Our SMS round 2.4 was where we put all our rail safety workers in a team based environment to train together. The feedback from train controllers was very poor in relation to that round of training. They didn't feel that it was very relevant to them and that it was well targeted to their job, and I can only assume from that that there is a cultural issue around train control that is less mature in terms of moving toward the sort of safety culture we would like to have.
> Q: SMS training is safety management system training?
> A: Yes.
> Q: And does part of the training include a discussion of Professor Reason's model of the way in which accidents occur?

A: Yes, their last round 2.4 certainly did.

Q: Do you think it is of much benefit to operational staff to be given training in things such as the model of organisational accidents that Professor Reason is famous for having identified?

A: Not in any detail, no, but I think as an overview it is very helpful for them to understand from a human factors perspective that there are lines of defence in a safety management system, some of them engineered, some of them human factors based, and the Swiss cheese model is a useful visual cognitive reference point to understand how important it is to ensure that all those lines of defence are in place, and if they're not in place and the Swiss cheese lines up inappropriately, an accident or incident can result.

It is not difficult to see why a group of train controllers, where the culture, is one of on-time running, would regard training dealing with matters of the kind referred to in this evidence given by Ms Love as irrelevant to the activities that they are required to perform. Theories about the causes of organisational accidents are unlikely to be either of interest to, or relevant to, operational staff whose conditioning has been and remains that the only objective worth pursuing in the conduct of their work is on-time running.

The impression gained from the evidence given about the training provided to train drivers and guards is that there is a recognition of the need for better training, but no comprehension of the best way to achieve the objective of better training staff to conduct their activities safely and efficiently.

After the public hearings were adjourned for the purpose of writing this final report, the Special Commission of Inquiry was delivered five boxes of folders containing policy documents in relation to training. These documents were produced in response to a request by the SMSEP auditors for documents relating to RailCorp's training programs. By the time they were produced, the SMSEP had completed its report. Those boxes also contained some of the documents produced by RailCorp in response to one of the milestones of its 2004 provisional accreditation by ITSRR.

The milestone, which was a condition of RailCorp's 2004 provisional accreditation by ITSRR, appeared under the heading "training and worker competence":

> Within six months the Corporation shall demonstrate a competency management regime, including a risk assessment of its suitability, for all staff undertaking safety critical tasks. Issues to be covered include, but are not limited to:
>
> 1. Accountability for possession by staff of adequate safety skills to undertake required tasks.
>
> 2. Independent risk assessments, for different classifications of staff, of training course requirements, including but not limited to:
>
> (a) duration and content of training for personnel who are new to railway operations;

(b) duration and content of training for personnel who are changing job classification; and

(c) refresher training frequencies, duration and content (including SMS training).

3. Demonstration that the Network Rules, Procedures, OSPs, Train Operations Manual and all other safety requirements are adequately covered in initial and refresher training.

4. Provision of an effective mentoring process for train drivers.

5. Provision to all rail safety workers of handbooks relevant to their particular tasks.

6. Processes for management of any conflicts between:

(a) assessed training requirements and availability of staff for training; and

(b) centralisation of training and assessment in the one organisation, and having an independent check on training outcomes.

7. Requirements for trainers, including but not limited to:

(a) qualifications, skills and personal attributes;

(b) currency of experience; and

(c) knowledge and understanding of safety issues.

8. Processes for on-the-job assessment of safety skills covered in training.

9. Reinforcement of training course content by relating it to actual incidents occurring locally or elsewhere.

10. Emergency and security training awareness for appropriate staff.

11. Reinforcement of safety culture by ensuring that trainers understand:

(a) the commitment to safety of all levels of management; in particular, the corporation's commitment to safety is the first priority ahead of "on time running"; and

(b) the importance of following rules and procedures, and reporting dangerous occurrences or situations, so that fellow staff and passengers are not injured or killed.

In view of the failure to implement all but one of the very clear and precise recommendations of the Glenbrook Inquiry final report in the years since those recommendations were made, it

is almost farcical to expect that an organisation such as RailCorp, with deficiencies in its capacity to systematically analyse its training needs and to design and deliver appropriate training, could achieve one of those requirements, let alone all of them, in the six month period stipulated. The passage of time has proved this to be correct.

It is therefore not surprising that when the safety climate survey was undertaken, most operational staff who were interviewed said the safety management system training was either "rubbish" or "irrelevant". It should have been obvious that such a method for trying to improve the training performance of RailCorp was doomed to failure, given the training and procedures manual that RailCorp issued in October 2003. This was the third revision of that manual. To improve training will require a careful and systematic analysis of training needs, to develop a plan that will take a long time to fully implement. The process will take years, not months. The reasons for such a time scale are set out in the evidence of Dr Edkins:

> This manual provides, as determined by the auditors, a fairly limited guidance in regard to a number of issues, and if I could I will just list some of those issues that were determined.
>
> The first point I would like to make is this manual exists in isolation, with no structured link between it and, if you like, parent corporate policy procedures or documents.

Q: What's the significance of that and what are you actually referring to there?

A: The significance of that is if the document is not linked to a core suite of documents that has the appropriate authority, there's a danger that this document exists in isolation and has no authority and, more to the point, is not followed by particular parts of the organisation. It's no good having a document sitting in isolation and potentially not recognised by key individuals within the organisation. It may mean they may go off and develop their own training, and so forth, without significant consultation with the Australian Rail Training group. There was certainly evidence of that within this audit. For example, this particular document, this policies and procedures manual, was not recognised by key training design and development staff within ART. So within ART itself some staff interviewed were unaware of this particular document.

Q: ART stands for?

A: Australian Rail Training.

Q: That's operated where?

A: It's a centre at Petersham which is responsible for a number of issues, particularly training for drivers and guards.

Q: Thank you.

A: So apart from the manual existing in isolation and having it not linked to parent documents, if you like, and the fact that there was a number of key training design development staff who were unaware of this document, the guidance provided in the document is at quite high level, it is very generic. I think I've mentioned the issue of section two and the course design development and lack of detail regarding both a training needs analysis and a task analysis, but in addition, what was quite interesting from the audit process is that important sections of the document were

> missing. One of the very important parts of a document like this is a process on which to clearly evaluate the type of training that has been developed. In other words, you need a good process in place to ensure that products and services you're delivering as a training provider to the organisation are indeed the ones that the organisation wants and are being used appropriately.

In view of the unchallenged findings of the SMSEP in relation to the training procedures manual, the several thousand pages of documents in relation to training policies that have been developed in response to the milestones imposed as a condition of provisional accreditation are certain to have the same, if not greater, deficiencies than the training and procedures manual.

Mr Garling SC, who appeared for RailCorp, although not challenging the SMSEP report, submitted that:

> …vocational training had, broadly speaking, been undergoing a great development in the 1990s, from being classroom-based and didactic-style teaching to competency based assessments, vocational training and assessment. The expert report recognises that the training facility has progressed a very great way in obtaining all of those necessary fundamental framework qualifications.

They have, however, been developed in isolation without a needs analysis and thus are not based upon a systematic and integrated approach to training that should form part of an overall integrated safety management system. The needs analysis is required to determine what skills a particular person is required to have to carry out the tasks of a position safely and efficiently.

It is obvious that if RailCorp, and the SRA, could not achieve the implementation of the straightforward recommendations from the Glenbrook Inquiry final report in a period of two years, RailCorp would not be able to achieve what it was supposed to do as a condition of provisional accreditation. What it was required to do by the accreditation milestones document was not done within the six month period.

What RailCorp should be doing, under the supervision of the safety regulator, is designing a systematic approach to training which accords with what is accepted practice in all complex industries.

The first part of the design of an adequate system for training is to consult with the individuals involved in the particular area, such as train drivers, guards, signallers and the like, to identify the needs of the particular individuals.

Considerable work has already been done by overseas organisations. For example, the approved code of practice for train driving issued in October 2002 by the Railway Safety and Standards Board in the United Kingdom provides considerable guidance for both regulators and train operating companies as to what is required in the training of train drivers. The code of practice is Figures 15.1 to 15.5. The document is set out in full, so that it can be contrasted with the milestones required by ITSRR. The differences in precision and identification of the needs to be met and the skills appropriate are readily apparent.

Approved Code of Practice - Train Driving

Part D
Training

10 Training of drivers

GO/RT3251 **Section 6 - Training**

6.1 General

6.1.1
Train operators shall ensure that systems are in place to provide the training necessary to achieve and maintain performance at the required standard, for driving trains and carrying out other responsibilities required by this document.

6.1.2
Training requirements shall be determined by train operators' to meet their individual operational needs, but shall be generated by reference to:

a) the risk assessment process defined in section 4.1 of this document

b) an analysis of all aspects of the train driving role in the context of their operation.

6.1.3
National occupational standards for train driving shall be considered both as a top-level checklist to ensure that train operators' identified training requirements are comprehensive in scope, and as a possible structure into which train operators' particular training requirements may be consistently organised.

6.1.4
Train operators shall have processes in place to ensure all those who deliver or assist in the delivery of training for their drivers are competent to do so.

6.1.5
Processes shall be in place to ensure information relating to driving performance is passed, in both directions, between all those who are responsible for, or involved in, driver training, assessment and management.

6.1.6
Training shall be recorded so as to identify the date, duration, purpose, content, and the trainers involved. Training records shall also include:

a) the detailed results of assessments of performance made during training and on completion of training, identifying actions required and taken to address shortfalls in competence

b) information passed in compliance with section 6.1.5.

6.2 Basic training for drivers

6.2.1
Basic training, leading to initial certification as a train driver, shall provide:

a) formal training in driving theory, including rules, procedures, the necessary technical knowledge and the basic principles of learning routes

b) in-cab training

c) practical train driving experience.

6.2.2
Such training shall be sufficient for the development and application of the necessary skills and underpinning knowledge, to enable the driver to undertake competently the following core driving activities:

Figure 15.1 RSSB approved code of practice – train driving (page 1)

Approved Code of Practice - Train Driving

a) personal preparation for train driving

b) prepare and mobilise trains, including all checks necessary to establish the fitness of a train for service, and checks of the availability of safety systems and equipment

c) shunt, couple and uncouple trains, where applicable

d) operate trains in service, including controlling, monitoring and maintaining progress

e) operate trains in foreseeable abnormal and degraded operations, and respond to foreseeable emergency situations, including faults and failures in service, taking trains out of service and actual and potential hazards on the line

f) immobilise trains and hand over trains in service

g) dispose of trains, where applicable.

Simulation shall be used as one of the means of meeting the requirements of section 6.2.2 e).

6.2.3
Where applicable to each of the core driving activities listed in section 6.2.2, the training shall include:

a) relevant rules and instructions, including their practical application in normal operations and foreseeable abnormal, degraded and emergency situations

b) opportunities and the appropriate training media to support the development of drivers' knowledge of the routes over which they will be required to drive in normal operation, and in foreseeable abnormal and degraded driving conditions

c) opportunities for drivers to acquire practical driving experience, under direct supervision, including driving appropriate trains over routes which the driver will be required to drive, in a range of different driving conditions, including poor visibility and low adhesion conditions

d) instruction in and practice of defensive driving techniques in normal, perturbed and emergency situations

e) safety-critical communications between drivers, signallers and others involved in train movements, including the correct operation of communications equipment, use of speech protocols and terminology

f) communications between drivers, other train crew, and (where applicable) passengers, including the correct operation of all available internal communications equipment

g) response to failure or non-availability of train-borne safety equipment, and the development of understanding of the consequences of, and responses to, common faults and failures

h) train protection and evacuation procedures

i) an appreciation of the role and responsibilities of signallers and their workload.

Simulation shall be used as one of the means of meeting the requirements of section 6.2.3e) (safety-critical communications).

Figure 15.2 RSSB approved code of practice – train driving (page 2)

Approved Code of Practice - Train Driving

6.2.4
Where a trainee is required to drive trains for training purposes, the trainee shall be directly supervised by someone who is both:

a) competent in train driving, and

b) qualified to provide practical training in the operational driving cab environment.

6.2.5
Before being permitted to drive trains, trainees shall have reached a level of competence which is sufficient such that, when driving under supervision, the risk to the safety of operations on Railtrack controlled infrastructure is as low as reasonably practicable.

6.3 Training for skills renewal and development
6.3.1
For all drivers, training systems shall be in place to enable them to renew and develop train driving skills and the necessary underpinning knowledge, following initial certification.

6.3.2
Specifically, training systems shall provide for:

a) renewal of drivers' knowledge of routes over which they have driven infrequently

b) development and practice of appropriate responses to abnormal and degraded operations and emergency situations

c) practice and development of competence in safety-critical communications

d) change to the infrastructure of routes over which they drive

e) the introduction of new or altered routes

f) the introduction of new or altered trains or equipment

g) changes to operating rules and procedures

h) new or improved train driving techniques

i) dealing with faults and failures on traction and rolling stock

j) refreshing of knowledge and skills in response to changes to the basic driver training curriculum (eg safety-critical communications, use of safety equipment, operations in abnormal and degraded conditions and emergency situations).

Simulation shall be used as one means of meeting the requirements of section b).

6.3.3
Train operators shall have systems in place to ensure that personnel who train, monitor or assess the competence of drivers, maintain and develop their own skills and necessary underpinning knowledge.

6.4 Evaluation of training
Train operators shall have systems in place to evaluate the effectiveness of the training (including route training) provided for their drivers.

Evaluation shall be carried out using information derived from:

Figure 15.3 RSSB approved code of practice – train driving (page 3)

a) performance monitoring and assessments (including data from data recorders)

b) safety incidents involving that train operator's drivers or the routes over which they operate

c) performance against company safety performance indicators and safety objectives

d) those who train, monitor the performance and/or assess the competence of drivers

e) current trainees and drivers who have recently completed training

f) periodic independent assessments of the standards of training delivery in training schools, depots and during practical handling and front-end turns

g) results of the analysis carried out to comply with section 6.1.2 of this document.

The frequency of evaluation shall be determined by each train operator as part of its review of safety performance, but shall not be less than once every three years. Results of the evaluation should be fed back into the training process at the appropriate stage.

6.5 Training system documentation

Train operators shall document their training systems in a way which justifies:

a) the process used to identify training needs

b) the contents of the developed training course, given the company's activities and the required standards of competence

c) the time and other resources allocated to each component of training

d) the training methods and media to be used

e) measures used for assessing progress and performance during training and the means of applying them (eg demonstration, observation in the workplace, question and answer, etc)

f) processes for establishing training needs of new employees with previous driving experience

g) processes for, and frequency of, evaluation of training

h) processes for ensuring that training is recorded and safety information is passed in both directions between those responsible for training and those responsible for the assessment, monitoring and management of driver performance

i) processes for providing relevant training to those who train, monitor the performance of, or assess competence of, drivers.

RACOP

10.1 Development of a driver training programme

10.1.1

Training and assessment requirements should be determined with reference to a risk analysis of the routes and train types operated by the company, and analysis of the training needs of its drivers operating its traction over these routes. Consideration should also be given to national occupational standards, developed and published by the Railway Industry Training Council (RITC). The core units identified by the RITC for train driving are listed in Appendix F. Appendix G presents a comprehensive driver competence list derived from the

Figure 15.4 RSSB approved code of practice – train driving (page 4)

national occupational standards, with additional detail relating to performance and assessment requirements. Specific, additional information on route learning is provided at Appendix J.

10.1.2
The training analysis process should initially determine the competence requirements of train drivers, including detailed descriptions of:

a) what they are required to do

b) the standard to which each activity must be performed

c) the conditions under which each activity must be performed

d) underpinning knowledge required to support each activity.

These competence requirements should then be mapped onto national occupational standards. This would enable resulting training to be directly linked with the award of National Vocational Qualifications for train driving, if so required.

10.1.3
Having determined what is to be performed, the process should then assess how these activities should be taught. This process should consider the knowledge and skills required to be learnt, and the effectiveness of training media to support these activities. Consideration should also be given to the degree to which the training media are required to look (physical fidelity) and operate (functional fidelity) like the real equipment.

10.1.4
Once the training media requirements have been determined, the training course structure should be designed. This process should initially define lesson or module assessment requirements and methods by reference to the identified competence and knowledge requirements. Once this is done, training content should be created, to present information and/or skills training in support of the identified competence and knowledge requirements. Training media should be developed or procured, and instructor lesson plans and course notes prepared, along with student handouts. The completed course should then be piloted, to ensure its effectiveness.

10.1.5
This process should be regularly reviewed and revisited in response to feedback from:

a) driver managers (commenting on performance of newly qualified drivers)

b) driver trainers (commenting on effectiveness of course content or training media)

c) revision of driver performance requirements arising from revisions to GO/RT3251 and national occupational standards

d) changes to company policy

e) changes to traction and/or routes driven.

Guidance

10.1.6
Detailed guidance in the conduct of effective training analysis, design and development, is provided in the associated 'Guide to Good Practice in Training'.

Figure 15.5 RSSB approved code of practice – train driving (page 5)

Figures 15.1 to 15.5 are only part of the approved code of practice for train driving in the United Kingdom, but it gives an indication of the kind of precision that such analysis should contain.

Secondly, in addition to identifying the training needs and task analysis features of any training, the training should be delivered in a structured way, based upon the needs that data identifies from time to time. This necessarily involves the accurate collection of safety critical data, which has been discussed in some detail in the earlier chapter on safety documentation. In view of the criticisms made by the SMSEP of the training and procedures manual, it is equally obvious that there must be proper safety document control of all training related documents.

In view of the content of the training milestones that ITSRR has imposed, and the inability of RailCorp to produce a training procedures manual which is of an acceptable standard, it is apparent that the development and integration of training as part of the overall safety management system of RailCorp is an area where expert assistance is required.

In the United Kingdom, guidelines have been promulgated for the assistance of train operating companies on what is needed to be developed for adequate training. The United Kingdom document is titled "Railway Safety: Good Practice in Training, a Guide to the Analysis, Design, Delivery and Management of Training". It was last issued in October 2002 and sets out in detail the methods for identifying training requirements, for designing a training program, for training delivery, for assessing competence, for evaluating and updating a training course and for developing the skills that trainers require and the resources they need to carry out their responsibilities. The document is lengthy but I have included it as Annexure H to this report because it appears to be a superior guide to the way in which training should be developed.

RailCorp needs the assistance of appropriate experts: to develop its training system; to integrate it into its overall safety management system; to ensure the necessary controls are in place to manage all relevant safety documentation; and to ensure the ongoing implementation and improvement of the type of training of operational staff which best ensures a safe and efficient rail service.

16. Rail Accident Investigation

The final report of the Special Commission of Inquiry into the Glenbrook Rail Accident contained a number of recommendations in relation to the creation and role of an independent Rail Accident Investigation Board. The evidence in this Inquiry has confirmed that all those recommendations should have been implemented. While some recommendations have been implemented, in part only, the majority were not.

The recommendations relating to the Rail Accident Investigation Board were recommendations 80 to 95 of the Glenbrook final report:

80. The second interim report recommended the establishment of a Rail Accident Investigation Board.

81. The Rail Accident Investigation Board should have as its primary role the independent, impartial and unbiased investigation of accidents and incidents for the purpose of identifying any matter which may have or did contribute to an incident or accident or which might contribute to an incident or accident in circumstances similar to those which occurred.

82. The legislation should provide that the Rail Accident Investigation Board may conduct its own investigations or require an accredited rail organisation to conduct an investigation and provide it with a report.

83. The legislation should provide that any incident or accident involving an accredited organisation be notified to the Rail Accident Investigation Board in writing as soon as practicable after its occurrence and in any event no later than 24 hours after the occurrence.

84. The Rail Accident Investigation Board should have the power to conduct public hearings at which witnesses can be compelled to attend and be examined.

85. The Rail Accident Investigation Board should collect, analyse and report on data relating to rail safety matters within New South Wales.

86. The Rail Accident Investigation Board should have as one of its functions the collection and analysis of information in relation to rail safety from interstate and overseas.

87. The Rail Accident Investigation Board should have as one of its functions the ongoing liaison with overseas rail safety organisations, including membership of and participation in international railway organisations and conferences.

88. The legislation should provide that the Rail Accident Investigation Board be required to provide such information to the Department of Transport, the Rail Safety Inspectorate and any accredited rail organisation.

89. The legislation should provide that proceedings of the Rail Accident Investigation Board and communications made in the course of its investigations may not be

disclosed, other than by the Board, and may not be used in any legal or other proceedings except a prosecution for perjury or a prosecution for an offence under the relevant rail legislation.

90. The legislation should provide that save for coronial proceedings an investigator authorised by the Board is not compellable as a witness in any court proceedings.

91. The legislation should provide that any statement by a member or officer of the Rail Accident Investigation Board relating to an investigation is inadmissible in any legal, disciplinary or other proceedings.

92. The legislation should provide that no member or officer of the Rail Accident Investigation Board may disclose any information obtained by the Board in the course of the discharge by it of its functions.

93. The Rail Accident Investigation Board should maintain a confidential system for the reporting to it of any incident which did or may have caused an unsafe activity or outcome in the course of rail operations.

94. The Rail Accident Investigation Board should make public each of its investigation reports.

95. The Rail Accident Investigation Board should publish an annual report to be tabled in Parliament.

The recommendation to establish a Rail Accident Investigation Board, with the characteristics described in those recommendations, was not implemented in New South Wales.

In the United Kingdom, a Rail Accident Investigation Branch, with the same degree of independence as that recommended in the Glenbrook Inquiry final report, has been established as a result of the recommendations of Lord Cullen in the Ladbroke Grove Inquiry. In the European Union, independent accident investigation bodies of the kind recommended in the Glenbrook Inquiry report are now mandatory. Directive 2004/49/EC of the European Parliament and of the Council, of 29 April 2004, mandates relevantly as follows:

> A safety investigation should be kept separate from the judicial inquiry into the same incident and be granted access to evidence and witnesses. It should be carried out by a permanent body that is independent of the actors of the rail sector. The body should function in a way which avoids any conflict of interest and any possible involvement in the causes of the occurrences that are investigated; in particular, its functional independence should not be affected if it is closely linked to the national safety authority or regulator of railways for organisational and legal structure purposes. Its investigations should be carried out under as much openness as possible. For each occurrence the investigation body should establish the relevant investigation group with necessary expertise to find the immediate causes and underlying causes.

The similarities between what is now mandated in the European Union, and what exists in the United Kingdom, in Canada, the United States and in Australia at a national level, in the form

of the ATSB, and the Rail Accident Investigation Board recommended in the Glenbrook final report are obvious. Had the recommendations in the Glenbrook Inquiry final report been implemented, New South Wales would be at the forefront of rail accident and incident investigation.

After this Inquiry commenced, and without this Special Commission of Inquiry being given an opportunity to comment on the proposed legislative changes introduced by the government, the parliament enacted the Transport Legislation Amendment (Safety and Reliability) Act 2003.

It is a matter for government to introduce whatever legislation it wishes. When a major public inquiry concerned with rail safety, established by the government, is proceeding, it is to be expected that at the least, any rail-related proposals, including in particular any safety-related proposals, would be subject to the scrutiny and comment of this Inquiry.

The third term of reference requires me to make recommendations for the improvement of the safety of rail operations, which includes improvements in relation to rail safety investigations.

By section 42W of the Transport Administration Act 1988, as inserted by the Transport Legislation Amendment (Safety and Reliability) Act 2003, the Minister for Transport Services is to review the operation of the amendments made by the Transport Legislation Amendment (Safety and Reliability) Act 2003, to determine whether the policy objectives of the amendments remain valid and whether the amendments are appropriate for securing those objectives. That review is to be undertaken as soon as possible after the period of 12 months from the date of assent to the Transport Legislation Amendment (Safety and Reliability) Act 2003. A report of the outcome of the review is to be tabled in each House of Parliament within three months of the end of the said 12 month period.

During the course of the second reading of the Transport Legislation Amendment (Safety and Reliability) Bill the government advised parliament that this review would provide an opportunity for it to consider the final outcome of this Inquiry. Parliament was also advised that the government "would reconsider safety legislation following the receipt" of the final report.

My consideration of this somewhat unusual safety-related legislation must commence with the observation that the model for safety investigation that has been implemented in accordance with this legislation includes the accident investigation body being a division of the so called "independent" transport safety and reliability regulator, known as ITSRR. The relevant provision provides in terms "the ITSRR is to have a division called the Office of Transport Safety Investigations". This is not what was recommended in the Glenbrook final report. What was recommended was a truly independent accident investigation body, not one that is a division of the safety regulator. This, as it will appear, is not a body that is independent of all the actors in the rail industry.

The Chief Executive of ITSRR gave evidence about how the legislation was developed. She stated:

> I was responsible for pulling together a project team to provide that advice through Mr Christie to the Minister, so I was responsible for the overall project direction, for ensuring that we had adequate skills and capacities within that

> project team to provide that advice and to manage the time lines in order to get the legislation in place, which did occur later in 2003, and to ensure that we had the planning in place to ensure that we had an effective regulator operational from January 2004.

There can be little doubt that Mr Christie convinced the government to reject the Glenbrook final report recommendations and accept his view. His is a view at odds with overseas instrumentalities and rejected by all relevant expert witnesses in the Glenbrook Inquiry. I noted in the Glenbrook Inquiry final report that Mr Christie was the only witness who did not acknowledge the possibility of a conflict of interest where a body required to ensure standards of performance and reliability was also required to ensure the safety of the travelling public at all times.

The Glenbrook final report recommended a Rail Accident Investigation Board which was legally and structurally independent of the rail safety regulator, so as to avoid any possible conflict of interest. That opinion was formed after hearing all the evidence on that question during the Glenbrook Inquiry. As referred to above, all the expert witnesses, with the exception of Mr Christie, favoured a structurally and legally independent rail accident investigatory body. Mr Christie believed the accident investigation body could be housed within the safety regulatory body. That proposal was rejected by me in the second interim and final reports of the Glenbrook Inquiry. It is not what has happened in the United Kingdom, Canada, the United States of America, the European Union or in Australia at the national level, in the form of the ATSB. In those countries it is recognised accident investigation must be independent of the regulatory bodies, because the conduct of the safety regulator itself would likely be a matter for scrutiny by the accident investigation body when it investigates an accident.

To locate the investigatory body within the same organisation as the safety regulator produces the obvious conflict of interest, that a division of the safety regulator is investigating the conduct of the safety regulator when an accident has occurred.

The type of accident investigation body recommended in the Glenbrook Inquiry reports and which has been established in the above countries is a body which conducts its investigations impartially and independently of any actors involved in the rail accident under investigation. Such a body must be free from any interference by government, the rail safety regulator or rail organisations and be able to act without fear or favour in relation to its findings as to the cause of any rail accident and any recommendations made for safety improvements. In order to discharge those functions properly, the investigation body must have adequate funding and technical personnel.

Mr Robert Lauby, the Special Commission's Lead Investigator, and a distinguished rail investigator formerly employed by the National Transportation Safety Board (hereafter referred to as the NTSB), gave evidence during the first stage of the Inquiry which reinforced the importance of the lead investigatory body being independent of other bodies in respect of rail safety. Mr Lauby referred to the independence of the NTSB, the lead accident investigation body in the United States, and said:

> Therefore, when commenting on transportation matters in the United States, the safety board is able to do so without essentially upsetting their boss. They are free to say whatever needs to be done. Of course, they do this in a

> responsible manner, but they are free to say whatever needs to be said about transportation safety. They are free to make whatever conclusions need to be concluded on tragic accidents and work very hard towards trying to prevent accidents in the future.

The deficiencies in the present investigation model and structure are numerous.

Deficiencies in investigation model and structure

It is hardly likely, having regard to the fact that the Chief Investigator of OTSI is appointed, and may only be terminated, and that his salary, wages and conditions of employment are fixed, on the recommendation of the Chairperson of the Advisory Board, that the Chief Investigator is likely to reject any advice given by the Advisory Board or its Chairperson.

The New South Wales public transport system is owned and run by government bodies and it is politically sensitive because commuters are also voters. In those circumstances, there is an even greater need for transparency and independence in the investigation of safety incidents and accidents and in the public reporting of those investigations.

Whilst it is acceptable for the Chief Investigator of OTSI to obtain independent expert assistance in an accident investigation, that is to be distinguished from there being a permanent Advisory Board without accountability, where the Chairperson of that Board has power to decide the identity of the Chief Investigator, to determine his or her conditions of employment, and the power to terminate the Chief Investigator's employment. Under the legislation, the Chief Investigator is required to refer any report that he makes in an accident or incident investigation to the Advisory Board and consider the advice of the Advisory Board, which may only be verbal advice. This creates at least the perception that the Advisory Board, in giving advice to the Chief Investigator, may influence the contents of the reports of the Chief Investigator. After all, that is the whole purpose of the advice being sought. Given the perception that the influence of the Advisory Board over the Chief Investigator is capable of reducing the impartiality and objectivity of investigations, the existence of the Advisory Board is contrary to the public interest. It is not suggested that the present Chairperson of the Advisory Board or its other members would act in such a fashion, but nevertheless the perception remains that deficiencies in the management or regulation of railway operations could be concealed by this process. This perception must not remain and the Advisory Board must be abolished.

The second deficiency in the structure of accident investigation under the current legislation is that the Advisory Board has no accountability. The imposition of accountability is one means by which the public can ensure some degree of diligence in organisations responsible for public safety.

The establishment of the Advisory Board is said to be justified on the basis that it evaluates the quality of investigations and gives technical advice to the investigators. There are a number of problems with this argument. The first is that it assumes that the investigators, and in particular the Chief Investigator, do not have the skill or capacity to conduct a competent and independent investigation. If that were the case, the person holding the position of Chief Investigator should not hold it. Secondly, investigations are conducted in accordance with an Australian Standard for railway accident investigations, which ensures that the investigation is conducted in accordance with acceptable standards. Thirdly, OTSI could, if it required

expert assistance, retain the services of a suitably qualified external expert to assist in the investigation.

The position of the Advisory Board vis-a-vis ITSRR also has an adverse influence on the accountability of ITSRR, thereby removing one of the mechanisms by which the public can ensure diligence in ITSRR in the performance of its regulatory functions. One example of the way in which this may occur will suffice. The Advisory Board may advise ITSRR that something should or should not be done. The ITSRR may accept that advice, and act in accordance with it. A major accident may then occur as a result of that decision. The ITSRR may say that its course of conduct was based upon the advice that it received from the Advisory Board. The Advisory Board may say that its advice did not have to be accepted by ITSRR, that ITSRR had a choice to accept or reject the advice. Where, in those circumstances does the accountability lie? Without such accountability, how can the public ensure an adequate safety performance by organisations to which it looks for ensuring the safety of rail operations?

The position of the Chairperson of the Advisory Board, on any view, is untenable. The Chairperson obviously exercises executive power. The removal of the Chief Investigator of OTSI can only be effected on the recommendation of the Chairperson of the Advisory Board. It is relevant to note the use of the word "only" in this context. That is plainly an exercise of executive power, but there is no accountability for the making or failure to make such a recommendation by the Chairperson when appropriate.

Another example of the exercise of executive power by the Chairperson may be found in section 67 of the Rail Safety Act 2002, which relevantly provides:

> The ITSRR or the Chairperson may inquire into any railway accident or incident that may affect the safe carrying out of railway operations.

If the Chairperson can exercise that power, then his role is not limited to an advisory function, but under the legislation he has no accountability.

If there be any doubt about whether the Chairperson exercises executive power, subsection 42V(2) of the Transport Administration Act 1988 makes that crystal clear. It provides:

> For the purposes of exercising functions relating to a rail safety inquiry or a transport safety inquiry, the Chairperson may arrange for the use of any staff or facilities of the ITSRR.

The executive power to be exercised by the safety regulator should be exercised only by the Chief Executive. The Chief Executive, in the exercise of his or her powers, may retain the services of expert consultants to provide any necessary expertise that the safety regulator may not have within its own staff. It does not need an Advisory Board with a Chairperson having the power to exercise executive power directly or indirectly, thereby diluting the accountability of the Chief Executive of the safety regulator, ITSRR, for the regulation of rail safety. Again, the Advisory Board should be abolished.

The third deficiency in the present structure also relates to the Advisory Board. It might advise ITSRR in regard to the acceptability of a particular request for accreditation. If ITSRR accepts and acts on that advice and accredits the organisation, an issue of

independence could arise in any subsequent investigation. If there were an accident and the investigation revealed the advice provided by the Advisory Board in some way contributed to accreditation being granted to an organisation which had inadequate safety management, what advice or actions would the Advisory Board be likely to take in respect of any report that names the Advisory Board as a body which has indirectly contributed to the occurrence of that accident? Would the safety regulator and the Chief Investigator really feel at liberty to criticise the actions of the Advisory Board and the Chairperson of the Advisory Board? In my opinion, in reality, this is not likely. Under the legislation, the Chief Investigator is appointed on the recommendation of the Chairperson of the Advisory Board, may be removed from office only on the recommendation of the Chairperson, and the salary, wages and conditions of employment of the Chief Investigator are fixed by ITSRR, again on the recommendation of the Chairperson of the Advisory Board. For these reasons, too, the Advisory Board must be abolished.

A fourth deficiency in the present structure of accident investigation relates to resources. The current procedure is that, when conducting investigations, OTSI can utilise staff of ITSRR's Technical Panel to assist it in the conduct of its investigations.

Mr Nicholas Bahr, Safety Management System Review Director, identified two potential problems with OTSI and ITSRR sharing the Technical Panel. First, Mr Bahr noted the Technical Panel might be required to assist OTSI in its investigations, resulting in its expertise not being available to the regulator for purposes such as audits for compliance and accreditation. If OTSI were undertaking a large-scale investigation, the Technical Panel's resources could be engaged for long periods. Secondly, in its work in investigating an accident, the Technical Panel may identify a failure to comply with conditions of accreditation which would attract sanctions. OTSI is required to be a non-punitive investigative body and in those circumstances it must not pass on any information relating to non-compliance with conditions of accreditation because that may involve sanctions of a punitive nature. What would the Technical Panel then do if subsequently asked to provide expert assistance for a compliance investigation?

Another problem with sharing the resources of the ITSRR Technical Panel with OTSI is that the Technical Panel, whilst assisting ITSRR in an accreditation application, may provide assistance which satisfies ITSRR that accreditation should be granted. A serious accident may then occur because of the advice given by the Technical Panel. This may not be immediately obvious, but could arise during the course of an OTSI investigation. If the Technical Panel is involved in the investigation of the accident, clearly a conflict of interest would exist.

Power to initiate an investigation

A question arises whether OTSI can of its own motion initiate an investigation of a railway accident or incident. Under the legislation that created OTSI, namely the Transport Legislation Amendment (Safety and Reliability) Act 2003, as amended, section 42R, which was inserted in the Transport Administration Act 1988, as amended, established OTSI. By virtue of subsection 42R(1), OTSI is a division of ITSRR. By subsection 42S(1), the head of OTSI is the Chief Investigator. His appointment, wages and conditions of employment are made and fixed respectively, by ITSRR on the recommendation of the Chairperson of the Advisory Board, and the employment of the Chief Investigator may only be terminated by

ITSRR on the recommendation of the Chairperson of the Advisory Board: see subsections 42S(2), (3) and (4).

The Chief Investigator is not subject to the direction and control of ITSRR in respect of the exercise of any functions relating to a rail safety inquiry (subsection 42S(6)(a)) or any function delegated to the Chief Investigator by the Chairperson of the Advisory Board under any Act (subsection 42S(6)(c)). The Chairperson of the Advisory Board may delegate to the Chief Investigator the function of carrying out a rail safety inquiry under section 67 of the Rail Safety Act 2002. Under subsection 67(1) of the Rail Safety Act 2002, ITSRR or the Chairperson of the Advisory Board may inquire into any railway accident or incident that may affect the safe carrying out of railway operations. The Minister for Transport Services may also require the Chairperson of the Advisory Board to inquire into and report to the Minister on any railway accident or incident that may affect the safe carrying out of railway operations or the personal security of any railway employee or member of the public using a railway or in or on railway premises: subsection 67(3).

Under section 42V of the Transport Administration Act 1988, as amended, the Chairperson of the Advisory Board, when exercising functions relating to a railway safety inquiry, may arrange for the use of any staff or facilities of ITSRR, and the Chairperson may delegate to an authorised person, presumably including the Chief Investigator of OTSI, his functions under any Act.

Section 108A(2) of the Rail Safety Act 2002, as amended, states that the functions of the Chairperson of the Advisory Board are to conduct rail safety inquiries and to report on these inquiries. This gives the Chairperson wider powers to conduct inquiries without there having been an accident or incident: section 67.

Mr Singleton, on behalf of ITSRR, in his submissions on whether OTSI could commence to investigate a railway accident of its own motion, submitted the legislation was sufficiently clear to permit the Chief Investigator of OTSI to initiate an investigation. He conceded, however, having regard to the complexity of the legislation, that the power of OTSI to commence an investigation is open to some doubt. He submitted that neither ITSRR nor the Director General of the Ministry of Transport opposed this being clarified, and that neither disputed that OTSI should have this function, and that it should be expressly provided for in the legislation, if it were found to be unclear.

He submitted that a railway accident or incident could be investigated severally by ITSRR and the Chairperson of the Advisory Board. He said this was so lest a serious regulatory failure led to an accident. In those circumstances, ITSRR may be reluctant to investigate its own failures. This submission reinforces, in my view, the need for the Chief Investigator, and OTSI, to have the power to initiate an investigation into an accident or incident.

I am of the view that, in light of the power conferred on the Chairperson of the Advisory Board, it is unclear whether or not OTSI can commence an investigation without being directed to do so by either the Chief Executive of ITSRR or by the Chairperson of the Advisory Board.

It could be argued that since ITSRR can instigate an investigation into a rail accident, given that OTSI is a division of ITSRR, it could itself commence an investigation. It may also be argued that under subsection 42S(6) of the Transport Administration Act 1988, as amended,

the functions relating to a rail safety inquiry pursuant to section 67 of the Rail Safety Act 2002 which are given to OTSI may imply the power to institute an investigation into a rail accident or incident.

The legislation, in my view, is unnecessarily complex and there remains doubt in the circumstances as to the power of OTSI and its Chief Investigator to initiate an investigation into a rail accident or incident. The relevant legislation should be amended consistently with the submissions made on behalf of ITSRR and the Director General of the Ministry of Transport, to remove this doubt, and express provision made for the Chief Investigator and OTSI to initiate such an investigation.

Role of ATSB

For the reasons stated earlier in this chapter, the Advisory Board should be abolished. I repeat the recommendations made in the Glenbrook Inquiry final report that there should be an independent accident and investigation body, having the functions and characteristics identified in the Glenbrook Inquiry final report. Those recommendations need modification as a result of changes to the rail industry since they were made.

The New South Wales rail environment has changed significantly since the final report of the Glenbrook Inquiry. In particular, the functions and business of FreightCorp, the freight operating organisation of the New South Wales government owned railway, was acquired by a private company, Pacific National. The SRA and RIC have been merged to form RailCorp and the country rail infrastructure, including the Hunter Valley network, has been leased by ARTC for operation as part of the defined interstate network. Accidents and incidents on the defined interstate rail network are mandated to be investigated by the ATSB. That organisation has been involved in the investigation of rail accidents in New South Wales, Victoria and Queensland. It can investigate accidents occurring on the defined interstate network or, alternatively, on other rail networks at the invitation of government bodies in each State.

Given these developments since the Glenbrook Inquiry final report was delivered, and the continued need for independent accident investigation, the independent accident investigation body for rail accidents in New South Wales should be the ATSB. There are intergovernmental arrangements that would need to be put in place to ensure that this could occur, but the benefits are obvious. They include a standard approach to rail accident and other transport accident investigations. Wherever a rail accident occurs, it should be investigated by the ATSB. Such an arrangement is consistent with what occurs at present in marine and aviation accident investigations.

Mr Donaldson believed that both ITSRR and OTSI needed an external body checking on them because they can become complacent and make mistakes. He was then asked by Mr Bauer, of counsel, who appeared for the RBTU:

> Q: Do you think a national transportation investigation body might provide such a check?
> A: Yes, and I think, in my opinion, over time it may even come to a national regulator as well, in addition to a national investigation board.

Ms Carolyn Walsh, Chief Executive of ITSRR, was asked by Mr Johnson, Senior Counsel appearing for ITSRR, whether she was in favour of a national regulator. She thought that was a positive concept, because it would make what had to be done in the regulatory sphere easier to manage. She felt it important to take a national approach to rail safety regulation. Her view was it would be quite useful in the industry. She is also in favour of a national standard of accreditation.

In view of the mistakes made in the rail industries in each State with matters such as different gauges, the time, I believe, has also come for national regulation of rail operations. Whether this will happen, of course, is a matter of political will. Such an approach is consistent with the approach that has been adopted in the United States of America and in Canada, and has been demonstrated to be effective and in the public interest where it has been established. For the reasons previously given, the bodies that have been established in New South Wales for this purpose cannot be effective and are not in the public interest.

Although it is necessary for there to be truly independent accident investigation, the sufficiency of such investigation will depend upon the resources available to the investigators. If there are insufficient investigatory resources to properly investigate all incidents and accidents that should be investigated, then the process will fail to identify the safety deficiencies that require remedial action. There not only needs to be a sufficient number of trained and experienced investigators, those investigators need to have the power to retain, for the purpose of the investigation, whatever expertise is required for a thorough investigation to be conducted. The experts retained need to be independent of each actor who may be involved in the incident or accident, including the safety regulator itself.

To this point in time, no incident has arisen where the Technical Panel has provided advice to ITSRR in relation to a particular process, structure or train alleging it is safe and then, acting on that advice, ITSRR has accredited the relevant organisation and it has later been found that the Technical Panel's advice was inaccurate or incomplete, and caused an accident. Under the present structure, OTSI would be required to use the same Technical Panel that provided the inaccurate or incorrect advice for the purpose of investigating the accuracy or correctness of the advice provided. The conflict of interest and duty to provide impartial technical advice is obvious.

Another advantage of the ATSB being the body to conduct the investigation is that it is a permanent body. A permanent body has the advantage that it can conduct investigations of the kind that were conducted during the course of this Inquiry much more efficiently than a Special Commission of Inquiry. It has within its ranks the necessary skills and personnel to conduct such an inquiry. Being a permanent body, it can track the implementation of its recommendations. Not only would a permanent body have the skills within its ranks for the more efficient conduct of major investigations, its own skills would be improved over time. In addition, if necessary, it could co-opt people from rail organisations to an investigation and thus give them the necessary experience to be able to conduct accident investigations within their own organisations. This is, I understand, what happens in the NTSB in the United States of America.

An important reason for having such investigations conducted by the ATSB is that it avoids the conflicts of interest, which have earlier been identified in this chapter. It also avoids the conflict of interest inherent in the investigatory organisation reporting to the same minister as

is responsible for the safety regulator. It would also have the ability to co-opt particular experts, if required, in particular circumstances.

Finally, being part of a national structure, the collection of data relevant to the management of rail safety can be more efficiently performed if there are standard procedures for the definition of matters to be recorded under particular categories of incident. If there are mandatory reporting requirements under which safety regulators and railway organisations are required to report incidents or accidents, a national body would have the ability to carry out national data analysis, which may not be able to be done within individual States. New South Wales could benefit from information gathered about events occurring in other places, such as the Footscray accident in Victoria.

This recommendation does not mean that investigations should only be conducted by the independent investigatory body. The safety regulator should also conduct its own investigations for the purpose of ensuring compliance with conditions of accreditation, or prosecuting breaches of regulations, relating to matters such as fatigue management or drug related issues such as "just culture" regulations, which would not be open to the ATSB unless it was relevant to an accident.

The role of the investigative body, such as the ATSB, is to conduct investigations for the purpose of learning why the incident or accident occurred and making appropriate recommendations. Such recommendations may be confined to the individual organisation or have effect Australia wide, which may prevent a recurrence of similar accidents in States other than New South Wales.

In addition to the safety regulator conducting its own investigations to better assist it in the discharge of its functions, accredited rail organisations are obliged, pursuant to subsection 66(1) of the Rail Safety Act 2002, to conduct their own investigations into rail accidents or incidents that may affect the safe carrying out of their railway operations. Reports following such investigations are available to the rail safety regulator. These reports, and those of OTSI, should be able to be reviewed by the ATSB. The obvious advantage of rail organisations being required to investigate every incident or accident is that it can often lead to the discovery of precursors to accidents, which may avoid a catastrophic accident of the kind that occurred at Glenbrook. The Glenbrook and the Hexham rail accidents are classic examples of a breakdown in communications protocols producing very serious consequences. There were many precursor events identifying deficiencies in communications protocols which, if addressed, could have avoided each of those accidents.

This hierarchy of investigations by different organisations is in accordance with the practices that are now adopted in many other countries. Whether or not an investigation is conducted by the independent accident investigation body is a matter for its discretion. If it decides not to investigate, the rail safety regulator should then exercise its discretion whether or not to investigate.

I do not favour attempting to identify specific criteria which would mandate an investigation by the independent rail accident investigation body. There are obvious circumstances where such investigations are justified, even though the amount of loss or damage to persons or property in the particular incident might not be great, but the potential for harm may justify such an investigation. Obviously, if there is a major rail accident such as the Waterfall or the Glenbrook rail accidents, then the national body would investigate. One of the reasons why

Special Commissions of Inquiry are established to investigate such incidents is because there is at present no adequate independent accident investigation body to investigate such accidents. If there were a body which enjoyed the same public confidence which the NTSB does in the United States of America, then there would not be a need to establish Special Commissions of Inquiry to investigate accidents such as the Waterfall rail accident, because there would be a specialist body which enjoyed public confidence in terms of its openness, transparency and integrity to conduct those investigations.

As this last paragraph implies, an ATSB investigation should be conducted, unless circumstances demonstrate otherwise, by the use of public hearings or, if not in public, then with transparency and disclosure to the public of the processes of investigation that are being undertaken and the progress that is being made as it occurs. Reports produced as a result of such investigations should be made available to the public and not subject to any process of vetting.

By the implementation of the recommendations set out in this chapter, the recommendations earlier made for independent accident investigation in the Glenbrook final report can bring about the highest standard of rail accident investigation, which is the standard that the public must receive.

17. Safety Culture

The final report of the Special Commission of Inquiry into the Glenbrook Rail Accident stated:

> For an organisation to have an optimum level of safety performance there must be a safety culture. A safety culture does not consist of a group of individuals proclaiming that safety is their first priority or disseminating safeworking units or safety guidelines. A safety culture consists of the individuals participating as part of a group and being guided in their behaviour by jointly held beliefs about the importance of safety and by their knowledge that the importance of safety is a matter which every member of the organisation believes in and is prepared to support other members of the organisation in trying to achieve the result that there will be no incidents and no accidents. The combination of the individual belief and the sharing of that belief then influences behaviour producing co-operation which in turn ensures that the safety management system works either by application of particular specified procedures or by their appropriate modification to ensure a safe outcome.

The report also stated:

> The evidence in relation to the Glenbrook rail accident demonstrated that the dominant culture in the rail industry in New South Wales is a culture of on-time running.

At the conclusion of the chapter on safety culture in that final report it was said:

> The creation of an adequate safety culture will, I believe, take three to five years. The establishment of an adequate safety culture together with safety management systems within the rail organisations, with external monitoring and supervision by the Rail Safety Inspectorate is, in my opinion, the most effective way by which those organisations and the government can discharge their duties to the travelling public and to those who work on the railways.

One of the significant matters which the interim report demonstrated was the fact a number of senior managers of the SRA were informed of the inherent deficiency in the deadman foot pedal, but despite many warnings no steps were taken to adequately test the device. This lack of action is difficult to understand. The interim report also established that some train drivers were using flag sticks to jam the deadman foot pedal in the set position. This was established by an examination of the underside of the driver's desk on all trains examined. Such matters are classic examples pointing to the lack of a safety culture. Given the reference made in the final report of the Glenbrook Inquiry, it was necessary to determine whether any improvement had occurred in the safety culture of the SRA between that time and when evidence was being heard during this Inquiry.

Mr Robert Hayden, the President of the RTBU, believed that for a period there had been an improvement in safety culture, but the safety culture had again deteriorated. When asked specifically about safety culture Mr Lauby, the Special Commission's Lead Investigator, said:

> The railroad culture is built on a lot of history and a lot of history on the way we do things, and safety has been reflected in that culture over the years, but usually not to the extent that other aspects of railway operations have, such as on-time running etc.

He later said:

> In talking with operators, they are very concerned about on-time running. They are very concerned about, you know, making sure their trains arrive at the station on time or, you know, someone will be upset.
>
> In changing a safety culture again, you start at the top, you change the way you look at safety, you change the way you approach it, you reward people for bringing safety issues to you, you don't punish them, and you basically go through a process where unsafe practices are no longer tolerated.

One can readily understand the importance of on-time running, but it must not be achieved at the expense of safety. Unsafe operations jeopardise efficiency and impact adversely on on-time running. When on-time running is emphasised, safety considerations can often be treated as secondary. It is then only when a serious accident like the Glenbrook or Waterfall rail accidents occur that safety assumes importance in the minds of commuters. The examination of the circumstances of the Waterfall rail accident by this Inquiry demonstrates failures to manage safety in many areas, which itself is indicative of a lack of safety culture.

The culture of the SRA, and now RailCorp, still continues to be focussed on on-time running, without adequate and proper consideration being given to safety matters. Numerous illustrations were given during the course of this Inquiry as to the dominant effect that on-time running has on the culture of the SRA, and now RailCorp. This report has already discussed the incidents involving train drivers being required to take trains with defective driver safety devices, defective radios, or with a broken glass panel on a door, and a train driver being directed to continue to drive a train notwithstanding the presence of a suicidal trespasser on the track in front of his train. Mr Hayden gave an example of a body that was on the Harbour Bridge, apparently as a result of a death being occasioned by suicide, and train drivers being directed to drive over the body. He gave an example of rocks being thrown at a train and the train driver being requested to continue to drive the train in the area where the persons were throwing rocks. He gave evidence of train drivers being abused for refusing to drive defective trains.

The culture of on-time running, which continues to pervade the values, systems, beliefs and behaviours of individuals working on the RailCorp network, both at operational and managerial level, is misconceived. Emphasis on safety in a railway increases the efficiency and punctuality of the railway. An unsafe railway is one where trains are not properly maintained, where train drivers are directed to do things which create a risk of incidents or accidents, which in turn disrupts the rail network. Safety and reliability are two sides of the one coin.

The lack of an adequate safety culture results in train drivers' reports of defects in trains not being recorded or ignored and, on occasions, train drivers being abused for reporting defects. It is trite to say that badly maintained trains will ultimately cause disruption to rail services. This will defeat the very purpose of pursuing the ethos of on-time running. Insisting trains

continue to operate in circumstances where the trains have defects is further evidence of lack of a safety culture.

What is not appreciated by RailCorp is that safety is an integral part of the business it conducts. Ensuring trains are well maintained makes rail operations safer, enhances reliability of services and reduces the level of government subsidy required. The rolling stock must be properly maintained. This means that there must be a proper system for the reporting of defects, recording of reports and remedying the defects. Staff must be properly trained in the performance of their duties and, at operational and managerial levels, all persons within the organisation must work towards the same objective. The culture must be one whereby all employees feel they have the same objective, namely safe and reliable train services.

The evidence given during this Inquiry demonstrated that instead of operational and managerial staff working towards the same objective, relations between the two were so strained that there had developed an "us and them" mentality. Train drivers believed they were blamed for any delay or disruption to services, and employees in supervisory positions adopted a practice of bullying operational staff for the purpose of maintaining punctuality of train services. Perhaps the best example of this is the exchange between a train driver and a train controller about a report of the presence of a suicidal trespasser on the tracks in front of a train. The following exchange took place:

Controller:	Driver one one bravo from operations over.
Driver:	Yeah, the driver of eleven bravo receiving operations.
Controller:	Driver, this person is on the up Illawarra local you can reduce your speed through the area there and keep running. Over.
Driver:	No, it's quite obvious this person has no respect for their wellbeing, their safety, they are wandering onto the line.
Controller:	What assessment is that driver?
Driver:	A risk assessment.
Controller:	You can run at restricted speed.
Driver:	I'm not going to run at restricted speed.
Controller:	You're not going to run at restricted speed?
Driver:	They're around out there.
Controller:	The person is on the up Illawarra local.
Driver:	They're crossing from up and down Illawarra.
Controller:	Driver you can proceed down at walking pace.
Driver:	Excuse me, and what happens if the person takes a dive under the train?
Controller:	Walking pace driver.
Driver:	No, I'm not going out there sorry.
Controller:	On what grounds driver?
Driver:	A risk assessment.
Controller:	A risk assessment?
Driver:	And they're walking around, it's quite obvious …
Controller:	I've sent the duty manager, Arncliffe to go up and apprehend the person. Over.
Driver:	The person is still out there.
Controller:	I've asked the duty manager, the police are nearly there, the duty manager is going out to apprehend the person, thank you.

Driver: And I'll wait 'till they remove the person.
Controller: No, driver you'll remove your train now! (sic)
Driver: This is 11 bravo out.
Controller: An inspector will meet you at Hurstville. Operations out.

Another train driver gave evidence of an altercation that he had with a supervisor as a result of his refusing to drive a train with a defective train radio. The relevant questions and answers were as follows:

Q: When the Operations Control officer at Central station had what you described as the dispute with you as to whether or not the train radio was or was not working, what did you do?
A: I quoted the rule NTR 410 and told him that it was defective and that as the train had now changed ends twice already and it had completed three runs, that it should be going to a maintenance centre for repairs. He told me that it was right - as long as I could keep entering the area numbers manually it was right to continue in service indefinitely, and I said that that was not the case and I would not be taking the train to Glenfield, I would be taking it to Mortdale sheds.
Q: What did he say?
A: He disagreed. He said that there was nothing wrong with the radio apart from the fact that I could enter the area numbers manually. I said no. He then asked me if I had an operational working WB radio, which is the open channel local radio. I said yes. The equipment examiner then said, "Well, the train is okay to run then" and I said, "No, the local radio is not a safety device like the Metronet radio - I have no emergency function and probably 99 per cent of the other CityRail trains do not have a working WB radio in the cab either".
Q: What did you do then?
A: At that stage I basically told him that the only place that I was taking the train was Mortdale. He then got on his mobile phone to Operations Control and spoke to Brian McGregor and had some nasty things to say about me to Brian McGregor.
Q: Use the actual words that he said. What –

Commissioner: As best you can recollect.
A: He swore, Mr Commissioner. Is that okay that I repeat those words?
Mr Barry: Repeat the words that he used.
A: His exact words were, "This cunt is not going to take the train".
Q: That was said about you in your presence?
A: That was said. He was standing on the platform, I was in the cab, and that was said so that I could hear it in the cab and I would imagine all the passengers in the front car and all the passengers standing on the platform also heard it.

Both these episodes are illustrations of the dominance of the culture of on-time running over safety considerations. Many earlier examples have been given in the area of failure to follow communications protocols and the tragic consequences that have, on occasions, resulted from that.

One of the matters weighing against a good safety culture is the authority gradients that operate within the rail industry, which produce the opposite result to shared values and beliefs in relation to safety. The example of the train controller and the train driver being directed to proceed notwithstanding the presence of a trespasser on the tracks in front of him, is one example of the train controller asserting his authority over the train driver. There were other illustrations, the most noteworthy of which was referred to in the interim report, being the reluctance of train guards to apply the emergency brake when it was obvious the trains are travelling at an excessive speed.

Poor relations between management and staff, and between different levels of operational staff, work against the achievement of a good safety culture. An environment of distrust and fear of punishment creates a negative safety culture where staff are reluctant or even fearful of reporting incidents or safety concerns. The SRA's safeworking policy issued on 16 November 2003 states:

> When a safeworking incident occurs, each individual involved must be assessed and their individual culpability in regards to the causal factors of the incident must be determined prior to those individuals either remaining on or being removed from safeworking duties.

The use of the words "individual culpability" clearly denote that the relevant culture when an incident occurs is a "blame culture". In the area of post-incident management the policy document states:

> The RMC shift manager/manager must make a determination on the culpability of each individual involved.

Apart from such procedures identifying that there is a blame culture, they also suffer the deficiency that it is assumed that one or more individuals must always be culpable for some incident occurring, rather than that there are organisational deficiencies to do with such matters as training or fatigue, which require examination and remedial measures taken to avoid a recurrence.

There must be a relationship of trust between operational staff and supervisory staff so that operational staff in those circumstances will be more likely prepared to provide relevant information to supervisory staff. This in turn can then be used to better manage risks and incidents. This authority gradient is well demonstrated by the culture of blame within the SRA. The SRA, and now RailCorp, claimed to have a "no blame" policy. There were two problems with this policy. The first was that it was difficult to understand what the policy was. Its scope was described as follows:

> This procedure is applicable to all safety incidents which do not cause injury or damage sufficient to be reported under other procedures or systems.

> **It should be noted** that persons cannot claim protection under this procedure by making the first report of an incident that would have been reported later, e.g., when damage caused in the incident was noticed by someone else. (Original emphasis)

This is a confusing statement of what is meant by the "no blame" policy. Dr Edkins said in evidence:

> I'm confused about what that means, but it contradicts the previous statement that people both involved and making the report will be protected, but those who report first can't claim protection. I'm not exactly sure what the procedure is trying to illustrate. The point I'm trying to make is if managers don't understand this procedure, how do employees understand the procedure and what the implications will be for reporting various hazards and issues out there within the environment.

The second deficiency in the "no blame" policy was that in practice it was not followed. The evidence before the Special Commission was that if a train driver was involved in an incident, such as a signal passed at danger, even to a minor degree, the train driver was immediately taken off driving duties. Many were sent to Australian Rail Training at Petersham and were subjected to psychological testing. There did not seem to be a defined system which determined which train drivers were sent to Petersham for psychological testing and which were not. As the RailCorp psychologist who carried out the psychological testing, Ms Michelle Small, conceded, train drivers treated in this way could have a perception that they were being blamed or they had psychological problems.

The reason for having a "no blame" culture is to encourage the gathering of important information which can be used to better manage risks on the railway.

The SMSEP report found that, in many areas of the SRA, a blame culture continued to exist. During the course of the safety systems review it became apparent that many RailCorp personnel were not even aware of this "no blame" policy.

Some of the confusion in this area appears to be attributable to the use of the expression "no blame". It cannot be the case that an organisation can ever have a "no blame" policy as such. Otherwise, no one could be held accountable for serious deliberate breaches of safety rules. The purpose of such a policy is to gather information in relation to behaviours which are the result of inadvertent behaviour or mistakes, so as to better inform managerial staff how such errors can occur. This would enable systems to be better designed to minimise the repetition of such events. Dr Edkins believed that what is required is not a "no blame" culture or a "no blame" policy, but a "just culture".

For such policies to work there must be consistency in their application across the organisation. In addition, the reporting of incidents in accordance with such a policy is done in an environment where the person making the report trusts that the person receiving the report will receive it and act on it other than in a disciplinary manner. This does not appear to be the case with the SRA or RailCorp. On the contrary, when any incident has occurred, whether through some oversight or inadvertence, the train driver is often blamed for the disruption to train services because of the consequential effect that it has had in relation to on-time running.

One of the reasons for the demise of what was said to be a better safety culture was the disaggregation in 1996 of the New South Wales railways. That process was part of the policy of both Labor and Coalition governments. In the debate following the second reading of the Transport Administration Amendment (Rail Restructuring and Corporatisation) Bill, the then Shadow Minister for Transport, Mr Photios stated, among other things:

> In conclusion, the Opposition welcomes the continuation of the coalition's policy. Opposition members are delighted that the Minister has dumped the policy he espoused when in opposition, which was to establish a supertransport bureaucracy. The Opposition supports the framework of this legislation and accordingly will not oppose it.

The re-aggregation of the rail infrastructure owner and the commuter train service provider is an admission that the disaggregation in 1996 was a mistake. It certainly fragmented the available knowledge and skill that then existed in the government owned rail system in relation to safety management. It also had a deleterious effect on the morale of the staff who had been part of a large monolithic organisation with which they felt a sense of identity.

A second reason why the culture of the government owned rail organisations has been weak from a safety point of view is that there is no system of reward or encouragement based upon safety performance. Mr O'Donnell, the Chief Executive Officer of Pacific National, regarded rewarding good safety practices as essential for ensuring a safety culture.

A third reason for a weak safety culture was the lack of accountability and responsibility in any individuals for the safety of the organisation. When attempts were made in the first part of the Inquiry to identify who was responsible for the deficiency in the deadman foot pedal not being attended to, no one was prepared to accept responsibility. Rail organisations, such as Virgin Trains in the United Kingdom, require individual safety responsibility statements to be signed by various personnel. RailCorp has introduced what are called safety accountability statements, but these lack clarity and precision. Two of them were in the same terms although they related to two different positions. They also lacked any identifiable basis upon which an assessment could be carried out as to whether or not the particular individuals had complied with their obligations set out in the statements.

It is necessary that there be measurable criteria for the safety performance of individuals in the organisation. For example, in the maintenance workshop, statistical information in relation to the lost time injury frequency rates of employees would indicate the extent to which maintenance operations have been conducted safely. Although statistics are kept in relation to on-time running, they do not appear to be kept for the purpose of setting targets for either the reduction of incidents overall or incidents of a particular class. If individuals were rewarded upon the basis of statistics kept in their relevant area, which could demonstrate the extent to which they were better managing the safety of operations in those areas, then an improvement would, I believe, result.

A fourth reason for the failure to develop an adequate safety culture appears to be related to a lack of leadership. If the message coming from the Board through the Chief Executive to operational managers is a message of on-time running, then that message will be transmitted down the line to line managers and operational staff as the dominant purpose that should influence behaviour. If, on the other hand, from the top management of the organisation down to operational staff the message is made clear, the primary focus of the organisation is

the safe carrying out of its activities, employees will understand that senior management genuinely cares about such matters and this in turn would affect their approach to safety. Mr Graham, the Chief Executive of RailCorp, in evidence said that he had a strong commitment to safety within the organisation. It is too early to tell whether or not that commitment has been transmitted to other staff in such a way as to achieve the outcome required.

Mr Stephen O'Donnell, the Chief Executive Officer of Pacific National, claimed also to have a commitment to safety in the way in which he carried out his duties. One of the matters he emphasised as important were site visits. This enabled him to speak both to management and operational staff and in doing so improved his understanding of the duties being performed by those staff. When making such visits he engaged both the management personnel and the operational staff for the purposes of conveying his view of the importance of safety in the organisation's operations. He stated:

> What's very important in any organisation with the pressures on people – I mean, the most common response I hear from some of my managers at times is, "we are too busy". My first response to that is, "if you have a serious incident, I don't know where your work goes, but you will be spending the rest of the week following up that and investigating that". And when I go and visit a site, I can talk to drivers or operators, I can talk to them about football, I can talk to them about the family, I can talk to them about the business results. What I believe is extremely important is I might see that one person once every five years in an organisation our size. I think it is very important that people in my position, or lower down, that when we interact or communicate with our employees, we give a strong safety message. So I will particularly spend time, you know, to ensure that I am reinforcing the importance of safety to any employees I meet in the normal course of events in the organisation.

It necessarily follows that if the operational staff are to be influenced by the Chief Executive Officer, he must be seen to be engaging with them regularly and emphasising the importance of rail safety in the organisation's operations. As Mr O'Donnell indicated, he may see the same employee once every five years. It necessarily follows that he would have to be in the position of Chief Executive Officer for at least five years for that to occur. In the case of the SRA there was evidence to the effect that it had had eight Chief Executives in ten years. Obviously, the capacity of any one of those individuals to display, on a long-term basis, the sort of leadership which is necessary to establish an adequate safety culture, is very limited if they are being replaced every few years.

A fifth reason why an adequate safety culture has not been established in RailCorp is, as I have already identified, that there was a culture of blame. Mr Lauby in his evidence said:

> In changing a safety culture, again, you start at the top, you change the way you look at safety, you change the way you approach it, you reward people for bringing safety issues to you, you don't punish them, and you basically go through a process where unsafe practices are no longer tolerated.

Such a policy would dictate encouragement to train drivers to report defects in trains rather than discouraging them.

A sixth reason for the failure to develop an adequate safety culture is the way in which safety deficiencies are addressed. Instead of a strategic plan being developed, such as a plan for the efficient and timely fitting of data loggers to trains, activities are conducted in a piecemeal fashion. A similar approach appears to occur in many aspects of train maintenance, where grading of repairs is done in accordance with the extent to which on-time running may be impaired. Piecemeal solutions for the purpose of putting a train back into service are capable of producing the result that the equipment fails to perform, thereby disrupting the reliability of services. These deficiencies can only be addressed by carefully planned procedures, with adequately trained personnel carrying out the work with the necessary resources in accordance with a fully developed safety and reliability plan. If the staff engaged in such activities are left with the belief that management is not prepared to approach the task at hand in a thorough and systematic way and provide adequate resources to carry out the duties properly, they take steps to ensure they are not blamed for the disruptions that follow when the system breaks down. Such steps include failure to record complaints from train drivers or failure to answer the telephone in the maintenance depot.

The evidence suggests that safety culture has deteriorated significantly since the 2000 Olympics. On that occasion the staff were motivated to ensure that the trains would run without incident. As Mr Lewocki, the Secretary of the RTBU, said during the course of the Glenbrook Inquiry:

> If you look at the Olympic period you could almost see our members' chests swell up with pride in the wraps they were getting about delivering a public transport system when everyone was predicting it to be in chaos. Our members are very proud of the work they do and very skilled at it.

During the Glenbrook Inquiry, Dr Leivesley, an expert on safety management, who had been retained by the then Department of Transport, said of the then SRA workforce:

> Most major corporations would pay huge amounts of money to have a workforce that is as dedicated as this workforce, and I think within a highly committed workforce, such as these workers, there is a wish to do their job well.

It should not have been very difficult to tap into that pride and dedication of the operational staff for the purpose of improving safety culture.

Matters such as defects reporting, just culture, proper communications procedures and better industrial relations all have to be addressed as part of the overall process. There is no reason why that cannot be achieved. Many large organisations have achieved similar transformations. As the history chapter earlier demonstrated, the railway organisation which is now RailCorp was once like one large family. It should have been relatively easy to revitalise those cultural features of the organisation to bring about the change in safety culture that is so necessary. This would require strong, capable and committed management.

The Chief Executive and senior management must make it clear that safety must be the cornerstone of the way in which it conducts business. It is also important to ensure that at an individual level operational staff recognise the message, and supervisors instil in them that their primary obligation is to go about their tasks safely. To achieve this they must have

adequate training, to ensure they conduct their activities in a safe and proper manner. The message from senior staff should be continually reinforced.

There is cause for optimism in the response of RailCorp employees to the safety climate survey conducted on behalf of the Special Commission of Inquiry. The SMSEP pointed out that it was not feasible to measure such a complex phenomenon as safety culture with any single tool. In the interest of efficiency a questionnaire can be used to measure perceptions of safety within an organisation, commonly referred to as a safety climate. Safety climate has more passive connotations than safety culture, reflecting attitudes and perceptions of the organisation, and is open to both internal, for example management action, and external, for example economic, influences.

A distinction can be drawn between culture and climate. Climate is an observable part of culture. Culture is the understanding of people's fundamental values with respect to, among other things, risk and safety. Dr Edkins said one of the key aspects of the safety management systems review was the conducting of a safety climate survey, to enable a measurement to be made of the safety climate in the SRA, RIC and RailCorp, because it is a much more tangible thing to measure than safety culture. A well conducted survey, he said, can be used to assess different groups for safety perceptions and attitudes, and compare the views of different organisational groups within an organisation. Because systematic sampling of the entire organisation was not possible in the time available to the SMSEP, sufficient numbers of key occupational groups within RailCorp were surveyed so that comparisons could be made. RailCorp staff interviewed were train drivers, train guards, signalling staff, maintenance staff, station and customer service staff, management and supervisory staff and new employees with less than 12 months service.

The questionnaire was drawn up by Associate Professor Glendon. Professor Reason, in his review of the SMSEP report, referred to the safety climate questionnaire study as another model of excellence, referring to the markedly high return rate. He said it is likely that many other investigators will use this combination of instruments once the material is published.

The nature of matters canvassed in the survey included: the extent to which staff were informed of safety matters relevant to them and whether staff felt able to openly discuss safety problems with supervisors; whether reported technical faults that could impact on safety were rectified; whether staff were given sufficient feedback in relation to safety incidents across the organisation; and whether staff were encouraged to consider safety as being more important than keeping to the schedule.

Four hundred and seventy staff were approached to complete the questionnaires and 469 complied. A Special Commission representative visited a number of locations and asked groups to complete the questionnaire. This assured a good response rate, an adequate sample size for statistical analysis and a reasonable representation across key operational groups. The main part of the questionnaire comprised 34 questions on various aspects of safety. Respondents answered those questions on a five point scale ranging from one, strongly disagree, to five, strongly agree. In order to interpret the survey results, a statistical technique called "factor analysis", which reduces the complexity of the data, was used.

Figure 17.1 shows the RailCorp operational groups and scores on two factors: management and staff safety and safety training and rules.

Occupational Group	Safety Climate Factor	
	Management & Staff Safety – Factor 1	Safety Training & Rules – Factor 2
	Group Average	Group Average
Train drivers	2.28	2.82
Train guards	2.66	2.98
Signalling staff	2.96	3.11
Maintenance staff	2.88	2.88
Station staff etc.	3.42	3.52
Management and supervisory	3.60	3.27
New employees	3.75	3.94
Overall	**3.11**	**3.24**

Figure 17.1 RailCorp occupational groups average scores for two safety climate factors

The average scores were 3.11 for factor 1, 3.24 for factor 2. It follows that overall respondents perceived both RailCorp safety climate factors to be just above the mid-point of the five point scale, where a score of three indicates neutral. Thus the overall perception of RailCorp's safety climate is that it is above neutral, but it falls short of four, which would represent agreement on a five point scale.

The overall scores of train drivers, train guards, signalling staff and maintenance staff indicate these groups disagreed more than they agreed with the items in factor 1, and their scores are well below the scale mid-point of neutral. Only the scores for new employees, management and supervisory staff, and station and customer service staff were all well above the mid-point of the scale, and only the new employees scores came close to agreement with items in the factor.

This picture is similar to those found in factor 2, with train drivers, train guards and maintenance staff scoring below the scale mid-point and other groups scoring higher than three, but none reaching four. These findings indicate a substantial difference between the operational groups' perceptions of rail safety climate.

Widely different perceptions between employee groups within RailCorp on vital matters, the SMSEP stated, should also be a cause of serious concern. In respect to aspects of safety climate measured in the management and staff factor, factor 1, train drivers shared their perceptions with no other occupational group. There were also wide disparities between perceptions of other operational staff, train guards and signalling staff, indicating that the three key groups of operational staff have very different perceptions of RailCorp's safety climate. This, according to the SMSEP, is a matter of some concern because they are front line operators. Perceptions of these groups in respect of this safety climate factor differed significantly from those of management and supervisory staff, as well as station and customer relation staff and new employees.

Overall, the perceived level of rail operations safety by all groups sampled was dismal. None of the groups' average scores on the question relating to this topic reached the level four representing safe on the five point scale, the overall score being 3.34 and just above the

neutral position. The SMSEP again said this should be of concern to RailCorp. Even management and supervisory respondents rated the overall level of rail operations safety at 3.65, which is still some way below representing "Safe".

The picture in respect of perceived changes in rail operations safety over the previous 12 months, including the period since the Waterfall rail accident, gives even greater cause for concern. The overall score in response to the question on this topic was 3.20, a figure that represents only a 20 per cent movement towards the scale point identified as "Improved". This means that across all groups, the dominant view was that there had been a barely perceptible improvement in rail operations safety in the 12 months since the Waterfall rail accident. Indeed, the train guards' view was that rail operations safety had slightly deteriorated during this period, while even the management and supervisory group, which had the highest average score of 3.68, still fell short of unambiguously perceiving rail operational safety as having improved over the previous 12 months.

The open-ended question inviting respondents to make further comments indicated that a wide range of safety-related topics was of concern to all occupational groups.

The SMSEP report concluded that different perceptions could give rise to different interpretations of safety, misunderstandings between safety critical groups of employees and divergent behaviours in respect to safety.

The findings of the safety climate survey are findings that I accept because they are in accord with the evidence I have received. In the light of that evidence I would have been surprised if the findings had been different. Professor Reason, in his review of the SMSEP report, agreed it was legitimate to interpret the low-rating averages as reflecting a poor perception of RailCorp's safety climate, but he said there may have been other influences at work. He noted that well over 80 per cent of the sample had been with the SRA at the time of the Waterfall rail accident, and the closeness of the event and the fact that the questionnaire was sponsored by the Special Commission could have exerted some downward or negative pressure on the ratings. He said some may have felt it inappropriate to give high positive safety ratings to an organisation that had so recently been involved in a tragic event, even if there had been a good safety climate. He said they should be treated with caution.

Whilst I take on board the eminence of the views expressed, I cannot agree with them in the special circumstances here. This review took place more than 12 months after the Waterfall rail accident. I would not have regarded that as a recent event. In respect to the other matters he referred to, whilst there may have been some effect on the answers, I believe such effects were minimal. I repeat, the safety climate review strongly confirms my view from the evidence I have received, of which Professor Reason of course is unaware. It is also confirmation of a view I had formed in the Glenbrook Inquiry, and one which does not seem to have changed between the Glenbrook and Waterfall Inquiries.

I would expect, as Professor Reason pointed out, that managers would have a more optimistic view of organisational safety. Professor Reason says that individuals who carry out a vital function do not really feel they are a valued part of the organisation, when they rarely have face-to-face contact with management. If that is the case, then clearly the fault is with first line management and it is incumbent therefore on such management to communicate with train drivers, instead of standing aloof as they apparently do. This is contrary to the attitude

of Mr O'Donnell, of Pacific National, who believes talking to staff will improve the safety culture, if senior staff understand their problems. This to me is a matter of common sense.

The uncontradicted evidence I received in this Inquiry and in the Glenbrook Inquiry is that there is a blame culture in management in the SRA. That is, when an incident or accident occurs, attempts are made to pin culpability on the operational staff. There are many examples of this from the evidence.

I can well understand why train drivers are normally more pessimistic than other employees. Who is the employee most likely to be injured in a rail accident? A driver. Why would he not be more concerned about railway safety than station staff or managerial staff? I find nothing in such a finding to make me doubt the accuracy of the survey.

Mr Worrall, in his comments on the safety climate review, said it was necessary to obtain a "snap shot" of what the front line safety critical staff thought about RailCorp's attitude to safety. He said a questionnaire has been widely used elsewhere with varied results. It surprised him that such a low percentage of RIC staff were surveyed, but he felt it was doubtful whether any different conclusions could be drawn from the exercise had the percentage of RIC staff been greater. The findings did not surprise him. He said they were in line with similar surveys in the United Kingdom. He concluded that the results of the safety climate survey are wholly in line with other findings in the safety management systems review. He concluded that the attitudes and opinions are manifestations of the failure relating to management of some safety system components and the problems with communication and training. It is not a surprising outcome.

Whilst I do treat with some caution the results obtained in the safety climate survey, because of the obvious problems in obtaining an accurate statement of safety climate, it is, however, in line with my own view, having heard a considerable amount of evidence about these matters.

However, putting the results of the survey, which are discussed in some detail in the SMSEP report and an annexure to this report, to one side, what is instructive is that there was such a degree of motivation and interest among those interviewed in participating in the survey.

The results of the safety climate survey and the degree of participation demonstrate that, as with the performance during the 2000 Olympics, it is possible to motivate the staff to make the improvements in the safety culture which are essential to bring the safety performance of RailCorp to an acceptable level. Improvements in safety culture have been successfully made in many other complex organisations. There is no reason therefore why, using well established techniques and with an appropriate degree of dedication to the task by management, the same cannot be achieved within RailCorp, with the obvious benefits to public safety and operational efficiency that this would produce.

18. Occupational Health and Safety

In relation to the accident, I was satisfied that the train driver, Mr Zeides, suffered a heart attack. I was unable, however, to determine whether this resulted in his death before or after the rollover of G7. The horrific injuries he suffered in the accident would have resulted in instant death in any event. The train guard, Mr van Kessel, suffered spinal and psychological injuries. The Occupational Health and Safety Act 2000 imposes strict obligations on employers. There is a general obligation on employers to ensure the health, safety and welfare at work of all employees, with an obligation of "ensuring that systems of work and the working environment of the employees are safe and without risks to health". In view of the findings made in the interim report as to the inadequacies of the driver safety systems on G7, it appears that the SRA failed to comply with the Occupational Health and Safety Act 2000.

The issues relating to occupational health and safety were an integral part of the safety management systems in place at the time. The interim report found that Mr Zeides collapsed at the controls of G7 as a result of a heart attack. If the driver safety systems on G7 had worked effectively, G7 should have been brought to a stop. If Mr Zeides was still alive at that time, and received appropriate urgent medical attention, he may have survived. There could be no doubt that the driver's cabin and the systems provided to train drivers for the operation of a train, including driver safety systems, are part of the workplace for which the employer, the SRA, was responsible.

The SMSEP concluded that the approach to occupational health and safety reflected the same approach that had been adopted to system safety generally, namely it was fundamentally a reactive approach. The approach to occupational health and safety was one which involved identifying particular incidents or classes of incidents that had occurred, for example trips, falls, lifting injuries and so on. There is no doubt that there are considerable benefits in analysing occupational health and safety that way. It is obvious, however, that when it comes to events which are of an infrequent occurrence, such as train driver incapacitation, such an approach to occupational health and safety does not enable the identification of that particular type of hazard. The only approach which will identify that particular type of hazard is a risk assessment of all the hazards which confront a train driver. Then examine the controls in place to prevent this particular risk materialising or, alternatively reducing it to an acceptable level. The deadman foot pedal provides an illustration of how this process works.

The deadman foot pedal was a driver safety device. Its purpose was to ensure that if the train driver became incapacitated, then the braking system on G7 would automatically apply and G7 would be brought to a halt. In the case of approximately 50 per cent of train drivers, with a body mass of 105 kg or more, they were able to set and keep the deadman foot pedal in the set position by the static weight of their legs alone. This situation could occur if the train driver became incapacitated. The deadman foot pedal, as a driver safety system, did not achieve its desired purpose, because Mr Zeides was within that 50 per cent of train drivers.

When an examination was undertaken of the background history of the deadman foot pedal, it was clear that considerable attention had been directed to occupational health and safety issues in both the design and subsequent modification of the deadman foot pedal. This was done to make the device more convenient for train drivers to use. The analysis undertaken, however, focussed on the risk of repetitive strain injury to train drivers' ankles and legs.

There was no attempt to examine the system safety issue, whether the pedal would have the effect of stopping the train if a train driver became incapacitated when the train was being operated by train drivers above a certain weight. The reason for this failure to conduct a risk assessment of the effectiveness of this particular driver safety system is that there was no overall risk analysis done at the time when the system was designed and the trains were being built.

The Engineering Manager, Rolling Stock Group, Capital Works Section, of the SRA, at the time when the Tangara train was being built, was Mr David Kippist. He was asked how it was that repetitive strain injuries became the predominant criteria for the particular design. He said:

> I think there is a compromise, or a balance between – if you make it that unsound that the drivers won't drive it, then you are defeating the purpose anyway. So I repeat, that there is a balance between those two. I think they are totally mutually different ends of the spectrum, to comply fully with one or the other. I think all railways worldwide are having the same review of foot man pedals, to – I don't think anything can be considered 100 per cent fail-safe. (sic)

Mr Kippist was making it clear that foot pedals could never be 100 per cent effective and there must be a compromise between the foot pedal having sufficient pressure put upon it for it to be held in the set position, and the likelihood that if too much pressure is required, it will give rise to occupational health and safety concerns, such as repetitive strain injury.

Prior to the Waterfall rail accident, there was apparently no assessment made of the risk that it may fail to work if train drivers above a certain weight collapsed. This assessment only occurred after the Waterfall rail accident, resulting in a vigilance device being added to the driver safety system. It has been pointed out in earlier chapters of this report that the risk should have been obvious and should have been dealt with when it became apparent.

In the Glenbrook Inquiry there was a number of other illustrations of failure to manage risk in an occupational health and safety context by first identifying all the hazards and ranking the risks. During the course of that Inquiry, reports were received relating to a tragic accident on 15 October 1998, at Bell. The ganger working with a rail grinder had to work in the six foot, the gap between the eastern and western tracks. He was struck and killed by a train travelling in an easterly direction. An assessment had been carried out of the risks to trackside workers from working on the western track, but no effort was made to tell train drivers travelling in an easterly direction that there were trackside workers at the particular location. The reason given for this was that work was only being done on the western tracks. The risk assessment carried out followed normal practice, which was to examine the safeworking rules to determine which applied to the particular work. The safeworking rule did not protect the trackside worker who was between the tracks from being struck and killed by the train.

Any proper assessment of the relevant hazards would have identified that the hazard of people working on or near a track being hit by a train was the major hazard against which an assessment of the risks needed to be made and for which adequate controls needed to be put in place. No consideration was apparently given to workers having to work in the six foot gap between the tracks being struck by the train travelling in an easterly direction. This should have been an obvious danger and should have been dealt with. The safeworking rule,

in effect, did not provide the means by which the most serious hazard could be adequately controlled.

The Glenbrook Inquiry was also required to consider the circumstances of an accident which occurred on 18 August 1998, at Kerrabee in the Hunter Valley, when two track workers were killed when their vehicle was hit by a freight train while traversing the track to obtain access to a worksite. The method by which their safety was supposed to be protected was a safeworking rule which depended upon communication of the movement of trains in the area. Any assessment of the nature of the hazard that arose, namely, the risk of being hit by a train, would have included an assessment of the reliability of the control. This depended upon relayed radio communications being accurate. The result of the misunderstanding was that two workers were killed.

Since the Bell and Kerrabee accidents, the safeworking rules have been rewritten and a risk analysis has apparently been undertaken as part of that process. It appears that even though many opportunities were available to the SRA and RailCorp to present to this Inquiry a systematic hazard analysis, no such analysis was forthcoming.

Although the SMSEP expressed some favourable views about the occupational health and safety systems that were in place at the beginning of 2004, at the time of the review, there is evidence to the contrary effect. The SMSEP said in its report:

> Occupational Health and Safety (OH&S) committees were prevalent throughout State Rail and now RailCorp. These OH&S committees were very effective in educating front-line staff in worker safety. Committees were well respected, and have effected change within depots to enhance worker safety. The OH&S program was very well developed and managed, and especially effective with the use of these committees to assure that corrective actions were implemented and validated. Front-line staff had a fairly good understanding of workplace hazards and how to prevent workplace accidents. The safeworking program had been effective as an institutional device to ensure workplace safety. However, very little attention is given to managing risks and the effectiveness of control measures. Feedback on actions taken to improve safety is not done well, with concerns expressed by many people interviewed as to the lack of timely feedback.

That view was not shared by the Chairman of the Board of RailCorp, Mr Bunyon, when discussing the overall safety systems in place in RailCorp:

> If I can use the OH&S as an example, the occupational health and safety standards within the organisation are totally unsatisfactory. The idea that we have that many incidents at work where people lose time by virtue of an accident is just totally unacceptable, as a person who has a commitment to the employees and also to the organisation.

Mr Medlock, the consultant retained as project manager for the Safety Reform Agenda of RailCorp, when asked about the amount of time lost through employee injuries, stated:

> Despite the fact that there may have been improvement, by any standard, the lost time injury frequency rate still existing in the State Rail part of RIC - RailCorp, is unacceptable.

The reason why the SMSEP may have come to a different conclusion was because that aspect of the safety review concentrated on railway station and other operational staff and the evidence of Mr Bunyon and Mr Medlock was based upon their assessment of the performance across the whole of the organisation, including areas involving infrastructure and maintenance. If the management of occupational health and safety issues has not reduced the incidence of injury to acceptable levels, the reason appears to be that the same deficiencies apply to occupational health and safety issues as applied to risk assessment generally. The approach to occupational health and safety is reactive to particular incidents and does not involve the systematic analysis of all the hazards, the examination of the controls that are put in place and an assessment of the adequacy of those controls in reducing the risk of those hazards to an acceptable level.

It follows that for the occupational health and safety management system to work effectively, it must be integrated with and form part of the overall safety management of the organisation. This does not mean that occupational health and safety issues should not be separately examined. There are hazards in the workplace which are different from those involved in railway operations. What is needed is a single set of processes and procedures for conducting hazard analysis and risk assessment. It is this that is lacking in both the overall management of safety in RailCorp and in the management of occupational health and safety.

The final observation that needs to be made in relation to this subject matter relates to some references in the SMSEP report and other evidence suggesting that there was an overemphasis on occupational health and safety. One such reference was in the evidence of Dr Edkins, who stated in relation to the safety review conducted at the beginning of 2004:

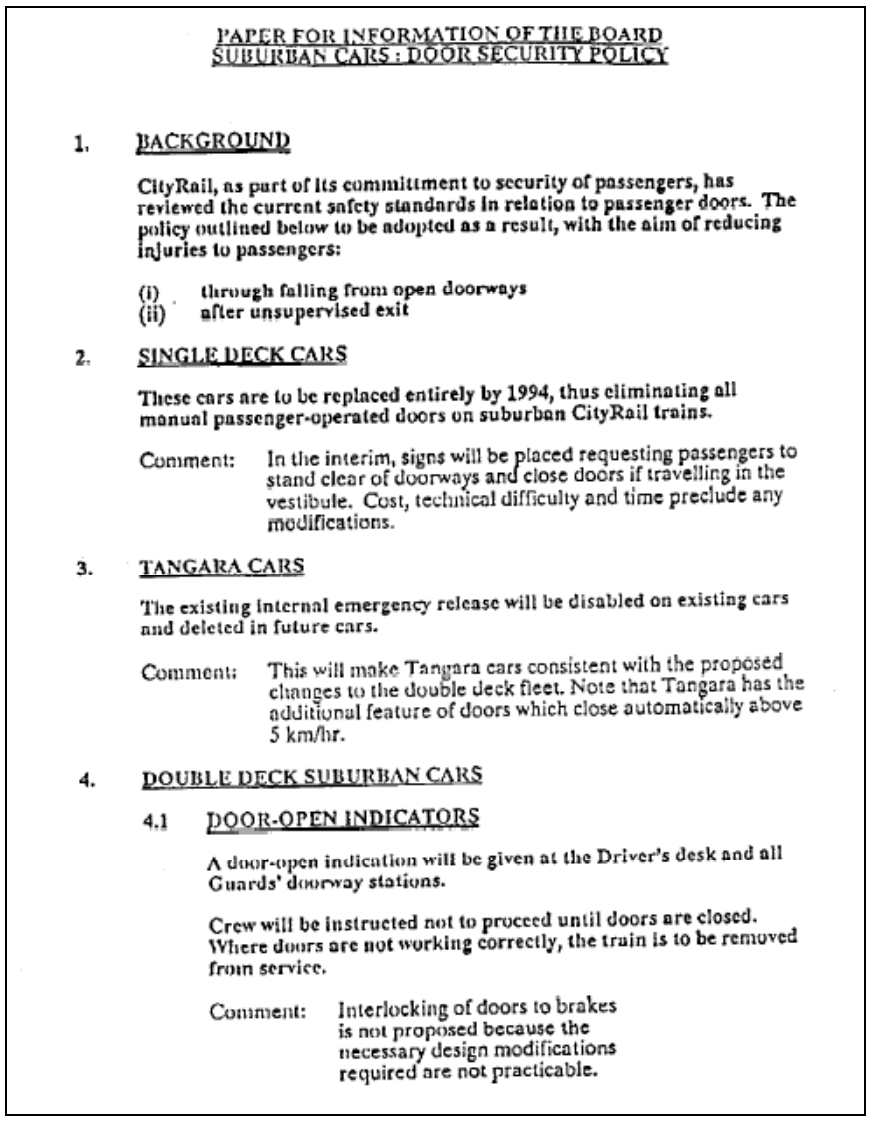
> In general, I think, what is clear from this review in relation to RailCorp, firstly, is that most day-to-day activities within the organisation are undertaken safely, without any adverse impact upon passengers, equipment or assets. However, it is quite clear from this process that the New South Wales rail industry has an immature safety management system, characterised by a number of features. Firstly, in relation to RailCorp in particular, they have an overemphasis on complying with New South Wales Occupational Health and Safety Acts and Regulations.

A number of observations need to be made in relation to this. The first is, as demonstrated in the safety culture chapter, most day-to-day activities within the organisation are undertaken safely. This can lead persons within the organisation to have a lack of risk awareness, thus preventing the identification of hazards of the kind that occurred in the Waterfall rail accident. These accidents do not occur frequently, but when they do occur, they are invariably catastrophic. The second is that Dr Edkins was not saying that it was not proper to emphasise occupational health and safety issues, he was saying that the approach towards safety was concentrated on occupational health and safety issues to the extent that there was no focus on an overall integrated safety management system.

19. Passenger Safety

The interim report of the Special Commission of Inquiry identified a number of areas where there were deficiencies in those parts of the safety management systems of the SRA, and now RailCorp, relating to passenger safety. This chapter is concerned with the issues associated with crashworthiness of G7 and passenger safety generally. Investigation of these issues has raised a number of matters which require consideration and about which it is necessary to make recommendations. In particular, concern has been expressed during the course of this Inquiry about the containment policy adopted by the SRA and which is now a RailCorp policy.

The containment policy is a policy whereby passengers cannot be released from a train involved in an incident or accident unless the train driver or the guard, or another person using the external door release mechanism, unlocks the doors and allows passengers to leave the train. Unless this is done there is no escape for passengers. They remain trapped in the train until someone releases them.



PAPER FOR INFORMATION OF THE BOARD
SUBURBAN CARS : DOOR SECURITY POLICY

1. BACKGROUND

CityRail, as part of its committment to security of passengers, has reviewed the current safety standards in relation to passenger doors. The policy outlined below to be adopted as a result, with the aim of reducing injuries to passengers:

(i) through falling from open doorways
(ii) after unsupervised exit

2. SINGLE DECK CARS

These cars are to be replaced entirely by 1994, thus eliminating all manual passenger-operated doors on suburban CityRail trains.

Comment: In the interim, signs will be placed requesting passengers to stand clear of doorways and close doors if travelling in the vestibule. Cost, technical difficulty and time preclude any modifications.

3. TANGARA CARS

The existing internal emergency release will be disabled on existing cars and deleted in future cars.

Comment: This will make Tangara cars consistent with the proposed changes to the double deck fleet. Note that Tangara has the additional feature of doors which close automatically above 5 km/hr.

4. DOUBLE DECK SUBURBAN CARS

4.1 DOOR-OPEN INDICATORS

A door-open indication will be given at the Driver's desk and all Guards' doorway stations.

Crew will be instructed not to proceed until doors are closed. Where doors are not working correctly, the train is to be removed from service.

Comment: Interlocking of doors to brakes is not proposed because the necessary design modifications required are not practicable.

Figure 19.1 SRA Board paper re suburban cars: door security policy (page 1)

4.2 LOCKING DOOR CYLINDER

Door cylinders that lock closed, will be fitted as replacements for the existing units which allow the doors to be forced open. The door cylinders will fail close if there is a loss of air. Passengers will not be able to exit unsupervised.

4.3 DOOR RELEASES ACCESSIBLE TO PASSENGERS (Internal or External to Car)

No facility for isolating doors will be available to unauthorised staff.

Comment: Should a door control fail, the guard or other authorised staff, will provide local exit, by door release.

4.4 SPEED SWITCH

A speed sensor will be installed to automatically close doors above 5 kilometres per hour.

The doors will close even if the Guard neglects to push the door-close button

4.5 COMMUNICATION

A passenger-crew intercom will be provided in all vestibules.

Emergency communication will be available similar to Tangara.

4.6 MAINTENANCE .

The standard of maintenance of the door system will need to be high to ensure there is no decrease in on-time running performance due to delays occasioned by crew investigating door-open indications.

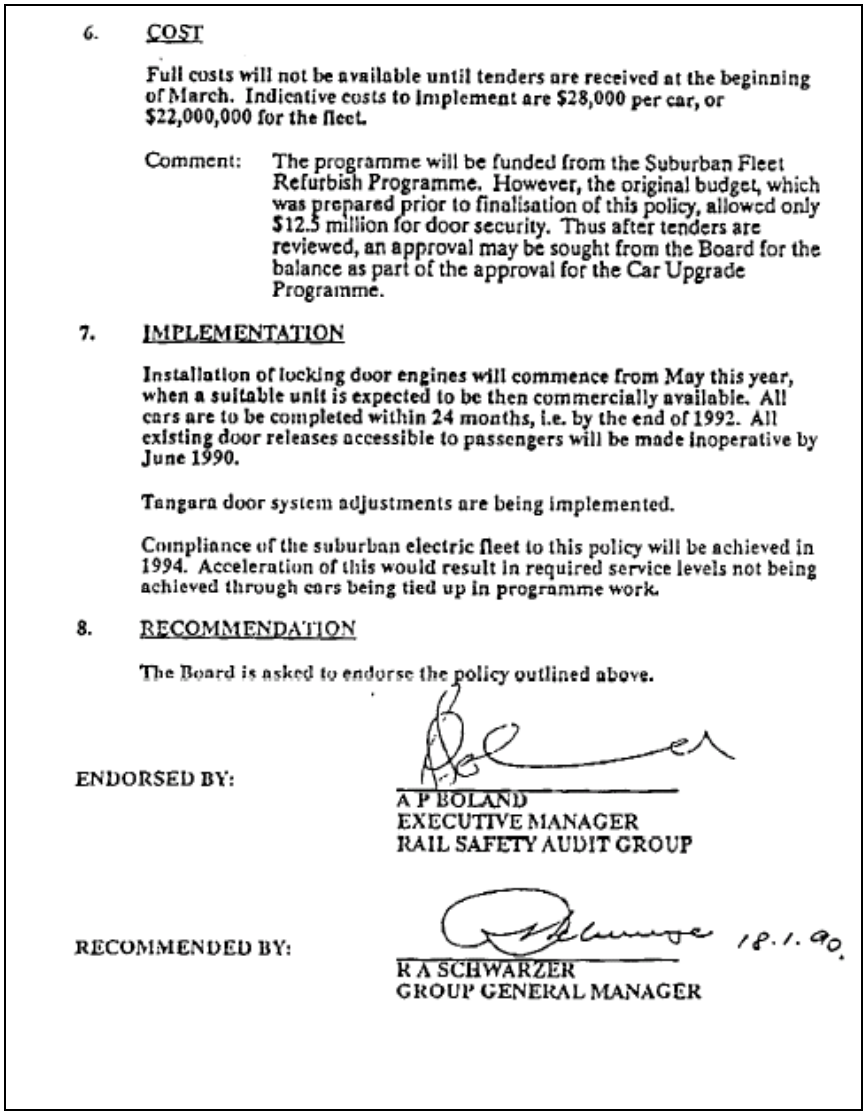
4.7 CREW TRAINING

Crew and station staff will be progressively provided with an opportunity to understand the door policy and their responsibilities.

5. PASSENGER/COMMUNITY EDUCATION

Appropriate signs indicating routine and emergency exit procedures will be displayed in all carriages, supported by a suitable public education/community awareness programme.

Figure 19.2 SRA Board paper re suburban cars: door security policy (page 2)



6. COST

Full costs will not be available until tenders are received at the beginning of March. Indicative costs to implement are $28,000 per car, or $22,000,000 for the fleet.

Comment: The programme will be funded from the Suburban Fleet Refurbish Programme. However, the original budget, which was prepared prior to finalisation of this policy, allowed only $12.5 million for door security. Thus after tenders are reviewed, an approval may be sought from the Board for the balance as part of the approval for the Car Upgrade Programme.

7. IMPLEMENTATION

Installation of locking door engines will commence from May this year, when a suitable unit is expected to be then commercially available. All cars are to be completed within 24 months, i.e. by the end of 1992. All existing door releases accessible to passengers will be made inoperative by June 1990.

Tangara door system adjustments are being implemented.

Compliance of the suburban electric fleet to this policy will be achieved in 1994. Acceleration of this would result in required service levels not being achieved through cars being tied up in programme work.

8. RECOMMENDATION

The Board is asked to endorse the policy outlined above.

ENDORSED BY:

A P BOLAND
EXECUTIVE MANAGER
RAIL SAFETY AUDIT GROUP

RECOMMENDED BY: 18.1.90.

R A SCHWARZER
GROUP GENERAL MANAGER

Figure 19.3 SRA Board paper re suburban cars: door security policy (page 3)

The history of the containment policy is instructive in relation to a number of safety management deficiencies within the SRA, and now RailCorp, and it is worth identifying how the policy was adopted. The policy had its genesis in a recommendation dated 18 January 1990, prepared for the Board of the SRA. The recommendation was accepted on 25 January 1990 by the Board and became the policy of the SRA. The entire paper which contained the recommendation accepted by the Board is Figures 19.1 to 19.3.

There are a number of features of Figures 19.1 to 19.3 concerning "the door security policy", which need to be highlighted. The first is that under the heading "background", the paper states:

> The policy outlined below to be adopted as a result, with the aim of reducing injuries to passengers:
>
> (i) through falling from open doorways;
> (ii) after unsupervised exit.

The obvious deficiency in what was placed before the Board was that although it identified two risks, it did not address risks associated with the adoption of such a policy, namely that in an accident passengers may be trapped in trains and this could cause injury or death from fire or other hazards, including panic-driven behaviour by trapped passengers.

The second matter to be highlighted in relation to the policy document is that, although there were risks associated with passengers falling from open doorways in relation to some of the types of train car then being used on the suburban rail network, this did not then apply to Tangara trains. Tangara trains were originally fitted with an internal passenger emergency release facility and they were designed so that the doors closed and locked when the trains reached a speed of 5 km/h. The paper identifies this feature in relation to Tangara trains where it states "note that Tangara has the additional feature of doors which close automatically above 5 km/h". In other words, one of the risks that was intended to be managed by the adoption of the door security policy had already been dealt with in the design of Tangara trains. There was no apparent consideration, by way of a risk analysis or otherwise, of the appropriateness of having a policy aimed at preventing falls from trains where certain trains were designed with such door security to prevent this happening. What became of the internal passenger emergency door release mechanism on Tangara trains is dealt with below.

The policy of containment was adopted by the Board. In accordance with the recommendation for Tangara trains that "the existing internal emergency release will be disabled on existing cars and deleted in future cars", a cable tie was used to prevent passengers from using the internal door release. This was initially a single cable tie to the internal release handle to stop the handle being moved. A report from the maintenance centres that this method was regularly being bypassed resulted in the recommendation that a second cable tie, or the use of a heavier tie, be substituted and a more permanent disabling procedure be investigated.

It seems that as a result of this latter recommendation, the mechanism for internal door release was removed and altered. A small pneumatic reservoir independent of the power system on the train was substituted. This enabled the doors to be pneumatically opened, rather than having to release the lock mechanism by pulling the cable, then having to push and open the doors. This enabled the doors to be opened by pushing an external button, as well as by the train driver or guard operating the door release from the cabin. This was in addition to the normal operation. The installation of a pneumatic power supply had the desirable feature that it would force the doors to move away from the frame, which was necessary to enable them to be opened.

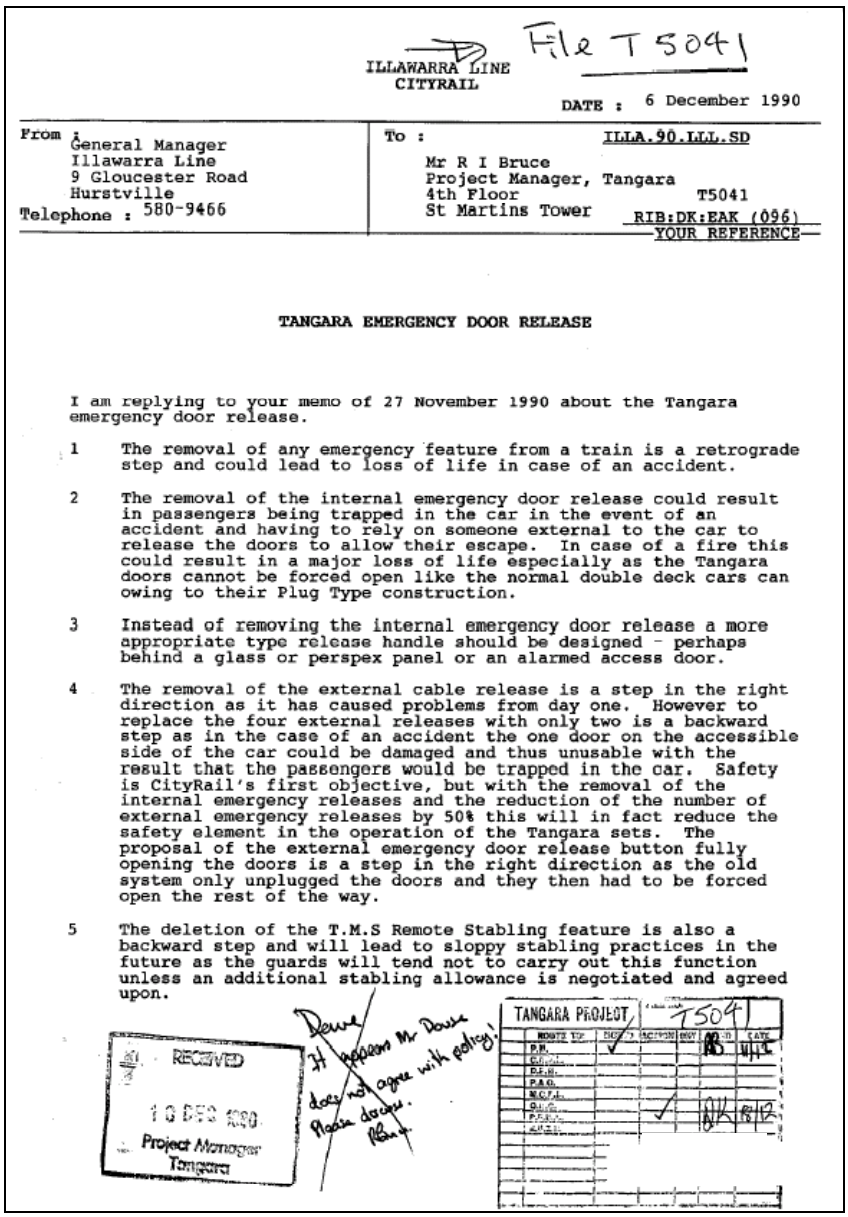
It seems that while the process of disabling this safety feature was being carried out, there were concerns about the desirability of the containment policy. This appears to have given rise to the circulation of a discussion paper dated 26 November 1990, which began with the words:

> During the recent investigation into Tangara plug door unreliability it was determined that one of the significant factors which contribute to in-service failures was the arrangement of the internal emergency [door] release and to a lesser degree the external emergency [door] release.

In line with the rail safety audit recommendations the internal releases are being disabled on current sets and eliminated on future sets.

The external door release, being cable operated is prone to jamming and not being reset by the normal door close signal. This causes a door failure.

Although the focus of the discussion appears to be service reliability there was, in this discussion paper, an acknowledgement of the risks of containment. The discussion paper concluded with the words "with the elimination of the internal emergency release, there is now a real concern of passengers and/or staff becoming trapped in an isolated car". This particular matter was the subject of a letter written on 6 December 1990 by the General Manager of the Illawarra line, who wrote to the Project Manager of the Tangara project and made a number of salient points about the disabling of the internal passenger emergency door release on Tangara trains. That two page document is reproduced in Figure 19.4.



ILLAWARRA LINE
CITYRAIL

File T5041

DATE : 6 December 1990

From :
General Manager
Illawarra Line
9 Gloucester Road
Hurstville
Telephone : 580-9466

To : ILLA.90.LLL.SD
Mr R I Bruce
Project Manager, Tangara
4th Floor
St Martins Tower
T5041
RIB:DK:EAK (096)
YOUR REFERENCE

TANGARA EMERGENCY DOOR RELEASE

I am replying to your memo of 27 November 1990 about the Tangara emergency door release.

1 The removal of any emergency feature from a train is a retrograde step and could lead to loss of life in case of an accident.

2 The removal of the internal emergency door release could result in passengers being trapped in the car in the event of an accident and having to rely on someone external to the car to release the doors to allow their escape. In case of a fire this could result in a major loss of life especially as the Tangara doors cannot be forced open like the normal double deck cars can owing to their Plug Type construction.

3 Instead of removing the internal emergency door release a more appropriate type release handle should be designed - perhaps behind a glass or perspex panel or an alarmed access door.

4 The removal of the external cable release is a step in the right direction as it has caused problems from day one. However to replace the four external releases with only two is a backward step as in the case of an accident the one door on the accessible side of the car could be damaged and thus unusable with the result that the passengers would be trapped in the car. Safety is CityRail's first objective, but with the removal of the internal emergency releases and the reduction of the number of external emergency releases by 50% this will in fact reduce the safety element in the operation of the Tangara sets. The proposal of the external emergency door release button fully opening the doors is a step in the right direction as the old system only unplugged the doors and they then had to be forced open the rest of the way.

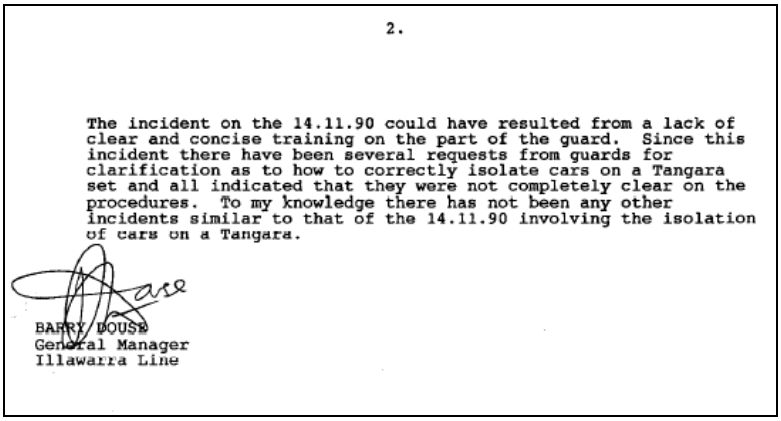
5 The deletion of the T.M.S Remote Stabling feature is also a backward step and will lead to sloppy stabling practices in the future as the guards will tend not to carry out this function unless an additional stabling allowance is negotiated and agreed upon.

RECEIVED
16 DEC 1990
Project Manager
Tangara

Dave
It appears Mr Douse does not agree with policy!
Please discuss.
RIB

TANGARA PROJECT T504

Figure 19.4 SRA internal memorandum dated 6 December 1990 from General Manager, Illawarra Line to Project Manager, Tangara re Tangara emergency door release (page 1)



2.

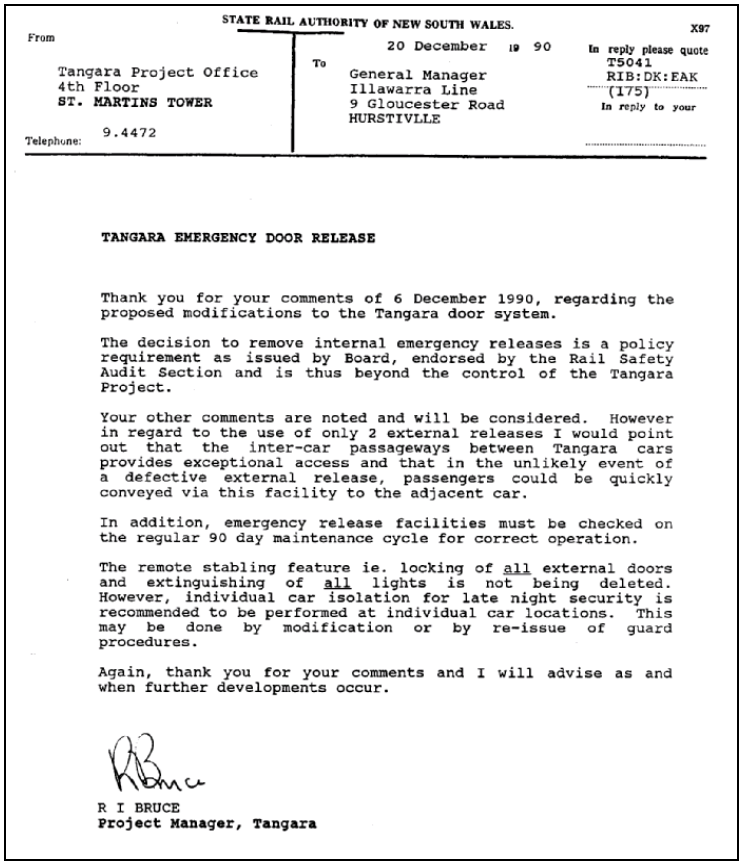
The incident on the 14.11.90 could have resulted from a lack of clear and concise training on the part of the guard. Since this incident there have been several requests from guards for clarification as to how to correctly isolate cars on a Tangara set and all indicated that they were not completely clear on the procedures. To my knowledge there has not been any other incidents similar to that of the 14.11.90 involving the isolation of cars on a Tangara.

BARRY DOUSE
General Manager
Illawarra Line

Figure 19.5 SRA internal memorandum dated 6 December 1990 from General Manager, Illawarra Line to Project Manager, Tangara re Tangara emergency door release (page 2)

The particular risks to safety identified by the General Manager of the Illawarra line, to which I wish to direct attention, are those identified in the following passage:

> The removal of the internal emergency door release could result in passengers being trapped in the car in the event of an accident and having to rely on someone external to the car to release the doors to allow their escape. In case of a fire this could result in a major loss of life especially as the Tangara doors cannot be forced open like the normal double deck cars can owing to their plug type construction.



STATE RAIL AUTHORITY OF NEW SOUTH WALES. X97

From
Tangara Project Office
4th Floor
ST. MARTINS TOWER

Telephone: 9.4472

20 December 19 90

To
General Manager
Illawarra Line
9 Gloucester Road
HURSTIVLLE

In reply please quote
T5041
RIB:DK:EAK
(175)
In reply to your

TANGARA EMERGENCY DOOR RELEASE

Thank you for your comments of 6 December 1990, regarding the proposed modifications to the Tangara door system.

The decision to remove internal emergency releases is a policy requirement as issued by Board, endorsed by the Rail Safety Audit Section and is thus beyond the control of the Tangara Project.

Your other comments are noted and will be considered. However in regard to the use of only 2 external releases I would point out that the inter-car passageways between Tangara cars provides exceptional access and that in the unlikely event of a defective external release, passengers could be quickly conveyed via this facility to the adjacent car.

In addition, emergency release facilities must be checked on the regular 90 day maintenance cycle for correct operation.

The remote stabling feature ie. locking of all external doors and extinguishing of all lights is not being deleted. However, individual car isolation for late night security is recommended to be performed at individual car locations. This may be done by modification or by re-issue of guard procedures.

Again, thank you for your comments and I will advise as and when further developments occur.

R I BRUCE
Project Manager, Tangara

Figure 19.6 SRA internal memorandum dated 20 December 1990 from Project Manager, Tangara to General Manager, Illawarra Line re Tangara emergency door release

The Project Manager for the manufacture of the Tangara trains replied to those concerns in an internal memorandum which is Figure 19.6.

What is instructive about Figure 19.6 is the statement:

> The decision to remove internal emergency releases is a policy requirement as issued by the Board, endorsed by the rail safety audit section and is thus beyond the control of the Tangara project.

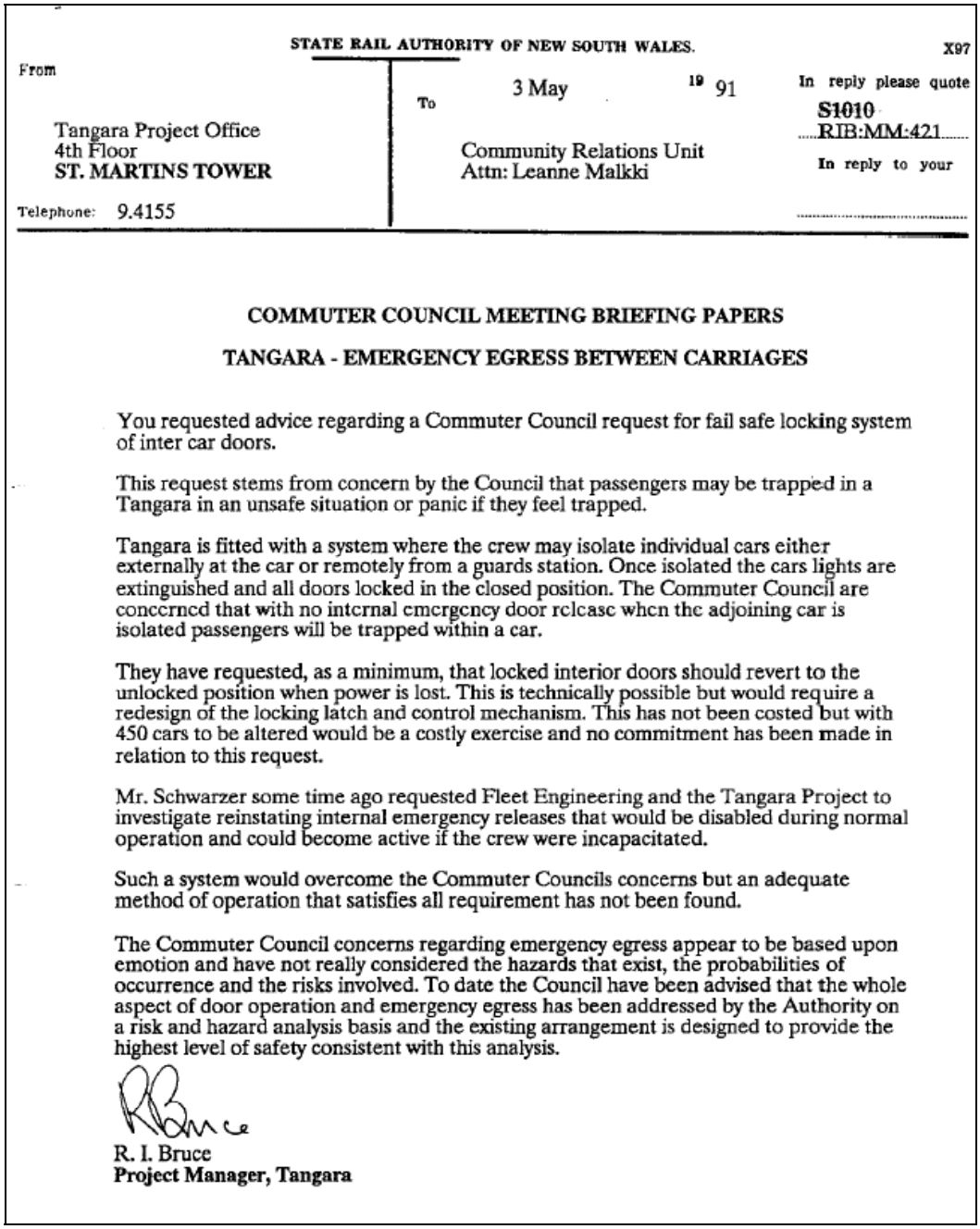
As the discussion paper upon which the Board's decision to keep passengers in locked trains demonstrates, there was no consideration in that paper of the risks associated with keeping passengers locked in trains, particularly in the event of a fire in the train. This was the very point which the General Manager of the Illawarra line was bringing to the attention of those responsible for the manufacture of the Tangara trains.

The other feature of the reply which is worth noting is that even though Tangara trains had originally been fitted with emergency door releases, no risk analysis had been done of the risk created by removing them. The hazard that was specifically identified was that of passengers being trapped in the train when a fire occurred. None of these concerns produced any examination or reconsideration of the "door security policy".

It is also worth noting that the primary focus of the recommendation was the risk of passengers falling from trains. This could not occur with Tangara trains, because the doors locked automatically.

Another deficiency that would have been identified by any risk analysis undertaken at that time was that the external emergency door releases would not work if the train was on its side. Given the fact that double deck trains have a higher centre of gravity than single deck trains, and that the design of the Tangara train involved the air conditioning unit being in the roof of the train, one would have expected that the ability of passengers to escape from a car which rolled on its side was a matter that should have been part of the analysis of the crashworthiness of this particular type of rail car.

The Commuter Council also expressed concerns on behalf of commuters in relation to this policy. This resulted in a memorandum being prepared by the Project Manager of the Tangara project for the information of the Community Relations Unit within the SRA, in response to those concerns. That memorandum is Figure 19.7.



STATE RAIL AUTHORITY OF NEW SOUTH WALES. X97

From

Tangara Project Office
4th Floor
ST. MARTINS TOWER

Telephone: 9.4155

To 3 May 19 91

Community Relations Unit
Attn: Leanne Malkki

In reply please quote
S1010
RIB:MM:421

In reply to your

COMMUTER COUNCIL MEETING BRIEFING PAPERS

TANGARA - EMERGENCY EGRESS BETWEEN CARRIAGES

You requested advice regarding a Commuter Council request for fail safe locking system of inter car doors.

This request stems from concern by the Council that passengers may be trapped in a Tangara in an unsafe situation or panic if they feel trapped.

Tangara is fitted with a system where the crew may isolate individual cars either externally at the car or remotely from a guards station. Once isolated the cars lights are extinguished and all doors locked in the closed position. The Commuter Council are concerned that with no internal emergency door release when the adjoining car is isolated passengers will be trapped within a car.

They have requested, as a minimum, that locked interior doors should revert to the unlocked position when power is lost. This is technically possible but would require a redesign of the locking latch and control mechanism. This has not been costed but with 450 cars to be altered would be a costly exercise and no commitment has been made in relation to this request.

Mr. Schwarzer some time ago requested Fleet Engineering and the Tangara Project to investigate reinstating internal emergency releases that would be disabled during normal operation and could become active if the crew were incapacitated.

Such a system would overcome the Commuter Councils concerns but an adequate method of operation that satisfies all requirement has not been found.

The Commuter Council concerns regarding emergency egress appear to be based upon emotion and have not really considered the hazards that exist, the probabilities of occurrence and the risks involved. To date the Council have been advised that the whole aspect of door operation and emergency egress has been addressed by the Authority on a risk and hazard analysis basis and the existing arrangement is designed to provide the highest level of safety consistent with this analysis.

R. I. Bruce
Project Manager, Tangara

Figure 19.7 SRA internal memorandum dated 3 May 1991 from Tangara Project Office to Community Relations Unit re Commuter Council meeting briefing papers: Tangara – emergency egress between carriages

Mr Bruce criticised the Commuter Council's concerns being in emotive terms. One can understand a degree of emotion being engendered when one is considering passengers trapped in a train when there is a fire and they are unable to escape.

The identification of the hazards associated with passengers trapped in trains was not the subject of any consideration when the containment policy was adopted on 25 January 1990 by the Board of the former SRA. The obvious hazards associated with passengers trapped in trains were not the subject of any further consideration for a further two years. Indeed, the CityRail passenger door policy dated 19 April 1993 omitted any reference to emergency passenger escape. That policy is Figure 19.8 to 19.9.

CITYRAIL'S PASSENGER DOOR POLICY

Purpose

This document states CityRail's policy on operating the passenger doors of its trains.

Rationale

The policy is a part of CityRail's overall Train Operating Policy which is directed at its mission of providing safe, clean, reliable and efficient passenger rail services.

Basic Principles

The policy is based upon

* CityRail's being responsible for safe passenger boarding and alighting trains at all times
* CityRail's being responsible for all passengers being made aware of the inherent dangers in boarding and alighting trains
* passengers deserving maximum protection from the inherent dangers of boarding and alighting trains
* passengers deserving ready means of resolving uncertainties with regard to safe boarding and alighting.

Application

The policy applies to all rollingstock types and operating conditions other than those specifically referred to by exception.

Policy

Trains are not to move without all passenger doors being closed and locked.

This is the fundamental tenet of passenger door safety.

2. **All passenger doors are to be locked when closed.**

This is to prevent passengers opening doors while trains are moving.

3. **All crew compartments are to have door-closed status indicators.**

This is to enable crew to prevent a train from moving with an open door.

4. **All passenger doors are to be closeable from crew compartments.**

This is to enable crew to close all doors prior to moving the train.

...2/..

Figure 19.8 CityRail's passenger door policy (page 1)

5. **Suburban rollingstock doors are to open automatically when unlocked by the crew.**

   This is to facilitate loading and unloading at busy stations.

6. **Interurban rollingstock doors are to be selectively unlockable by crew.**

   This is to facilitate opening by passengers of only those doors with platform access in interurban areas.

7. **All doors are to have an automatic means of warning passengers that they are closing or are about to close.**

   This is to provide passengers with a means of avoiding being caught in a closing door.

8. **All carriage foyers are to have a means of passenger-to-crew communication.**

   This is to provide passengers with a way of seeking advice in the event of door failure.

9. **All carriages are to have a means of crew-to-passenger communication.**

   This is to provide passengers generally with advice in the event of door failure or service delay.

10. **All carriage foyers are to have static signage warning of dangers of interfering with door operation.**

    This is to ensure all passengers appreciate the danger of interfering with doors.

-oOo-

19 April 1993

Figure 19.9 CityRail's passenger door policy (page 2)

The first attempt at risk analysis associated with the containment policy appears to have been undertaken in 1993, after the SRA commissioned a consultant, GHD-Transmark Australia, to "assess the hazards that exist for CityRail passengers where evacuation of the train may be necessary and how these risks may be reduced by the provision of an external emergency release device for the doors". The analysis of the consultant was restricted to the provision of external door releases, not a consideration of the containment policy. In its 1993 report, GHD-Transmark Australia observed:

> When first delivered, Tangara units were provided with emergency release both inside and out. The internal release was found to be operated (accidentally or deliberately) far too often with resulting delays in service. Operation of this release also caused reliability implications leading to its removal of the internal emergency release. The external release was operated by a mechanical system incorporating a bowden cable. However, the forces to operate the device coupled to the maintenance problems has caused the mechanical system to be replaced by a pneumatic one, which utilises a "dedicated" air reservoir.

It is instructive to note that, once again, issues associated with on-time running appeared to be a significant factor in decisions being made as to the desirability or otherwise of safety features in these trains.

The authors of the report conducted a limited review of emergency door release facilities in Australia and overseas and concluded that section of the report as follows:

> This section has shown that most of the railway administrations consulted have some form of emergency egress device. Many have an internal device interlocked with the train brakes and traction controls.
>
> It is understood that an internal device is not to be installed on CityRail cars through fear of vandalism (confirmed by Tangara experience).
>
> However, the absence of such facility for use in genuine high-risk hazard scenarios, as previously discussed, makes the provision of an external emergency egress device all the more necessary.

The reference to vandalism appears for the first time, in the documents provided to the Special Commission of Inquiry, in the 1993 GHD-Transmark Australia. Its significance is not developed or discussed in the report. If the reference to vandalism was intended simply as a reference to the fact that vandals from time to time damage various parts of trains, then this did not justify the removal of a feature designed to ensure passenger safety. If, however, vandalism had been demonstrated to create risks to the safety of other passengers, then there would need to have been some examination of the evidence in that regard. No such examination seems to have been undertaken. The only concern appears to have been that if the doors do not close properly, the train will not move. If the failure of the doors to close is the result of some deliberate interference with the door mechanism, then this will have adverse effects on on-time running. It was decided that a modification should take place so as to eliminate the likely effect of vandalism at the same time as removing a passenger safety feature.

Mr Bruce Hall, the Group General Manager, Safety and Environment of RailCorp at the time he gave evidence, said as much in his evidence, when he stated:

> The issue is if people continue, through an act of vandalism, to operate these doors it affects the operation of the service. That's not desirable. That affects the majority of people.

The result of the GHD-Transmark Australia report was a decision to fit external door release facilities to those suburban Tangara trains which did not have them. As already noted, Tangara trains originally had such a feature from the outset.

The external door release on the Tangara train was operated by a button. For reasons which are not clear, the external door release of other suburban trains required the use of a key to unlock the external door release. It is understood that the most modern train on the system, the Millennium train, has the same system. If the train crew do not have possession of a key or have misplaced the key, the passengers cannot be released by the external door release. It appears that the reason for requiring the key was to restrict the ability of opening the doors to SRA staff. This carries with it the assumption that the first persons to arrive at the scene of an accident will be those in possession of a key. This has the added danger that emergency response personnel such as police, ambulance or fire brigades will be unable to use the external door release.

The facilities for passengers to escape from trains following the fitting of external door releases have not been changed. There remains no means by which passengers can escape from a train without being evacuated by authorised staff such as the train driver or the guard. As the Waterfall rail accident demonstrated, when the train driver was dead and the guard suffered severe back injuries and was rendered unable to assist the passengers, the passengers were trapped in the train for a significant period of time. The accident occurred at approximately 7:14 am and the first emergency personnel arrived approximately half an hour later. It was fortunate for the passengers trapped in G7 that no fire had occurred, although many of them became fearful when they observed what they believed was smoke. Fortunately, this was ballast dust which had been thrown up in the course of the derailment of G7.

The next feature in the sequence of events is that having fitted external emergency door releases to trains, these were not adequately identified. Some were marked with the letters "EDR", which is a less than self-evident description of the purpose of a particular button. When Mr Hayden was asked a question about stickers that had been placed on the outside of Tangaras saying "EDR", he said, "EDR, what's that?" If the President of the RTBU did not know what "EDR" stood for, it would be reasonable to assume that other railway personnel, emergency personnel and members of the public would not know what that particular button was for, if it was labelled in that way.

The deficiencies associated with the inadequate labelling of the emergency door releases were demonstrated by the emergency response exercise known as Blue Rattler, which has already been discussed in the emergency response chapter of this report. The debrief reports on the exercise include the following observations:

1. No one knew the location of the outside door releases.

2. The emergency doors were unable to be opened from the inside or outside of the train.

The Transport Safety Advisory Council, which participated in this exercise, identified as one of the issues:

> Obsessive attention to vandal proofing trains has to be weighed against the welfare of the travelling public as a whole.

As observed in the emergency response chapter, all the notional passengers in the train in exercise Blue Rattler died, either in the train or from asphyxiation in the confines of the tunnel, if they somehow managed to escape from the train. The results of this exercise did not lead the SRA to reconsider the policy of containment.

Notwithstanding these conclusions, nothing appears to have been done to improve the emergency escape facilities for passengers.

The risks associated with passengers being trapped in trains where a fire occurred received international publicity in 1996, when a rail accident occurred at Silver Springs, Maryland, in the United States of America. A videotape of a documentary containing live footage and simulations of what occurred in that accident was tendered in evidence. What was significant was that the documentary showed that the National Transportation Safety Board investigation of the accident disclosed that many of the passengers had died because they were trapped in the train and could not escape from the fire that followed the rupture of the fuel tank in the passenger train involved in the collision.

Another serious accident resulting in passenger deaths which were caused by the inability of passengers to escape from a train occurred in November 1994 in Canada. In that accident, a piece of rail placed on the track punctured the fuel tank of a train locomotive and severed electrical power cables, causing a fire which engulfed the first two passenger cars, and inadequate emergency escape facilities resulted in injuries to a number of passengers. The Transportation Safety Board of Canada, following an investigation of this accident, recommended that the safety regulator take steps to ensure that a suitable standard was developed and enforced for emergency escape of passengers.

The Department of Transport, having become aware of the Canadian accident, requested the SRA to "assess the implications of the incident with respect to train operations in New South Wales". The response of the SRA was to commission a "passenger train fire risk assessment" from consultant Det Norske Veritas. Its report relevantly noted that:

> On K, C, S and R sets there is no means of releasing the doors from the outside in an emergency. Furthermore there is no indication of how to override the door opening mechanism within the carriages and only staff are trained in this procedure. Similarly on Tangaras passengers cannot open the doors in an emergency. An external door release mechanism is provided although this only operates with train power and so may not always be available in an emergency situation.

The authors of that report also conducted a type of risk assessment, comparing risks on the New South Wales suburban rail network with overseas experience, and concluded:

> However, the level of risk is high for a single element individual risk and this risk is dominated by the high fire frequency rate on the SRA network.

Relevantly, the authors also concluded:

> The provision of a facility to open the doors from the inside in an emergency is recommended.

Nothing appears to have been done in relation to that recommendation.

In January 2000 at Asta, Norway, a collision occurred between two passenger trains on the Roros line and the diesel tanks on both trains burst into flames. Nineteen people died as a result of that collision and resulting fire.

In November 2000 there was a fire in Kaprun, Austria, in a tunnel on the funicular railway carrying skiers up a mountain. The fire released poisonous fumes and 158 passengers died as a result.

If these events, and the other incidents identified in the chapter on emergency response, had not been sufficient to overcome the reluctance of the SRA to act on the recommendations that it had received, the fire which occurred on 25 July 2000 in its own train at Linden should have done so. On that occasion a fire started in the roof of the leading car of a four car train and smoke entered the first and second cars through the air conditioning system. The two crew evacuated passengers to rear cars on the train and then left the passengers trapped inside the train while they proceeded 500 metres and 1,500 metres, respectively, in opposite directions, for the purpose of putting detonators on the tracks to warn any other approaching train of the presence of the disabled train. In the meantime, emergency services personnel arrived and, being unaware of the external door release, they began smashing the train windows with rocks. Not only did the police and emergency services personnel try to break the windows with rocks, SRA security guards observed the police and emergency services personnel doing this and, according to the Department of Transport investigation report, began smashing windows. As a result of this incident six passengers were taken to hospital suffering from smoke inhalation.

Following this incident, there were a number of discussions between the Department of Transport, the then rail safety regulator, and the Chief Executive of the SRA in relation to emergency escape from trains. In a letter dated 18 January 2001 from the Executive Director, Transport Safety Bureau, Mr John Hall, to Mr Ron Christie, Acting Chief Executive, SRA, the issue of escape from trains in case of emergency was described as "a matter of major importance which appears to have stalled". The letter included the following:

> In essence, the issue is that there has been an increasing recognition around the world that there need to be guaranteed well designed escape routes from trains under emergency situations; in many cases, this principle is enforced by a high level of regulatory requirements. On the State Rail system, however, the recent tendency has been to place yet further restrictions on passenger initiated escape, so that at least in the case of the electric fleet, passengers may be

> totally dependent on other persons to permit their escape even in the most extreme circumstances.
>
> In some cases, situations have developed which seem self-defeating. For instance, there has been increasing emphasis (appropriately) on the labelling of external door releases; but where these can only be activated by keys held by drivers and guards, the releases are useless when the driver and guard are incapacitated or otherwise unavailable, which is the very situation when need for the releases is likely to be greatest.

It would appear that the risk that was identified by the then Department of Transport was not recognised by the SRA. This impression is confirmed by the more detailed response provided on 30 March 2001 by the SRA to Mr Hall, which relevantly states:

> State Rail has assessed risks to passengers that would be associated with passenger self-evacuations. As a result, it concluded that self-evacuation of trains by passengers is of far greater risk than the aided evacuation by train staff or emergency services. This is primarily due to the nature of the hazards associated with in close proximity to railway lines.

It is necessary to observe that this response bears no relationship to the risk that was identified. The risk that was identified was the risk of injury or death being occasioned to passengers because of fire or smoke inhalation in circumstances where they could not self-initiate escape from a train. It appears that one of the matters that influenced the thinking of the author of this response was the belief that passengers may attempt to leave the train if it is stationary on the tracks. The risk of that occurring is remote. Even if contemplated, it does not outweigh the exposure to danger to which all the other passengers are being placed by providing no means of emergency escape, to prevent abuse by a foolhardy passenger. The other feature of this letter is that it contained the following paragraph:

> External emergency door operating devices are fitted to all carriages and this allows trained emergency services and train crew to open doors and evacuate each carriage in a controlled manner.

As the Linden incident demonstrated, emergency services personnel were not trained in the use of the external emergency door operating devices and the train crew, rather than opening the doors and evacuating each carriage in a controlled manner, abandoned the passengers for the purpose of walking along the track to put down detonators.

The events following the Waterfall rail accident, predictably enough when one looks at the material already identified from exercise Blue Rattler and what happened at Linden, produced the result that passengers remained trapped in the derailed G7 for a period of half an hour.

As an exercise in elementary risk analysis there were two relevant hazards that needed to be managed. The first was the hazard that passengers would inappropriately use internal emergency release mechanisms and jump down onto the track into the path of an approaching train. During the course of the Inquiry, many witnesses were asked to identify any circumstance where that had occurred in which death had resulted. None was able to do so.

Counsel Assisting, at my request, conducted investigations in the United Kingdom, Europe and the United States of America and informed me that on each occasion they enquired of the various regulators and operators of railways as to the incidence of death being occasioned to any person as a result of the improper use of an emergency egress facility, no one was able to identify any such incident.

On the other hand, the rail accidents to which reference has already been made, such as the Silver Springs, Norwegian and Canadian accidents, provide clear and unequivocal evidence of the danger of death and serious injury inherent in a policy of passenger containment.

The risk that needed to be managed was that, if an accident occurred and fire resulted because the train caught fire or the accident involved a second train which was diesel powered or there was deliberate conduct by a person causing a fire in a train, in circumstances where the train crew were themselves incapacitated or slow to act, there was a risk inherent in not having a facility by which the passengers could self-initiate an emergency escape.

If there were any doubt about the need for self-initiated emergency escape, the incident on 18 February 2003 on the Dae-gu subway in South Korea, where a person who was apparently attempting to commit suicide ignited four litres of petrol on a train, resulting in a fire which killed 198 passengers and injured 147 others, would remove it. Even with a crew member able to assist, delay in recognising what had occurred and consequent failure to respond quickly enough, could produce catastrophic consequences.

It does not take a very extensive analysis to determine, when confronted with a choice between providing an emergency escape for passengers and avoiding possible abuse of it by an individual passenger, whether or not the so called "containment policy" is in the public interest. I am firmly of the view that such a policy is not in the public interest.

Because the conclusion to which I have come seemed to me to be such an obvious one, I attempted to determine the reasoning by which the SRA came to a contrary conclusion. Again, it would appear that the culture of on-time running influenced the decision in favour of the containment policy for the reason that, if you contain passengers in the train, there is less risk of any of them doing anything which may disrupt the movement of the train in accordance with the timetable.

Secondly, to the extent that there was an actual or alleged statistical basis for the decision, it appears to have been based upon information gathered at a time when the train doors could not be locked while the train was in motion. Those statistics are, of course, irrelevant when considering the risks associated with such a policy in circumstances where the train doors can be locked.

The other defect in the reasoning which lay behind the containment policy was the assumption that it must be either all or nothing. By this I mean that there is no need to choose only between a system by which passengers can let themselves out of trains at any time, or a policy by which passengers are contained at all times. The SRA, and now RailCorp, has adopted the latter policy.

There is no reason why the operation of the train doors cannot have an override facility, whereby the train driver or the guard can override an internal passenger emergency door release system if the door release is being interfered with when there is no emergency. There

should be an alarm, together with an intercom, in the train guard's compartment so that, if a person attempts to initiate an emergency door release, there is an appropriate delay during which time an alarm sounds in the train guard's compartment and the guard can then, after first attempting to speak by the intercom to the person concerned, if necessary, override the door release, and make an appropriate announcement over the intercom system in the train.

In addition, the risk of abuse of such a facility could be further reduced by introducing significant penalties for any improper use of such an emergency facility. It should be a criminal offence for anyone to use or tamper improperly with an emergency escape facility in a train.

Another means by which such risk can be controlled and managed is by fitting the internal passenger emergency door release with a facility which prevents it from operating unless the train is stationary. The risk of a passenger falling from a train, can also be managed by such a feature.

The final observation that needs to be made is that, if the recommendations in the emergency response and communications chapters are implemented, the risk of any evacuating passenger being struck by another train should be reduced to negligible proportions, because quick and effective procedures would be in place to recognise that an accident had occurred.

Mr Donald Heumiller, an expert consultant to the Special Commission, who was involved in the design of the Tangara train and who had extensive overseas experience in emergency escape facilities on passenger trains, gave evidence that "it is an international practice now to be able to escape".

During the course of overseas investigations, Counsel Assisting examined the emergency escape facilities in rolling stock in the United Kingdom, Europe and the United States. All of those rail systems provided an emergency escape facility. None had a policy of passenger containment. It is unlikely that the wisdom of the SRA, as revealed in the chronology of events outlined earlier in this chapter, is greater than the collective wisdom of all train operators in the United Kingdom, the European Union and the United States of America.

In addition to the above analysis, which strongly supports the provision of emergency escape facilities to passengers, there is a further reason why these facilities should be available. As a matter of individual responsibility, if people are in a life threatening situation, they should be entitled in my view, where the circumstances justify them taking control of their own safety and well being, to be given the opportunity of making rational and responsible decisions in their own interest. Underlying the containment policy appears to be a view, held by the SRA, and now RailCorp, that they know better than members of the public what those members of the public should be entitled to do to protect themselves in emergency situations. As indicated, the decisions underlying the containment policy can have life threatening consequences for passengers. People should be given the opportunity to make their own decisions when their own lives may be in jeopardy.

The Chief Executive of the SRA and RailCorp, Mr Vince Graham, was given the opportunity, during the course of his evidence, to acknowledge the deficiencies in the containment policy. His evidence in this regard was as follows:

Counsel:	In those circumstances, would not a good policy have behind it a procedure to manage the risk of passengers being trapped in the trains if the crew were unable to assist them in the evacuation?
Mr Graham:	In those particular circumstances, as I understand the detail of Waterfall, the containment of passengers, if I can come back to our earlier discussion about the definition and use that term as we have discussed it, as I understand it, the containment of passengers at Waterfall did not result, in the case at Waterfall, in any further …
Commissioner:	I don't think that was the question that was asked, Mr Graham? You are an intelligent man, I would like you to answer the question that was asked, if you don't mind?
Mr Graham:	Perhaps Mr Barry might like …
Commissioner:	Could the question be repeated so that Mr Graham could understand what the question was?
Counsel:	The question was: in those circumstances would not a good policy have behind it a procedure to manage the risk of passengers being trapped in the trains, if the crew were unable to assist them in evacuation?
Mr Graham:	A good policy, in those circumstances, should deal with that particular outcome and a good policy needs to consider all of the predictable outcomes from at circumstance and from other circumstances.

The containment policy does not protect passengers in a train which is on fire or subject to terrorist attack when the train driver or guard are incapacitated or not able to react in time. There must be a means of emergency escape in such circumstances. The risk of improper use of emergency escape facilities can be controlled by other means.

I have reviewed the evidence and indicated my reasoning in relation to passenger initiated emergency evacuation. There are, however, a number of other means by which passengers should also have their safety protected in an emergency situation.

The first and most obvious of these is by having windows available through which passengers can escape. I do not have in mind that windows for this purpose be the same as those currently used along the sides of rail cars. These are made of a toughened material which withstood enormous forces during the course of the Waterfall rail accident and no doubt saved the lives of a number of passengers by remaining intact. It seems to me that it would be desirable, however, to have a window available in the vestibule area which could be removed in appropriate circumstances. There are several window designs utilised in the United Kingdom and the United States which could be adapted for New South Wales conditions.

As a minimum, passengers should be provided with not less than two means of emergency escape at all times. This requirement is not met by the current position with the Tangara train, whereby the doors will not open if the train is on its side. This was the case with the overturned carriages on G7. The two separate means of emergency escape should be available whether the train is upright or on its side.

In addition to dual means of emergency escape at all times, there should also be marked, on the roof of each rail car, a section where emergency response personnel know they can safely cut or penetrate the roof of the rail car, to obtain access to passengers inside. On some rail networks these are called "soft spots". What they consist of is an area where, behind an area clearly marked "emergency access cut here" or similar, there are no primary structural members, no electrical services, no hydraulics or pneumatics which would render that an unsuitable area for a person to use welding or cutting equipment or an axe or similar means to try to gain access to the train.

In addition to the provision of emergency escape through doors and windows, there needs to be appropriate signage and appropriate lighting. Unless the passengers know where the escape routes are, their effectiveness will be diminished. Emergency lighting of the kind that is used in commercial aircraft should, in my opinion, be a feature of all future trains. In the United States of America, emergency lighting is now mandatory on or near doors and along aisles in all passenger cars. In addition, clear and conspicuous marking is mandatory on all external door release mechanisms.
It is impossible to see why one would mark an emergency door release on the outside of a rail vehicle with any signage with other than the words "emergency door release", particularly in circumstances where the relevant button could not be accessed, or readily seen, from a station platform, because it is below the level of the platform. For the same reason, to enable emergency response personnel to utilise such a facility they must know its location.

As noted previously, it is disturbing to note that the emergency door release on the Millennium train consists of an external locked cover. All emergency door releases should be accessible without the use of a key and, as stated above, should be clearly marked with the words "emergency door release". This seems to show that the SRA, and now RailCorp, has learned little.

In addition to having emergency door releases which are accessible to emergency services personnel or anyone who may arrive first at the scene of a rail accident, emergency services personnel and all persons working on railways, including station staff, should be trained in the location of such emergency door releases so they know how to use them as expeditiously as possible.

I have dealt with passenger safety in the context of emergency escape. Some evidence was received during the course of the Special Commission of Inquiry in relation to other features of the Tangara train to do with crashworthiness. At the time of the design of the Tangara train, there were no crashworthiness design standards. Mr Heumiller, in his evidence, said that the Tangara train would not now comply with current standards for the design of rail vehicles in respect of impacts at various speeds at the under frame level, although some aspects of the design were an outstanding success in respect of train crashworthiness. The Tangara laminated window design was well considered and forms a well designed part of the Tangara structural strength and crashworthiness requirements. The fact that the passengers were contained other than where the roof was opened by contact with stanchions, significantly reduced the loss of life in the Waterfall rail accident. Given the forces involved in the accident, no criticism is made of the roof structure not being able to withstand those forces, resulting in the opening of the roof and the ejection of the passengers who died. It is a fact that no train could be designed to withstand the forces of the Waterfall rail accident and maintain its integrity.

There should be developed an Australian Standard dealing with crashworthiness of trains. There are several railway standards which are available. The European Commission has developed a set of standards for the European community and although Australian Standard AS4292 states "standards and procedures shall be established and maintained for the selection and design of rolling stock", this has not occurred. It is highly desirable. Such a standard should deal with the recommendations that have been made in relation to passenger safety in this chapter.

20. Corporate Governance

The earlier chapters of this report have identified a large number of deficiencies in the management of safety which existed in the SRA at the time of the Waterfall rail accident and which are still present within RailCorp to varying degrees. The range and depth of those deficiencies point to failings in the management of safety at an organisational level which are indicative of failings in overall governance and management accountability. Although it is corporate governance which is the subject of this chapter, what is sought to be discussed is not corporate governance at large, but corporate governance relating only to the management of safety.

Corporate governance encompasses the processes and systems by which corporate entities are directed, controlled and held to account in meeting the objectives of the organisation. It goes beyond the management of an organisation to include the monitoring and control mechanisms put in place to ensure that management is accountable. Key elements of corporate governance include transparency of corporate structures and operations, the implementation of effective risk management and internal control systems, and the accountability of the Board to stakeholders.

It is worth noting that the forces and constraints that define the boundaries of corporate governance in the commercial sphere are very different to those of public sector corporations. In commercial organisations, the Board has ultimate responsibility and accountability to the shareholders to ensure effective return on investment. This is a united objective. In public sector organisations, the Board is constrained by legislation, guided and directed by ministerial involvement, which is open to parliamentary scrutiny. This creates a set of diverse and often misaligned objectives.

However, in both cases, the Board is responsible for setting the strategic objectives that will guide the organisation in achieving its intended purpose. It establishes the corporation's policies, defines acceptable risk, defines the required standards of performance and establishes control and reporting mechanisms. The Board also appoints the Chief Executive Officer (hereafter referred to as CEO) and monitors and reviews the performance of the CEO. Within the boundaries set by the legislation and the policy and standards set by the Board, the CEO leads and manages the organisation.

Clearly, the CEO has responsibility and is accountable to the Board for the leadership, management and implementation of processes, procedures and systems to achieve the organisation's objectives. However, the Board has legal and public responsibilities to ensure that safety is being properly managed. This involves:

1. Ensuring that all of the necessary systems for effective communication, information management, performance measurement, independent verification and documentation control are in place.

2. Prescribing and communicating which matters are reserved for the Board to decide.

3. Defining clearly which matters must be brought to the attention of the Board, by what process and within what time frame.

4. Determining and communicating the bounds of acceptable risk and prescribing how events that may lead to unacceptable risk are to be identified and controlled.

5. Ensuring that the organisation is aligned under the CEO and that there are no separate unauthorised agendas or strategies.

6. Ensuring that there are levels of external audit and verification sufficient to enable the Board to exercise its governance functions with an appropriate degree of independence from management. This will include access to independent professional advice necessary to make informed judgements and decisions.

Whilst prime responsibility for good governance lies with the Board of an organisation, and management in turn is accountable to it, it is of course essential that each layer of an organisation, from the Board to front line employees, has clearly defined accountabilities and systems in place to ensure that activities for which they are accountable are undertaken safely. At Board level, this should include ensuring that processes exist and are adequate for identifying major hazards, that is events that involve low probability of occurrence but with severe consequences, such as occurred at Glenbrook and Waterfall, and that adequate control strategies have been or are being designed with expert input and have been or will be fully implemented. It is the responsibility of management to clearly define the duties of individual employees relevant to safety, to specify the performance, criteria against which appropriate evaluations can be made of their performance, and for there to be a proper and adequate sharing of information, so that all staff with responsibility for safety can contribute in a constructive, integrated and purposeful fashion to maintenance and improvement of the safety performance of the organisation, part of the management of safety.

It must be emphasised that unless governance of an organisation is underpinned by both strong management and effective accountability, the corporate governance system sanctioned by the Board will probably be ineffective. Both leadership and management accountability processes ensure that the Board's policies are implemented effectively. It is the responsibility of management to implement the Board's corporate policies and to ensure that there is a basis whereby it can verify their implementation. This is fundamental to the effective implementation of safety management systems. Management must also accept and agree with the level of risk judged to be acceptable by the Board.

The Australian Standards on Good Governance Principles emphasise that accountability is the essence of good governance. The SMSEP in turn referred to accountability as:

> A situation where an individual can be called to account for his or her actions by another individual or body authorised both to do so and to give recognition to the individual for those actions.

The SRA document "Safety Standards 2.001 Safety Responsibilities and Authorities" defines accountability in similar terms:

> … action, function or event which must be completed or managed by the person to whom that accountability is assigned.

The foundations of accountability have been frequently discussed in corporate governance literature. It is generally recognised that they include:

1. A clear chain of command – identifying who is responsible to whom and for what.

2. Clarity as to the scope of authority and of the functions attaching to key management positions.

3. Availability of knowledge and skills.

4. Documentation of instructions, advice and outcomes, combined with systematic and effective record keeping.

5. Systems to ensure that people at every level have the human, financial and technical resources to achieve what they are required and accountable to achieve.

6. Effective measures and means for evaluating performance.

7. Consequences for failure to achieve what the individual is accountable to achieve. This may range, according to the significance of the failure, from counselling or training to reduction or loss of bonus, demotion or dismissal.

8. An effective reporting system which facilitates accountability of management to the Board.

While it is not the function of the Board to manage the corporation, in holding the CEO accountable for that management and measuring the performance, the Board will need to maintain a close critical oversight of the quality of the management systems, including the safety management system, that the CEO has in place.

Since the Board sets the agenda and then relies on the CEO and management to implement and manage it, the Board must have, for the proper management of safety, access to current, reliable information on all aspects of the management and performance of the organisation, especially system safety and risk information. It is critical to accountability that there is an effective reporting system between the Board and management. This enables the former to carry out its monitoring and review responsibilities that are essential to the proper and effective functioning of the Board. In particular, it will enable the Board to maintain critical oversight of the quality of the management systems that the CEO puts in place.

In examining the adequacy of the corporate governance arrangements applicable to the SRA and RailCorp, it is clear that there are common failings in the governance and management accountability framework employed by these entities which have affected the management of safety. However, it must first be acknowledged that there are some key distinctions between the current legislation that defines RailCorp's governance and the legislation in place in respect of the SRA at the time of the Waterfall rail accident.

The SRA, as a statutory authority, operated under a fundamentally different corporate guise to that of RailCorp. The legislative differences have some bearing on the corporate governance of these entities, particularly in respect of the accountabilities between the Minister, Boards and Chief Executive.

At the time of the Waterfall rail accident, the relevant statute was the Transport Administration Act 1988. Pursuant to section 10(1) of the Transport Administration Act, the SRA Board had the function of determining the policies of the SRA. The affairs of the SRA were managed and controlled by the Chief Executive in accordance with the policies of the SRA Board: section 12(1). However, pursuant to section 13, the Board and the Chief Executive were, in the exercise of their functions, subject to the control of the Minister, who also had power to remove the Chairman or any Board member from office at any time.

Whilst there was a Board in place, which ostensibly had the function of determining the policies of the SRA, it was potentially subject to direction from the Minister in the exercise of that function. Further, whilst the Chief Executive ostensibly had the power and responsibility to manage and control the affairs of the SRA in accordance with the policies laid down by the Board, the Chief Executive was also potentially subject to directions from the Minister without reference to the Board. The circumstances under which the Minister could give directions were neither prescribed nor limited, which meant that the Minister had power under the legislation to intervene in the management of the SRA if the Minister so chose.

RailCorp is a State owned corporation constituted under the State Owned Corporations Act 1989, which is a marked shift away from the ministerial control model that applied to the SRA. Under this framework, directions by the Minister for Transport Services are, apart from the process of settling the statement of corporate intent in the early months of the financial year, limited to particular circumstances and are required to be made in the form of written requests to the Board. The Board is the only body that can give directions to the Chief Executive and as such the Board retains appropriate control over the business of RailCorp and is in a much better position to determine the strategic direction and policy settings of RailCorp than was the Board of the SRA.

The SMSEP concluded that the ministerial control model that characterised the SRA "is not consistent with effective corporate governance and clear accountability". The primary concern was the failure of the legislation to clearly set out the responsibilities of the key entities involved in the governance structure, which could adversely impact on effective accountability. This inhibited the effective functioning of the Board of the SRA and diminished its effectiveness to the organisation.

Mr Bunyon, the Chairman of RailCorp, acknowledged there had been a number of elements in the organisational structure of the SRA that gave rise to concern with regard to its governance and strategic direction prior to the Waterfall rail accident. He said that at the time the SRA was an organisation driven by rules and prescriptions in the way it operated and that the Board structure was such that it was in effect only an advisory Board. He did not believe the organisation recognised the contribution that a Board should be making to it.

The confused responsibilities and accountabilities within the SRA extended beyond ministerial and Board level and pervaded the entire organisation. This is acknowledged by Mr Graham in his response to the Special Commission's Notice under paragraphs 2 and 3 of the Terms of Reference. He commented:

> State Rail had a structure which, because of a lack of clear accountabilities and reporting lines, meant that there was a significant level of confusion about responsibilities generally and potentially safety responsibilities …

> Within State Rail there were two quite distinct and separate safety cultures identifiable: At the corporate level there were developed and documented safety plans, approved by the Regulator. At the operational level, to a very large extent, individuals were trying to behave safely and with commonsense, but were doing so without explicitly understanding their role within the organisation safety management system.
>
> There was an inability of management to make what I regarded as relatively straightforward decisions efficiently. I saw what I regarded as a management culture that was unable or unwilling to manage or lead.

The SRA's corporate governance deficiencies, acknowledged by Mr Graham and Mr Bunyon above, are clear. The changes made to RailCorp's governance arrangements, which have been outlined above, do go some way to providing the potential to improve the governance, particularly in respect of the relationship between the Minister and the Board of RailCorp. However, it is apparent that many of the governance failings in the SRA have carried over to RailCorp.

Improvement in the governance arrangements for RailCorp will be dependant on the Minister, the Chairman of the Board and the Chief Executive fully comprehending the changes in legislation and changing the way in which they interact.

Whilst the formation of RailCorp arose through a major restructure of the New South Wales rail sector, and significant alterations have been made to the legislative regime governing this sector, the differences between RailCorp and the SRA are not as significant in reality. The short time frame available to effect the merger of the SRA and RIC to form RailCorp by 1 January 2004, inevitably resulted in RailCorp inheriting the former's operating systems. The formation of RailCorp took place in the absence of an in-depth analysis of the organisational effectiveness, and deficiencies, of the SRA and RIC. In addition to that disadvantage, RailCorp also faced the challenge of implementing substantial systemic and other changes mandated by the 2004 provisional accreditation milestones and RailCorp's own Safety Reform Agenda which is dealt with in chapter 21. Many aspects of that Agenda and of the 2004 provisional accreditation milestones are directed to overcoming deficiencies in the safety management systems identified in this Inquiry, as existing at the time of the Waterfall rail accident.

The continuing safety problems within RailCorp were recognised by ITSRR. On 4 April 2004, in response to a Notice of this Commission concerning issues arising from paragraphs 2 and 3 of the Commission's terms of reference, ITSRR identified six categories of safety deficiencies within RailCorp. The categories of deficiencies identified by ITSRR all have direct bearing on the efficacy of the governance arrangements within RailCorp, and further substantiate the fact that many of the deficiencies in the governance of the SRA apply equally to RailCorp. Outlined below is a number of these deficiencies.

The first matter relates to a lack of adequate competencies in modern, integrated safety management systems among the relevant managers within RailCorp. I have discussed earlier in this chapter the necessity for the governance of an organisation to be underpinned by strong management. It is the responsibility of management to implement the management systems under the policy direction of the Board. Accordingly for RailCorp, in respect of safety management, adequate skills in the design and implementation of modern integrated safety

management systems are vital.

The audit team and the SMSEP found that key managers charged with the task of managing and leading safety within RailCorp did not possess competencies in line with modern safety management principles and practice. The SMSEP, in particular, determined that there were serious limitations to the safety management skills of senior managers of the SRA. It observed that most senior managers, that is levels 2, 3 and 4, who were interviewed displayed a lack of awareness of current safety management principles. They lacked the capability to provide the requisite safety leadership within the areas for which they were accountable and the knowledge as to how to successfully implement integrated safety programs. This conclusion does not reflect on the overall ability or professionalism of the managers in question, but rather points to a specific subset of skills and competencies in the area of modern, integrated safety management systems.

The management of safety in rail operations is a complex and difficult task. Mr Bahr referred to mass transit as "one of the most complex human-machine interfaces in industry." He observed that the safety of a railway is very dependent on how well staff understand the hazards that can arise and whether they have the tools that are needed to manage a range of risk factors. The manner in which safety is now managed in complex and high risk environments has evolved significantly in recent times. Dr Edkins also made this point in emphasising the need for regulators to keep abreast of developments relating to safety management systems

Even Mr Graham, the RailCorp Chief Executive, recognised that there have been significant developments in the 1990s in safety management systems and approaches and methodologies in high risk industries.

Mr Edwards, the Executive Safety Manager of Pacific National, referred to the recent advances that have been made in the area of railway safety management, including in particular the work that he is performing as a member of the national review committee for AS4292, the standard for railway safety management, a committee which is chaired by Mr Donaldson. Mr Edwards stated that whilst AS4292 was groundbreaking when it was first written in 1995, it is now under review to align it more closely with AS4360, the risk management standard, and to reflect more enlightened views on safety risk management. With the development of contemporary safety management principles and practice, it is clear that managers leading safety in high risk organisations, such as RailCorp, need to be capable of working within and applying the contemporary paradigm of safety management.

Mr Graham expressed strong disagreement with the conclusions drawn by the Special Commission's auditors, including Mr Bahr, that key RailCorp managers lacked the safety competencies required to lead and manage safety. It was his firm belief that RailCorp does have the management capability and capacity to ensure that improvements are made in the safety management systems. He conceded, however, that the management staff needed the assistance of an outside consultant to assist them in developing the system.

Mr Graham was questioned on the process for the appointment of managers and how he determined whether the applicants for the General Manager positions whom he interviewed had the capacity to implement integrated safety management systems. He stated that this assessment was made on the basis of their experience in general management roles and their ability to respond to changing environments and not in relation to their safety management

knowledge. There is very little information, documentary or otherwise, of the precise basis upon which the appointments of senior managers of RailCorp were made. The evidence available to the Special Commission failed to establish a sufficiently cogent basis for Mr Graham's confidence in the level of expertise of his managers in safety critical positions.

Mr Graham stated that the circumstances with which RailCorp was faced at the time the executive recruitment was being undertaken did not permit a full executive search to be made. Mr Bunyon reiterated this point, saying that he and the Chief Executive made a decision not to undertake an extensive recruitment campaign because this would expose the organisation to greater risk through vacancies at level 2 management during the recruitment period of four to five months. I acknowledge this explanation, however, now that matters have settled to some extent, there is in my view plainly a need for there to be a full review of management competencies to ensure that managers have the ability to carry forward the reform process. Furthermore, upgrading the competencies of managers is not a matter that can be adequately addressed by them attending short professional development courses. There is an existing need for competencies that are commensurate with those found in other industries that operate with high risk levels. A combination of targeted recruitment and professional development training is required.

The second matter inhibiting effective governance of safety within RailCorp relates to the lack of effective accountability in management. I have detailed at length earlier in this chapter the critical nature of accountability to the effective governance of entities such as the SRA and RailCorp. Whilst there have been some improvements made through legislative changes which have improved accountability, it is apparent that problems of accountability remain.

To be effective as a management tool, the responsibilities and accountabilities for safety need to be specific to particular positions. The accountability statements need to identify the individual's authority, what he or she is accountable to achieve and the time frames under which those targets are to be achieved. RailCorp has sought to improve accountability, as part of its Safety Reform Agenda, by incorporating into contracts of service some fairly generically worded accountability statements. The SMSEP commented on the deficiencies of the safety accountability statements that were developed for each Group General Manager position, stating that the language in these statements was generic and there was not much in the way of measurable performance indicators and nothing in the way of time lines.

Without measurable performance indicators, the accountability of the managerial staff cannot be effectively imposed. At the time of the Special Commission's review of RailCorp, it was obvious to the skilled and experienced auditors engaged in that work that RailCorp did not adequately define accountabilities, performance measurements and competency assessments, which are essential to the effective management of a large and complex railway organisation.

One of the advantages of having proper systems of responsibility, authority, accountability and performance measurement is that the chief executive can evaluate the performance of his subordinates within the organisation. For the accountability statements to mean anything, there must be means for evaluating performance. This necessarily requires that adequate documentation be kept, that the data be analysed and that there be criteria against which the performance of individuals in managerial positions can be measured.

The third matter inhibiting effective governance of safety within RailCorp relates to the inadequate safety auditing processes. Without competent auditing systems there is no means available to the Board or senior management to test the adequacy of the safety management systems. Mr Bahr noted that this was something that was most often forgotten by railways, that is, to ensure the system in place is being implemented and is adequate to control the risks identified. This could only be done by auditing within the organisation to determine whether or not the processes and procedures within the safety management system were being carried out by qualified staff and, where non-compliance was found, identifying the causes and reasons. The SRA conducted occupational health and safety audits, but the overall audit plan was not sufficient to determine whether the safety management system that was supposed to exist was being carried into effect. The SMSEP noted that the SRA relied upon the external regulatory agencies, the rail safety regulator and the WorkCover Authority of New South Wales (hereafter referred to as WorkCover), undertaking compliance auditing to identify and correct system safety deficiencies, rather than establishing an independent external review process.

Without proper safety auditing systems, there can be no reliable means available to either the Board of RailCorp or its senior management, whereby the adequacy of the organisation's management systems can be evaluated. Both internal and external auditing controls are essential in evaluating risk control processes and in identifying the possible sources of operational hazards. In particular, regular auditing is essential in ensuring the implementation of risk control measures and that such measures remain effective and do not become outdated or otherwise deficient.

Mr Edwards gave evidence of an annual external risk and safety compliance review of Pacific National, performed by Aymwon Pty Limited. This is what would be expected of a major rail operator. He stated that this review, which was conducted in addition to the regulator's audit, addresses both occupational health and safety and rail safety, and also examines other matters such environmental compliance. A copy of the report and a brief in relation to the outcomes is provided to the Board of Pacific National. Furthermore, once the external review is complete and a number of corrective action plans have been put in place, there is a process of follow-up within the business groups to ensure appropriate and timely close-out of those action plans. Close-out involves a formal process of evaluating the effectiveness of controls that have been put in place to address identified risks and shortcomings. The level of criticality of the subject matter affects the level of acceptance. Critical matters are required to be signed off by the more senior management personnel.

The situation at RailCorp in relation to both internal and external auditing is unsatisfactory. The SMSEP noted that when asked to provide copies of the most recent external audit conducted, the only response provided by the SRA was a Ministry of Transport audit. In March 2004, RailCorp was asked to provide evidence that progressive safety validation audits had taken place. It produced a special audit report undertaken by SAI Global during February and March 2004. This was an audit requested by the Customer Service Group – Station Operations. It recorded the fact that certain accidents had in fact occurred. The SMSEP commented that whilst SAI Global provided some evidence of accident close-out, it was specifically asked not to review the effectiveness of those actions. SAI Global was provided with the documents by RailCorp as the only means of verification and undertook no further independent verification, such as on site checking of document availability or on-site checking of implementation. The SMSEP noted:

> Of particular note is that this audit was undertaken in February/March 2004 indicating that despite ongoing investigations such as the Waterfall Inquiry, there remains an absence of critical self-examination of the effectiveness of improvement actions within the organisation.

To the extent that there was any compliance auditing that was carried out in respect of the SRA, this was only carried out by the former Department of Transport under the accreditation arrangements, giving rise to an absolute reliance on the former rail safety regulator by the SRA to ensure the adequacy and effectiveness of its safety management system.

It is a fundamental principle of safety management that the organisation that creates the hazards is the one which is responsible for ensuring all the hazards are sufficiently controlled, and that the controls are continually monitored.

If the SRA did not have the resources within its own staff to conduct the type of safety audits which were necessary to determine whether or not its safety management system was being implemented and was effective, then it should have used external auditors to obtain the necessary information on those issues.

RailCorp, in a document provided to the Special Commission in response to the evidence given by Dr Edkins, agreed the SRA and RailCorp approach to auditing had been insufficient, ineffective and quite fragmented. It further acknowledged that there had been a lack of initiative exercised by RailCorp and its predecessors in conducting meaningful examinations of safety critical matters. It claimed that this issue was being addressed as part of RailCorp's Assurance Programme and Auditing Programme, and it had established a position titled Manager Assurance and Investigation, which had the specific function of ensuring an adequate internal auditing programme and process.

The fourth matter inhibiting effective governance of safety by RailCorp relates to the capacity of the Board of RailCorp to scrutinise management. The Board should have, but does not presently have, the means to enable it to validate information that is supplied to it by management. This, of course, impacts upon its capacity to provide accurate and effective oversight. The SMSEP reported in relation to the SRA:

> No evidence could be found of the Board requesting, or being shown, external verification of the information provided by StateRail staff or requesting independent verification of the adequacy of measures being developed.

The evidence before the Special Commission indicates that this applies equally to RailCorp.

If the Board is unable to validate information from management, it effectively places itself in its hands. In those circumstances it is not in a position to undertake effective judgements and therefore cannot effectively discharge its responsibilities. The SMSEP was unable, through its extensive inquiries, to establish evidence that the Board of RailCorp had information validation processes available to it.

The Board, particularly when dealing with matters of a critical safety nature, must have available to it independent expert analysis and advice on matters it cannot critically analyse for itself. The Board must be in a position to question management on the practices and measures upon which the safe conduct of rail operations by RailCorp depends. To do so

effectively it must not be overly dependent upon management itself.

The evidence of Mr Bunyon leads me to conclude that the Board of RailCorp, at least to some extent, is at risk of operating in a manner which makes it overly dependent upon management. When asked by Senior Counsel Assisting how information provided to the Board could be validated, Mr Bunyon indicated that the Board relies upon the Chief Executive in his reports to the Board, and stated that this is not unusual. He agreed, however, that the lack of adequate control of information flowing within RailCorp, as observed by both Mr Bahr and Dr Edkins, can affect the Board. That clearly is an unsatisfactory situation and must be carefully reviewed, especially in light of the fact that the Chief Executive is also a member of the Board.

In my view, a validation process with respect to important safety information provided from time to time to the Board of RailCorp is essential, as a means of ensuring proper attention by it to significant safety critical issues. In this respect I observe, by way of illustration, the approach of Qantas, where safety information is periodically reviewed by a highly qualified external expert, prior to it being received by the Board. Mr Bunyon in his evidence stated the only means whereby the Board of RailCorp can be generally confident the information received by it is correct is essentially by inquiry, personal observation or audit. He considered the Qantas approach was akin to an audit of the information which goes to the RailCorp Board quarterly. I am satisfied, from this evidence, that RailCorp does not meet the Qantas standard.

The Board of RailCorp needs to be satisfied as to the soundness and accuracy of the safety information for which it is ultimately responsible in the proper discharge of its duties. This requires a system of independent assessment and an increased level of scrutiny. It is unsatisfactory for the Board to simply indicate that there is no reason to question information that is provided to it, without there being a process that provides an objective basis to support that view.

The SMSEP commented that at a meeting of the SRA/RIC Transition Safety Validation Board on 1 October 2003, the question of external assistance for the new RailCorp Board was raised. The Chairman reminded the meeting that the Safety Validation Protocol document reflects the desire of the rail safety regulator that the Board and Chief Executive of RailCorp be able to seek advice from suitably qualified and experienced safety and risk professionals. This, it was suggested, could take the form of a safety advisory panel, that could work with the Board's safety subcommittee, as required. The SMSEP commented favourably upon such an approach:

> If acted upon, this statement would ensure that the Board had the capability to verify information presented to it as valid and would ensure that the Board had access to suitably qualified people to assist the Board in undertaking its high level governance activities.

The Board of course has the power to call upon such assistance, whether it be by audit or by way of expert assistance, in relation to matters it is called upon to review or approve. In some such circumstances it is essential for the Board to obtain independent advice from a qualified and experienced expert in safety and/or by appropriate audit processes.

The fifth matter inhibiting effective safety governance within RailCorp relates to a failure to appropriately manage the significant change which is required for the implementation of an effective safety management system. Success at large scale transformation demands more than the best management efforts of the Board and senior executives. It requires an in-depth understanding of the human side as well – the organisation's culture, values, people and behaviours that must be changed to deliver the desired results. This is not something that has been adequately addressed in attempts to introduce change to both the SRA and RailCorp.

The members of the SMSEP were unequivocal in their observations as to the flaws in the current approach of RailCorp to managing change. They stated:

> There is a real risk that RailCorp will be ineffective in implementing safety improvement due to poor implementation strategies.

Managing change is a critical component of any major transformation, such as that required by RailCorp to create and implement an integrated safety management system. Effective change management gets results by building sponsorship from the top, creating leaders who will act as change agents or "champions", and by changing behaviours in frontline staff and operating groups. Every level of the organisation has a critical role to play if large scale change, such as the design and implementation of an effective safety management system, is to be successful.

Conclusion

Overall, it is clear that there is a number of factors referred to in this chapter that inhibit the effectiveness of the governance of the management of safety by RailCorp. Such was the situation in the SRA and I am of the opinion it still exists in RailCorp. The organisation formed by the merger of the SRA and RIC is in need of a comprehensive review to assess organisational effectiveness and to evaluate leadership and accountability, in order to ensure the quality and internal consistency that is required in the management of a complex organisation involving technology and human systems.

The range and depth of the organisational deficiencies within RailCorp, relating to safety management, will not be able to be addressed in a period of months. It is not surprising that such deficiencies exist when one looks at the history of the structure of government owned railways in New South Wales. In 1996, there was a large monolithic integrated government owned railway system, where track ownership, train services provision, track maintenance, train maintenance, country rail services and freight services were all operated within one organisation.

It is not difficult to see, when one briefly analyses what occurred in the six years from 1996, that such enormous disruption, as described in chapter 3 of this report, to the corporate structures of the various government owned rail organisations was going to undermine effective corporate governance in relation to the management of safety within RailCorp.

Added to this is the fact that the SRA had eight chief executive officers in the last ten years. This lack of continuity in leadership goes to demonstrate why the SRA was unable to implement the type of corporate governance structure that was necessary to ensure that such a transport service provider was a safe and efficient organisation.

The observations that have been made in this chapter relate to the specific subject matter of the second term of reference, which is the adequacy of the safety management systems applicable to the circumstances of the accident, insofar as the corporate governance of safety is relevant to that issue. Obviously, there are other areas within this organisation, such as its financial management and its resource management, which are beyond the scope of the terms of reference and have not been examined, but it would be surprising if the deficiencies in those areas were not at least as great as has been identified in the area of the corporate governance of safety. The overriding question of a change management program within RailCorp is addressed in chapter 23.

The deficiencies in risk management skills at the senior management level in RailCorp is a major issue. They include poorly defined responsibilities and accountabilities in relation to the following:

1. Poor communications and information flow;

2. The lack of systems for ensuring significant failures and issues are reported up to senior managers;

3. Inconsistency in approach to processes between departments;

4. Failure to subject systems to review to ensure that they are current and effective; and

5. Lack of suitable skills and necessary training at all levels of the organisation.

It can be seen that the deficiencies in corporate governance of the management of safety and accountability within RailCorp are substantial. These issues need to be at the centre of the change management program which I have recommended elsewhere in this report.

21. RailCorp Safety Reform Agenda

The Special Commission of Inquiry into the Glenbrook Rail Accident identified a large number of deficiencies in the overall management of safety. The report identified that many of these had arisen as a result of disaggregation of the rail industry in 1996. Disaggregation and the failure to manage the process resulted in a fragmentation of safety knowledge and expertise. The State owned corporations with particular business objectives were required to pursue those business objective. There was a tension between the commercial objectives of the infrastructure owner and the infrastructure maintainer to maximise their profits and increase the return to the government, and the need of the then SRA to provide safe and reliable train services to the travelling public. Various examples of this tension can be cited from the Glenbrook Inquiry, where there was evidence that when track maintenance was necessary to keep services operating efficiently, the infrastructure owner's assets management plan could not accommodate the necessary works.

The second interim report of the Glenbrook Inquiry recommended merging the infrastructure owner, RAC, with the infrastructure maintainer, RSA, to become the Rail Infrastructure Authority. Amending legislation, the Transport Administration Amendment (Rail Management) Act 2000 was passed constituting a State owned corporation, the Rail Infrastructure Corporation.

The next major organisational change was effected by the Transport Administration Amendment (Rail Agencies) Act 2003. It constituted RailCorp and conferred on it the rail passenger functions of the SRA and vested RIC rail infrastructure facilities within the metropolitan rail area in RailCorp. The announcement that this was to occur was made on 2 April 2003 by the Minister for Transport Services, the Hon. Michael Costa. He replaced the previous Minister for Transport, the Hon. Carl Scully, after the New South Wales election held on 22 March 2003.

In July 2003, a Train Services Safety Improvement Program (hereafter referred to as TSSIP) was commenced by the SRA, to co-ordinate various projects designed to address deficiencies that emerged during the course of this Inquiry. There were six sub-programs developed:

(i) Driver Safety Management Systems;

(ii) Train Speed Compliance;

(iii) Rail Safety Worker Fitness for Duty;

(iv) Management of Safety Critical Fleet Assets;

(v) Defects Management System; and

(vi) Emergency Evacuation.

The driver safety management system program involved examination of deadman systems and vigilance control systems on passenger trains. The train speed compliance program was focussed on implementing safety systems to ensure that train speed is maintained within an identified limit. The interim report identified that many train drivers exceeded the prescribed

speed limits in the area between Waterfall railway station and where the accident occurred. One of the reasons for such failure to comply with speed restrictions may have been timetables that could not be met. Mr Edward Oliver, a contractor to the Transport Co-ordination Authority in the area of rail safety, said that the timetable allocation of eight minutes for a train to travel between Waterfall and Helensburgh railway stations was unattainable when obeying the speed restrictions on that section of track. Speed boards were inappropriately located in this area, according to Mr Oliver, and this also encouraged train drivers to ignore the speed limits. Evidence of the high proportion of trains speeding through this section of track, therefore, testifies to inappropriate speed boards and timetables.

Medical standards and fatigue management were identified as being contributory factors to the accident, during the first stage of this Inquiry, and they were included in the part of the TSSIP dealing with train crew fitness for duty.

In the first part of this Inquiry a number of deficiencies in the systems for reporting and maintaining trains were identified, and the TSSIP developed a set of projects dealing with the management of the rolling stock, including matters dealing with maintenance, inspection and the procedures for rectifying defects. The TSSIP also identified the deficiencies in the systems for emergency evacuation, and there was a project undertaken to revise the policies and procedures for emergency access and egress by passengers and crew. The various projects, above, were included in the TSSIP which commenced, with one exception, in September 2003. The safety issues identified in the particular programs referred to have been the subject of other chapters in this report.

In addition to the specific deficiencies identified in this Inquiry, the Special Commission of Inquiry into the Glenbrook Rail Accident identified a greater need for risk management. This led to the enactment of the Rail Safety Act 2002, which came into force on 8 February 2003, eight days after the Waterfall rail accident. That Act required rail operators seeking accreditation to demonstrate that they had procedures in place for the identification and control of all risks in their operations.

In view of the criticisms of the way in which the process of disaggregation in 1996 had been managed and the more onerous requirements of risk management imposed by the Rail Safety Act 2002, a committee was established to specifically manage the safety implications of the re-aggregation of the RIC and the SRA. It was named the Safety and Environment Transition Working Group, and Mr Peter Medlock, a consultant, was appointed in May 2003 by the then Deputy Chief Executive, Ms Fran McPherson to "lead" that group. Mr Medlock had previously undertaken consultancy work for the previous rail infrastructure maintainer, RSA, when it was investigating safety management systems to better protect trackside workers, following a number of deaths which had occurred to its employees during previous years. Mr Medlock's experience in safety management systems with regard to train operations was limited. Mr Medlock also conceded he had no formal qualifications in safety management, no formal training in safety management and limited project management skills. However, he maintained he had the skill and experience developed from other projects which qualified him to undertake the consultancy for which he had been retained. Mr Medlock was asked how he came to be appointed and his evidence was:

> Q: Do you have an understanding of the basis upon which you were selected to carry out that responsible position?

A: I'm not aware of a selection process. However, I understand my selection was based on the fact that I have a good practical record in addressing safety issues in a range of organisations and industries.
Q: Do I understand the position to be this? Firstly, you were appointed to this position as project manager without going through any form of selection or formal selection process?
A: I'm not aware of a selection process.
Q: I dare say had there been one, you would have been aware?
A: That's the case.
Q: Were you provided with a scope of works document before you accepted this position?
A: I had developed a scope of works document as part of my initial brief.
Q: So the scope of works for this Safety Reform Agenda was developed by yourself?
A: That's right – and the safety working group that was in place at the time.

The new combined organisation which became known as RailCorp was to operate from 1 January 2004. Under the Rail Safety Act 2002 (hereafter referred to as the Act), before RailCorp could begin as a rail operator, it needed accreditation. Accordingly, part of Mr Medlock's responsibility was to devise a program which would satisfy the Department of Transport and the new regulator, ITSRR, which was also to come into existence on 1 January 2004, that RailCorp should be accredited in accordance with the requirements of the Act. It was necessary to develop a number of programs that would support the accreditation application. These programs formed the basis of a safety management framework, devised by Mr Medlock, that contained a number of elements. These elements included strategic planning and performance, a safety and environment management system, a compliance and assurance program, an operational safety program, a network rules review and a program for compliance with statutory and any other, obligations enforced by the Environment Planning Authority.

Mr Medlock and the group then commenced that task for the purposes of satisfying what they perceived would be the accreditation requirements in order for RailCorp to become an accredited organisation, enabling it to commence operations on 1 January 2004. The program upon which Mr Medlock and others were engaged had to be significantly revised, it appears, after Mr Graham, the Chief Executive of the SRA and RailCorp, received a letter dated 19 August 2003 from Mr Kent Donaldson, the Executive Director, Transport Safety and Rail Safety Regulator. Mr Donaldson's letter stated, in part:

> The new accreditation process will seek much stronger evidence from operators to convince the regulator that they have the systems, skills and capacity in place to ensure the safe running of their railway operations. This extends to responsibilities of the senior management team and the Board in ensuring they are actively keeping themselves informed of the condition and management of the rail infrastructure, the safety critical risks facing their operations and the actions being taken to effectively manage those risks.

The letter attached a document with the heading "accreditation principles", which set out in some detail the extensive matters requiring attention.

Mr Graham was asked a number of questions about the arrangements for Mr Medlock to deal with the matters identified as accreditation principles and, it appears, it was only after Mr Graham received the letter from Mr Donaldson that he realised the immense task ahead of RailCorp to obtain accreditation. Previously, I believe, he thought that problems associated with the Waterfall rail accident could be fixed by addressing the four causal factors identified in the interim report: installing vigilance devices, improving medical testing, improving training of drivers and guards, and improving the safety culture throughout the organisation.

Mr Donaldson sent a further letter to Mr Graham on 27 August 2003, which included the statement: "an operator who is unable to sufficiently convince the ITSRR that his/her systems are working effectively in practice to deliver safe outcomes, may not be granted accreditation".

Mr Donaldson, I am satisfied, is a person of integrity and was conscientious and dedicated to placing public safety as his first priority. He made it clear that if he was not satisfied that an operator could deliver safe rail services he would have no hesitation in refusing accreditation. Whilst I accept that Mr Donaldson held such views, I could not envisage RailCorp being refused accreditation, because of the resulting chaos, particularly on the metropolitan network. It is significant, however, to note that when ITSRR was established, Mr Donaldson lost the power to refuse accreditation. He was limited to reporting to others who would make the decision as to whether accreditation should be refused or granted.

I am satisfied that the Safety Reform Agenda resulted from Mr Donaldson putting Mr Graham on notice that the requirements for accreditation under the new Rail Safety Act 2002 required much greater focus on risk management than had been the case. Mr Graham was questioned about this and the following evidence, in my view, confirms this proposition:

> Q: So you think that it may have been - you asked Mr Medlock to prepare a Safety Reform Agenda before you got this letter?
> A: Commissioner, I'm not confident about that. I think that - and I'm certainly prepared to determine when that would have been.
> Q: You see, I suggest that an inference is open that what prompted you to ask Mr Medlock to prepare a Safety Reform Agenda was prompted by this letter?
> A: And I'm not able to confirm that.
> Q: I beg your pardon?
> A: I'm not able to confirm that conclusion. Mr Commissioner, I am certainly prepared to go back and give you more precise information on that. I simply cannot go to the date immediately.

It is significant that it was not until November 2003 that Mr Graham asked Mr Medlock to design a Safety Reform Agenda. Mr Medlock prepared the Safety Reform Agenda, and it was presented for the consideration and approval of the SRA Board on 17 December 2003. The only elements of the Safety Reform Agenda that added to what already was in the safety management framework were a risk management element and an element called "performance measurement reporting and improvement".

It must have been obvious to Mr Graham that Mr Donaldson would not be satisfied that RailCorp, when it came into existence on 1 January 2004, should receive accreditation on the basis that it had adequate systems and processes in place to properly manage the safety of its

operations. This is apparent from the fact that Mr Graham did not apply for accreditation in December 2003, but applied for provisional accreditation. There was no legal basis upon which an application could be made for provisional accreditation. Applications were required to be submitted for accreditation and it then became a matter for the operator to satisfy the regulator as to whether it should be granted accreditation or provisional accreditation or refused accreditation. A grant of provisional accreditation meant that its accreditation was subject to it satisfying the conditions of accreditation imposed by the regulator over a period of 12 months.

Mr Graham in his evidence stated, "I did have personally an understanding of what constituted good safety management systems, and clearly they were not present in the State Rail organisation when I took it over". When one examines Mr Medlock's Safety Reform Agenda, it is clear that there had been no improvement to the safety management system at the time it was presented to the Board in December 2003. The Board of RailCorp met on 22 January 2004 to consider the Safety Reform Agenda and it also approved the Charter of rail reform, of which Mr Medlock's ten elements were the cornerstones. These are outlined below.

The SMSEP report assumes that implementation was part of Mr Medlock's scope of works, but all he was required to do was to prepare a strategic plan. He was not to be responsible for its implementation. Mr Medlock stated the Safety Reform Agenda was designed to serve two practical purposes:

1. It would form the basis upon which RailCorp would apply for full accreditation in 2005.

2. It would address the types of risks that were revealed in the Waterfall Inquiry and other Inquiries so as to achieve a long-term sustainable safety culture across RailCorp.

Most of the proposals that Mr Medlock was considering in the Safety Reform Agenda involved the development of safety management elements. The major criticism of these developments is the unrealistic time frames involved.

The first element of the Safety Reform Agenda was to form a representative team to guide the progress of the Safety Reform Agenda. This team was to have its first meeting in January and it was intended that, by 30 June 2004, responsibility would be handed over to line managers for the implementation of the Safety Reform Agenda. Mr Medlock was asked what he meant when he was referring to line managers:

> Q: You have also been asked questions about front line managers and front line staff. I just wanted to understand from you when you use the term "line manager" to whom you are referring?
> A: I refer - when I am talking about line managers I use that term broadly to refer from group general managers down to supervisors who actually supervise the work in the workplace, in the operational areas of RailCorp.

The other glaring deficiency in the proposal was that there was no basis upon which the line managers could be thought to have the skills to implement the programs identified by the

Safety Reform Agenda. When Mr Medlock was asked about the method by which line managers might acquire those skills he stated:

> We are hoping to have all our line managers go through the safety science training program that we are developing so we develop those competencies in line management.

Other documentation made available during the course of the Inquiry demonstrated that the safety science training program did not commence until a pilot course was introduced on 17 May 2004. It is therefore improbable that by 30 June 2004 the line managers would have the necessary competency to introduce and oversee the implementation of the Safety Reform Agenda. Dr Edkins emphasised the importance of having appropriately qualified personnel to manage the safety systems as the two disparate cultures of SRA and RIC are integrated. He gave the following evidence:

> Now, the professionals leading this particular complex task must have both good experience in safety management systems and appropriate qualifications. By not doing that, the implication of this is that, if you like, safety skills and knowledge should be valued as much in the organisation as rail operations experience, and I would argue that it is not rail operations experience that the organisation needs at the moment - they have got plenty of that - it is safety systems experience. Having 40 years of experience in rail operations does not make you an expert in safety management systems, and there appears to be a lack of emphasis and lack of understanding that, one, that balance is required; and, number two, a two-week course in safety management systems might suffice for it, for the correct qualification. I think that came very strongly out of the audit process that we followed.

Dr Edkins later corrected an error in this evidence, saying that a two-week course in safety management systems would not suffice for the appropriate qualifications in safety management systems.

The second element of the Safety Reform Agenda related to the development of effective processes to communicate RailCorp safety objectives and to enable all employees to provide their views and input into improving safety performance. That process of communication was to start on 31 March 2004 with initial briefings for all groups, followed by regular structured workplace communications from 30 June 2004. Initial briefings for all management groups was said to have been done, while the regular workplace communications were "delayed pending formation of workplace safety committees".

The next element of the Safety Reform Agenda was to clearly identify safety accountabilities at all levels of management and supervision, supported by regular performance assessment and appropriate management training programs. The process by which this element was to be implemented is intriguing. Essential to the process is that management be made accountable for particular safety matters within their areas of responsibility. Before they could be made accountable, it was necessary for them to receive training in system safety and risk analysis. Although they signed their accountability statements on 31 March 2004 the management training was, according to the time line in the Safety Reform Agenda, not to be developed until 30 September 2004. This type of training, one assumes, must be different from the safety science training programs that commenced in May 2004. In any event, this falls

somewhat short of reinforcing the obligations which processes of accountability are intended to ensure.

The fourth element of the Safety Reform Agenda was to develop an effective structure of supervision at the workplace, with a clear focus on safety to ensure that supervisors have the skills to supervise safety of the workplace.

Communication of new supervisory roles with position descriptions and accountabilities was a milestone that was due to be completed by 30 September 2004, which was also the date set for the initial management training program milestone which was included in the third element in the Safety Reform Agenda being leadership and management accountability. If a training program for management accountabilities was to be initiated on 30 September 2004, one wonders how management could be expected to communicate new roles and accountabilities before they had the requisite training.

The fifth element of the Safety Reform Agenda related to risk management. On one view this was the only element necessary, because all the others were part of the management of the risks of the operations. Nevertheless, for reasons already identified, risk management was added as a discrete element following Mr Donaldson pointing out to Mr Graham that the regulator would be requiring the new organisation, RailCorp, to comply with the more stringent requirements in relation to risk management imposed by the Rail Safety Act 2002.

The elements of the risk management framework were to include a methodology for identifying major hazards, the development of a comprehensive risk manual, the development of simple tools for risk assessments to be applied by persons working at each level of the organisation, the development of comprehensive risk registers, the development of processes to identify, control, monitor and escalate risks at all levels, training in risk management and the establishment of a central role for workplace safety and risk committees.

RailCorp would appear to have recognised that, within its own ranks, it did not have the expertise to develop such a comprehensive risk management system and it retained a consultant, Lloyd's Register Rail, to develop the risk management framework. Although Lloyd's Register Rail commenced the work it was retained to carry out on 19 April 2004, it would appear that the formal contractual documentation between them was not completed until some time later.

Lloyd's Register Rail delivered its first report on 25 June 2004 and its second report on 30 June 2004. Lloyd's Register Rail identified three key aspects of what it described as the "deliverables" which, as at 30 June 2004, required three key aspects to be addressed and implemented "during the course of the coming months". Lloyd's Register Rail identified the three key aspects in its executive summary as follows:

> 1. There needs to be a re-definition of risk within the organisation and this must be clearly and consistently communicated. Fundamentally, RailCorp is an integrated rail system provider, delivering a transport service and operating under general business rules, regardless of how it is structured organisationally or functionally. Therefore, there is a critical need for the organisation to understand throughout that regardless of structure, line reporting arrangements, etc, risk within any part of the organisation will ultimately present risk to RailCorp.

2. Having established this clear re-definition, there is then a need to determine what the baseline risk is to RailCorp as a system and business provider, who also has a higher degree of public accountability within New South Wales. RailCorp has in its possession an abundance of data in terms of operational performance, incident information, audit findings, etc. However, analyses of these data and subsequent action have traditionally been limited and not particularly effective in delivering a predictive risk based approach. This document provides a way forward to rectify this situation. RailCorp must establish a benchmark against which improvement can be monitored, measured and reported.

3. The third step involves establishing a systematic and commonly applied means of controlling change to this baseline risk. RailCorp in its endeavours to improve safety performance will be faced with multiple choices over the coming months and years. It is therefore vital that a commonly understood and applied system is available to appraise these choices and decisions and ensure that within the organisation the most risk beneficial approaches are adopted. This will require amongst many things a significant cultural shift whereby RailCorp moves from being a predominantly reactive organisation to one which embraces forward planning in terms of risk management.

What the authors of this document appear to say in the first two paragraphs which have been quoted is that RailCorp needs to comprehend that it is conducting an activity with numerous hazards which create risks which need to be properly managed and, because of public expectations about rail safety, it needs to identify the level at which the risks would be regarded as acceptable. The third paragraph points out the problems that will face RailCorp in implementing the necessary reforms.

The sixth element of the Safety Reform Agenda related to the review and enhancement of the safety training framework to achieve an effective balance between on and off-the-job training, and an assessment to ensure safety training needs at all levels are identified and addressed. As at 30 July 2004, a report proposing a new safety training program was being formulated. The adequacy of the so called safety science training has not been able to be reviewed as no adequate documentation has been provided to the Special Commission. A review of train driver and guard training procedures applicable to the Waterfall rail accident is the subject of chapter 15 of this report.

The seventh element of the Safety Reform Agenda required the establishment of safety and risk committees amongst the employees, which had the desirable objective of having the staff involved in the processes of identifying risks, to better manage them and facilitate improvements in training. As at 30 July 2004, a management committee structure had been developed and there were discussions with trade unions about the role and structure of workplace safety committees. The committees had not been established at that time.

The eighth element of the Safety Reform Agenda was to develop an effective framework of quality assurance, with processes of auditing and certification, to demonstrate that the desired outcomes in safety performance have been met. The status of this aspect of the Safety Reform Agenda appears to be that programs are ready for "rollout", whatever that means, but were not being implemented.

The ninth element of the Safety Reform Agenda was to establish an effective safety reporting framework for RailCorp, covering performance reporting needs and responsibilities at Board, executive division and workplace levels. The progress of that element of the Safety Reform Agenda, as at July 2004, was that a "draft matrix of performance indicators and draft performance reports" had been "developed". The matrix and performance reports were to be "refined", and measurement and reporting processes were to be "identified". In other words, no progress or implementation of that particular element had been made.

The tenth element of the Safety Reform Agenda required the development of a revised structure for an integrated safety and environment management system, ensuring a consistent approach to implementation across the RailCorp organisation. It was to involve "linkages" into safety management across all areas – trains, infrastructure and people.

As at July 2004, the progress of that somewhat ambitious proposal was that there had been a "dedicated resource engaged to develop the framework and plan for the [Safety and Environment Management System]", with specialist assistance being provided by Lloyd's Register Rail and CASA with a need to review that approach "against concerns raised by SCOI". It was further said in the progress summary for the Safety Reform Agenda that the "SMS elements were agreed and under development". It is clear that the tenth element of the Safety Reform Agenda is still in the planning stage.

The Special Commission has had extreme difficulty in ascertaining the progress RailCorp has made against its Safety Reform Agenda initiatives. A letter dated 19 July 2004 was sent by the Special Commission to RailCorp requesting, among other things, "the latest reports and/or documents outlining the current status of the [Safety Reform] Agenda including detailed comments on the progress of each element against its timeframe for completion". RailCorp responded by letter dated 22 July 2004, enclosing a summary of progress. The summary is Figures 21.1 to 21.3.

Figure 21.1 RailCorp Safety Reform Agenda status summary dated July 2004 (page 1)

Figure 21.3 RailCorp Safety Reform Agenda status summary dated July 2004 (page 3)

Safety Reform Agenda Progress - Summary – July 2004			
Reform Agenda Element	Milestone	Current Situation	Comment
8. Assurance ▪ to develop an effective framework of assurance activities across all areas and levels of RailCorp	**30 June:** ▪ Safety Observation program ready to roll out ▪ Engineering Authorities documented in all areas ▪ comprehensive audit program in place **30 September:** ▪ processes for certification of safety critical work in place in all areas	▪ assurance processes and SO program to be rolled out across RailCorp in the second half of 2004	Safety Observations: ▪ SO training for managers and supervisors to be included in Safety Science Training program (initial program completed) ▪ strategy for roll out across RailCorp to be finalised and endorsed. ▪ GGM's have allocated resources to assist in development of assurance matrix ▪ Mapping of assurance matrix with various groups under-way ▪ Corporate Configuration Control Committee being set up, reporting to Asset & Reliability committee chaired by CEO. ▪ Configuration Control / Management processes existing in Infrastructure, being finalised in PFM. ▪ Engineering Authority procedures in place in Infrastructure and PFM. → **SRAP PCG**
9. Measurement, Improvement & Reporting ▪ to establish an effective safety reporting framework for RailCorp covering performance reporting needs and responsibilities at Board, Executive, Division and workplace levels.	**30 September:** ▪ performance reports in place and published	▪ draft matrix of performance indicators and draft performance reports developed	▪ Performance indicators included in safety strategic plan ▪ Detail to be developed where required. ▪ matrix and performance reports to be refined and measurement and reporting processes to be identified → **SRAP PCG**
10. Safety & Environment Management System ▪ to develop a revised structure for an integrated S&EMS	**30 September:** ▪ revised S&EMS structure		▪ dedicated resource engaged to develop the framework and plan for the S&EMS ▪ specialist assistance being provided by Lloyd's Rail and CASA ▪ need to review approach against concerns raised by SCOI ▪ SMS elements agreed and under development → **SRAP PCG, GM S&HF**

The response is entirely unsatisfactory and provides the Special Commission with no assurance that what RailCorp says is being implemented is, in fact, being implemented.

The conclusion to which I have come in relation to the Safety Reform Agenda is that it was not capable, and could never have been capable, of bringing about the safety reform that is necessary within RailCorp in the 12 months required by the conditions attaching to its provisional accreditation, or indeed at all.

There are a number of reasons for this. The first is that the rail Safety Reform Agenda posed unrealistic time frames. If one wishes to return to the realms of what is realistically achievable, it is worth noting that Mr Bahr stated in evidence that to do a hazard analysis across the New South Wales system in a period of 12 months would be a Herculean effort. He gave an example of a hazard analysis being undertaken on a rail car that was being purchased in the United States and said:

> I have had teams of engineers do hazard analysis on a rail car procurement and it can take months at a time to do that. It is a complex process. Imagine multiple rail car designs and a complex network that moves over 900,000 people a day.

Dr Edkins, the Chairman of the SMSEP, said:

> Of particular notice is the time frames outlined in the Safety Reform Agenda. Experiences from other organisations which have embarked on what is a fairly sizeable task is that the time lines to implement fully effective systems across an organisation as complex as RailCorp are quite lengthy. I think similar organisations have taken up to three years to implement an effective risk management program and four to five years to have a functioning integrated safety management system.

One must contrast this evidence from an eminently qualified expert with the time line identified by RailCorp, which required that all major hazards would be identified by 30 September 2004 and that by 31 December 2004, the comprehensive risk manual would be operating and the risk registers would be not only developed, but would be utilised in all areas of the organisation.

The method by which these implementation programs are to be carried out is not identified. Nor is there any identification of how it is contemplated that such a task can be achieved. In the time frame specified, it is plainly fanciful and unrealistic to expect that "an effective, consistent, integrated and predictive safety risk management framework for RailCorp" could be developed and established in a period of less than three years.

Secondly, the Safety Reform Agenda developed from other programs that were designed to meet the requirements of provisional accreditation. The process used to meet these requirements was to use the language of the statute and the accreditation principles provided by Mr Donaldson as the means by which an attempt would be made to meet the requirements of accreditation.

It was obvious to Mr Graham that the level of safety management within RailCorp was so deficient that the only means by which accreditation could be obtained would be on a

provisional basis and this, in turn, depended upon RailCorp seeking to persuade the rail safety regulator, which by then was ITSRR, that it was developing various programs to deal with the rail safety management issues which it thought were of concern to the safety regulator.
In the meantime, its operational and executive staff went about their ordinary duties in a way which bore no relationship to what was being done by Mr Medlock, an external consultant, for what was perceived to be a process divorced from the main business of the organisation, the provision of train services. Mr Thompson, a driver-trainer employed by RailCorp, gave evidence that his knowledge of the Safety Reform Agenda was very limited and he was not aware who was in charge of the Safety Reform Agenda. The first time he heard of Mr Medlock was when Mr Medlock gave evidence, when Mr Thompson was in the hearing room waiting to be called as a witness. The evidence of Mr Thompson suggests that the Safety Reform Agenda has had a negligible impact on operational staff, which again shows poor communication between management and staff.

In other words, what was fundamentally wrong with the Safety Reform Agenda was that it bore no relationship whatsoever to the way in which the organisation was carrying out what it perceived to be its core activities. It was simply, like accreditation itself, a process that had to be undertaken, using the appropriate language with a sufficient amount of jargon, to give the impression that something was being done about the management of safety. When the lack of practical content was identified during the course of evidence, the usual response was that the documentation was at a "high level". This is why many of these proposals are expressed in language such as "to develop" or in terms of "drafts".

This overlaps with the third deficiency, which is a lack of detail in the Safety Reform Agenda. The level of detail is such that the Safety Reform Agenda is not more than 22 pages in length. Dr Edkins confirmed that, despite repeated requests, no documentation was provided to the Special Commission beyond that contained in the 22 page Safety Reform Agenda. Dr Edkins said that the lack of detail in the agenda with regard to time frames and accountabilities could jeopardise the whole operation. Ms Carolyn Walsh, Chief Executive of ITSRR, also believed that the agenda document contained no analysis, but was rather a series of tasks and time lines. Ms Walsh agreed, in evidence, with the description of the agenda as being "rudimentary in the extreme".

Mr Medlock agreed, in evidence, that the ability to quantify the Safety Reform Agenda elements was a fundamental prerequisite to measuring the performance of the organisation against the elements. He conceded that the elements of the agenda were not capable of being quantified, but persisted in his belief that the elements provided a sound basis for the project to go forward. Mr Graham disagreed with the views expressed by independent experts engaged by the Special Commission that the elements did not form a detailed project plan.

The fourth criticism of the Safety Reform Agenda was that the personnel involved did not themselves understand what the task of developing an adequate risk management and safety management system involved. The SMSEP found that RailCorp's organisational competency to manage system safety and risk assessment effectively was less than adequate, especially in the fields of system hazard analysis, risk assessment and human factors analysis. The subject of human factors was not even considered as an element of the Safety Reform Agenda and, at the time of the SMSEP report, RailCorp had no documented human factors policy.

What the rail Safety Reform Agenda represents is the same characteristically reactive approach to rail safety management, with the use of concepts and ideas which have been borrowed from other contexts.

The fifth deficiency in the Safety Reform Agenda is that there was no audit of the entire organisation prior to the elements being set down and the Charter of rail reform being approved by the Board. The hurried approach in devising this agenda is understandable when one looks at the time constraints faced by RailCorp in achieving full accreditation within 12 months of 1 January 2004. The temptation to rush through many projects must have been weighing on the minds of RailCorp management, considering the requirements of the regulator and the findings of this and the Glenbrook Inquiry. This temptation has manifested itself in the poorly designed Safety Reform Agenda. There was no organisation-wide audit undertaken before launching into the agenda and the result was that RailCorp did not have a benchmark from which it could measure the areas that needed improving.

Dr Edkins in his evidence discussed the importance of undertaking a detailed factual review of the current safety systems and processes within an organisation, before the organisation embarked upon a detailed system of safety reform. He thought it was crucial to clearly understand the nature and scope of the risks inherent in the organisation before proposing to change the organisation. This would involve conducting, he said, a very detailed and comprehensive identification and analysis of the risks within the entity, including interfaces with other organisations with which the particular organisation will come into contact. He went on to say that, if you do not have a baseline on which to base a change management program, it may be based on ill-conceived facts and it would be like asking a Special Commissioner to release his report to the government prior to him considering all the evidence.

Mr Medlock agreed, in evidence, that a thorough factual investigation was a prerequisite before launching a Safety Reform Agenda, but then went on to say that he did not believe it detracted from the validity of the Safety Reform Agenda process. He gave no satisfactory explanation of the lack of logic in those answers.

Mr Graham indicated that whilst a baseline audit was an important issue it was not a luxury he was afforded at the time the Safety Reform Agenda was developed. It might here be observed that the pursuit of an inadequate or deficient reform agenda may ultimately cost a good deal in terms of time and money, if the agenda requires overhaul. Mr Graham, however, would not concede that the substance of the Safety Reform Agenda had suffered in the absence of such an audit being performed. Mr Graham is out of step with other more experienced safety management experts. It was put to him by Counsel Assisting that in order to carry out this process it would be mandatory to understand thoroughly the facts of the organisation. Mr Graham replied he had already acknowledged that that needed to be done. He said the priority facing him as Chief Executive in 2003 was to develop and respond in a short and medium term to the safety environment as he perceived it.

What should have been done was to use the data that was able to be gathered, to identify the hazards that existed within the organisation, examine the controls that were in place to manage the risks created by those hazards, and then for RailCorp to satisfy itself that those controls would be effective. If it were not possible to eliminate the hazard, then it would be necessary to identify a level at which the risk was regarded as acceptable. A program should then have been devised to control all of those risks and to co-ordinate and integrate that

program within the core business activities of the organisation. The development of such a program would involve the assigning of aspects of the project to particular persons. Such persons must be allocated sufficient resources to enable them to undertake the tasks for which they are accountable.

Finally, the deficiencies relating to accountability for those persons implementing the Safety Reform Agenda means that the whole process has the potential to fall apart. Someone must take responsibility for implementing the Safety Reform Agenda. Whilst the aim was to transfer these responsibilities to line managers by 30 June 2004, this did not happen. The SMSEP report and Mr Donaldson's evidence stressed the importance of a level 2 manager being appointed as the "champion" to lead the Safety Reform Agenda and to make sure that the safety management system is implemented across all organisational interfaces. While signed safety accountability statements are in place for level 2, 3 and 4 managers in the operating divisions, their language is generic and cannot be measured in a practical way. In respect of each of those project managers there needed to be a clearly defined scope of the work, a schedule setting out when the work was to be completed and a system for measuring whether or not the objectives had been achieved in time.

That overview and the co-ordination of the programs could not be undertaken by retaining an external consultant, such as Mr Medlock, to "develop" a Safety Reform Agenda. It required the establishment of a separate and permanent senior officer, responsible to the Chief Executive for the development of the program and the implementation of the necessary reforms in a realistic time frame.

The underlying deficiencies in the Safety Reform Agenda were, to an extent, reflected in the TSSIP. An independent report on the program management of the TSSIP found that all programs had insufficient closure and reporting mechanisms on safety improvement actions, which meant there was little or no means of measuring the performance of these actions. All programs were found to be deficient in terms of the identification of required resources and the efficient use of those resources. All program elements were found to be "slipping" from the target dates set out in the Charter of rail reform.

As was identified in the Safety Reform Agenda, a lack of proper planning and expertise has meant that the timetables in which to implement the charters for the six sub-programs have been unattainable. Also, the fact that so many different projects were being undertaken at the one time has, I believe, caused a sense of confusion among those responsible for developing and implementing these safety reforms. Dr Edkins observed the following, in his evidence:

> The sheer nature of the changes going on in the organisation again adds some problems in achieving those safety agenda items. It has got to be acknowledged that every organisation has a finite capacity to implement change, it requires time and effort, so I suppose a word of caution with the reform agenda is that attempts to implement too many programs over too short a time period may indeed result in ineffective implementation or, indeed, a lack of commitment within the organisation to following through on some issues. I mean what would be prudent is for RailCorp to perhaps look at the key issues in that reform agenda, rather than taking a broad-brush approach, and focus on those within a shorter time frame, so that they get some success, get some runs on the board, so that those actions are effective and sustainably implemented, which can be then looked at and followed up through an audit program to look

at their success over time; so focussing on key issues rather than the more broad brush approach that the reform agenda appears to be adopting.

For the necessary reforms to be achieved, even in more realistic timeframes, requires substantial changes in the overall management of safety within RailCorp as discussed in chapter 20.

22. Safety Regulation

The interim report highlighted the fact that non-disclosure of information by the SRA was one of the key difficulties faced by the rail safety regulator in providing adequate regulatory oversight. The history of repeated non-disclosure of information relating to the known problems of the deadman foot pedal by the SRA was a prime example of the former safety regulator's effectiveness being diminished due to inadequate disclosure by the operator. Indeed one of the findings in the interim report was:

> The regulation of rail safety by the Director General of the Department of Transport was ineffective because it depended upon the State Rail Authority reporting a safety risk to the Department when identified. Neither the relevant risk nor the partial response to it was disclosed.

The SRA failed to ensure that the information about its systems supplied to the safety regulator was complete and accurate. The main reason for this was that the SRA had no adequate system for communicating the necessary safety information to those in managerial positions who were responsible for informing the safety regulator of relevant safety matters.

On the other hand, the safety regulator failed to perform the function of validating that the safety systems of the SRA adequately controlled safety risks arising from its operations, because the safety regulator did not have the necessary resources to discharge his functions under the Rail Safety Act 1993 (hereafter referred to as the 1993 Act). The lack of resources limited the safety regulator's activities to safety issues that presented themselves rather, than independently investigating whether identifiable risks were being properly managed and controlled. The purpose of having a safety regulator was to enable the identification of such risks in order that they could be managed and controlled and thus avoid the type of catastrophic accident which occurred at Waterfall.

Before the Waterfall rail accident

The system of rail safety in New South Wales is described as "co-regulation". This is the type of regulation prescribed by the Rail Safety Acts 1993 and 2002, respectively. Railway owners and operators are required to satisfy the safety regulator they are safely managing their operations. If the rail safety regulator is satisfied as to this, the railway owner or operator is then accredited by the safety regulator on the basis of the information provided. The co-regulation model sits between models at either end of the regulatory spectrum, where either the safety regulator is responsible for the whole of the regulatory framework and the industry is required to abide by prescribed regulations (hereafter referred to as the prescriptive model) or alternatively, the industry is not subject to any independent scrutiny and there is only limited government intervention (hereafter referred to as the self-regulatory model). The Glenbrook and Waterfall rail accidents, and the numerous other serious accidents considered in this and the Glenbrook Inquiry reports, demonstrate that co-regulation has simply not worked in New South Wales.

Co-regulation is discussed in more detail later in this chapter, however, it is important first to establish the history behind the development of the New South Wales co-regulatory model, so that the extent of its failings can be determined, and the reasons for them identified. Prior to the passing of Rail Safety Act 1993, the SRA was responsible for managing the safety of

its own activities, without being subject to independent scrutiny. This was essentially a self-regulation system, with limited government intervention. Such a self-regulation system allows organisations to run operations without a critical external examination of their safety management procedures.

In the late 1980s there was a number of accidents throughout the world, which served to change community expectations in relation to the management of safety. In the Glenbrook Inquiry, Dr Sally Leivesley, an expert retained by the Department of Transport, gave evidence as to how this process developed in the United Kingdom. She said in the nineteenth century there was not the public perception that there was the right to safe public transportation. That view changed because developments in mass communications increased the capacity of the media to display graphic images of disaster to large numbers of the population. Dr Leivesley said a number of particular disasters increased public awareness of safety issues and increased the demand for governments to protect the public. The accident at the Chernobyl nuclear power station in the former Soviet Union and the accident at Three Mile Island in the United States raised the level of public concern about safety management in hazardous industries.

Accidents in the United Kingdom, including the fire on the Piper Alpha offshore oil platform, the death of several chemical workers at Flixborough, the Kings Cross underground railway station fire and the Seabrook Ferry accident, together with the Challenger space shuttle accident and other similar catastrophes, contributed to public concern about safety management in transport and other hazardous industries. The result was, Dr Leivesley said, that government required organisations that were conducting activities which were dangerous, and particularly those that could produce multiple fatalities and injuries, to prove in a written form that could be tested that they were conducting their operations safely.

Dr Leivesley said that the public perception in the United Kingdom was that the government owed a duty to the public to ensure that potentially dangerous activities were being conducted safely. This public expectation became a feature of transport related industries. A catalyst for this was an accident on 12 December 1988 in the United Kingdom, when a crowded commuter train ran into a stationary train in a cutting just south of Clapham Junction railway station. This caused the first train to derail and strike a third, oncoming train. This accident resulted in the deaths of 35 persons and injuries to 500 other passengers, 69 seriously.

In New South Wales there was a similar change in public perception, followed by government policy which mandated that regulatory activities of hazardous operations be separated from operational activities. In 1990, a rail accident occurred near the Hawkesbury River, north of Sydney, when a privately owned heritage train was struck in the rear by an inter urban train, on the incline or embankment leading from the Hawkesbury River to Cowan, killing six people. The cause of this accident was the heritage train distributing sand onto the track, which affected the signalling system, thus causing the inter urban train to be unaware of the presence ahead of the heritage train. This accident was a further catalyst for the government's decision that safety should be regulated by a body which was independent of the operations being conducted by railway owners and operators. Accordingly, the Department of Transport began to regulate New South Wales railways.

The statutory means by which this was achieved was the Rail Safety Act 1993, which established a system that became known as co-regulation. This was novel and unique legislation in Australia, being the first statute to create and define a rail safety regulator's

powers and functions. It has since been repealed and replaced by the Rail Safety Act 2002, which commenced on 8 February 2003, eight days after the Waterfall rail accident. The long title of the Rail Safety Act 1993 was, "An Act to promote the safe construction, operation and maintenance of railways". The rail safety regulator was the Director General of the Department of Transport. The significance of the co-regulatory system established under that Act was that the onus lay on the railway owner or operator to conduct its rail operations in a safe manner, to the satisfaction of the rail safety regulator. The Act required the railway owner or operator to create its own standards by which it was assessed. Upon the rail safety regulator's acceptance, it then operated its system in accordance with those standards. This was considered an appropriate system because of the complex and dynamic rail operating environment in which the rail owner or operator ran its system twenty four hours a day. The responsibility of setting up the safety management systems to control the risks created by its operations was considered to be the responsibility of the railway owner or operator.

Mr Singleton, junior counsel for ITSRR, submitted it was important to bear in mind the differing roles between a rail safety regulator and a rail owner or operator. Regulators, it was said, under a system of co-regulation must strike a firm balance between independence and co-operation, to achieve a safe rail system. It was pointed out the operator runs the railway, and if it fails to accept responsibility for railway safety, safety will not be achieved. It was submitted that primary responsibility for safety rests on the operators and that is as it should be. It was also said that the role of the operator was to achieve and maintain a regime that facilitated safe operations by the operator. Whilst the power to grant accreditation always lies with the rail safety regulator, it must be remembered that railways are run by operators and they must always accept primary responsibility for safety and no regulator can supplement any deficiency in that regard.

This is brought home in the United Kingdom House of Commons Transport Committee 2004 Report titled "The Failure of the Railway", where it is stated that "The actions of the Rail Regulator to strengthen the terms of Network Rail's network licence may be welcomed in themselves but are no substitute for sound day to day management and powerful managerial accountability to the owner".

If an owner or operator believes responsibility for safety rests with the regulator, it is likely to concentrate on its core business and leave safety to the rail safety regulator. The accreditation of operators for the safe operation of railways was a key function under the Rail Safety Act 1993 and operators had to be accredited before they could operate in New South Wales. Operators applying for accreditation were required to identify the standards they proposed to manage the safety of their operations, in order for the Director General to accept those standards, if appropriate. These would then provide the means whereby the performance of the accredited person could be evaluated and monitored.

To obtain accreditation, a railway operator had to submit sufficient information to the rail safety regulator to demonstrate that it was capable of managing its operations safely. This meant that it had identified the risks associated with its operations and that it had the systems, management and technical expertise and resources necessary to eliminate or effectively control those risks. It was then for the rail safety regulator to assess the information supplied to it and independently satisfy itself that the safety management system adopted by the operator would efficiently control the risks of the operation.

It followed that all elements of the operator's accreditation documentation, including its standards, procedures and rules, became the basis upon which the application for accreditation was approved. They then became enforceable and were checked for compliance, by the rail safety regulator. The regulator was required to annually inspect the operator against the terms of its accreditation, to ensure that it was complying with the terms of the accreditation. These related to its financial viability, its managerial and technical competency, the suitability of its rolling stock, the appropriateness of its safeworking systems, the availability and competency of the employees, the availability and adequacy of the infrastructure generally and, in particular, the railroad track, associated track structures and signalling systems.

Importantly, an applicant for accreditation was required to submit to the Director General, under section 14 of the 1993 Act, a comprehensive safety management plan which identified any "significant potential risks" that may arise from the construction or maintenance of the railway and the construction or maintenance of the rolling stock specified in the application. The management plan was required to specify, pursuant to section 14(1)(b) of the Act, the "systems, audits, expertise and resources that are to be employed by the applicant to address these risks". In addition, an accredited person was required, under section 14(2), to submit to the Director General annually a revised safety management plan.

Accreditation under the Rail Safety Act 1993 was, in effect, a form of endorsement by the regulator that the rail operator had the competency and capacity to meet the standards submitted by the accredited operator.

In the case of the SRA, accreditation was obtained in 1994. Interim accreditation was obtained after the disaggregation of the rail industry in 1996. It was also accredited in 2001 and 2002. From 2002, the regulator used a system of milestones to attach various conditions to the grant of accreditation. Mr Donaldson, Executive Director of Transport Safety Regulation, ITSRR said this was a means whereby the regulator required further demonstration that a certain practice or procedure was being followed. These milestones or conditions were established against a time frame with which the SRA had to comply. These were essentially performance benchmarks on which accreditation was granted pursuant to the conditions contained in the milestones.

The 1996 application for accreditation was made to accommodate the disaggregation of the rail industry in which the SRA, the RIC, RSA and FreightCorp were established as separate entities, thereby requiring the SRA to obtain accreditation for its revised role as a train operator. The next application for accreditation was made in 2001, after an anticipated application in 2000 had been postponed to await the findings of the Special Commission of Inquiry into the Glenbrook Rail Accident. In the intervening years to 2000, the SRA remained accredited by virtue of the Director General extending the interim accreditation granted in 1996. As were other operators, the SRA was required under the Rail Safety Act 1993 in those years to submit a revised safety management plan to the regulator at least 28 days before each anniversary of the accreditation: section 14(2).

The non-disclosure of the deadman system risk in the 1994 and 1996 applications for accreditation by the SRA was clearly a contravention of the provisions of section 14(1)(a), and marked the beginning of what became a protracted history of non-disclosure of the problem to the Director General. Although the officer who prepared the application for accreditation was unaware of the safety risk posed by the deficient deadman system, others

senior to him did know about it, but did not advise him of the problem. The history of repeated non-disclosure represented a serious omission and effectively defeated one of the principal objects of the Rail Safety Act 1993, which was to promote the safe operation of railways: section 3(1). Through the repeated failures of the SRA to disclose the existence of the problem, the rail safety regulator was deprived of information to which he was not only entitled, but also required by statute to be provided with, in order to determine whether, in the interests of public safety, directions should be issued under section 51 of the 1993 Act to the SRA requiring remedial safety work to be carried out. Mr Singleton conceded on behalf of ITSRR that the previous regulator should have questioned why there was not more than one system of deadman controls. The regulator, he submitted, should enquire "what are the lines of defence?" and should have enquired "why a vigilance device was not fitted".

The regulator was nonetheless heavily dependent upon accredited operators understanding the importance of the identification and disclosure of risks and in complying with the legislation. Applications for accreditation under the 1993 Act were required to contain information verified by a responsible officer of the organisation. In the case of the SRA, the accreditation application for the year 2002 was verified by the then Chief Executive, Mr Lacy. He was required to make a personal declaration that all information provided in relation to the application was complete and correct. The application was neither complete nor correct in that it omitted significant information concerning the potential risk inherent in the deadman system. At page 21, the application stated:

> State Rail has a risk management philosophy and awareness of all risks at all levels of the company. It has a logical and systematic approach to the identification, analysis, assessment and treatment of its risks and rigorously monitors and reviews the effectiveness of its management of those risks.

This was not the case. Although the Chief Executive may not be expected to personally know all the information in the application for accreditation, he should know whether the systems said to be in place are, in fact, in place and working.

A further example of the failure by the SRA to comply with its statutory obligations related to the program for equipping the DDIC fleet with task-linked vigilance control devices. An accredited person was required under the 1993 Act to notify the regulator of any material change to the systems employed in the rolling stock covered by the grant of accreditation. The regulator was not informed that the SRA proposed to equip the DDIC fleet with vigilance devices and a deadman foot pedal, nor was the regulator subsequently advised that this had been done. Mr Donaldson, when still the Executive Director of Transport Safety and Rail Safety Regulation in the Ministry of Transport, confirmed that it is a requirement for any material change to be notified to the regulator, and stated:

> The normal events would be that we would want specifications, we would want a project time plan, the implication on other systems, and we would want to make sure that all stakeholders involved in that system had a sign-off in terms of the interaction with other systems that may or may not affect the safe operation of the rolling stock or asset.

The SRA left the safety regulator in a position of ignorance with respect to these significant matters, notwithstanding the legislative obligation to advise of relevant safety matters. The failure to disclose the safety issues relating to the deadman system on the Tangara trains and

the modifications carried out on the DDIC trains, indicates that the system of co-regulation that has operated for many years between accredited rail operators and the regulator has not worked as intended. The failure by an accredited operator, such as the SRA, to comply with mandatory statutory reporting requirements is unacceptable, as is the lack of a proper understanding by the regulator as to the true situation within the organisation which it had the responsibility for regulating.

The accreditation process simply became a paper shuffling exercise. At no time did the regulator attempt by audit or other means to verify independently that the SRA was carrying out its operations safely. In effect it accepted without query what was provided by the SRA. It was a "tick in the box" exercise. A desktop exercise only. In reality the SRA was a self-regulating organisation which was not properly regulating the safety of its operations, with disastrous consequences.

After the Waterfall rail accident

The Rail Safety Act 1993 contained a provision requiring a review of the Act's operation after a period of five years from the date of assent. The safety review commenced in 1999 and was continuing at the time of the Glenbrook rail accident on 2 December 1999. This accident and the subsequent investigations by the Special Commission of Inquiry into the Glenbrook Rail Accident resulted in the postponement of further consideration of the 1993 Act, until the Glenbrook Inquiry had published its final report on 11 April 2001. There then followed a period of consultation with rail organisations, trade unions, commuter organisations and other persons interested in rail safety. This led eventually to the Rail Safety Act 2002 (hereafter referred to as the 2002 Act). The 2002 Act commenced on 8 February 2003, eight days after the Waterfall rail accident, and replaced the 1993 Act which was repealed.

The Special Commission of Inquiry into the Glenbrook Rail Accident had emphasised in its final report the need for organisational risk management within the rail industry. The Rail Safety Act 2002 contained a much greater focus on the need to manage risk in the operation of rail activities than did the 1993 Act. The 1993 Act had emphasised matters such as "suitability of rolling stock" and "availability and competency of railway employees". Whilst focussed on rules and procedures, it was known as a mechanistic system model of safety management. This meant that it not only relied on rules and specifications, but also on defined engineering standards. On the other hand, the 2002 Act identified the purpose of accreditation to enable the operator to demonstrate to the regulator it had the systems in place to identify, manage and properly control all the risks of the railway operations it proposed to carry out.

The most fundamental change in the 2002 Act was its requirement for a dynamic risk management system approach to safety management. The move away from what was a rule-based model, under the 1993 Act, whereby the regulator was required to audit and review compliance against certain criteria, has meant that the 2002 Act is now largely risk-focussed. Applicants for accreditation now need to demonstrate how such risks are to be managed, through such matters as an effective safety management system, clear assignment of safety responsibilities, effective control of interfaces, and arrangements for monitoring and reporting safety performance.

The 2002 Act, as did the 1993 Act, contained the necessary statutory provisions which, if given full effect to, would have been capable of properly managing safety on New South Wales railways.

The creation of ITSRR, on 1 January 2004, brought with it amendments to the 2002 Act. The ITSRR is now the independent rail safety regulator. This is a significant departure from the previous regulatory regime, whereby the Director General of the Department of Transport had responsibility for the safety regulation of the rail industry, as outlined above.

Under the provisions of the 2002 Act, RailCorp applied for and was granted provisional accreditation on 1 January 2004. Provisional accreditation is a means whereby the regulator can allow an operator to continue to operate, even though it does not fulfil all the requirements necessary to merit full accreditation. The 2002 Act provides that the grant of provisional accreditation may be appropriate where the regulator is satisfied that the rail operator is "in the course of preparing to satisfy" those accreditation requirements.

RailCorp's provisional accreditation was granted conditionally upon the achievement of specific milestones over a period of 12 months. After provisional accreditation expires, the 2002 Act provides that an operator may be granted an additional one-year renewal of provisional accreditation. At the completion of that renewal, the operator must establish that it satisfies all the requirements for a grant of full accreditation. No further extensions of provisional accreditation may be granted. Therefore, RailCorp's provisional accreditation may only be extended to the end of 2005.

Under the terms of the 2002 Act, RailCorp must submit, as part of its application for accreditation, a document setting out its "comprehensive" safety management system. This is different from the requirement for the submission of a "safety management plan" under the previous legislative provisions. The 2002 Act does not specify what format the safety management system is to take, however, it does define in somewhat broad terms what the safety management system is to include. The crux of the safety management system remains the identification and analysis of risks and the measures in place for monitoring and controlling those risks.

Specifically, RailCorp must identify any risks that have arisen, or those risks which "may arise", from the carrying out of its rail operations. The legislation thus places a strict onus on RailCorp to identify and then disclose all risks to the regulator. RailCorp must then specify the controls which it employs, and will employ, in relation to these risks. This includes audits, expertise, resources and staff. These are to be identified by their respective roles in managing the risks, and also in monitoring the safety outcomes of RailCorp's operations.

The 2002 Act also specifies that RailCorp must provide ITSRR with an annual safety report, to be submitted at least 28 days before the anniversary of the existing accreditation. The annual safety report must describe and assess the safety performance of RailCorp over the preceding year. It must also review any significant developments relating to the safety of its rail operations during the year, and set out for the regulator any safety initiatives which it plans to implement in the following 12 months. The ITSRR may request that RailCorp amend or resubmit its safety management plan or annual safety report.

The difficulty with the Rail Safety Act 2002 is that it does not specify when, after full accreditation is granted, RailCorp or any other owner or operator must re-apply for

accreditation. Presently, RailCorp's provisional accreditation is for a fixed term and, hence, RailCorp must re-apply before the period of provisional accreditation expires. However, the legislation does not specify that a grant of full, as opposed to provisional, accreditation must be for a fixed period, after which it expires by effluxion of time. Further, if RailCorp were granted full accreditation, it would then only be under an obligation to submit an annual safety report. This report does not necessarily have to include details of the safety management system in force at the time of the report. This is probably less onerous than the provisions of the 1993 Act, where pursuant to section 14 the accredited person was obliged to revise the safety management plan annually and submit the revised plan to the regulator at least 28 days before the anniversary of the accreditation. It must be noted, however, that ITSRR has wide powers to request information from the operators.

Further, the legislation provides for regulations and guidelines in relation to annual safety reports. It should also provide for an annual obligation in relation to the submission of a safety management plan.

To determine the specific reasons why rail safety regulation in New South Wales has proved to be so inadequate following the introduction of the regulatory system under the 1993 Act, the following are considered in turn:

1. Co-regulation;
2. The accreditation system;
3. Independence of the regulator;
4. Compliance and enforcement;
5. Competencies of the regulator; and
6. Auditing.

1. Co-regulation

In attempting to achieve a precise understanding of co-regulation, as it is said to apply to the New South Wales rail industry, it is clear that any instructive definition is lacking. This was acknowledged by the SMSEP, who stated that, "The concept of co-regulation within the Australian rail industry has defied clear definition and is poorly understood, partly due to a lack of detail in the accreditation authorities' documents regarding the role of a regulator in a co-regulatory environment".

In order to understand precisely what co-regulation entails for the New South Wales rail industry, the role of both the regulator and the operator must be clearly defined and understood. This is a matter which Dr John Loy referred to in the peer review he did of the SMSEP report. He expressed concern over the ready acceptance of the notion of a co-regulatory system and referred to the need for a very clear statement of the responsibilities of the operator and the regulator as being a fundamental underpinning of the system.

The 1993 and 2002 Acts do not define the term co-regulation. It is a term used to describe a statutory regulation regime and is not used in any statute. Various definitions can be found

within the industry. For instance, the National Rail Accreditation Authorities Group, quoted in the SMSEP report, defined it as:

> … a process by which Track Managers and Operators are held responsible for the assessment and control of the risks associated with their proposed railway operations and then establish a safety management system (SMS) to ensure the identified risks are controlled in a manner, which is based on the needs of their organisations and accountability to shareholders through their SMS.

The National Transport Commission has defined co-regulation in the following way:

> A co-regulatory system is one in which some of the responsibilities for regulatory development, implementation and/or enforcement are shared between industry groupings and Governments. Governments delegate certain responsibilities to industry by lending legislative backing to codes or other instruments that are primarily industry developed.

One possible source of confusion as to the meaning of co-regulation, as it applies to the New South Wales rail industry, is that it is perceived to involve some kind of power sharing arrangement. The SMSEP appeared to believe that this is what the regime involved. In their report the SMSEP said:

> Co-regulation generally refers to a situation in which government shares regulatory authorities with one or more industry representative groupings. The extent of this sharing of regulatory power and the question of what specific powers are shared can vary considerably. However, co-regulation is usually effected through legislative referencing or endorsing one or more codes of practice, and the granting of some regulatory responsibility to an industry body.

With the greatest respect to the authors of the SMSEP report, there is no sharing of power in co-regulation. The obligation to set standards by which the operator has to abide is always on the regulator. It may be said to be sharing in the sense that a railway operator has a say in the setting of standards by which the operator has to abide, but such standards will be policed by the regulator to ensure compliance with those standards. There is no power sharing between the regulator and the railway. The regulator always retains the power to override a standard and enforce more stringent ones. It is the regulator's responsibility to ensure that any standards proposed by a railway operator will effectively achieve a safe outcome.

Regardless of the apparent lack of clarity surrounding its precise meaning, the current balance of opinion is that co-regulation is an appropriate model for rail safety regulation. Self-regulation is only appropriate for activities where the owner or operator is the only organisation affected by any risks arising from its activities. It is not an appropriate model for railway operators whose activities involve significant risks to passengers and other rail operators in their daily operations. It is necessary that there be independent scrutiny in the rail industry to ensure an operator is conducting its activities safely. Mr O'Donnell, of Pacific National, believed it was important to have all rail operators in the system accredited.

At the other end of the regulatory spectrum, the prescriptive model uses extensive regulation and guidance to ensure the operator adheres to the regulator's prescribed regulations. Such a

regulatory system is unworkable in a complex, dynamic industry such as the rail operating environment. A regulator would require considerable resources to ensure compliance with the regulations and the task of prescribing every aspect of rail operations would undoubtedly be beyond the practical capability of any regulator.

Co-regulation provides for a framework of co-operation between the regulator and the operator in dealing with regulatory issues, particularly in the setting of appropriate standards. This overcomes the problem of the regulator receiving a great volume of paper at the time of accreditation, containing material of which the regulator has little or no knowledge, thus making it difficult to assess whether the documented standards are appropriate. It is clear, however, that co-regulation places great faith in the ability and competence of the regulator to maintain a degree of independence from the railway organisations. If the relationship between the regulator and the railway operator is too close, this may lead to personal allegiances or conflicts which affect the regulator's ability to make objective judgements.

There are at least six essential elements of co-regulation that are vital to its effectiveness, all of which have been lacking to varying degrees in the New South Wales rail industry. First, the relationship between railway operators and regulators must be open, transparent, and co-operative. Secondly, the regulator must have an effective set of regulatory tools with which to enforce compliance, together with the willingness and independence to use those tools. Thirdly, the staff of both the regulator and the operator must be competent in system safety and risk management, system safety engineering and auditing, and have extensive railway engineering experience. Fourthly, the regulator must have rigorous and effective processes in place with which to independently audit the operator. Fifthly, there must be effective processes in place with which to evaluate and validate the operator's accreditation application materials. Finally, where the regulator requires an operator to meet safety milestones in order to achieve full accreditation, such milestones must be realistic and achievable. These elements are all interdependent and, as such, they must all exist for co-regulation to work properly. The reason why these elements are necessary is that regulation involves setting standards, gathering information, changing the behaviour or practices of operators when necessary, and enforcement of compliance with the standards that the regulator requires.

The setting of standards is done through the accreditation process and the regulator granting the accreditation needs to have expertise and skills in safety management systems and risk management in order to effectively assess the standards and processes that are submitted by the railway as part of its accreditation application. In the co-regulatory system, the issue of standard setting is dealt with by operator and regulator in a co-operative fashion. However, when the standards are set following such consultation, they must be complied with by the operator and the regulator has various enforcement tools to ensure that this occurs.

The gathering of information is an important part of the regulator's functions. It enables it to audit the accredited organisation against the documented basis on which it obtained accreditation. The regulator can gather information about incident rates and other safety performance factors, and by analysing this information can determine whether the operator has the safety management systems in place that it said that it had when it applied for accreditation and whether these are operating effectively.

The regulator, as part of compliance regulation, needs to conduct investigations into incidents to determine the reasons for their occurrence. Finally, particularly in the area of service of notices on operators, the regulator must have staff with the necessary technical safety

systems, risk management and legal skills to ensure that notices are relevant, practical and achievable and that, where prosecution may be necessary, the evidence is gathered in admissible form to ensure that there is a proper basis for any prosecution.

One of the fundamental reasons for the failure of the accreditation process is the failure of the regulator to independently verify information submitted to it by the railway operator and thus satisfy itself that the operator has appropriate systems in place. This in part resulted from the lack of resources in the regulator to enable it to carry out the range and depth of activities required by the legislation. The lack of resources was acknowledged by the Minister for Transport Services when he announced the creation of ITSRR. The capacity of the regulator to scrutinise operators through field testing and audit was significantly impaired. All that could be realistically done by the regulator was to conduct desktop examination of the accreditation application, which proved inadequate. There was also constant change in the role and functions of the safety regulator because of the restructuring and reorganisation of the rail organisations as a result of the 1996 disaggregation of the government owned railways. The failure of the regulator to adequately fulfil its role as a proactive independent regulator contributed significantly to the failure of the co-regulatory framework in place. Whether because of lack of resources, or for any other reason, there was too great an acceptance of what the SRA stated in its accreditation applications.

The regulatory reality that manifested itself in the New South Wales rail industry has been closer to a de facto self-regulatory environment, due to the passive approach taken by the regulator. The basic characteristics of a self-regulatory model are a passive regulator, confusion over standards, reactive rather than proactive improvement, lack of accountability, policy drift and limited monitoring. These are all characteristics that I have observed about the regulation of the New South Wales rail industry in the evidence before the Special Commission.

Whilst the regulatory regime governing New South Wales railways has been altered significantly with the restructure that took place at the beginning of 2004, the extent to which this has improved the ability of the regulator to access adequate information, and to properly assess the competence and capacity of the operators, remains to be seen. The SMSEP identified a number of factors that constrained the previous regulator, which included the fact that it had limited resources, systems and expertise to effectively regulate, that it had limited capacity to undertake comprehensive systems-based compliance inspections, and there was a limited capacity for research and analysis. The ITSRR formation, on the face of it, has gone some way to improving these manifest problems of the previous regulatory regime. Dr Edkins stated that there has been general improvement to key business processes and additional resources that will ultimately benefit the New South Wales rail industry and bolster ITSRR's approach and capacity to regulate. He also stated that in comparison to the previous regulatory regime, ITSRR has much clearer policies, and the legislative power to ensure compliance with and enforcement of conditions of accreditation and safety directives.

At present there remains a situation where the information to which the regulator has access and is reliant upon is not adequate for the purposes of assessing the competence and capacity of the operators. Mr Donaldson indicated, however, that there had been improvement in the provision of information by operators to ITSRR. He said:

> I think there has been, in recent times, a big change, a turnaround in supplying information such as consultants' reports, maintenance procedures and

> processes… I think there has been a big turnaround in willingness of all people in RailCorp and other accredited bodies in giving us that information.

However, Ms Carolyn Walsh, the Chief Executive of ITSRR, acknowledged that there remain significant limitations on the information that ITSRR has in making assessments of RailCorp. Ms Walsh agreed that the co-regulatory model is dependent on the operator being competent to identify a risk and divulge relevant material to the regulator. She said there was currently no assurance that RailCorp's accreditation application was built on accurate data, because the document control processes of RailCorp were substandard. Ms Walsh stressed that it was one of the aims of ITSRR to ensure that this situation is not allowed to remain, and it was its aim to have this issue addressed by operators in their future applications for accreditation.

Mr Singleton, junior counsel for ITSRR, submitted that the response dated 4 April 2004 by ITSRR to the Notice under Terms 2 and 3 of the Special Commission's Terms of Reference, demonstrates that ITSRR has a satisfactory understanding of RailCorp and an appropriate and robust capacity to analyse rail safety issues. The fact remains, however, that until RailCorp has successfully reformed itself, a process that will take time, the regulator is reliant upon questionable information provided by the operator. This situation makes the capacity of the regulator to independently assess and scrutinise RailCorp all the more important, particularly in view of the immaturity of RailCorp. The ITSRR will have to be more prescriptive in its requirements with RailCorp, because of RailCorp's immaturity, for as long as that is necessary.

To enable the requirements of the Rail Safety Act 2002 to be successfully implemented, the regulator needs adequate resources in terms of persons with the competence, skill and training to carry out the responsibilities required by the 2002 Act. It must be understood that the success of the co-regulatory regime in New South Wales will be dependent on the regulator being adequately resourced. An effective regulator must deploy its finite resources by concentrating its skills and attention on RailCorp's organisational safety and RailCorp's effective implementation of an appropriate safety management system. It is not possible for the regulator, with an organisation as large and as complex as RailCorp, to audit every detail associated with its operations. The ITSRR is yet to establish that it has this capability. The regulator's independent verification of information submitted to it, and active assessment of the operators, is critical to the success of co-regulation. For the co-regulatory model to work effectively in the future, the regulator's failure to fulfil this function must be addressed.

2. The accreditation system

Accreditation is the mechanism by which an operator demonstrates to the satisfaction of the regulator, by submissions of appropriate systems with which the applicant agrees to comply, that it possesses the competency and capacity to safely carry out the railway operations for which it is seeking accreditation. The National Rail Safety Accreditation Guideline (Version 1.1), which remains in draft form at present, states:

> Fundamental to the accreditation process, is the accredited person demonstrating that they understand their obligations under the law, that they have accepted responsibility for the safety of their operations, and that this has been reflected in their having taken measures to ensure that their responsibilities have been, and will continue to be discharged effectively.

The Rail Safety Act 1993 developed the original form of the accreditation system that is presently employed in New South Wales. This was done in accordance with principles embodied in the safety case model, which has been in place in the United Kingdom rail industry since the mid 1990s. The system of accreditation defined by the 1993 Act is also prescribed, with some alterations, by the relevant provisions in the 2002 Act.

Dr Edkins gave evidence that the operator, in a safety case model, must make a case to the regulator in respect of its safety management system and risk management plan. He defined the safety case approach as:

> A detailed document that outlines the types of safety studies undertaken, and the results obtained together with management arrangements in place, to ensure the continued safety of the organisation and personnel within it. It must demonstrate to the satisfaction of the regulator, by its contents and supporting material, that the operator knows what technical and human activities occur, how they are to be managed, and how safety will be managed in the event of an emergency. It must also identify methods to be used for monitoring and reviewing all activities in connection with the organisation, with a view to the continual improvement of safety arrangements.

In my view, a safety case approach is consistent with the present accreditation system in New South Wales, as required by the legislation. However, the failure to apply the co-regulatory model effectively in New South Wales has meant that the manner in which the accreditation system has manifested itself in practice has not fulfilled the requirements of a safety case approach.

Mr Donaldson said he did not believe the current New South Wales approach to accreditation complied with a safety case approach. Whilst he believed that there were aspects of the accreditation system that were found in a safety case approach, the safety case approach on the safety critical elements would be far more prescriptive. Mr Donaldson expressed the belief that a safety case approach were an appropriate one to be followed in the accreditation process. He expressed concern, however, that there was not yet adequate understanding within the industry of what a safety case approach embodied. This observation is one with which I wholeheartedly agree. Mr Donaldson believed that the accreditation milestones program was moving towards a safety case approach but had a long way to go.

Dr Edkins also expressed the view that the safety case approach goes further than the requirements of the present accreditation model, and that it is "a much more rigorous and robust method for demonstrating to the regulator, on safety grounds, that the operator has competence and capacity to manage safety".

Whilst the present accreditation model affords the regulator extensive powers of investigation and enforcement under the legislation, there is no legislative requirement defining the extent to which the regulator should test the information submitted to it by operators under the accreditation process. Further definition of the requirements of the regulator is required in this respect. At present the legislation, for example, gives no guidance to ITSRR as to how it should determine, whether or not it is satisfied that the systems submitted for accreditation are acceptable to it.

The method which would achieve guidance to the organisations seeking accreditation, and to ITSRR in determining whether the safety management systems in place are sufficient to grant accreditation, is by a regulation made under the Rail Safety Act 2002. Annexure I to this report is a draft regulation which would provide such guidance. It may require modification, following consultation between ITSRR and the industry, but it contains, I believe, all the essential elements of a good safety management system. The draft regulation is necessarily generic, and will require redrafting by Parliamentary Counsel. The ITSRR will also be required to prepare the guidelines referred to in it. By the use of such a regulation, the accreditation system will have the force of law and the guidance of ITSRR, which will make the accreditation system less prone to failure.

In determining the reasons why the accreditation system failed, it must also be recognised these extend beyond the limitations of the regulator. Fundamental flaws in the approach to accreditation taken by the SRA and RailCorp have contributed to this failure. The lack of systems for the validation of information within StateRail and RailCorp are key failures in this respect.

The failure of both the SRA, and subsequently RailCorp, to have in place systems for the validation of information in accreditation applications was confirmed in the evidence given by Mr Prestwidge. He was involved in the preparation of the SRA's accreditation applications in 1999, 2001 and 2002, and in RailCorp's application for provisional accreditation submitted in 2003. Mr Prestwidge holds no formal qualifications or expertise in proactive hazard identification. He has been given no internal training to assist him with understanding the accreditation process or the relevant legislative requirements. In observing this, I must emphasise that the references I make to the work undertaken by Mr Prestwidge are not intended as personal criticism. He is a long-time employee who has done his best in difficult circumstances. He should have been provided with a greater level of training and assistance and, from time to time, expert advice in order to assist him to validate information in the SRA and RailCorp accreditation applications.

Mr Prestwidge agreed that there was no system of validation in place to ensure that the information which he received in respect of RailCorp's 2003 application for provisional accreditation was accurate. More importantly, however, was the fact that Mr Prestwidge was unaware of any investigation to tighten up the accreditation process by ensuring, so far as possible, that the information coming from the divisions of RailCorp was cross-checked and validated before it was relied upon for accreditation purposes. He agreed that validation of the information is essential, and that it would be beneficial to engage an external safety auditor to examine all systems of the organisation relevant to the accreditation process.

Mr Ross, a consultant to the Special Commission of Inquiry, criticised the process whereby the person who prepares the accreditation application circulates the application to managers for their comment in order to verify the accuracy of the accreditation application. He said this indicates both a flaw in the application process and in the accreditation process, and considered that it was a difficult task to ensure the Chief Executive had confidence in the validity of the accreditation application coming before him for signature. He stated:

> It is a very difficult task to achieve what you are asking there. The CEO can sign an application feeling fully confident that it has been cross-checked and validated and is accurate and complete. That is, in my opinion, a very difficult task. However, you have got to endeavour to get as close to it as you

> practically can, and I don't believe that just sending a copy to various senior managers for their comment is necessarily going to do that.

Whilst the difficulties of validation of the accreditation application are understood, the Special Commission received evidence in relation to the practice of Pacific National in respect to this matter. It has in place a process to ensure that managers at all levels are constantly aware of the safety issues within their various departments. Such issues are then communicated through the organisation. There are weekly safety management meetings chaired by the Chief Executive Officer. The group general managers are required to be aware of all the safety issues within their own divisions, and the weekly meetings allow a review by the Chief Executive Officer of the actions taken in respect to any safety problems. This type of continuous validation and communication of information results in an ongoing process of validation.

If the validation process within RailCorp is not rigorous, the difficult talk of trying to determine the accuracy of the material in support of the accreditation application will be passed on to the regulator. At the time of the SMSEP review, this problem had yet to be resolved. The SMSEP observed, "ITSRR appears to have given little thought to providing a clear basis of how accreditation applications both in content and in the management processes outlined therein, are verified".

One method presently employed by the regulator to improve the content and management of the accreditation process has been the implementation of milestones, which are intended to chart RailCorp's progression from provisional accreditation to full accreditation. However, the attempt by the regulator to impose performance benchmarks on RailCorp, which can then be measured over the course of the provisional accreditation, has a number of practical deficiencies.

The conceptual goals in RailCorp's current accreditation milestones will take far longer than the two year maximum period permitted by the legislation for provisional accreditation. Mr Donaldson said many of the milestones call for plans and strategies to address major issues, as opposed to the actual development and implementation of new systems. Furthermore, he acknowledged that many of RailCorp's milestones were not being completed according to the schedule. He believed the milestone to plan and establish an integrated safety management system could not be achieved within its 12 month deadline. Mr Medlock also agreed that achieving the milestone would be a challenge to complete within the 12 month time frame. This was in addition to Mr Medlock's observation that accomplishing safety reform, to the extent necessary to change RailCorp's safety culture, would take five to ten years. The resulting conclusion is that safety change in RailCorp is a process that will take more than two years to achieve and will thus extend beyond the two year maximum period permitted by the legislation for provisional accreditation.

Mr Bahr described the challenge of completing a system wide hazard analysis, as required by milestone 2.2, as "a Herculean effort" that would be very difficult for any organisation to complete in the 12 month time frame. Dr Edkins, in describing ways in which RailCorp's current provisional accreditation is flawed, noted that some of its milestone time frames are unrealistic, resulting in a lack of progress on meeting the required milestones.

The milestones are unclear as to what will be needed to satisfy the requirement for a grant of accreditation. It appears, ultimately, that each and every milestone would have to be met in full in order for full accreditation to be granted. The SMSEP stated in its report:

> ITSRR has not been able to provide a clear picture as to how they will manage and assess the close out of conditions and milestones of the RailCorp Provisional Accreditation, based on currently agreed timelines.

It is apparent that there needs to be direct dialogue between ITSRR and RailCorp in understanding what each milestone requires. At the time of the SMSEP review, Mr Ross had not uncovered any evidence of an understanding or agreement on this matter. The ITSRR, in its submissions, agreed that the milestones needed to be reassessed and refined. Such a process, it said, was always envisaged and it was always intended they be kept under review. By the end of the public hearings of the Special Commission no such review had been undertaken by ITSRR. The SMSEP was of the view that the milestones would have to be reassessed and redefined with better defined accountabilities and measures of effectiveness. This is inevitable.

The regulator must focus on the competencies of RailCorp in the fields of safety engineering, system hazard analysis, risk assessment and human factors analysis. The ITSRR must determine RailCorp's arrangements in each area and particularly in regard to the existing competencies in each discipline. This could be done as part of the accreditation process or by way of a questionnaire to be answered by RailCorp.

The overwhelming evidence, therefore, is the milestones cannot be achieved within the two year time frame. Thus they cannot be achieved in an effective way by the time RailCorp's provisional accreditation two year maximum period expires at the end of 2005. Therefore, although bound by the terms of the legislation, the regulator's and operator's assurances of success under these time frames, while optimistic, are unachievable. The practical conclusion must be that either the provisional accreditation two year maximum period is insufficient to accommodate the conditional milestones, or the milestones themselves are impossible to achieve. This dilemma may well result in the hurried completion of milestones necessary to meet the deadlines, followed by "business as usual" as soon as the deadlines pass.

In other words, focussing on unrealistic time limits encourages operators like RailCorp to cut corners and lose sight of the long term necessities for an effective and integrated safety management system, in favour of meeting the short term needs to stay in business. This encourages the same kind of reactive, "by the seat of their pants" discipline that has plagued the New South Wales rail industry for so many years. Instead there must be proactive, methodical and systematic planning and implementation, necessary to make systemic changes. There must be a legislative framework that assures a reasonable level of safety and holds officials accountable for effective safety improvement.

The draft rail safety management system regulation, Annexure I to this report, is the best means of achieving that type of legislative framework. It provides guidance to operators and to ITSRR about what is required and it gives ITSRR criteria against which to determine whether or not the organisation's safety management system justifies it being granted accreditation. It will take years for RailCorp to develop and implement a safety management system which conforms to the draft regulation. The ITSRR will need to monitor the progress

of RailCorp as it develops and implements such a system. The mechanisms to achieve that should be a process involving guidelines and ongoing liaison, to ensure progress that is being made is going to be much more effective than fixing unrealistic milestones.

3. Independence of the regulator

The results of the SMSEP review made clear that the historical relationship between the SRA and the rail safety regulator, prior to the Waterfall rail accident, was not open and transparent. Mr Bahr emphasised that, in a co-regulatory environment, it is essential that a regulator have a trusting relationship with the operators, while maintaining an authoritative position from which it can evaluate the operators' safety management systems. He explained that the regulator should be able to "trust but verify". Mr Bahr observed that, in his experience, most railways' Board meetings were open to the public, with regulators sitting at the Board table to address safety issues as partners, not opponents. Mr Bahr stressed that such an environment did not exist in New South Wales, and it is essential that in future the RailCorp Board's actions must be open and transparent to ITSRR for co-regulation to succeed. In order for co-regulation to succeed, I believe, as stated previously, it is necessary for the regulator and operator to co-operate in setting the standards by which the railway is to operate. This can be done successfully by a co-operative open arrangement, and once the regulator is satisfied that the operator has submitted appropriate standards, the areas of behaviour modification, auditing and enforcing compliance remain with the regulator.

Mr Bahr contrasted the situation in New South Wales with the co-operative, co-regulatory environment in which transit operators and regulators work in many parts of the United States. In his country, he explained, regulators are often invited to sit at the table with operators throughout the entire process of developing safety management systems. In doing so, the regulators are kept informed throughout the year of the plans and progress being made within the operator's safety systems. This avoids the alternative of receiving a pile of unfamiliar paperwork from the operator at the eleventh hour, as has occurred in New South Wales, which makes it impossible for the regulator to verify the accuracy of all the material. Mr Bahr also noted that a co-operative, open relationship forces both the operator and regulator to share liability for any shortcomings in the development of safety management systems.

In keeping with the motto that a regulator must "trust but verify", it is always important to ensure that, in maintaining a co-operative, open relationship, a regulator and operator must continue at arm's length in respect to enforcement actions when necessary. It is therefore essential to ensure that ITSRR's regulatory actions are never hampered by political agendas, and that it remains entirely free to take enforcement action whenever and wherever it determines it is necessary.

Concern has been expressed over the fact that if ITSRR reports to the same Minister that is responsible for the operation of RailCorp, it will not be independent of, and insulated from, political interference. To some extent, the 2003 legislation includes measures to alleviate such concerns over ITSRR's accountability to the Minister for Transport Services. These are improvements over the Rail Safety Act 2002 prior to its amendment. The Transport Administration Act 1988, as amended, now provides a greater measure of independence in relation to the performance of ITSRR's Chief Executive, by introducing limitations on ministerial control. The Transport Administration Act 1998, as amended, now provides that

"ITSRR is subject to the direction and control of the Minister", but not with respect to, relevantly, the following matters:

1. The exercise of a function relating to the accreditation of a person under the Rail Safety Act 2002 (including the variation, suspension or cancellation of an accreditation);

2. Any decision to take or not to take enforcement action under any Act;

3. The exercise of a function relating to a rail safety inquiry or a transport safety inquiry or other inquiry under an Act into a transport accident or incident;

4. The outcome of any monitoring or auditing of the safety or reliability of a transport service (and any decision to carry out or not to carry out any such monitoring or auditing); and

5. The contents of any report or recommendation of ITSRR.

Mr Singleton submitted that, as both ITSRR and RailCorp are public bodies, it is unavoidable that their lines of accountability will ultimately meet in one single authority. Whilst it was conceded there are conflicts of interest between those parties, he was submitted that it is important that they report to the one authority. He also submitted that if that authority had primary responsibility for either of those functions, there would be a direct conflict of interest. It is said, however, that because there is an independent rail operator and an independent rail regulator, it is appropriate they be accountable to the same Minister. This, it was said, is the reason why ITSRR should not report to the parliament. The reporting relationship is designed to secure improvement in safety procedures. ITSRR's safety advice needs to go to someone who can give direction to RailCorp. The regulatory regime is to drive improvement, which is an executive function, which means there are limits to what parliament can deliver. He submitted that whilst the regulator should be independent and not subject to political interference, the rail operator should be amenable to directions from the Minister on safety issues.

Whilst there are unsatisfactory features about this position, it was submitted, given today's political realities, reporting to the Minister for Transport Services is the only way this issue can be solved. The Minister is responsible for the safe operation of the railways and it is in his interest to ensure that they are being conducted safely. It is necessary, however, that all reports from ITSRR to the Minister be tabled in parliament to enable appropriate public scrutiny.

The above concerns about the regulator's perceived lack of independence can be alleviated by two additional factors. First, as has been discussed in chapter 16, dealing with rail accident investigations, the abolition of the Advisory Board and transfer of its investigatory responsibilities to the ATSB would ensure an independent evaluation of future accidents. Secondly, public scrutiny of the accreditation process will better ensure effective regulation.

4. Compliance and enforcement

Enforcement of safety regulations is critical to a regulator's success. Where a regulator lacks the power or resolve to impose appropriate sanctions for safety violations or omissions, a lethargic or defiant operator is at liberty to delay and obstruct the implementation of safety standards. The SMSEP determined that, prior to the Waterfall rail accident, "The Department of Transport had not sufficiently used its authority to identify critical safety issues that exist on the railway". As a result, the Department of Transport was not aware of the specific safety problems within the SRA that contributed to the accident. Even if the Department of Transport had properly evaluated the SRA's safety management system, it lacked many of the necessary regulatory tools to enforce safety standards.

Recent amendments to the Rail Safety Act 2002 have provided the current regulator, ITSRR, with additional tools to enforce a rail operator's compliance. The SMSEP report states that ITSRR's new enforcement powers under the 2002 Act provide for escalating action, depending on the seriousness of the non-compliance, and include:

1. Counselling and/or warnings (intended to guide and educate);

2. Agreed undertakings (milestones or agreed actions to restore compliance);

3. Improvement Notice (used for non-urgent rectification);

4. Prohibition Notice (used to cease operations immediately until the non-compliance is rectified);

5. Variation, suspension or cancellation of accreditation (used to remove a threat to rail safety);

6. Penalty Notice (used in conjunction with Improvement/Prohibition Notices or variation, suspension or cancellation of accreditation where a deliberate action has resulted in the non-conformance); and

7. Prosecution (used for serious, deliberate or repeat breaches of the regulatory framework).

If these new powers are used effectively, it will help to demonstrate ITSRR is carrying out its responsibilities independently and efficiently, particularly when used against a government owned rail organisation. However, the possession of new regulatory powers and resources does not necessarily translate into regulatory resolve or competence. The SMSEP determined that, "[i]t is not clear that the ITSRR rail authority oversight process is robust, systematic and based on system safety principles". The SMSEP was also concerned that ITSRR thus far has not demonstrated it has the willpower to regulate the industry to the full extent required. They stated, "it is yet to be seen how ITSRR will tackle serious breaches of accreditation or failure to meet milestones timeframes set by ITSRR".

Mr Donaldson agreed in evidence that, in the event that a railway operator applying for accreditation did not possess the necessary competency and capacity to safely conduct rail operations, then the applicant should be refused accreditation. Mr Singleton submitted that if

RailCorp failed to meet the requirements for full accreditation by the end of 2005, this would cause considerable problems. There would be a temptation in those circumstances to exempt RailCorp from accreditation and the accreditation requirements. Under section 21 of the Rail Safety Act 2002, ITSRR may exempt an operator from all or any of the requirements of the Act, including the requirement of accreditation. That exemption may only be granted if an operator demonstrates to ITSRR that the systems, expertise, resources and methods to be employed by the operator, in respect of carrying out the railway operations, are likely to achieve a level of safety which in the opinion of ITSRR is appropriate for the operations concerned. Nevertheless, the option would be a tempting one in the circumstances if RailCorp was not able to satisfy ITSRR's requirements for full accreditation at the end of 2005.

Under the current legislation, however, Mr Donaldson no longer has the power to grant or refuse accreditation. The Chief Executive of ITSRR, Ms Carolyn Walsh, is now the responsible person. During the public hearings, Ms Walsh, I believe, carefully avoided giving specific detail as to when or if ITSRR would be prepared to deny accreditation. She noted that the use of milestones is but one of various regulatory tools available to ITSRR. Others included improvement and prohibition notices, penalties and prosecutions, as well as the variation of accreditation and the use of conditions to accreditation. She went on to explain that ITSRR has already issued a number of compliance notices. She contrasted ITSRR's current situation with the previous, more disadvantaged regulatory regime, in which the only substantive regulatory tool available was the denial of accreditation.

As Mr Bahr stated in his report: "no comprehensive strategy was identified that addressed what [ITSRR] would do if the railway did not meet accreditation, other than a graduated sanction regime. It was unclear if ITSRR was prepared to actually shut down the railway if it truly failed to comply". I am satisfied it would not shut down RailCorp. It is important, however, that ITSRR develop a comprehensive strategy, along with a systematic oversight process with which to regulate the rail industry. Perhaps most importantly, it must make an unequivocal internal commitment to utilise fully and effectively its new regulatory tools and to firmly enforce safety standards.

5. Competencies of the safety regulator

The role of the safety regulator is to ensure a safe transport outcome through good management and administration. This is done by a process of discovery, monitoring, investigation and sanctions. The regulator, therefore, must have the skills to implement these processes. The SMSEP review revealed deficiencies in the system safety competencies of ITSRR staff. This is of particular concern because, on the evidence, these same skills are lacking in the staff at RailCorp. Under a co-regulatory model, both the regulator and the operator must have strong bases of knowledge and skill in order to achieve appropriate safety standards.

Ultimately, however, as Mr Bahr said in evidence, ITSRR's regulatory effectiveness is largely dependent upon its individual members having strong safety competency, especially in understanding how a railway works, how system safety processes work, and the issues of both policy and compliance. In his evidence, Dr Edkins also discussed the importance of the regulator's staff having strong skills in safety management systems, human factors and safety system engineering, to enable the regulator to guide and evaluate the industry. If it remains true that the persons within ITSRR do not have the requisite skills in safety system

management to be able to properly assess rail operators, they will be unable to determine if the operators have adequate safety management systems in place to control the risks of their operations.

Prior to the Waterfall rail accident, the regulator did not demonstrate the necessary competencies to fulfil its intended role in railway safety. In its report, the SMSEP concluded that, "[a]part from notable exceptions, prior investigations were not consistently systematic or risk-based due to a lack of appropriate training for staff and the requisite skills and resources". Furthermore, "[l]ittle evidence was found that investigation results impacted upon continuous improvement in regulatory safety policy". It was also evident that the previous regulator's "[a]uditors had not received system safety training", despite the important necessity that they "be fully trained in technical report writing, audit and verification processes, and risk-based system safety assessments".

During the safety review of ITSRR, the SMSEP was concerned about a variety of current staff competency issues. First, noting that ITSRR's position descriptions specify tertiary qualifications only as "desirable", the SMSEP suggested that "this policy needs to be reviewed for more technical positions, where senior specialists may be required". In addition, the "legislation requires the Chair[person of the Advisory Board] to possess safety experience, but not the CEO. Interviews and document reviews indicated that the CEO does not have any significant operational safety experience". Furthermore, "ITSRR Accreditation and Compliance staff have operator backgrounds, with a primary focus on rolling stock and safeworking rules. There is no clear indication of appropriate safety system experience".

The SMSEP made a number of additional observations about the competencies of the ITSRR management. "Interviews and document reviews [conducted during the safety review] indicated that the ITSRR senior leadership had safety management systems and operational rail experience, excluding the ITSRR CEO who brings a strong policy (without safety) background". However, the review of ITSRR indicated that although the leadership does have safety experience, its safety background may be insufficient to assess whether an appropriate safety management system can be implemented at RailCorp. The SMSEP reported, "the current organisation does not have significant skills or practical experience in system safety and risk assessment or implementation of system safety programs to effectively evaluate rail operator accreditation programs or provide guidance to the industry". I have been assured by the ITSRR managers that they intend to address these deficiencies through Technical Panel members. Nevertheless, as the SMSEP found, "ITSRR staff have recognised, and the safety review results corroborate, that the current organisation does not have significant skills or practical experience in system safety and safety management systems. The primary concern is that staff and managers do not have a strong system safety and risk assessment education and background to effectively evaluate rail operator accreditation programs".

The ITSRR's management has asserted that there are plans to address the lack of staff competencies through training and education programs. In particular, ITSRR has plans to develop investigation skills training programs using outside contractors, but the SMSEP is still concerned that these programs will not have sufficient "in depth skill-based training in contemporary safety investigation techniques using appropriately qualified training providers". As discussed earlier, ITSRR's management has also articulated plans to recruit new, appropriately qualified staff.

Whilst acknowledging that ITSRR has set these goals to improve its technical competencies, it is necessary for ITSRR to take immediate, substantive steps to improve its staff competencies in system safety principles, and to ensure that the staff in its entirety has the proper mix of skills in safety management, including both qualifications and experience. It should consider making tertiary qualifications mandatory for its technical employees in senior specialist positions. Its Chief Executive should have qualifications in operational safety. In the absence of these arrangements, ITSRR should immediately arrange for its senior managers to undergo continuing professional development in safety system principles. Similarly, ITSRR's accreditation and compliance staff must demonstrate significant skills and experience in safety system principles. Its auditing staff should be fully qualified to conduct audits, and to evaluate issues relating to system safety. In addition, ITSRR should require ongoing, in-depth training for its staff in contemporary safety principles, to be carried out by highly qualified training providers. Only by ensuring that its staff fully understand the issues they are charged with overseeing, can there be any confidence that the New South Wales rail industry is being regulated safely.

6. Auditing

Before addressing the regulator's duty to audit rail operators, it is necessary to recognise that ITSRR is not the only organisation charged with a responsibility to conduct compliance audits. Co-regulation will only work if the regulator and the operator possess the capacity to audit. It has been shown that, in the past, the SRA was unable to carry out effective audits of its operations.

It is a fundamental principle of good safety management that the organisation creating the risks is the one that has the primary responsibility for managing and controlling those risks. It is obvious that in order to do so, RailCorp must know what risks exist in its operations. In order to do this effectively, it is necessary for RailCorp to have an auditing capacity. The disbanding of the safety audit division in the former SRA, which occurred at the time of the disaggregation of the railway organisation into four separate components, removed the auditing function from that organisation. Thus the SRA relied on outside organisations, such as WorkCover, to provide audit information. Rail safety cannot be achieved unless RailCorp makes substantial advancements in improving its own self-auditing capacity.

ITSRR has attempted to overcome criticisms in the SMSEP report by stating the report is out of date because, since the period covered by it, ITSRR has moved on and resolved, or is in the course of resolving, problems referred to by the SMSEP. In an endeavour to establish this fact a large body of material, now Exhibit 516A, consisting of three volumes, was produced by ITSRR. No attempt was made to dissect this material. For example, on the question of data analysis it was submitted a system known as PRISM (Performance, Regulation, Investigation and Safety Management) was being developed. Some part of it is said to have been developed.

It was being implemented in a phased approach. It was to be one project in a suite of projects intended to provide ITSRR with the capability to collect, store, retrieve and analyse, and report on safety issues in rail, bus and ferry. The other projects are an electronic document management system, a remote access project and an underpinning information management project. PRISM, it is said, comprises a database, a user interface and a research "datamart". Given the stage of development of the organisation, building a system in its entirety was

considered too risky. The IT platform for the integrated PRISM database will be determined once ITSRR's requirement has been fully analysed and specified. Four phases are referred to.

It is not possible for this Special Commission, in the circumstances, to form any concluded assessment of this document. The system is incomplete and is not phased in, and there is no way of determining its ability to overcome the audit problems. It appears to be a very generic document. However, whatever may be the position and by whatever means, it is necessary, as the SMSEP pointed out, for ITSRR to ensure that whatever system is implemented, it provides an effective knowledge and framework for trend analysis, record keeping and decision support.

In addition, ITSRR must carry out its own independent auditing of RailCorp safety management systems. I have serious concerns over ITSRR's ability and commitment to audit RailCorp to the extent necessary to identify any safety deficiencies, and to verify that the systems RailCorp says it has in place, are in fact in place and are effective. It is essential in a co-regulatory regime, with a safety case approach to accreditation, that the regulator audits the industry thoroughly and frequently, and satisfies itself that the operators are running their operations safely.

In order to carry out the level of auditing required, ITSRR will need a sufficient number of properly qualified and trained safety auditors. At the time of the SMSEP review, ITSRR was focussing too heavily on developing its "top policy structure", and in doing so had created an environment in which there were insufficient field staff to conduct audit and compliance inspections. According to current plans, ITSRR's staff is to be more than double the size of the previous regulator's staff. At the time of the SMSEP review, it was only at 60 per cent of full staffing and was still recruiting. There were many vacancies for positions filled by seconded staff. At that time, only about 20 per cent of the staff had been dedicated to field work, while the SMSEP report concluded, "there may be too many staff focused on management, policy and administration". The SMSEP was concerned that, given the size of RailCorp, Pacific National, and the then pending lease of infrastructure to ARTC, ITSRR's mandate to review the safety accreditation of all New South Wales rail operators "will require a significant number of field staff to conduct audit and compliance functions". The SMSEP suggested that 28 to 30 dedicated field staff would be necessary to support an active regulator.

Mr Donaldson stated in his evidence that current ITSRR staffing was not at intended levels, and that he needs additional field officers to sufficiently conduct his work. The Chief Executive, Ms Carolyn Walsh, agreed that ITSRR did not have enough inspectors in the field, but argued that ITSRR would indeed have around 30 full-time field inspectors when full staffing was achieved.

The answer to the criticism that there were too many staff focussed on management and policy, was that this was the situation at the time when the SMSEP review was conducted. It was said that at that time, the concentration had to be on the establishment of the corporate body and thus the majority of staff was concerned with management and policy, but that would change in the future.

Both ITSRR and RailCorp have obligations to conduct thorough and ongoing audits of RailCorp's safety systems, but it appears neither is equipped to do that adequately. The ITSRR, in particular, must not focus too heavily on management and policy at the expense of

its field staff. It is critical that ITSRR have a large, highly qualified and active field staff deployed to conduct rigorous audits of RailCorp and other operators in the system. Adequate training is also essential to ensure that the field staff are informed and experienced in contemporary safety and auditing principles. Without taking these important steps, ITSRR will never be able to detect deficiencies in RailCorp's safety management system, and will not regulate effectively.

Conclusion

Making the transition into an effective co-regulatory regime cannot occur overnight. Therefore, interim measures must be taken immediately to ensure a responsible transition from the current situation into an effective one. The means whereby this can be achieved is discussed later in this report.

Underpinning those changes should be a safety management systems regulation, a draft of which is Annexure I to this report. The ITSRR should develop guidelines in consultation with the rail industry, to provide assistance to the rail organisations involved in relation to the particular means by which they will be required to give practical effect to the regulation. This approach has been adopted in the European Commission in relation to its member States and it is an approach that should be used in New South Wales. The existence of a regulation and guidelines removes the element of subjectivity, which can mean that the quality of rail safety regulation depends upon the quality of the rail safety regulator. Mr Donaldson is a dedicated and conscientious rail safety regulator. There is no guarantee that future regulators would possess his qualities or diligence.

Regulations have been promulgated under the 2002 Act, relating to such matters as drug and alcohol testing. This adoption of a prescriptive approach in some areas of rail safety is not to be seen as a move against the spirit of co-regulation, or one towards prescriptive regulation. This is the approach of the United Kingdom Railway Group Standards, which state that, "the framework for specifying risk controls has moved significantly from a regime of defining explicit requirements to one specifying the core safety requirements. The advantage of this approach is that it provides comprehensive risk coverage whilst allowing reasonable flexibility for those responsible for implementation to find the optimum means of compliance". The desired approach for the New South Wales regulator would be to have defined regulations, with guidelines, which are enforceable and easily measured in terms of RailCorp's or any other operator's compliance with them, whilst building on the co-operative relationship achieved through a proper system of co-regulation.

When one considers the numerous failings in the application of the co-regulatory regime and the accreditation process, it is clear that there are significant failings which need to be addressed. The opening paragraph of the document titled "Rail Accreditation Version 3, 28 August 2003" captures the fundamental purpose of a rail regulator when it states:

> The public is entitled to expect that the Transport Safety and Reliability Regulator (ITSRR) will protect its interest and well being by ensuring that both public and private railway operators have the systems, skills and capacity to run their railway operations safely.

Only through effective regulatory arrangements supported by an appropriate accreditation process can ITSRR discharge this obligation to the travelling public.

23. Integrated Safety Management

The earlier chapters of this report identified a number of specific areas where safety deficiencies existed. Rectification of those deficiencies in those specific areas would not by itself achieve the level of safety management which RailCorp needs to have in order to operate to an acceptable level. What it needs to achieve is the integration of the safety improvements, on an ongoing basis, into the overall activities and business which it conducts.

The establishment of an integrated safety management system is crucial to the success of RailCorp in achieving the level of safety which the travelling public expects. There is considerable evidence before the Inquiry about the absence of an integrated safety management system within RailCorp. To assess what was missing or insufficiently developed in RailCorp's safety management, the SMSEP used criteria from other transport organisations who had achieved some measure of success in developing an integrated safety management system. The Chairman of the SMSEP, Dr Edkins, in his evidence referred to the fact that Qantas and Emirates Airlines were used as a benchmark against which to measure the safety management systems of the former SRA and now RailCorp, and he went on to define what he meant by an integrated safety management system. He said:

> … what I mean by "integrated" is that the safety management system does not stand alone from other management systems within the organisation, it is part of normal business practice …

More detail as to the content of an integrated safety management system can be found in the definition of a safety management system mandated by CASA. In the CASA operators' guide the following definition is provided:

> A safety management system is an explicit element of the corporate management responsibility that sets out an operators' safety policy, and defines how it intends to manage safety as an integral part of its overall business.

The SMSEP in its report stated:

> … all successful safety management systems include the following five basic elements:
>
> 1. Top level management is committed to safety and communicates this effectively.
>
> 2. Systems are in place to ensure that hazards are identified, assessed and reported in a timely manner.
>
> 3. Action is taken to manage risk.
>
> 4. Accidents and incidents are investigated systemically, and the resulting information is fed back into the organisation and used for process improvement.
>
> 5. Effects of safety actions are evaluated.

> A fundamental characteristic of a successful SMS is that these core elements are integrated. This requires that the diverse processes of an organisation all use the same protocols for defining interfaces and communication across the organisation.
>
> If the SMS is not integrated, but is stand-alone and fragmented, it will function independently of other management systems. This usually results in hazards, errors, violations and safety deficiencies being overlooked, or not communicated throughout the organisation. The result is that the organisation does not learn or improve its ability to manage the safety of its operations.

The relationship between an integrated safety management system and the culture of an organisation was set out in the SMSEP report, in a passage where the authors said:

> In summary, successful safety management systems provide a systematic process for managing risk, and are integrated within the various levels of an organisation. Various core SMS elements are common to high reliability organisations, and safety culture is viewed as a "fabric" that links these elements in a co-ordinated manner.

These definitions are very generic in their content. There are two ways in which the notion of an integrated safety management system can be more clearly explained. The first is by identifying what happens within an organisation which does not have an integrated safety management system. The second is by identifying the elements that exist within an organisation that does have an integrated safety management system.

In an organisation which does not have an integrated safety management system, information is provided to particular areas of the organisation but the significance, from a safety point of view, of the information is either not appreciated because of a lack of capacity to assess risk or, alternatively, it is not referred to areas of the organisation where the necessary assessment can be undertaken. The history of the failure to deal with the deficiency in the deadman foot pedal is an example of this. That deficiency was well known to a number of persons within the SRA from 1988 onwards, but at no stage was a proper risk assessment undertaken in relation to the identified deficiency. Nor was the safety risk referred to anyone within the organisation who was both responsible and accountable for ensuring that there was a thorough assessment of the risks inherent in the capacity of heavier train drivers to keep the system set even if they were asleep or dead.

The ITSRR was required to respond to a request from the Special Commission, seeking its comments on the issues which it regarded as relevant to the second and third terms of reference. Included among the matters that it regarded as demonstrating inadequate safety management within the former SRA, and now RailCorp, was that there was a lack of proper accountability. The ITSRR's findings about RailCorp's safety management system were:

> 1. Lack of conclusive and publicised definition of responsibility for the safety management system itself and its operational implementation by line management.

2. "Silo" mentalities where a topic is believed to be someone else's responsibility or where the relationships between responsibilities are not well understood.

3. Leaving actions for other persons, e.g. failures to report and act on defects.

4. Persistence of recognised problems, e.g. the ongoing failures to apply proper communication protocols.

5. Inappropriate motivational patterns, for instance where those who take the strongest stand on safety matters may be perceived to be negatively treated.

These criticisms are characteristic of an organisation that does not have an integrated safety management system. The Chairman of the Board of RailCorp, Mr Bunyon, agreed that RailCorp did not have an integrated safety management system.

The SMSEP, when identifying what was missing or underdeveloped in RailCorp's safety management system, identified 29 elements of what would be expected to be found in an integrated safety management system. These elements were drawn from organisations such Qantas, BlueScope Steel and Emirates Airlines. Mr Nicholas Bahr, who was retained by the Special Commission to design and lead the safety management system audit of the SRA and RailCorp, took 23 of these elements from the Qantas safety management system. He said the Qantas system conformed to international standards for very mature safety management systems. To those 23 elements he added six further elements, which he stated were characteristic of good safety management practices in high hazard industries other than the airline industry and which were applicable to the rail industry. The 29 elements of an integrated safety management system identified by Mr Bahr and the SMSEP were:

1. Management commitment.

2. Policy and objectives.

3. Safety representatives and personnel.

4. Safety committee.

5. Management review.

6. Training and education.

7. Hazard identification and risk management.

8. Document control.

9. Record control.

10. Internal audit.

11. Incident/accident reporting system.
12. Incident/accident investigation.
13. Analysis and monitoring.
14. Emergency response procedures.
15. Change management.
16. System for managing requirements and changes.
17. Customer feedback.
18. Contracted goods and services.
19. Traceability of goods and services.
20. Measuring equipment and calibration system.
21. Procurement of goods and services.
22. Equipment maintenance.
23. Design and development.
24. Management and staff recruitment.
25. Medical issues.
26. Human factors.
27. Safety organisation.
28. Safety awareness.
29. System safety program plan.

Detail of the content of each of these elements can be found in Appendix G to the SMSEP report, which report is volume 2 of this report. Although these elements were based upon what has been identified as characteristic of organisations with integrated safety management systems, Professor Reason, in his review of the SMSEP report, stated:

> In my experience, the full and "seamless" integration of an SMS across all of an organisation's diverse activities is a very rare thing. Indeed, I think it is more of an ideal than a reality. The only useful metric is some comparative or ordinal indicator of the extent to which a particular organisation falls short of this ideal.

I agree with Professor Reason's observation. There is obviously a continuum between organisations which have a very well developed integrated safety management system and organisations which have little or no integration of their safety management systems, or have significant elements of the safety management system either missing or not sufficiently developed.

What is relevant, as far as the adequacy of the safety management systems of the SRA, and now RailCorp, is concerned, is that there were many of the elements that would be expected to be found in an integrated safety management system that were missing and many others that were not sufficiently developed. For example, the elements of the safety management system which were missing from the SRA's and RailCorp's safety management systems included that there was no effective system for ensuring that new rolling stock or subsystems of new rolling stock were designed and constructed so as to be fit for the purpose for which they were intended. The deadman foot pedal is an obvious example. There is detailed discussion of this deficiency in the chapter of this report dealing with the design and procurement of rolling stock.

Another example was the absence of any system for the management of change. Again, when the Tangara trains were modified for use on outer suburban routes, the management of the change of use and, in particular, the safety implications that it gave rise to were not assessed at all. Another example was the lack of system safety engineering which, again, is discussed in some detail in the chapter of this report dealing with the design and procurement of rolling stock. As that chapter makes clear, nothing seems to have been learned from the mistakes in relation to the design and procurement of the Tangara train when it came to the design of the deadman foot pedal on the Millennium train.

In addition to the elements that were missing, the SMSEP found major deficiencies in the safety management systems of the SRA and RailCorp, in the areas of hazard identification, risk assessment, risk management, training, and quality control processes. An integrated safety management system requires not only that essential elements such as these be present and fully developed but that each of these elements is a core part of the way in which the organisation goes about its business. The SMSEP identified the failure of the SRA and RailCorp to have safety management systems integrated into their overall business operation as the "most serious deficiency". This is a very significant finding because, as the SMSEP pointed out:

> An SMS provides an organisation with the capacity to anticipate, address, and rectify safety risks before they result in a safety occurrence, and to cope effectively when they do. A key principle of contemporary safety management systems is that they provide the management of an organisation with the ability to deal effectively with accidents and near misses, so that valuable lessons are captured and applied to improve safety and efficiency.

The reference to "safety and efficiency" is significant. As has often been pointed out during the course of this report, the proper management of safety is essential to the efficiency of an organisation. Obviously, if trains are not properly maintained that can give rise to circumstances where the rail system is operating in a degraded mode. It is very well established in the area of safety science that when there is a degraded mode of operation, the risks to safety increase. Degraded modes of operation of trains also cause disruptions to the provision of train services. Alternatively, if operational staff are not properly trained for

example, if train guards are not properly trained in all areas necessary to manage passenger safety, people can be seriously injured or killed. The obvious example is if train guards are not properly trained, passengers may sustain injuries in the course of boarding or disembarking from trains. This will then disrupt rail services. If deficiencies in communications result in trains colliding with each other, as occurred in the Hexham and Glenbrook accidents, or trains are derailed in the numerous circumstances identified in the Glenbrook Inquiry then, obviously enough, serious disruptions will occur. Less serious incidents also cause significant disruption to services.

Efficient rail organisations recognise that the integration of safety management into the overall business operation of the organisation is not only a public expectation, it is good business practice.

For many years the integration of safety management into the overall business of the organisation has been a feature of the airline industry. If planes crash, passengers will not fly with the airline. Unfortunately for the commuters of Sydney, if they wish to catch a train they have no choice other than to take a RailCorp train. The same commercial imperative that drives private airline operators and private freight operators does not, to that extent, drive organisations such as RailCorp which are government owned. However, the users of those services have other means by which they can register their dissatisfaction with the safety and efficiency of rail services provided by government owned organisations.

As has been made clear at several stages in this report, the obsession with the culture of on-time running, without proper attention being given to safety related matters becomes a self-defeating exercise, because deficiencies in safety management and in the integration of safety management disrupt reliability and therefore on-time running. It is for this reason that the safety management system must be integrated into the overall operations of RailCorp for the purpose of producing an organisation which is both safe and efficient.

The more difficult question is how to go about achieving that process of integration. That process has been successfully undertaken by a number of other organisations in transport and other industries. There are clearly recognised means by which the necessary transformation from an organisation which does not have an integrated safety management system to one which does have such a system takes place. The starting point is a clear and focussed leadership in the organisation. One of the reasons for the lack of an integrated safety management system in the SRA was that it had eight Chief Executives in ten years. In those circumstances, it is impossible for an organisation to have the leadership that is essential for the integration of the safety management system.

Not only must the Chief Executive lead the organisation in the integration of the safety management system, those holding management positions within the organisation below him must pursue the same objectives in the same way and at the same time. Although they are responsible to the Chief Executive, they share with the Chief Executive the same obligations in relation to leadership of the respective divisions of the organisation for which they are responsible, as the Chief Executive has for the overall safety performance of the organisation. By the way in which they work with the Chief Executive, with other managers, and in their behaviour towards those employees who report to them, they make the importance of safety a feature of the way in which they and others should carry out their activities, so that safe behaviour becomes an integral part of what they see to be their roles within the organisation.

When that leadership by example then filters down to the next level, with the same message being communicated and with the same level of commitment from management down to operational level, then the organisation will establish integration within its safety management system and will also, at the same time, establish the safety culture which the SMSEP identified was the fabric that holds the organisation together. Implicit in this process must be not only commitment of the Chief Executive and those in senior management positions to the integration of safety into the business operations of the organisation, those persons must themselves have the necessary skills and training to identify hazards and analyse risks to ensure that the risks are being controlled.

The organisation as a whole must go through the process of learning how other organisations have moved from the position of being organisations which lacked an integrated safety management system to organisations that have such a system developed to the degree that they manage to avoid the kind of catastrophic accidents which the SRA experienced in recent years. The SMSEP identified that the organisations to which RailCorp could go for the purpose of obtaining the necessary assistance included the International Civil Aviation Organisation, CASA, the Australian Nuclear Science and Technology Organisation, Airbus Industrie, Emirates Airlines, Qantas and BlueScope Steel. These are all organisations which have made the necessary transition which RailCorp must make for the purpose of establishing an integrated safety management system.

A plan is required as to the means by which the necessary elements of a safety management system will be integrated into the operations of RailCorp. That plan should be developed and submitted to the Board. It is unlikely, given the demands on the time of management that exist for the operation of a relatively complex rail network, that the Chief Executive and senior management will have the time or resources to develop such a plan without assistance. The RailCorp Board should retain suitably qualified experts to guide it in the development of a plan, which should be developed in consultation between those experts and the Chief Executive and senior management of RailCorp and then submitted to the Board for its approval. Once approved, the plan should be implemented by the Chief Executive, who should report monthly on progress to the Board and to ITSRR. The plan should include the implementation of the recommendations of the Special Commission.

The time frame for such implementation to take place, including the implementation of the recommendations contained in this report, should be on a three to five year basis. It will involve proper project management of particular projects, as well as management of the transformation of the organisation, from one which does not have a developed integrated safety management system, to one that has the 29 elements identified in the SMSEP report integrated into its overall business activities.

This is not to say that process can ever be completed. The earlier section of this chapter made clear that a fully integrated safety management system is an ideal. However, in seeking to achieve the ideal, safety will be improved and this improvement will be ongoing. This is the objective which must be attained in relation to individual projects, as well as the integration of the safety management system into the overall business activities of the organisation.

This process of change management must also accommodate the existing projects that have been subsumed under the Safety Reform Agenda.

The various programs identified and discussed in the earlier chapters of this report have been poorly managed. There must be a program office, headed by a competent program director, to manage the programs and matters identified as being necessary in earlier chapters of this report. He must have qualifications suitable for recognition by the Australian Institute of Project Management as a master program director. The program director will need to work with the Chief Executive of RailCorp and the senior management, to ensure the implementation of an integrated safety management system and the cultural change required. He should report to and be under the control of the Chief Executive to ensure that the accountability of the Chief Executive is not reduced.

It should be part of the function of the Board of RailCorp to verify that the program office is working effectively and that reform is progressing satisfactorily. It is the role of the regulator, ITSRR, to monitor the development of an integrated safety management system and the implementation of each of the programs being implemented by the program office.

Unfortunately, ITSRR, like RailCorp, does not itself have sufficient maturity as a safety regulator and it will need to obtain resources, in particular in the area of system safety and risk management, to enable it to effectively monitor the transformation that is necessary within RailCorp.

24. Conclusions and Findings

Conclusions

The conclusions expressed in this chapter are neither exhaustive nor detailed. A fuller listing of conclusions is to be found in the Executive Summary.

The causes of the Waterfall rail accident on 31 January 2003 and the factors that contributed to it were the subject of the interim report delivered on 15 January 2004. The interim report is summarised in chapter 2 of this report.

The terms of reference also required inquiry into the adequacy of the safety management systems applicable to the circumstances of the railway accident, and safety improvements to rail operations which are necessary as a result of findings made under the first two terms of reference.

The examination of the adequacy of the safety management systems applicable to the circumstances of the accident necessitated an extensive inquiry. Fundamental to any safety management system is the way which risks are managed. Risk management is the subject of chapter 8 of this report.

As this report makes clear an adequate safety management system involves the integration of many elements, including risk management, into the overall safety management system which itself must be integrated into the business operations of the rail organisation. Such matters are the subject of chapter 23 of this report.

This report has identified a number of specific inadequacies in safety management. The system for design and procurement of G7 was inadequate, resulting in a train with an unsafe driver safety system being used on the rail network. Chapter 6 deals with the inadequacies in the processes by which the Tangara train was designed and chapter 7 deals with the inadequacies in the driver safety systems which produced the result that the Tangara train had a deficient deadman system. The deficiencies in that system would have been picked up had there been any proper assessment of the risk which the driver safety system was supposed to address, namely the risk of a high speed rollover accident occurring as a result of train driver incapacitation. Although the risk of this occurring was identified on a number of occasions, and these are discussed at length in the interim report, no proper risk analysis was done either when the risk was first identified or when the design of Tangara trains was modified to permit them to be used in the outer suburban area. An adequate risk assessment at the initial stages of design and procurement of the train, when it was built or when it was modified for use in the outer suburban area, would have identified that the driver safety system, in the case of train driver incapacitation, was grossly inadequate.

The interim report identified a large volume of documentation from sources within the SRA and external consultants which identified the risk. It was not only that there was no proper risk assessment done initially. Even when documentation relating to such an important safety matter was created or delivered to the SRA, no procedure was in place for managing the safety risks identified by those documents. Even in the case of consultants' reports which had as their purpose the identification of safety deficiencies in the rolling stock, no documented process for following-up and closing out the safety risks existed. The

inadequacy of the safety document control systems resulted in important safety information not being conveyed to those persons who had the responsibility for the overall safety of the organisation, in particular, the Chief Executive. Such matters are dealt with in chapter 14 of this report.

Inadequacies existed not only in the areas of rolling stock and document control, but also in personnel management and training. The train guard's failure to respond was not only the result of deficiencies in his training, it was also the product of poor crew resource management and lack of a safety culture. Inadequacies in train guard and driver training are discussed in chapter 15.

The emergency would not have arisen if the train driver, Mr Zeides, had not suffered a heart attack. The heart attack was predictable, if periodic medical examinations containing a predictive element had been conducted. As the evidence during the first stage of the Inquiry demonstrated, Mr Zeides may well have still been alive today, had there been the type of periodic medical examination which would have revealed the extent of the narrowing of his coronary arteries, before he had a heart attack. Such matters are dealt with in chapter 13 of this report.

The investigation of all possible causes of the accident, during the first stage of the Inquiry, required the identification of any conditions which may have impaired the train driver's or guard's performances. Although rejected as a causal factor, the investigation required an examination of the procedures in place for detection of safety critical staff who may be affected by alcohol or drugs. In this context, procedures for the introduction of alcohol and drug testing are considered in chapter 12 and, although in their relative infancy, significant improvements in that area and in the area of medical examinations appear to have occurred since the Inquiry commenced.

The management of the health of safety critical employees and the provision of driver safety systems which protect them in circumstances where train driver incapacity might occur, raised for consideration the adequacy of the safety management system in relation to occupational health and safety. This is discussed in chapter 18. Legislative specification of an employer's obligations have made the area of occupational health and safety one of the areas where the safety management systems in place were more developed than other areas.

The Inquiry has taken a long time to examine the matters that have thus far been referred to in this chapter. One of the reasons for this is the number of deficiencies that existed in the safety management systems that were revealed in the evidence. Another reason was the failure to implement the recommendation of the Glenbrook Inquiry that all trains be fitted with data loggers. Objective scientific information and data can be readily obtained from a data logger when an accident occurs, enabling the expeditious determination of the cause or causes of the accident. The saga of the program for installation of data loggers is very instructive in relation to the inadequacies of the SRA in the area of program management. These matters are discussed in chapter 9.

The important matter of rail accident investigation is discussed in chapter 16. In the case of rail accident investigations, the legislative model and structure give rise to significant deficiencies in the manner in which such investigations are to be conducted. Accident investigation must be truly independent of, and separate from, the safety regulator, and the Advisory Board must also be abolished to ensure this. An adequate safety system requires

that accident and incident investigations maximise the available learning from an accident or incident. This is not presently the case. The reasons why this has occurred are discussed in chapter 16.

Adequate systems of safety management not only deal with the methods by which accidents are prevented from occurring, they also deal with the response to such accidents so as to minimise the adverse consequences in terms of loss of life, injury or damage to property. This is the area of emergency response and passenger safety. Chapter 19 discusses, in some detail, the inadequacies in passenger safety. By far the greatest inadequacy is the lack of emergency escape for passengers. Chapter 5 discusses the deficiencies in the emergency response to the accident.

Inadequacies in the safety management systems for communications have been an emerging theme during the course of both the Glenbrook Inquiry and the present Inquiry. The deficiencies exist not only in the equipment that is available, but also in the procedures that employees have been following, or more accurately failing to follow, which themselves become a major source of risk. Chapter 10 of this report has identified, yet again, those failings, not only during an emergency response, but during normal operating conditions, and the consequences that they have in accidents of the kind that occurred at Hexham and Kerrabee, which are discussed in that chapter.

It is not possible to have inadequacies in the safety management systems in so many different areas of an organisation, without there being inadequacies in the way in which the organisation is governed and the way in which it goes about attempting to improve its safety performance. Chapter 20 deals with the inadequacies in corporate safety governance and chapter 21 deals with the inadequacies in the safety reform agenda process, which cannot achieve the safety improvements that could prevent accidents of the kind that occurred at Waterfall from recurring.

An adequate safety management system does not involve attending to each deficiency only after it is identified. This reactive approach to safety management has been a feature of the SRA's, and now RailCorp's, approach to safety management for far too long. Adequate safety management must involve assessing risks and ensuring procedures are in place to control those risks and, in turn, ensuring that those procedures, which include mechanical as well as human performance controls, are not themselves vulnerable to failure or to being bypassed.

Employees will not think about risks inherent in the activities that they are carrying out, unless the organisation has as its ethos that safety and the avoidance of accidents are the core business of the organisation. Safety and the management and control of risks will only become core parts of the transportation business being conducted if those governing the corporation lead by example in relation to the importance of safety in the operation of the organisation, and they ensure that, in the management of the business, the safety implications of what is done at all levels are not only considered, but managed. This only occurs when there is good corporate safety governance and when the organisation establishes a safety culture. If relations between management and operational staff are strained, if there is a blame culture, then it is impossible to achieve a culture in the organisation where everyone from the front line operational staff to the most senior management is attempting to pursue the same objective, namely safe and reliable transportation services. Where the culture continues to be a culture of on-time running, it is inevitable that incidents and accidents will

occur, which in turn will defeat the objective of on-time running. These matters are discussed in detail in chapter 17, dealing with safety culture.

Attention to safety and to risks, and to the proper management of risk, not only minimises accidents and incidents, it also ensures better reliability. In the chapter on train maintenance, many illustrations are given of complaints by train drivers about defects which had safety implications, which led to the train drivers being abused. It does not take much thought to realise that the effect of that is that train drivers will not report defects, they will leave it to another train driver to do so, and in the meantime the train will be at risk of failing to perform satisfactorily, with the consequent disruption to services that this produces. Proper train maintenance is not only a safety issue, it is an efficiency issue and it must be managed effectively. Chapter 11 deals with the inadequacies in this area of the safety management system and the means whereby improvement can be made.

The conclusion to which one is driven as a result of the findings and conclusions of the interim report, summarised in chapter 2 of this report, and of the analysis of the inadequacy in the safety management systems of the SRA and RailCorp that are discussed in detail in so many areas in this report, is that the safety management systems that have been in place and continue to be in place during the course of this Inquiry were grossly inadequate for the purpose of ensuring the safety of the travelling public. Those inadequacies were also due to, not only a failure to properly manage safety by the SRA and by RailCorp, but also an inefficient and ineffective system of regulation by the rail safety regulator. Chapter 22 discusses those deficiencies.

Findings

I make the following findings on the adequacy of the safety management systems applicable to the circumstances of the accident:

Emergency response

1. The RMC did not trigger a major incident management response until 7:32 am, although information sufficient to do so was known 14 minutes earlier.

2. Power to the area was not isolated until 8:06 am; during the intervening period several attempts were made to reset circuit breakers that had been tripped by the derailed carriages – fortunately, these were not successful.

3. Valuable time was lost by police, fire brigade and ambulance officers as a result of inaccurate information as to the location of the accident, and lack of knowledge about access gates and tracks.

4. Emergency response personnel were not aware of the external door release on Tangara carriages, which would have enabled passengers to be promptly evacuated.

5. The train guard was not permitted to use the most efficient means of communicating critical information to the RMC, namely the Metronet radio in his cabin.

6. There were other communications equipment deficiencies, including the lack of awareness of signal telephones by emergency response personnel, and the fact that satellite telephones were not immediately available.

7. There were deficiencies in communications procedures, including the fact that there was no single nominated contact person at the RMC and no compliance with any language protocol.

8. The procedure for identifying a site controller in charge of the accident site was not followed.

9. The emergency services were not operating under a co-ordinated response plan.

10. There was no proper site control; there were unauthorised persons on the site and congestion on the access track caused by vehicles with the keys removed.

11. The rail commander on site failed to perform the emergency response function intended for that role.

Design and procurement of rolling stock

12. The SRA failed to conduct an adequate risk assessment of the deadman foot pedal in Tangara trains to determine whether it was fit for its intended purpose.

13. The SRA failed to conduct a risk assessment in the design phase of Tangara trains to determine whether the driver safety system, in this case the deadman system, would stop the train and thus control the risk of an accident resulting from a train driver suddenly becoming incapacitated.

14. The SRA failed to do a design review of the driver safety system in Tangara trains to determine whether the design concept of the deadman foot pedal would control the risk of collision or derailment if a train driver became incapacitated.

15. The SRA failed to implement an engineering management system for the manufacture of Tangara trains, to ensure that there was a proper quality management system in place before manufacture commenced, to define standards to be met by subsystems and the trains in safety and functional performance, to test whether the subsystems and the trains performed in accordance with these safety and functional performance standards, or to ensure the continuing technical integrity of Tangara trains after they went into service, particularly in relation to safety critical systems.

16. The SRA failed to investigate whether the functional requirements of the driver safety system in Tangara trains would be met by the design for the deadman foot pedal that was proposed.

17. The SRA failed to prepare a functional performance specification for the driver safety system in Tangara trains, prior to commencement of their manufacture.

18. The SRA failed to determine whether the design of the driver safety system, and in particular the deadman foot pedal, would work, before the manufacturer was contracted to build Tangara trains.

19. The SRA failed to prepare a functional performance specification to identify the means by which there would be verification of the design specification of the driver safety system in Tangara trains.

20. The SRA failed to put in place a quality assurance program during the construction of Tangara trains.

21. The SRA failed to implement a system of regular review during the construction of Tangara trains to determine that the driver safety system, and in particular the deadman foot pedal, was going to achieve the functional purpose of stopping the train under all circumstances if the train driver became incapacitated.

22. The SRA failed to conduct a risk assessment to determine whether or not a vigilance device should have been added to the deadman safety system in Tangara trains, to ensure a sufficient level of control against the risk of derailment or collision if a train driver became incapacitated.

23. At the time of the design of Tangara trains, there was no rail safety regulator or system of safety regulation to ensure that rolling stock was fit for purpose or had adequate driver safety systems.

24. No systems were put in place after the introduction, by the Rail Safety Act 1993, of safety regulation, so that the rail safety regulator could, by auditing or otherwise, be satisfied as to the safety of passenger rolling stock.

25. The SRA failed to conduct a risk assessment in or before 1993, when Tangara trains were modified for use in the outer suburban area, although such use clearly created a greater risk of collision or derailment resulting from a train driver becoming incapacitated, by reason of the longer routes involved and the relative infrequency of traffic.

26. The SRA failed, prior to 2004, to fit vigilance devices in Tangara trains to control the risk of collision or derailment resulting from train driver incapacitation.

Driver safety systems

27. A significant deficiency in the SRA's safety management was that on its Outer Suburban Tangara trains, if the train driver became incapacitated in an automatic signalling area and there was no other train in the section, the only mechanical protection was the deficient deadman system.

28. When the Tangara design was modified for use in outer suburban areas, a risk analysis should have been conducted. Such analysis would have identified the issues with the driver safety system.

29. Vigilance devices should have been installed on Tangara trains when the deficiencies of the deadman system were first identified in 1988.

30. The SRA focussed on signals passed at danger and failed to control the risk of a rollover occurring in an area where the signals were green.

Risk management

31. The SRA failed, and RailCorp continues to fail, to implement a system for analysing the activities being performed and the circumstances in which they are being performed, then identifying the hazards that exist within those activities, and putting in place controls to eliminate or control the risks arising from the hazards, and thereafter validating whether the controls put in place reduce the risk to an acceptable level.

32. The SRA failed, and RailCorp continues to fail, to train staff, and in particular managerial staff with safety responsibilities, in systematic risk assessments.

33. The SRA responded, and now RailCorp only responds, to incidents and accidents after they have occurred, rather than examining systems to identify hazards and putting in place controls to prevent the hazards from materialising to cause accidents or incidents.

Data loggers

34. The SRA had no adequate system for program management of specific projects, such as the installation of data loggers.

35. One of the main reasons for the delay was technical difficulties encountered by those responsible for installing data loggers.

36. The RTBU was properly concerned that inaccurate information could be used adversely against its membership, in the "us and them" culture that existed within the railway.

37. The SRA failed to implement an adequate system for project management of specific projects, such as the project for the installation of data loggers.

Communications

38. The effectiveness of the emergency response following the Waterfall rail accident was impeded by deficiencies in communications procedures and equipment, including incompatible communications systems.

39. Notwithstanding the recommendations in April 2001 in the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident, little progress was made by the SRA, and has been made by RailCorp, in their implementation. In particular:

    (a) there has been no proper implementation or strict enforcement of communications protocols;

    (b) no standard for railway communications between rail operators has been established; and

(c) uniform or integrated communications systems have not been implemented.

40. The lack of progress by the SRA and RailCorp in the area of communications has been brought about by ineffective management.

Train maintenance

41. The SRA used, and now RailCorp uses, defective systems for documenting train maintenance.

42. The SRA used, and now RailCorp uses, defective systems for dealing with train driver complaints of defects in trains in that:

(a) train driver complaints were and are ignored or discouraged;

(b) train driver complaints of defects were and are not recorded; and

(c) train driver complaints of defects were and are not finalised and certified.

43. SRA and RailCorp record keeping in respect of defects complaints was and remains inadequate.

44. The SRA had, and now RailCorp has, no adequate system of feedback to train drivers of the results of defects reports made by them.

Medical examinations

45. The SRA's periodic medical examinations of train drivers and other safety critical staff were inadequate in that:

(a) they did not have any predictive element to identify train drivers or other safety critical staff who were in a high risk category for sudden incapacitation through heart attack or stroke;

(b) the medical practitioners conducting the examinations were not instructed in the nature of the duties and responsibilities as to which they were required to certify whether or not the employee was fit to perform;

(c) medical examiners conducting periodic medical examinations did not have access to the medical histories of employees;

(d) there was no system for referral to a medical specialist of an employee, where there was evidence of the possibility of a significant health risk;

(e) the SRA had no system of reviewing the reports from the periodic medical examinations, to ensure they were of a sufficient standard, or to identify any medical issue which required further investigation;

(f) there was no monitoring of the medical histories of employees to identify trends, and in particular, any trends indicating progressive deterioration in employees' health status; and

(g) periodic medical examinations did not include any basic psychological screening.

Safety document control

46. The SRA had, and now RailCorp has inadequate systems for safety document control, to enable identification of safety risks from internal documents, or external documents such as reports from consultants.

47. The SRA had, and now RailCorp has, no system for identifying documents with safety implications and then analysing and controlling the risks revealed in these documents.

48. The SRA used, and RailCorp uses, draft documents in areas with safety implications as if they are the finally approved procedure to be followed.

49. The SRA failed, and RailCorp continues to fail, to communicate the contents of existing safety policy documents to staff, suppliers, contractors and others, to identify what the policy is in a particular area and how to apply it.

50. The SRA did not, and now RailCorp does not, use a comprehensive safety document management system.

51. The SRA failed, and RailCorp continues to fail, to record, collate and disseminate safety documentation in a computerised system and to use that data and information to identify and control risks.

52. The SRA failed, and RailCorp continues to fail, to use information technology to identify the officer accountable for managing any particular safety risk, and whether or not that officer has dealt adequately with the risk.

Training

53. The SRA failed to train guards adequately in how to deal with particular types of emergencies.

54. The SRA failed, and RailCorp continues to fail, to ensure that authority gradients do not exist between train drivers and guards, so that train guards take action when necessary to stop a train in an emergency situation.

55. The SRA failed, and RailCorp continues to fail, to use in an interactive manner the simulators obtained following the Special Commission of Inquiry into the Glenbrook Rail Accident.

56. The SRA failed, and RailCorp continues to fail, to use simulators to train safety critical employees, and in particular train guards, in the ways in which they should deal with particular emergency situations.

57. The SRA failed, and RailCorp continues to fail, to adequately train guards and drivers to work as a team.

58. The SRA failed, and RailCorp continues to fail, to undertake a tasks analysis and training needs analysis for staff and, in particular, to analyse recorded data on incidents and accidents so as to identify the areas where particular safety training is necessary.

Rail accident investigation

59. The current legislative model and structure for rail accident investigation give rise to significant deficiencies in the manner in which rail accident investigations are to be conducted.

60. The recommendation contained in the Glenbrook Inquiry final report to establish a Rail Accident Investigation Board, with the characteristics described in recommendations 80 to 95 of that report, was not implemented in New South Wales.

61. Had these recommendations in the Glenbrook Inquiry final report been implemented, New South Wales would be at the forefront of rail accident and incident investigation.

62. The model for safety investigation that has been implemented in New South Wales includes the accident investigation body, OTSI, being a division of ITSRR, the rail safety regulator. This is not what was recommended in the Glenbrook Inquiry final report. What was recommended was a truly independent accident investigation body, not one that is a division of the safety regulator. The Glenbrook final report recommended a Rail Accident Investigation Board which was legally and structurally independent of the rail safety regulator, so as to avoid any possible conflict of interest.

63. In the United Kingdom, Canada, the United States of America, the European Union, and in Australia at the national level in the form of the ATSB, it is recognised that accident investigation must be independent of the regulatory bodies, because the conduct of the safety regulator itself would likely be a matter for scrutiny by the accident investigation body when it investigates an accident.

64. It is hardly likely, having regard to the fact that the Chief Investigator of OTSI is appointed, and may only be terminated, and that his salary, wages and conditions of employment are fixed, on the recommendation of the Chairperson of the Advisory Board, that the Chief Investigator is likely to reject any advice given by the Advisory Board or its Chairperson.

65. The New South Wales public transport system is owned and run by government bodies and it is politically sensitive because commuters are also voters, thus there is an even greater need for transparency and independence in the investigation of safety incidents and accidents and in the public reporting of those investigations.

66. The Advisory Board lacks accountability.

67. The present legislation creates at least the perception that the Advisory Board, in giving advice to the Chief Investigator, may influence the contents of the reports of the Chief Investigator.

68. Given the perception that the influence of the Advisory Board over the Chief Investigator is capable of reducing the impartiality and objectivity of investigations, the existence of the Advisory Board is contrary to the public interest.

69. The position of the Chairperson of the Advisory Board is untenable. The Chairperson exercises executive power. The removal of the Chief Investigator of OTSI can only be effected on the recommendation of the Chairperson. There is no accountability for the making or failure to make such a recommendation by the Chairperson when appropriate.

70. It does not need an Advisory Board with a Chairperson having the power to exercise executive power directly or indirectly, thereby diluting the accountability of the Chief Executive of the safety regulator, ITSRR, for the regulation of rail safety.

71. There remains doubt as to the power of OTSI and its Chief Investigator to initiate an investigation into a rail accident or incident. It is unclear whether or not OTSI can commence an investigation without being directed to do so by either the Chief Executive of ITSRR or by the Chairperson of the Advisory Board.

Safety culture

72. The dominant culture in the SRA and RailCorp was and remains a culture of on-time running, resulting in safety being a secondary consideration.

73. The pervasive culture of the SRA and RailCorp was and remains a culture of on-time running, preventing operational and managerial staff from considering the safety implications of decisions made at operational and managerial levels.

74. The SRA was unwilling to engage in critical self-examination of its safety performance or the effectiveness of its safety management.

75. The SRA had, and now RailCorp has, a blame culture, and not a just culture, when dealing with incidents or accidents.

76. The culture of the SRA was insular and inward looking, with the result that it failed to learn lessons from the experience of other railways.

77. Successive Chief Executives of the SRA failed to provide the leadership that is essential to establish a safety culture.

78. The SRA failed to detect or overlooked violations of safety procedures, such as exceeding speed board limits or using flag sticks to jam the deadman foot pedal on Tangara trains in the set position.

79. SRA senior management failed to have a commitment to safety as the paramount objective of the SRA.

80. SRA senior management failed to communicate to staff who reported to them that safety in the provision of transport services was the paramount objective of the organisation.

81. The SRA did, and now RailCorp does, discourage rather than encourage safety concerns to be brought to the attention of management.

Occupational health and safety

82. The SRA and RailCorp approach to occupational health and safety is reactive to particular incidents and does not involve the systematic analysis of all the hazards, the examination of the controls that are put in place and an assessment of the adequacy of those controls in reducing the risk of those hazards to an acceptable level.

83. For the occupational health and safety management system to work effectively, it must be integrated with and form part of the overall safety management of the organisation. What is needed is a single set of processes and procedures for conducting hazard analysis and risk assessment. This is lacking in both the overall management of safety in RailCorp and in the management of occupational health and safety.

Passenger safety

84. The SRA and RailCorp failed to fit any means of self-initiated passenger escape to Tangara trains.

85. Following the Waterfall rail accident, passengers remained trapped in the derailed G7 for a period of 30 minutes, after which time the first emergency personnel arrived.

86. There was no consideration in the SRA Board paper dated 18 January 1990 relating to the so-called door security policy of the risks associated with keeping passengers locked in trains, particularly in the event of a fire in a train.

87. The identification of the hazards associated with passengers trapped in trains was not the subject of any consideration on 25 January 1990 when the Board of the former SRA adopted the containment policy.

88. Even though Tangara trains were originally fitted with internal emergency door releases, no risk analysis was done on the risk created by removing them. No risk analysis was done at the time and hence the fact that the external emergency door releases would not work if a train was on its side was not identified by any risk analysis.

89. The culture of on-time running influenced the decision in favour of the containment policy because if passengers are contained in a train, there is less risk of them doing anything which may disrupt the movement of the train in accordance with the timetable.

90. The so-called containment policy is not in the public interest.

91. The containment policy does not protect passengers in a train which is on fire or subject to terrorist attack when the train driver or guard are incapacitated or not able to react in time. There must be a means of emergency escape in such circumstances. The risk of improper use of emergency escape facilities can be controlled by other means.

92. There is no need to choose between a system by which passengers can let themselves out of trains at any time or a policy by which passengers are contained at all times.

93. If the recommendations in the emergency response and communications chapters are implemented, the risk of any evacuating passenger being struck by another train should be reduced in negligible proportions, because quick and effective procedures would be in place to recognise that an accident had occurred.

94. As a matter of individual responsibility, if people are in a life threatening situation, they should be entitled, where the circumstances justify them taking control of their own safety and well-being, to make rational and responsible decisions in their own interest. They should be given the opportunity to make their own decisions when their own lives may be in jeopardy.

95. Given the forces involved in the accident, no criticism is made of the Tangara roof structure not being able to withstand those forces, resulting in the opening of the roof and the ejection of the passengers who died. No train could be designed to withstand the forces of the Waterfall rail accident and maintain its integrity.

Corporate safety governance

96. Successive Boards and Chief Executives of the SRA and RailCorp failed to implement a system by which each could quickly and readily obtain information as to the overall level of safety in the SRA and RailCorp.

97. Successive Boards and Chief Executives of the SRA and RailCorp failed to have clearly identified measures for determining the level of safety of the SRA and RailCorp and the safety performance of managerial staff.

98. Successive Boards and Chief Executives of the SRA and RailCorp failed to have clearly defined and appropriate safety responsibilities and accountabilities included in managerial position statements used in the SRA and RailCorp.

99. Successive Boards and Chief Executives of the SRA and RailCorp failed to have measurable criteria for assessing the safety performance of individuals in managerial positions within the SRA and RailCorp.

100. Successive Boards of the SRA failed, in the area of safety management, to set strategic objectives to guide the organisation in the establishment of an adequate safety management system, in the following respects:

    (a) they failed to ensure that all the necessary systems for effective information management, performance measurement, verification and document safety control were in place;

    (b) they failed to communicate to Chief Executives the matters that they reserved for their own decision in the area of safety management, the processes by which they expected to be provided with the necessary information, and the time frames within which they required that information from the Chief Executives;

(c) they failed to determine and to communicate to the Chief Executives what they regarded as the bounds of acceptable risk in the conduct of rail operations, and to prescribe how events that may lead to unacceptable risks were to be identified and controlled by the management of the SRA;

(d) they failed to ensure the executive action being carried out by the Chief Executives and other senior managers in the SRA was aligned with the strategic directions and policies of the SRA;

(e) they failed to ensure that auditing was carried out and verification received by the respective Boards, to satisfy them that the safety related information being provided by management was sufficient for the Boards to make informed decisions in relation to strategic policy directions that should be followed;

(f) they failed to ensure that the SRA had adequate processes in place for identifying major hazards, including low probability high consequence events, such as the Waterfall rail accident, that it had proper controls in place to prevent such accidents and that the controls had been tested and verified as effective, to either eliminate the risks, or reduce the probability of them occurring to a level which was acceptable to the Boards; and

(g) they failed to make the Chief Executives and senior managers accountable for the safety performance of the SRA.

101. Successive Boards and Chief Executives of the SRA and RailCorp failed to have adequate internal auditing systems in place to enable them to test the adequacy of the safety management systems supposed to be in place.

102. Successive Boards and Chief Executives of the SRA and RailCorp failed to use external auditors to enable them to test the adequacy of the safety management systems supposed to be in place.

RailCorp Safety Reform Agenda

103. There was no basis upon which the line managers could be thought to have the skills to implement the programs identified by the Safety Reform Agenda.

104. The Safety Reform Agenda was not capable, and could never have been capable, of bringing about the safety reform that is necessary within RailCorp in the 12 months required by the conditions attaching to its provisional accreditation, or indeed at all.

105. The Safety Reform Agenda posed unrealistic time frames.

106. In the time frame specified, it is plainly fanciful and unrealistic to expect that "an effective, consistent, integrated and predictive safety risk management framework for RailCorp" could be developed and established in a period of less than three years.

107. The Safety Reform Agenda was developed from other programs that were designed to meet the requirements of provisional accreditation. The process used to meet these requirements was to use the language of the statute and the accreditation principles

provided by the rail safety regulator as the means by which an attempt would be made to meet the requirements of accreditation.

108. The operational and executive staff of RailCorp went about their ordinary duties in a way which bore no relationship to what was being done by the external consultant retained regarding the Safety Reform Agenda, for what was perceived to be a process divorced from the main business of the organisation, the provision of train services.

109. What was fundamentally wrong with the Safety Reform Agenda was that it bore no relationship whatsoever to the way in which RailCorp was carrying out what it perceived to be its core activities. It was simply, like accreditation itself, a process that had to be undertaken, using the appropriate language with a sufficient amount of jargon, to give the impression that something was being done about the management of safety.

110. The Safety Reform Agenda, consisting of not more than 22 pages, lacks detail. Notwithstanding repeated requests, no documentation was provided to the Special Commission of Inquiry beyond that contained in the 22 page Safety Reform Agenda.

111. Whilst the ability to quantify the Safety Reform Agenda elements is a fundamental prerequisite to measuring the performance of RailCorp against the elements, the Safety Reform Agenda elements are not capable of being quantified.

112. The subject of human factors was not considered as an element of the Safety Reform Agenda.

113. The Safety Reform Agenda represents a characteristically reactive approach to rail safety management, with the use of concepts and ideas which have been borrowed from other contexts.

114. The Safety Reform Agenda is poorly designed. There was no organisation-wide audit undertaken before launching into the Agenda and the result was that RailCorp did not have a benchmark from which it could measure the areas that needed improving.

115. What should have been done was to use the data that was able to be gathered, to identify the hazards that existed within RailCorp, examine the controls that were in place to manage the risks created by those hazards, and then for RailCorp to satisfy itself that those controls would be effective. If it were not possible to eliminate the hazard, then it would be necessary to identify a level at which the risk was regarded as acceptable. A program should then have been devised to control all of those risks and to co-ordinate and integrate that program within the core business activities of the organisation. The development of such a program would involve the assigning of aspects of the project to particular persons with sufficient resources to enable them to undertake the tasks for which they are accountable.

116. The deficiencies relating to accountability for those persons implementing the Safety Reform Agenda means that the whole process has the potential to fall apart. Someone must take responsibility for implementing the Safety Reform Agenda. Whilst the aim was to transfer these responsibilities to line managers by 30 June 2004, this did not happen.

117. While signed safety accountability statements are in place for level 2, 3 and 4 managers in the operating divisions, their language is generic and cannot be measured in a practical way. In respect of each of those project managers there needed to be a clearly defined scope of the work, a schedule setting out when the work was to be completed and a system for measuring whether or not the objectives had been achieved in time.

118. The overview and the co-ordination of the programs could not be undertaken by retaining an external consultant to "develop" a Safety Reform Agenda. It required the establishment of a separate and permanent senior officer, with the modern safety management skills which the current level 2 managers lack, responsible to the Chief Executive for the development of the program and the implementation of the necessary reforms in a realistic time frame.

119. The underlying deficiencies in the Safety Reform Agenda were, to an extent, reflected in the TSSIP. A lack of proper training and expertise has meant that the timetables in which to implement the charters for the six sub-programs have been unattainable.

120. The fact that so many different projects were being undertaken at the one time has caused a sense of confusion among those responsible for developing and implementing the safety reforms.

Safety regulation

121. The SRA repeatedly failed to notify the rail safety regulator of known deficiencies in the safety of its operations.

122. The former rail safety regulator, the Director General of the Department of Transport, was not provided with sufficient resources to enable him to monitor, by the use of information technology, the safety performance of the SRA.

123. The SRA and RailCorp failed to provide accurate and reliable safety information to the former rail safety regulator, the Director General of the Department of Transport, in their applications for accreditation and provisional accreditation, respectively.

124. The former rail safety regulator, the Director General of the Department of Transport, failed to verify whether the information provided by the SRA and RailCorp in their accreditation applications was true and correct.

125. The SRA, prior to the Waterfall rail accident, failed to disclose to the former rail safety regulator, the Director General of the Department of Transport, the deficiencies in the deadman system on Tangara trains.

126. The former rail safety regulator, the Director General of the Department of Transport, failed to have an adequate number of field officers to verify whether the SRA implemented the safety systems which it claimed in its accreditation applications to have in place.

127. The former rail safety regulator, the Director General of the Department of Transport, was not given sufficient legislative means with which to enforce adequate safety performance by the SRA.

128. The former rail safety regulator, the Director General of the Department of Transport, failed to ensure that there were clear safety standards with which the SRA was required to comply.

129. The former rail safety regulator, the Director General of the Department of Transport, failed to take a proactive approach of conducting field audits and requiring accredited railway operators and owners to analyse and control risks before they resulted in an accident or incident or safety alert by the rail safety regulator, and instead took a reactive approach to safety deficiencies, only dealing with safety issues when they arose.

130. There is no rail safety regulation, guideline or otherwise to enable railway operators and owners seeking accreditation to understand what elements were required to be present in their safety management systems.

131. The SRA and RailCorp failed to have a system in place to ensure that the officers who prepared applications for accreditation were receiving accurate information, and that the Chief Executive, when he signed the application, could be satisfied as to the accuracy of the information provided.

132. There was lacking an open and co-operative flow of safety related information between the former rail safety regulator, the Director General of the Department of Transport, and the SRA.

133. The former rail safety regulator, the Director General of the Department of Transport, was not provided with sufficient resources, including field staff, to discover, monitor, investigate and then enforce adequate safety performance by the SRA.

Integrated safety management

134. The SRA failed, and RailCorp continues to fail, to have a sufficient level of training and expertise in safety management among senior executives of the SRA and RailCorp.

135. The SRA failed, and RailCorp continues to fail, to have specific accountability statements, clearly identifying the safety responsibilities and accountabilities of particular management positions within the SRA and RailCorp.

136. The SRA failed, and RailCorp continues to fail, to have a system to develop action plans, based upon the results of audits, within particular business groups or by individuals, to ensure appropriate and timely close-out of action to remedy safety deficiencies detected by audits.

137. The SRA failed, and RailCorp continues to fail, to have a system for checking the effectiveness of the controls put in place to prevent a safety deficiency giving rise to an incident or an accident.

138. To the extent that the SRA had, and RailCorp has, safety management systems, they were and are not integrated into the overall business activities of the SRA and RailCorp, so as to make safety in the provision of the services provided by them their paramount objective.

Generally

139. There were no truly independent Rail Safety Inspectorate, Rail Accident Investigation Board and Rail Safety Regulator in accordance with the model, functions and powers as recommended in the second interim report and final report of the Special Commission of Inquiry into the Glenbrook Rail Accident, to monitor, enforce, investigate and regulate the safety of the operations of the SRA, and now RailCorp.

25. Recommendations

Each of the following recommendations needs to be understood in the context of the analysis contained in this report. The relevant sections of the report should be read so as to facilitate an understanding of the scope and extent of each recommendation that is made. I make the following recommendations.

Emergency response

1. Staff at the Rail Management Centre (RMC) should receive training from RailCorp to enable them to quickly and accurately assess that an emergency has occurred and to provide precise and reliable information to emergency response personnel about the location of the emergency, the available access to the site and the resources necessary.

2. A dedicated telephone line should be established by RailCorp between the RMC and any Emergency Services Control Centre for use during any emergency.

3. A designated staff member at the RMC should act as the rail emergency management co-ordinator. He or she should be the sole point of contact at the RMC with other rail personnel involved in the rail accident and emergency services personnel during the rescue phase of the emergency response.

4. The RMC should be equipped by RailCorp with a transcriber system, or mimic board, or such other system as is necessary to enable identification of the precise location at any time of any train on the RailCorp network.

5. All train guards should be trained by RailCorp in the use of the Metronet radio and instructed to use it in any emergency.

6. Procedures should be put in place by RailCorp to ensure that electrical power supply to the area of an accident can be immediately isolated, if necessary, in the event of a rail accident, so as to reduce any risk of exposure of emergency response personnel to injury or harm.

7. Satellite telephones should be provided by RailCorp to all rail commanders at any emergency.

8. All signal telephones must be maintained by RailCorp in proper working order.

9. All emergency services stations should be provided with access keys to, and maps showing, all gates providing access to RailCorp tracks within their geographic area of responsibility.

10. A railway disaster plan, or rail displan, should be developed by RailCorp and the emergency services to ensure co-ordinated inter-agency response to rail accidents and incidents on the RailCorp network.

11. The rail displan should include the use by all emergency response personnel of a uniform incident command system, involving procedures for such matters as the

establishment of inner and outer perimeters, control of access to the site, orderly evacuation of injured passengers and the establishment of a staging area remote from the accident site, in a unified command structure with the site controller co-ordinating the various emergency services through representatives of each service.

12. The rail displan should include provision for the appointment of a rail emergency management co-ordinator at the RMC, and an on-site rail commander with the sole function of assisting and supporting the emergency services during the rescue phase of the emergency response.

13. The rail displan should provide for the site controller to have complete control of the site, with other agencies co-ordinating with and supporting him or her, until the rescue phase of the emergency response has been completed.

14. The incident command system should clearly identify the roles of the rail commander, site controller, police commander and commanders of the other emergency services, and the way in which each is to work together during the recovery phase of any rail accident.

15. The location of the command post for site control at the scene of any rail accident should be identified by NSW Police by a distinctive flashing light.

16. The role of the rail commander should be to provide support and assistance to the site controller and emergency services personnel until the rescue phase of the emergency response to any rail accident is completed.

17. The rail commander should have complete authority to direct and control any rail employees attending the site of a rail accident, in accordance with directions given or arrangements put in place by the site controller, until the rescue phase of the emergency response to the rail accident has been completed.

18. RailCorp should develop and implement an emergency response plan for management of all rail accidents. Such a plan should be subsumed by the rail displan in the case of serious accidents or incidents.

19. The RailCorp emergency response plan should include action checklists of the steps that each employee is required to take, and the order for specific employees to follow in case of emergency.

20. All operational rail staff should be trained by RailCorp in the action check list relevant to each.

21. The RailCorp emergency response plan should be provided to all emergency response agencies. The officers of each emergency service should be trained in any rail specific features of the plan, so as to better ensure inter-agency co-ordination in the circumstances of an emergency.

22. The RailCorp emergency response plan should include a requirement for the debriefing of all senior rail and emergency response personnel involved in any rail accident, so as

to determine the way or ways in which emergency response arrangements for rail accidents can be continually improved, and thereafter implement such improvements.

23. All emergency response personnel should be specifically trained in the features of railways which are relevant to their work, such as the location and means of operation of all emergency door releases on trains, the location and use of signal telephones, the methods by which electrical power can be isolated and the means by which they can readily identify and obtain information from the on-site rail commander.

24. Regular field training exercises should be conducted by RailCorp with the emergency services to ensure that the incident command system and rail displan are able to be fully implemented as quickly as possible and are reviewed and improved.

25. Uniform verbal descriptions identifying that power has been isolated should be developed by RailCorp and utilised by all railway personnel, electrical service providers and all emergency response personnel.

26. All rail employees should be trained by their employer to commence any emergency communication with the words "Emergency, emergency, emergency", thereafter to identify themselves, the train, its location, what has occurred, the approximate passenger load and whether death or injuries have occurred.

27. A direct line of communication should be established between the RMC and Emergency Services Operations Control Centre by a "tie line" or otherwise, so as to ensure that in the case of a serious rail accident there is an open line of communication between the officer in charge of the management of the incident at the RMC and the various emergency response services.

28. A training centre for emergency services personnel should be established by RailCorp. The emergency services personnel should be required to undertake training at such a centre, which should be equipped with features replicating railway infrastructure and rolling stock.

Design and procurement of rolling stock

29. All railway owners and operators should have a quality assurance program for the design and construction of rolling stock and regular review of construction to ensure that the rolling stock satisfies the original functional performance specifications.

30. The rail safety regulator should set standards for the design, manufacture, testing and commissioning of rolling stock to ensure that the rolling stock is fit for its purpose.

Driver safety systems

31. All trains must be fitted with a minimum of two independent engineering defences to minimise the risk of derailment or collision in the event of train driver incapacitation.

32. RailCorp should progressively implement, within a reasonable time, level 2 automatic train protection with the features identified in chapter 8 of this report.

33. All new rolling stock should be designed to be compatible with at least level 2 automatic train protection discussed in chapter 7 of this report.

Risk assessment and risk control procedures

34. RailCorp should undertake risk assessments of each of its activities as follows:

    (a) identify the features of the system, subsystem or activities that are to be risk assessed and managed, to determine what makes the system work in terms of equipment, infrastructure and human factors;

    (b) identify all hazards that may exist within the particular system, subsystem or activity, whether it is a driver safety system, passenger safety system, engineering design system, train maintenance system or involves human factors or performance;

    (c) identify what controls are in place to eliminate or minimise the risks associated with any identified hazard;

    (d) test the validity of the controls to ensure that the risk is eliminated or reduced to an acceptable level and, if not, institute additional or further control measures;

    (e) specify, in safety documentation, the level of any residual risk;

    (f) in the case of low probability, high consequence risks retain the services of an independent verifier of the risk assessments and controls to certify that all risks of such potentially catastrophic accidents have either been eliminated, or controlled to the extent identified by the independent expert;

    (g) the Board of RailCorp certify that it regards any residual risk of a high consequence, low probability accident as acceptable, notwithstanding the severity of the consequences, by reason of the cost of further measures to control the risk; and

    (h) provide to ITSRR records of the processes of hazard identification, risk assessment, risk control, independent verification and certification, and any Board certification relating to any high consequence, low probability accident.

35. The ITSRR should conduct its own risk assessment in relation to the risk of any such high consequence, low probability accident and, if necessary, direct RailCorp to conduct a further risk assessment to reduce the level of residual risk to a level ITSRR regards as acceptable.

Data loggers

36. The ITSRR should impose a standard in relation to the collection and use of data from data loggers.

37. The standard in relation to the collection and use of data from data loggers should provide that such information must be accessed in the circumstances of any accident or incident and can be accessed to monitor driver performance generally.

Communications

38. There must be compatibility of communications systems throughout the rail network. It is essential that all train drivers, train controllers, signallers, train guards and supervisors of trackside work gangs in New South Wales be able to communicate using the same technology.

39. Communications procedures must be standardised throughout the rail network, so that all railway employees describe the same subject matter in an identical way.

40. All RMC communications related staff should be selected upon the basis of the ability to convey information clearly, accurately and concisely and to follow strict communications protocols.

41. All communications protocols must be strictly enforced by all accredited rail organisations.

42. The ITSRR should audit the RMC to ensure communications protocols are being followed. The sanction for non-compliance with communications protocols should be identical to that in the aviation industry and involve immediate removal from duty. Any RailCorp employee not following communications protocols should be required to undertake further training. If, following return to duties after such training, the officer continues to fail to comply with communications protocols, that officer is not to be employed in communications related work.

43. Communications protocols and procedures should be standardised and mandated by regulations making them a condition of accreditation.

44. ITSRR should ensure that, as a condition of accreditation, each of these recommendations is carried into effect and should audit against them to enforce compliance.

45. The ITSRR should conduct random audits of accredited rail organisations for compliance with communications protocols.

46. There should be interoperability of communications equipment between all trains operating on the New South Wales rail network.

Train maintenance

47. Defects reporting, recording and rectification should be integrated with the RailCorp regimes for train maintenance.

48. All train drivers' defects reports should be entered by RailCorp into a computerised record and tracked to finalisation.

49. No RailCorp train should enter into revenue service or remain in service if, in the opinion of the driver in charge of that train, any defect in it creates a risk of injury.

50. All reported train defects should be certified by a person in a supervisory position in RailCorp as having been rectified.

51. The RailCorp defects unit should be combined with the passenger fleet maintenance division of RailCorp.

52. Maintenance plans on all trains should be revised annually.

53. Train inspections should be carried out at the time of stabling RailCorp trains, as well as a part of train preparation prior to entering service.

Alcohol and drug testing

54. Random alcohol testing should be continued.

55. Alcohol and drug testing should be mandatory for any train driver or guard involved in any accident or incident.

56. RailCorp should continue its system of voluntary self-identification and rehabilitation of employees with alcohol or drug related problems.

Periodic medical examinations

57. The ITSRR should develop standards for periodic medical examinations which include the following:

    (a) all medical examinations of safety critical employees must contain a predictive element, including use of a cardiac risk factor predictions chart to assess risk of sudden incapacitation, and follow-up procedures, where indicated;

    (b) medical examinations must be conducted by medical practitioners with an understanding of the duties and responsibilities of the safety critical employees being examined;

    (c) a medical practitioner conducting such a medical examination should, with the employee's consent, have access to his or her medical history. If such consent is not given, the employee must be required to undertake a more exhaustive medical examination with specialist diagnostic procedures;

    (d) all such medical examinations must be reviewed on behalf of the employer by an occupational physician;

    (e) appropriate follow up examinations, such as a stress ECG or examination by a cardiologist, must be arranged for any safety critical employee whom the occupational physician believes may be at risk of sudden incapacitation;

(f) medical histories of employees should be monitored by an occupational physician to enable identification of any trends that may indicate a deteriorating state of health;

(g) routine basic psychological screening, by means of a questionnaire such as the K10 questionnaire, should form part of periodical medical examinations;

(h) medical standards should be reviewed at least every five years to ensure that recent advances in medical knowledge and technology are utilised; and

(i) periodic examination standards prescribed by ITSRR should take into consideration medical standards for safety critical rail staff prescribed elsewhere in Australia to ensure, so far as possible, uniformity of such standards.

Safety document control

58. RailCorp should establish a comprehensive safety document management system.

59. The safety document management system should provide for the distribution of electronic versions of safety documentation to relevant staff.

60. RailCorp should employ a Chief Safety Information Officer to manage the collection, collation, and dissemination of safety information within RailCorp.

61. RailCorp should provide access to electronic versions of safety documentation for all operational staff at their workplace.

62. The ITSRR should have permanent access to the RailCorp intranet.

63. The ITSRR should establish an electronic document control system to enable effective and reliable information to be gathered for monitoring the safety of the New South Wales rail system.

64. RailCorp and ITSRR should co-operate with national programs for the collection, collation, trend analysis and dissemination of safety critical information.

Train driver and guard training

65. Recommendations one to seven of the final report of the Special Commission of Inquiry into the Glenbrook Rail Accident should be fully implemented, save that the random auditing referred to in recommendations five and seven should be carried out by ITSRR.

66. RailCorp should use its simulators in an interactive manner.

67. RailCorp should use its simulators to train drivers and guards in methods of dealing with degraded operations on the rail network.

68. Train driver and guard training should encourage teamwork and discourage authority gradients.

69. RailCorp must establish a task analysis for particular categories of employees, to identify the specific skills and responsibility of those employees or groups of employees, and thereafter undertake a training needs analysis, to develop the skills required in particular areas.

70. Training should be based upon a needs analysis, to determine what skills a particular person will require to carry out the tasks of any position safely and efficiently, and instruction and practice, to acquire and demonstrate those skills.

71. The position of team leader should be created by RailCorp to be responsible for a group of approximately 30 train drivers, with responsibility to ensure that each train driver's training needs are being met and that any safety concerns of train drivers are being properly addressed. The team leaders are to have direct access to the Chief Executive of RailCorp if any safety concerns they have are not addressed.

Rail accident investigation

72. The New South Wales Government should make the necessary arrangements with the Australian Government, including any necessary legislation, for the Australian Transport Safety Bureau (ATSB) to have the power to investigate all rail accidents occurring on the New South Wales rail network the investigation of which may advance the knowledge of the causes of rail accidents in Australia.

73. The ITSRR should ensure that OTSI, as a division of ITSRR, co-operates and assists the ATSB in the conduct of any independent investigation by the ATSB of any rail accident or incident in New South Wales.

74. The ATSB should deliver any report of any such rail accident which it investigates to the Board of any rail organisation involved in the accident, ITSRR and the Minister for Transport Services.

75. All ATSB accident investigation reports should be made public.

76. The ITSRR should establish a data and information management system, containing all data and information that it requires, to continually monitor the safety of the New South Wales rail system.

77. The data and information management system should be compatible with any data and information management system established by the ATSB for the designated interstate rail network, provided that the establishment of a compatible system does not reduce the amount or quality of the information obtained by ITSRR below the optimum levels which it needs to conduct trend analysis, and otherwise properly manage the safety of rail operations in New South Wales.

78. The OTSI should continue to conduct rail accident investigations on behalf of ITSRR and report directly to the Chief Executive of ITSRR.

79. The relevant legislation should be amended to provide expressly that OTSI and the Chief Investigator have the power to initiate a rail accident or incident investigation.

80. Any barriers to communication between OTSI and ITSRR should be removed, so as to ensure that any findings made by OTSI in relation to any investigation it conducts are reported immediately to ITSRR.

81. All reports of the Chief Investigator of OTSI should be delivered, upon completion and without being reviewed, to ITSRR and the Minister for Transport Services.

82. Legislation should be enacted and any necessary arrangements made, to enable the ATSB to review any reports of any investigation by a rail organisation or the OTSI into any serious incident or accident in New South Wales.

Safety culture

83. RailCorp should develop a plan to be submitted to ITSRR to address the deficiencies in the safety culture of RailCorp, including:

    (a) the means whereby RailCorp proposes to ensure that all its operational, administrative and managerial staff consider the safety implications of any decision or action undertaken by them;

    (b) the means whereby any distrust between management and operational staff is removed and replaced by a culture in which the whole organisation is motivated towards the safe conduct of its transportation activities;

    (c) the means whereby RailCorp proposes to implement a just culture instead of a blame culture;

    (d) the means whereby RailCorp proposes to establish and implement accountability and responsibility of individuals for the safety of the activities that they undertake;

    (e) the means whereby RailCorp proposes to measure the safety performance of all individuals with accountabilities and responsibilities for safety, for the purpose of determining whether their level of safety performance is satisfactory;

    (f) the means whereby the Board of Directors, the Chief Executive and the Group General Managers intend, by their actions and behaviour, to foster the development of a safety culture in the organisation;

    (g) the means whereby RailCorp proposes to reward employees for bringing safety issues to the attention of management, and the means whereby the management of the organisation proposes to track the safety issues raised, to ensure continual safety improvement;

    (h) the means, generally, whereby RailCorp intends to replace the present culture of on-time running with a culture encouraging safe, efficient and reliable provision of rail services;

(i) the means whereby RailCorp proposes to ensure that communications protocols are followed by the employees of the RMC and all other employees engaged in safety critical work;

(j) the means whereby RailCorp proposes to set safety targets for the reduction of incidents overall, and incidents in particular classes, and the means whereby the relevant information is to be kept and collated for the purpose of measuring safety performance in those areas;

(k) the means whereby employees responsible for particular areas are rewarded for safety improvements in their areas of activity;

(l) the means whereby RailCorp intends to integrate safety in all aspects and at all levels of the transportation activities which it undertakes;

(m) the means whereby RailCorp proposes to train staff in processes of hazard analysis and risk management relevant to the particular activities that they conduct; and

(n) the means whereby RailCorp is to integrate the management of safety in all aspects into the general management of its business undertaking.

84. If ITSRR accepts such a plan as an appropriate response to the existing weak safety culture, ITSRR should approve it and monitor the effectiveness of the plan.

Occupational health and safety

85. RailCorp's approach to occupational health and safety should be proactive and involve the systematic analysis of all current hazards, risks and controls and an assessment of their adequacy to reduce the risk of injury to, or death of, employees to an acceptable level.

86. RailCorp should integrate its management of occupational health and safety into its overall safety management.

87. Risk assessments of occupational health and safety issues by RailCorp should include an analysis of broader public safety risks and not be confined to narrow occupational health and safety issues.

Passenger safety

88. The RailCorp passenger containment policy must be abandoned.

89. There must be a minimum of two independent methods of self-initiated emergency escape for passengers from all trains at all times.

90. All passenger trains must be fitted with an internal passenger emergency door release.

91. All passenger trains operating in New South Wales must be fitted with external emergency door releases which do not require any special key or other equipment to operate.

92. The internal passenger emergency door release should be fitted with a facility which prevents it from operating unless the train is stationary.

93. The operation of the train doors should have an override facility whereby the train driver or the guard can override an internal passenger emergency door release system if the door release is interfered with when there is no emergency. There should be an alarm, together with an intercom, in the train guard's compartment so that, if a passenger attempts to initiate an emergency door release, there is an appropriate delay during which time an alarm sounds in the train guard's compartment and the guard can then, after first attempting to speak via the intercom to the person concerned, if necessary, override the door release, and make an appropriate announcement over the intercom system in the train.

94. The risk of abuse of internal passenger emergency door releases should be further reduced by introducing significant penalties for any improper use of such an emergency facility. It should be a criminal offence for anyone to use or tamper improperly with an emergency escape facility in a train.

95. All passenger trains operating in New South Wales must have the external emergency door release clearly marked with the words "Emergency Door Release".

96. All RailCorp operational personnel should be trained in the location and operation of external emergency door release mechanisms.

97. All emergency services personnel should be trained in the location and operation of emergency door release mechanisms on all rail cars.

98. All trains should have windows available through which passengers can escape.

99. All new rail cars must have appropriate signage and lighting identifying escape routes in the case of emergency.

100. All new rolling stock must be designed with an area of the roof through which emergency services personnel can access a rail car without encountering wiring or other equipment. That access point must be clearly marked with words such as "emergency services cut here".

101. ITSRR should initiate and/or participate in the development of a national standard for crashworthiness of all passenger trains.

Corporate governance

102. RailCorp should make it a condition of employment that all level 2 managers have or obtain a formal qualification in system safety management.

103. RailCorp should establish clear safety accountability statements and reporting lines for all management positions.

104. The RailCorp Board should establish independent external safety auditing processes to regularly audit and report to the Board on the implementation of an integrated safety management system by RailCorp and on safety performance generally.

105. The RailCorp Board should ensure that RailCorp has an adequate and integrated safety management system, including adequate systems for risk assessment, clearly defined safety responsibilities and accountabilities for persons holding management positions, and specific performance criteria against which evaluations can be made of safety performance and accountability for safety performance of all managers.

106. The RailCorp Board should require a full review of the safety competence of RailCorp managers to ensure that each has the ability to bring about those safety reforms recommended in this report which are applicable to his or her position.

107. RailCorp should ensure that where the safety competency of any manager is deficient such manager is required to undertake professional development courses to raise his or her safety competency level to an adequate standard.

108. RailCorp should conduct internal and external safety audits to evaluate the adequacy of its safety management system and to ensure that any risk control measures are effective.

109. Following completion of any external audit, a corrective action plan to remedy any identified safety deficiencies should be developed by RailCorp, implemented and followed up within the business groups affected, to ensure appropriate and timely completion of the action plan, by a formal examination of the effectiveness of the controls put in place. Senior management personnel should certify that the corrective action plan has been implemented and is effective. Senior management personnel should be accountable for any such certification.

Safety reform

110. A Safety Reform Program Director (hereafter referred to as SRPD), reporting directly to the Chief Executive of RailCorp, should be retained to manage, as head of a Safety Reform Program Office, any safety reform program being undertaken by RailCorp. The SRPD should work with the Chief Executive and senior management to ensure the implementation of an integrated safety management system and the cultural change required. The SRPD must have qualifications suitable for recognition by the Australian Institute of Project Management as a master program director. He or she should report to and be under the control of the Chief Executive, to ensure that the accountability of the Chief Executive is not reduced. The SRPD should co-ordinate and integrate any existing rail safety reform programs and, in consultation with and with the authority of the Chief Executive he or she should:

    (a) assign responsibility for particular aspects of the project to identifiable employees;

(b) ensure that each person to whom such an aspect of the program has been assigned has the time and resources to undertake the tasks each is required to perform;

(c) identify the period of time during which such persons are required to achieve the desired safety outcome for the particular aspect of the program;

(d) specify a clearly defined scope of work to be undertaken, a schedule setting out when such work is to be completed, and institute a system of measuring whether or not the objectives have been achieved in the time specified; and

(e) report to the Chief Executive of RailCorp on a monthly basis on each aspect of the program, and the Chief Executive is to report on a monthly basis to the RailCorp Board and to ITSRR, on the progress of each program.

Safety regulation

111. The Advisory Board established under the Transport Legislation Amendment (Safety and Reliability) Act 2003 must be abolished.

112. Legislative changes should be enacted to ensure the complete independence of ITSRR from the Minister for Transport Services.

113. The Chief Executive of ITSRR should have sole accountability and responsibility for the regulation of rail safety in New South Wales.

114. The ITSRR should publish guidelines to be followed by accredited organisations.

115. The ITSRR should not grant accreditation to any rail organisation unless it has an integrated safety management system in accordance with any safety management system regulation and the guidelines published from time to time by ITSRR.

116. The ITSRR should conduct field audits to satisfy itself that all accredited rail organisations conduct their activities in accordance with the safety management system on the basis of which each was accredited.

117. Staffing arrangements for ITSRR should be reviewed by it to ensure that adequate staff are employed in field positions, actively monitoring the safety of rail operations and compliance with conditions of accreditation.

118. All accredited rail organisations should be required to re-apply every three years to ITSRR for accreditation.

119. The ITSRR, when considering a re-application for accreditation, should conduct a field audit of the organisation to ensure that it is carrying on its activities in accordance with the basis upon which it seeks accreditation.

120. The ITSRR should continue to participate in the development of a national system for rail safety regulation, provided that any ultimate agreement between the States and Territories and the Australian Government does not produce a safety outcome for New

South Wales that is less than would be achieved by the implementation of all the recommendations contained in this report.

Integrated safety management

121. A safety management system regulation should be promulgated, specifying the requirements of safety management systems in all accredited organisations, using Annexure I to this report as a guide.

122. RailCorp should establish an integrated safety management system which includes the following:

    (a) a formal performance management system, incorporating measurable safety accountabilities and responsibilities for each managerial position;

    (b) defined safety accountability and responsibility statements for senior management;

    (c) an effective means of reviewing and acting upon audit investigation and review findings;

    (d) an effective system for managing audit and investigation findings, to ensure that any identified deficiencies have been rectified;

    (e) criteria for recruitment and promotion of management staff, including safety management qualifications, experience and expertise;

    (f) development of risk management procedures, including:

        (i) analysis of the nature of the activities being undertaken;

        (ii) identification of all potential hazards within those activities;

        (iii) analysis of the nature of the hazard;

        (iv) analysis of the risks of the hazard materialising;

        (v) development of controls to mitigate the risk;

        (vi) development of systems for monitoring the effectiveness of the controls to ensure that they are working;

        (vii) development of a continuing program to enhance the development of safe practices at all levels of the organisation;

        (viii) development of key performance indicators for safety performance by all persons in management positions;

(ix) development of a safety information data collection system which captures all hazards, occupational health and safety incidents, audit results, non-compliance findings and near miss reports;

(x) development of a system to arrange in priority order, on the basis of data and trend analysis, those safety deficiencies which require the most urgent attention;

(xi) design and implementation of communications protocols, including standard phraseology, with particular standard phraseology for emergency situations; and

(xii) development of training systems, based upon training needs analysis.

123. RailCorp should establish a safety management system containing the 29 elements identified in the SMSEP report which is in volume 2 of this report.

124. The ITSRR should ensure that RailCorp establishes a safety management system containing the 29 elements identified in the SMSEP report, and ensure the ongoing monitoring and improvement of the safety management system established.

Implementation of recommendations

125. The ITSRR must provide a quarterly report to the Minister for Transport Services on the progress made by RailCorp in implementing these recommendations, including:

(a) a statement as to whether or not the recommendation has been implemented and, if so, is working effectively; and

(b) if the recommendation has not been implemented, the means by which the safety objective of the recommendation is otherwise to be achieved.

126. The Minister for Transport Services must table in Parliament, each such quarterly report by ITSRR.

127. The Minister for Transport Services should retain, independently of ITSRR, safety auditors to provide a report to the Minister confirming or qualifying the contents of each such ITSRR quarterly report.

ANNEXURE A

SPECIAL COMMISSION OF INQUIRY

Counsel Assisting
Peter Hall QC
Christopher Barry QC
David Cowan

Solicitors
Christine Johnpulle, Solicitor to the Special Commission of Inquiry (to 11 March 2004)
Marina Rizzo (appointed Solicitor to the Special Commission of Inquiry on 12 March 2004)
Ann Dale (from 7 April 2003 to 31 October 2003)
Sudhir Sivarajah (from 13 April 2004 to 10 September 2004)
Maura McKenna (from 20 September 2004)

Rail Safety Adviser
Norman Thompson, Ministry of Transport (formerly the Department of Transport) seconded to the Special Commission of Inquiry

Lead Investigator
Robert Lauby, Booz Allen Hamilton Inc.

Consultants
Paul Barratt, Corporate Governance, Principal, CEO Collegiate Pty Limited (formerly Secretary, Department of Defence)
William Burnett, Coordinator, Maunsell Australia Pty Limited
Daryl Byrne, Rail Operations, Brookside Consultants Pty Limited
Klaus Clemens, Rail Management and Operations, Principal Consultant, RM Aus Pty Limited (formerly General Manager Organisational Development, State Rail Authority of New South Wales)
Peter de Bruyn, Maintenance Systems, Booz Allen Hamilton (Australia) Limited
Andrew Doery, Planning and Scheduling, Booz Allen Hamilton (Australia) Limited
Marion Enander, Organisation Planning, Booz Allen Hamilton (Australia) Limited
Captain C.W. Filor PSM, Accident Investigation, Deputy Director, Surface Safety, Australian Transport Safety Bureau
Paul Hayes, Governance and Implementation Processes, Director, Nostos Pty Limited (formerly Director of Policy, New South Wales Department of Transport)
Donald Heumiller, Rolling Stock, Don Heumiller & Associates Pty Limited
Douglas Higgins, Braking and Traction, TMG International (Australia) Pty Limited
Dr Andrew McIntosh, Human Factors and Biomechanics, Senior Lecturer in Biomechanics and Ergonomics, School of Safety Science, University of New South Wales
Bodo Mann, Organisation Planning, Booz Allen Hamilton (Australia) Limited
Fred Mau, Track Infrastructure, Booz Allen Hamilton (Australia) Limited
Professor Michael O'Rourke, Cardiologist, St Vincent's Hospital
Philip Pearce, Traction, TMG International (Australia) Pty Limited
Dr Tony Phillips, Geotechnical Factors, Tony Phillips Consulting Pty Limited
Dr Steven Rainer, Pathologist, St Vincent's Hospital
Dr George Rechnitzer, Accident Reconstruction, DV Experts Pty Limited

Alexander Wardrop, Simulation, TMG International (Australia) Pty Limited

Safety Management Systems Expert Panel

Dr Graham Edkins, Director, Public Transport Safety, Department of Infrastructure, Victoria (formerly General Manager, Safety Systems and Education, Qantas Airways Limited), (Chairman)

Dr Chris Darling, Manager, Safety, Health and Risk, Industrial Markets, BlueScope Steel (formerly BHP Steel Limited)

Associate Professor Ian Glendon, School of Psychology, Director, Organisational Psychology Postgraduate Programs, Griffith University Gold Coast

Dr Robert Lee, International Consultant on Human Factors and System Safety (former Director, Australian Bureau of Air Safety Investigation and former Director, Human Factors, Systems Safety and Communications, Australian Transport Safety Bureau)

Ken Lewis, former Group General Manager, Corporate Safety Department, Qantas Airways Limited

Norman Thompson, Ministry of Transport (formerly Department of Transport) seconded to the Special Commission of Inquiry

Safety Management Systems Review Director

Nicholas Bahr, Senior Associate, Booz Allen Hamilton Inc.

Safety Management Systems Review Project Managers

Peter Olsen, Associate, Booz Allen Hamilton (Australia) Limited (from 28 November 2003 to 16 February 2004)

Len Neist, Senior Associate, Booz Allen Hamilton (Australia) Limited (from 17 February 2004)

Review Auditors

Ken Lewis, former Group General Manager, Corporate Safety Department, Qantas Airways Limited (Lead Auditor)

Martin Baggott, Executive Manager Transport, Bovis Lend Lease Pty Limited

Barry Broom, Manager Network Safety, Network Access Group, Queensland Rail

John Evans, Safeworking Compliance Officer, Risk Unit, Queensland Rail

Charles Galea, Senior Consultant, Nova Aerospace Pty Limited

Dr Neil Isles, Director/ Principal Consultant, Ibis Business Solutions Pty Limited

Brian McBride, Senior Consultant - Management and Technology Consultant, Booz Allen Hamilton (Australia) Limited

Michael Nendick, Human Factors Specialist, Human Factors and Systems Safety, Civil Aviation Safety Authority

Michael Rodgers, Consultant, formerly Manager, Human Factors and Systems Safety, Civil Aviation Safety Authority

Alan Ross, Principal, A & K Ross Associates (formerly Executive Director, Public Transport Safety, Department of Infrastructure, Victoria)

Peer Reviewers

Dr John Loy, Chief Executive Officer, Australian Radiation Protection and Nuclear Safety Agency

Dr James Reason, Professor Emeritus, Consultant (formerly Professor of Psychology, University of Manchester, United Kingdom)
Terry Worrall, Railway Consultant (Operations & Safety) and Technical Advisor Rail Accident Investigation Branch, United Kingdom (formerly Director and General Manager, Thames Trains Limited)

Police Liaison Officer
Erica Nuttall, Detective Senior Constable, NSW Police

Commissioner's Staff
Peter Moon - Associate
Norman Hand - Tipstaff

Office of the Special Commission of Inquiry

Executive Officer
Robin Szabo (to 29 August 2003)

Office Administrator
Narelle Goold

Paralegals
Harpreet Baines
Henry Byrne
Orla Campbell
Maeve Colgan
Matthew Harper
Rosalind Keen
Elizabeth Lee
Garth McCarty
Alyena Mohummadally
Juhyan Pak
Joan Ryan
Matthew Taylor
Chantal Tipene
Natalie Truong
Terri Wilson
Davyd Wong

Administration and Secretarial
Yvonne Abela
Allan de Rooy
Rhonda Doughty
Sandra Gaha
Vicky Giangoulas
Amanda Morris
Penelope O'Grady
Robyn Schultz
Susan Stellino

Diana Tommasello

IT Support

Brett O'Brien (to17 June 2004)
Terry McLean (from 20 June to 29 October 2004)
Glenn Fitton (from 1 November 2004)

IT Consultants
<e.law> Australia Pty Limited
Rebecca Grant, Information Technology & Hearing Room Project Manager
Neeraj Chand, Bureau Manager
Nicholas Gouliaditis, Paralegal Supervisor
Gemma Edgar, Registry Manager
Peter Jonkman, Registry Manager
Vijay Sharma, Registry Manager
Priscilla Chehab, Court Operator

Document Processing Paralegals
<e.law> Australia Pty Limited
Daniel Brettell
Dawn Ellis
Iona Flett
Chris Gouliaditis
Michelle Hayward
Michael Holland
Kevin McCarthy
Andrew Nowell
Maaike Pullar
Rahul Shandil
Anne Trevaskis
Melanie Trezise

ANNEXURE B

LIST OF PARTIES AND THEIR REPRESENTATIVES

Counsel Assisting
Peter Hall QC, Christopher Barry QC and David Cowan instructed by Christine Johnpulle (to 11 March 2004) and Marina Rizzo (from 12 March 2004)

Director General, Ministry of Transport and Independent Transport Safety and Reliability Regulator
Peter Johnson SC and Peter Singleton instructed by the Crown Solicitor

State Rail Authority of New South Wales and Rail Corporation New South Wales
Peter Garling SC and Michael Elliott instructed by Mallesons Stephen Jaques

Rail Infrastructure Corporation
Martin Einfeld QC and Ian Neil instructed by Allens Arthur Robinson

Australian Rail, Tram and Bus Industry Union, New South Wales Branch
Harold Bauer instructed by McClellands

Pacific National Pty Limited
John Hennessy and Gary Rich instructed by Clayton Utz

Helen Zeides
Peter Capelin QC instructed by McClellands

Mitsubishi Electric Australia Pty Limited
Peter Morris instructed by James Tuite & Associates

United Goninan Limited
David Studdy instructed by Corrs Chambers Westgarth

William van Kessel
Paul Webb QC and Richard Scruby instructed by Duncan Cotterill

Relatives of the Deceased and Injured Passengers
Robert Sutherland SC (to 26 August 2003), Sharron Norton SC (16 to 20 June 2003) and Patricia Lowson (from 15 March 2004) instructed by Legal Representation Office

Robert Naylor
Richard Brading, Solicitor, Wesley Community Legal Service (10 June 2003)

Fischer Industries Pty Limited
Stewart Cuddy, Partner, Stewart Cuddy & Mockler (25 July and 4 August 2003)

ANNEXURE C

ALPHABETICAL LIST OF WITNESSES

Adriano, Rodrigo, Customer Service Officer, State Rail Authority of New South Wales

Anderson, Kevin John, Risk Engineer and Director, Risk and Reliability Associates Pty Limited, former Director, VRJ Risk Engineers Pty Limited (formerly Viner Robinson Jarman Pty Limited)

Aquilina, John Paul, Train driver, State Rail Authority of New South Wales

Audet, Keith Benjamin, former Operations Manager, State Rail Authority of New South Wales

Bahr, Nicholas Jerome, Senior Associate, Booz Allen Hamilton Inc.

Balmforth, Barry John, Duty Manager, State Rail Authority of New South Wales

Beshay, Hany, Passenger

Boyd, Ross John, Crew Operations Manager, State Rail Authority of New South Wales

Bruce, Ronald Ian, Project Director, State Rail Authority of New South Wales

Bucholtz, Roger Edward, Chief Superintendent, New South Wales Fire Brigades

Bunyon, Ross Murdoch, Chairman, Rail Corporation New South Wales, State Rail Authority of New South Wales, Rail Infrastructure Corporation, Eraring Energy and Pacific Western

Butler, Gregory Scott, Detective Leading Senior Constable, NSW Police

Butterfield, April Lea, Senior Constable, NSW Police

Cairnduff, Robert James, Detective Sergeant, NSW Police

Calder, Richard William, Senior Constable, Operations Support, NSW Police

Camage, Barry William, Manager Safety, Corporate Safety, Rail Corporation New South Wales

Carter, Allan Herbert, Accountant

Carter, Barry Stuart, Passenger

Cartwright, Michael William, Australian Rail, Tram and Bus Union, New South Wales Branch

Chopra, Rakesh, Program Officer, Passenger Security, State Rail Authority of New South Wales

Chuah, Dr Michael, General Practitioner

Coombs, Dr Elizabeth Mary, Acting Director-General, New South Wales Department of Women

Cooney, Wayne Phillip, Passenger

Corbin, Stephen Michael, Engineer, Rail Infrastructure Corporation

Couch, Dr Michael Henry Alan, former Medical Review Officer, State Rail Authority of New South Wales

Cox, Gregory Robert, Metallurgist, Rail Infrastructure Corporation

Creighton, Ronald Stanley, Chief Operations Officer, Rail Corporation New South Wales (formerly Chief Operations Manager, State Rail Authority New South Wales)

Dandridge, Christopher Leslie Colin, Manager, Payroll Services, State Rail Authority of New South Wales

Davidson, Matthew James, Constable, NSW Police

Dawes, John Emile, Project Manager Health Standards, Corporate Safety, Rail Corporation New South Wales (formerly Manager, Train Crewing, State Rail Authority of New South Wales)

Day, Richard Anthony George, General Manager, Rail Development, State Rail Authority of New South Wales

Doak, Brett Ian, Executive Manager, Safeworking, Rail Corporation New South Wales

de Bruyn, Koos Peter, Mechanical Engineer, Booz Allen & Hamilton (Australia) Limited

Dearing, Bradley Clement, Ambulance Officer, Ambulance Service of New South Wales

Docherty, Tod, Technical Maintenance Supervisor, State Rail Authority of New South Wales

Donaldson, Kent Victor, Executive Director, Transport Safety Regulation, Independent Transport Safety and Reliability Regulator (formerly Executive Director, Transport Safety and Rail Safety Regulation, Ministry of Transport)

Edkins, Dr Graham Derek, Director, Public Transport Safety, Department of Infrastructure, Victoria (formerly General Manager, Safety Systems and Education, Qantas Airways Limited)

Edwards, David Stanley, Executive Manager Safety, Pacific National Pty Limited

Erskin, Ralph David, Duty Manager, State Rail Authority of New South Wales

Etnasios, Charmain, Passenger

Falzon, Cheryl Vicky, Customer Service Representative

Fawor, Joe, Train guard, State Rail Authority of New South Wales

Fischer, Peter Brian, Managing Director, Fischer Industries Pty Limited

Foster, Paul Joseph, Train Driver, Rail Corporation New South Wales and Sub-division Secretary for Flemington, Australian Rail, Tram and Bus Union, New South Wales Branch

Fox, Craig Alan, Detective Senior Constable, NSW Police

Franklin, David Edward Charles, Train driver, State Rail Authority of New South Wales

Frankovic, Johnny Ivan, Passenger

Friedman, Virginia, Clinical Pathologist, Institute of Clinical Pathology and Medical Research, Division of Analytical Laboratories

Gafa, Joseph Anthony, Photographer

Gassman, Karina Ann, Detective Senior Constable, NSW Police

Georges, Fahim, Customer Service Team Leader, State Rail Authority of New South Wales

Gibbons, Eric Gain, Principal Engineer Electrical, Williams Worley Rail

Gilbertson, Paul Richard, General Manager Capital Works, Train Services, Rail Corporation New South Wales (formerly Director of Capital Works, State Rail Authority of New South Wales)

Gillen, Robert Keith, Roster Officer, State Rail Authority of New South Wales

Gleave, David John, Train driver, State Rail Authority of New South Wales

Glennie, Norman Stuart, Train driver, State Rail Authority of New South Wales

Goddard, Randall James, Train driver, State Rail Authority of New South Wales

Gomes, Maurillio, Train guard, State Rail Authority of New South Wales

Gray, Peter David, Backhoe Operator, Northern Suburbs Backhoe Hire

Graham, Vincent John, Chief Executive, Rail Corporation New South Wales, Chief Executive, Rail Infrastructure Corporation, and Acting Chief Executive, State Rail Authority New South Wales

Griffin, David Francis, Manager, Train Crew Resources, Rail Corporation New South Wales

Griffin, Peter John, Electrical System Control Engineer, State Rail Authority of New South Wales

Gudmann, Jeffrey Charles, Forensic Metallurgist, JC Gudmann and Associates Pty Limited

Gurule, Stanley Thomas, Senior Engineer, Transportation Technology Centre Inc., Pueblo, Colorado, United States of America

Guselli, John Anthony, Director, SCG Aviation Services Pty Limited

Guy, Jocelyn, Consultant to the Office of Transport Safety Investigations

Hall, Bruce William, Group General Manager, Safety and Environment, Rail Corporation New South Wales

Hatton, Terence Peter, State Rail Authority of New South Wales Contractor

Hayden, Robert Norman, President, Australian Rail, Tram and Bus Union, New South Wales Branch

Heckbarally, Jainool, Train guard, State Rail Authority of New South Wales

Hedley, Barry Robert, Acting Manager, Safety and Projects Coordination, Rail Corporation New South Wales

Henry, Owen Roger, General Manager, Business Operations, Rail Infrastructure Corporation

Herriman, Catherine Anne, Executive Director Safety, State Rail Authority of New South Wales

Heumiller, Donald Les, Rolling Stock Expert, Don Heumiller & Associates Pty Limited

Higgins, Douglas Michael, Engineer, TMG International (Australia) Pty Limited

Highley, Simon David, Train Driver, Rail Corporation New South Wales

Hill, Ian Vickery, Acting General Manager, Train Crewing, Rail Corporation New South Wales

Hilton, Associate Professor John Millar Napier, Department of Pathology, University of Sydney and Clinical Director, Department of Forensic Medicine, Central Sydney Area Health Services

Hingle, Garry, Secretary (Vehicle Division), Australian Manufacturing Workers Union, New South Wales Branch

Hocking, Dr Raymond Bruce, Specialist in Occupational Medicine, Bruce Hocking & Associates Pty Limited

Hockings, Gregory John, Senior Engineer, Rail Infrastructure Corporation

Hodges, Iaen Malcolm, Crew Area Manager Wollongong, State Rail Authority of New South Wales

Hoffman, Phillip James, Train driver, State Rail Authority of New South Wales

Holden, Graham Craig, Electrical Engineer, Halcrow Pacific Pty Limited

Holman, John Richard, Engineer, Holman Engineering Pty Limited

Hudson, Bernard William, Regional Network Operations Manager, Rail Corporation New South Wales

Inwood, David Brian, Maintenance and Operations Manager, Passenger Fleet Maintenance, State Rail Authority of New South Wales

Janik, John, Executive Manager, Sales, A Goninan & Co Pty Limited (now United Goninan)

Jarvis, Charles Richard, Retired Train driver, State Rail Authority of New South Wales

Johnson, David Edwin, Train driver, State Rail Authority of New South Wales

Karpik, Henry, Superintendent, NSW Police

Kayess, Roderick Harry, Crew Area Manager, State Rail Authority of New South Wales

Kennedy, John Richard, Train driver, State Rail Authority of New South Wales

Kerr, Malcolm Black, Acting Principal Engineer Track Assurance, Engineering Division, Rail Infrastructure Corporation

Kessey, Phillip Noel, Australian Rail, Tram and Bus Union, New South Wales Branch

Kippist, David John, Engineering Manager, State Rail Authority of New South Wales

Kwok, Dr Yoke Choong, General Practitioner

Lacy, Howard Andrew, former Chief Executive, State Rail Authority of New South Wales

Lai, Stan, Senior Project Engineer, Engineering Capital Works, State Rail Authority of New South Wales

Lauby, Robert Charles, Mechanical Engineer, Booz Allen Hamilton Inc.

Lee, Michael Patrick, Senior Constable, NSW Police

Legge, Peter Robert, Project Delivery Manager, State Rail Authority of New South Wales

Lidbetter, Alan, Security and Emergency Manager, Independent Transport Safety and Reliability Regulator

Linsley, Kenneth Alec, former Project Engineer, A Goninan & Co Pty Limited (now United Goninan)

Lovat, Barry Vincent, Project Director for Rolling Stock Delivery, State Rail Authority of New South Wales

Love, Fiona Linley, Director, Training and Development, Rail Corporation New South Wales (formerly Director, Training and Development, State Rail Authority of New South Wales)

Luxford, Paul Douglas, Train driver, State Rail Authority of New South Wales

Lyons, Associate Professor Timothy John, Faculty of Medicine, University of Newcastle and Director of Forensic Medicine, Royal Newcastle Hospital

Mann, Kylie Louise, Senior Constable, NSW Police

Martin, Albert John, Sergeant, NSW Police

Martinesi, Paul Peter, Driver Trainer, State Rail Authority of New South Wales

Mau, Fred Ian, Civil Engineer, Booz Allen & Hamilton (Australia) Limited

May, Julian Robert, Principal Brake Engineer CityRail, State Rail Authority of New South Wales

McCredie, Dr Richard Michael, Cardiologist

McIntosh, Dr Andrew Stuart, Senior Lecturer in Biomechanics and Ergonomics, School of Safety Science, University of New South Wales

McKenzie, Wayne Graeme, Customer Service Attendant, State Rail Authority of New South Wales

McLean, Arthur William, Train driver, State Rail Authority of New South Wales

McMahon, Keith Henry, Train driver Trainer, State Rail Authority of New South Wales

McPherson, Frances Mary, Group General Manager, Customer Services, Rail Corporation New South Wales (formerly Deputy Chief Executive Workforce Strategy and Development, StateRail Authority of New South Wales)

Meagher, Peter Ronald, Detective Senior Constable, NSW Police

Medlock, Peter John, Consultant to Rail Corporation New South Wales

Mellitt, Professor Brian, Engineer, Stilton, Peterborough, Cambridgeshire, England

Miller, Donald James, Train driver, State Rail Authority of New South Wales

Monjed, Jeff, Train guard, State Rail Authority of New South Wales

Muller, Daniel, Constable, NSW Police

Nabkey, Richard Michael, Testing and Commissioning Manager, Rolling Stock Engineering, State Rail Authority of New South Wales

Nash, James Edwin, Chief Operations Inspector, State Rail Authority of New South Wales

Naylor, Robert Paul, Organisational Psychologist

Neal, David Ashley, Detective Sergeant, NSW Police

O'Donnell, Stephen Godfrey, Chief Executive Officer, Pacific National Pty Limited

O'Rourke, Professor Michael Francis, Cardiologist, St Vincent's Hospital

Oliver, Edward Howard, Contractor, Transport Co-ordination Authority

Packer, Craig John, Ambulance Officer, Ambulance Service of New South Wales

Pearce, Philip Ian, Engineer, TMG International (Australia) Pty Limited

Peel, Dr Graeme Robert, General Manager Occupational Health Services, Qantas Airways Limited

Penin, Jean-Pierre Eric, Train guard, State Rail Authority of New South Wales

Philpott, Bruce William, Train guard, State Rail Authority of New South Wales

Pitblado, Dr Robin Maurice, Global Risk Fellow, Det Norske Veritas, Houston, United States of America

Pondekas, Andrew Con, former General Manager, Passenger Fleet Maintenance, State Rail Authority of New South Wales

Pontifex, Gary Alan, Train driver, State Rail Authority of New South Wales

Power, Geoffrey Charles, Manager Quality and Technical Support, Passenger Fleet Maintenance, State Rail Authority of New South Wales

Prestwidge, Ken, Manager, Audit and Accreditation, State Rail Authority New South Wales

Prior, Craig Peter, Driver Trainer, State Rail Authority of New South Wales

Pugh, Robert, Projects and Technical Systems Engineer, State Rail Authority of New South Wales

Rainer, Dr Stephen Peter, Senior Staff Specialist in Pathology, St Vincent's Hospital

Ramsay, Gary Mark, Train driver, State Rail Authority of New South Wales

Rayner, Scott Andrew, Passenger

Ready, Brian Gerard, Guard Trainer, Rail Corporation New South Wales and President, Guard Subdivision, Australian Rail, Bus Train Union, New South Wales Branch

Rechnitzer, Dr George, Engineer, DV Experts Pty Limited

Redshaw, Gareth, Passenger

Robinson, Elke Louise, Constable, NSW Police

Ready, Brian Gerard, Guard Trainer, Rail Corporation New South Wales and President, Guard Subdivision, Australian Rail, Bus Train Union, New South Wales Branch

Ross, Alan, Principal, A & K Ross Associates (formerly Executive Director, Public Transport Safety, Department of Infrastructure, Victoria)

Rosser, Brett Alan, Train driver, State Rail Authority of New South Wales

Rossiter, Luke David Lee, Passenger

Rutledge, Aaron, Probationary Constable, NSW Police

Ryman, Kerry Thomas, Duty Manager Port Kembla, State Rail Authority of New South Wales

Rymill, William Lockhart, Passenger

Samuel, Adrian Francis, Centre Manager, Mortdale Maintenance Centre, State Rail Authority of New South Wales

Sargent, Hayden, Constable, NSW Police

Scott, John Balfour, Engineer, Williams Worley Rail

Sharp, Timothy Andrew, Train driver, State Rail Authority of New South Wales

Shepherd, Barrie, Engineer, Halcrow Pacific Pty Limited

Shurety, Melanie, Train guard, State Rail Authority of New South Wales

Simons, Frances Antonia, Group General Manager, Human Resources, Rail Corporation New South Wales

Skinner, Matthew David, Detective Senior Constable, NSW Police

Small, Michelle Maree, Organisational Psychologist, Rail Corporation New South Wales

Smith, Arthur William, Deputy Chief Executive Operations and Infrastructure, State Rail Authority of New South Wales

Smith, Bruce Russell, Train guard, State Rail Authority of New South Wales

Smith, Craig Francis, Sergeant, NSW Police

Soni, Jai Kumar, Train guard, State Rail Authority of New South Wales

Spargo, Graeme, Duty Manager Waterfall, State Rail Authority of New South Wales

Spinelli, Leyla, Communications Assistant, Ambulance Service of New South Wales

Stevenson, Dr Michael Geoffrey, Occupational Ergonomics Consultant and former Head, Ergonomics Unit, Worksafe Australia

Stojkovska, Nada, Passenger

Stossel, Peter Helmuth, Train driver, State Rail Authority of New South Wales

Strojny, Edward, Train driver, State Rail Authority of New South Wales

Symmonds, Ronald Sydney, Retired Duty Manager, State Rail Authority of New South Wales

Taylor, Stanley John, Train driver, State Rail Authority of New South Wales

Taylor, Warrick Shane, Manager, Rail Management Centre, Rail Corporation New South Wales

Thompson, David, Senior Constable, NSW Police

Thompson, David, Driver Trainer, Rail Corporation New South Wales

Thorpe, Amanda Louise, Customer Service Officer

Thorpe, Leslie John, Train Controller, State Rail Authority of New South Wales

Tonks, Kelly, Constable, NSW Police

Turner, Peter Russell, Passenger

Van Helden, Raymond, Train guard, State Rail Authority of New South Wales

van Kessel, William, Train guard, State Rail Authority of New South Wales

Vogl, Dr Edward, Cardiologist

Walsh, Carolyn Jean, Chief Executive, Independent Transport Safety and Reliability Regulator

Walsh, Nonee Philomena, Passenger

Walsh, Ronald David, Engineer, Rail Infrastructure Corporation

Wardrop, Alexander William, Director, TMG International (Australia) Pty Limited

Watson, Natalie, Constable, NSW Police

Weir, Geoffrey Steven, Passenger

Wicks, David Colin, Senior Constable, NSW Police

Wilkins, Dr Peter Sydney, Director of Aviation Medicine and Principal Medical Officer, Civil Aviation Safety Authority

Williams, Robert Junior, Train guard, State Rail Authority of New South Wales

Williams, Troy Craig, Customer Service Attendant, State Rail Authority of New South Wales

Wills, Julie Anita, Manager, Health and Safety Strategy, State Rail Authority of New South Wales

Wise, Glen Adrian, Ambulance Officer, Ambulance Service of New South Wales

Wright, Kevin Ronald, Manager, Train Operations, Rail Corporation New South Wales

Yang, Dr Jindong, Technical Director, Leap (Australia) Pty Limited

Zeides, Helen Lorraine

ANNEXURE D

LIST OF EXPERTS

Overseas Experts

Adduci, Robert J, Transportation Industry and Analyst Safety and Security, Research & Special Programs Administration, Volpe National Transportation Systems Center, United States of America.

Bodmer, Ronald R, Lieutenant, Emergency Management Coordinator, Metro Transit Police Department, Washington Metropolitan Area Transit Authority, United States of America.

Butler, David, Recommendations Manager, Rail Safety & Standards Board, United Kingdom.

Chambers, Irving, Service Innovation Division, Bus Rapid Transit, Federal Transit Administration, Department of Transportation, United States of America.

Chipkevich, Robert J, Director, Office of Railroad, Pipeline & Hazardous Materials Investigations, National Transportation Safety Board, United States of America.

Evans, Andrew, Professor of Transport Risk Management, Department of Civil and Environmental Engineering, Imperial College London, United Kingdom.

Evans, Richard, Head of Operations and Human Factors, Rail Safety & Standards Board, United Kingdom.

Goodine, Fred C, Assistant General Manager, Department of System Safety & Risk Protection, Washington Metropolitan Area Transit Authority, United States of America.

Griffiths, Carolyn, Chief Inspector, Rail Accident Investigation Branch, United Kingdom.

Grillo, Patrizio, Principal Administrator, Rail Transport and Interoperability, Directorate-General for Energy and Transport, European Commission, Belgium.

Hart, Eur Ing Stanley, Her Majesty's Principal Inspector of Railways, Her Majesty's Railway Inspectorate, Health & Safety Executive, United Kingdom.

Hunter, Geoffrey C, Emergency Management Specialist, Program Decision and Information Sciences Division, Argonne National Laboratory, United States of America.

Hutter, Bridget M, Peacock Professor of Risk Management and Director, ESRC Centre for Analysis of Risk and Regulation, The London School of Economics and Political Science, United Kingdom.

Hynes, Ron, Associate Director – Railroad Division, National Transportation Safety Board, United States of America.

Jones, Brian, Accreditation Manager and IRCA Registered Lead Auditor, Rail Safety & Standards Board, United Kingdom.

Kennedy, Cheryl E, Vice President, Office of System Safety, New York City Transit, United States of America.

Krohn, Ted, Director, International Policy, Federal Railroad Administration, Department of Transportation, United States of America.

Lavin, Patrick, Manager, Rapid Transit Investigations, Office of System Safety, New York City Transit, United States of America.

Lodge, Dr Martin, Lecturer in Political Science & Public Policy, Department of Government, The London School of Economics and Political Science, United Kingdom.

Lundström, Anders, European Policy Adviser, Strategy Department, Banverket, Sweden.

Mayfield, Paul R, Manager, Accident Prevention/Investigations, Office of Safety, Washington Metropolitan Area Transit Authority, United States of America.

Meana, Mark D, Chief, Inspections and Evaluations, Office of Inspector General, Amtrak, United States of America.

Merritts II, James C, Superintendent, Rapid Transit Investigations, Office of System Safety, New York City Transit, United States of America.

Millard, Anthony, Assistant Superintendent Field Operations/OCC, Office of Rail Transportation, Department of Operations – Rail Service, Washington Metropolitan Area Transit Authority, United States of America.

Mills, Dr Ann, Principal Human Factors, Rail Safety & Standards Board, United Kingdom.

Pelletier, Barbara, Deputy Director, International Policy, Federal Railroad Administration, Department of Transportation, United States of America.

Pindiprolu, Venkat, Program Manager, Office of Mobility Innovation, Federal Transit Administration, United States of America.

Pritchard, Edward, Director, Office of Safety Assurance and Compliance, Federal Railroad Administration, Department of Transportation, United States of America.

Purkis, P I, Her Majesty's Principal Inspector of Railways, Health & Safety Executive, United Kingdom.

Raggett, Louise, Human Factors Specialist, Rail Safety & Standards Board, United Kingdom.

Raymond, Fritz, OCC Training Administrator, Office of Rail Transportation, Department of Operations – Rail Service, Washington Metropolitan Area Transit Authority, United States of America.

Ritter, Jim, Deputy Director, Office of Railroad, Pipeline & Hazardous Materials Investigations, National Transportation Safety Board, United States of America.
Roberts, Steve, Head of New Systems, Rail Safety and Standards Board, United Kingdom.

Rothstein, Dr Henry, ESRC Research Fellow, Centre for Analysis of Risk and Regulation, The London School of Economics and Political Science, United Kingdom.

Schanoes, D M, Superintendent, Operation Services, Metro-North Railroad, United States of America.

Sefton, Allan, Director of Rail Safety, Her Majesty's Railway Inspectorate, Health & Safety Executive, United Kingdom.

Sheikh, Farha, Detached National Expert, Railways, Directorate-General for Energy and Transport, European Commission, Belgium.

Shotton, Richard, Safety Director, West Coast, Virgin Trains, United Kingdom.

Size, Victor, Fire Life Safety Liaison Officer/Emergency Management Coordinator, Office of Passenger, Vehicle & Fire Life Safety, Department of System Safety & Risk Protection, Washington Metropolitan Area Transit Authority, United States of America.

Södergren, Christer, Accident Investigations and Dangerous Goods Matters, Swedish Railway Inspectorate, Sweden.

Soucheck CSP, John P, Director, Bus and Rail Field Operations, Office of System Safety, New York City Transit, United States of America.

Spackman, Michael, Visiting Fellow, Centre for Analysis of Risk and Regulation, The London School of Economics and Political Science, United Kingdom.

Taylor, Roger K, Controller Formal Inquiries, Rail Safety & Standards Board, United Kingdom.

Vidler, Paul, Transition Director and Professional Head of Engineering, West Coast, Virgin Trains, United Kingdom.

Watson, Keith J, Head of Acceptance Services & European Safety, Network Rail, United Kingdom.

Worrall MVO, Terry, Railway Consultant (Operations & Safety) and Technical Advisor, Rail Accident Investigation Branch, United Kingdom.

Zannoni, Mark E, Associate, Booz Allen Hamilton Inc., United States of America.

Interstate Experts

Baker, Brett, Senior Policy Analyst, Engineering & Technology, National Transport Commission.

Banham, David, Chief Information Officer, Commonwealth Department of Transport and Regional Services.

Bills, Kym, Executive Director, Australian Transport Safety Bureau.

Calvert, Fiona, Director, Strategic Planning, National Transport Commission.

Elliott, John, Assistant Secretary, Policy and Research Group, Commonwealth Department of Transport and Regional Services.

Filor PSM, Captain C W, Deputy Director, Surface Safety, Australian Transport Safety Bureau.

Habner, Lynne, Manager - Corporate Secretariat, National Transport Commission.

McIntyre, Kirsty, General Manager, Legislation & Compliance, National Transport Commission.

McLoughlin, Peter, Policy and Research Group, Commonwealth Department of Transport and Regional Services.

Moore, Barry, Director – Policy, National Transport Commission.

Mrdak, Michael, First Assistant Secretary, Policy and Research Group, Commonwealth Department of Transport and Regional Services.

Nye, Bryan, Chief Executive Officer, Australasian Railway Association Inc.

Rayner, Kathryn, Manger Policy, Australasian Railway Association Inc.

Salter, Paul, Policy Analyst, Economics, National Transport Commission.

Sochon, Phil, Deputy CEO & Manager Government Relations, Australasian Railway Association Inc.

Shalders, John, Code of Practice Manager, Australasian Railway Association Inc.

Thompson, Marc, Programme Manager, Rail, National Transport Commission.

Wilson, Tony, Chief Executive, National Transport Commission.

ANNEXURE E

EXHIBIT LIST

Revised for inclusion in the Final Report of the Special Commission of Inquiry

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0001A	Letters Patent dated 3 February 2003	03/02/2003	14/02/2003	N/A	00002
Exh. 0001B	Further Letters Patent dated 28 May 2003	28/05/2003	18/08/2003	N/A	06743
Exh. 0001C	Further Letters Patent dated 29 October 2003	29/10/2003	22/12/2004	N/A	In Chambers
Exh. 0001D	Further Letters Patent dated 28 April 2004	28/04/2004	22/12/2004	N/A	In Chambers
Exh. 0001E	Further Letters Patent dated 12 August 2004	12/08/2004	22/12/2004	N/A	In Chambers
Exh. 0001F	Further Letters Patent dated 28 October 2004	28/10/2004	22/12/2004	N/A	In Chambers
Exh. 0002	Coloured topographical map	N/A	01/04/2003	N/A	00084
Exh. 0003	Selection of photographs (10 documents)	N/A	01/04/2003	N/A	00084
Exh. 0004	Edited version of Police video	N/A	01/04/2003	N/A	00084
Exh. 0005	Video of controls of Tangara train	N/A	01/04/2003	N/A	00084
Exh. 0006	Video of train trip from south of Waterfall railway station beyond point of derailment	N/A	01/04/2003	N/A	00084
Exh. 0007	Survey Plan (3 documents)	N/A	01/04/2003	N/A	00085
Exh. 0008	Series of photographs in relation to markings on track (3 documents)	N/A	01/04/2003	N/A	00085
Exh. 0009	Photograph taken from police helicopter showing rescue work at front of train carriages 1, 2, 3 & 4	31/01/2003	01/04/2003	N/A	00087
Exh. 0010	Aerial photograph of accident scene	31/01/2003	01/04/2003	N/A	00088
Exh. 0011	Aerial photograph of carriage 1	31/01/2003	01/04/2003	N/A	00089
Exh. 0012	Aerial photograph of ladder used on accident scene	31/01/2003	01/04/2003	N/A	00089
Exh. 0013	Aerial photograph of accident scene showing damaged stanchion in foreground	31/01/2003	01/04/2003	N/A	00090
Exh. 0014	Aerial photograph of train	31/01/2003	01/04/2003	N/A	00090
Exh. 0015	Aerial photograph of accident scene	31/01/2003	01/04/2003	N/A	00091
Exh. 0016	Aerial photograph of accident scene	31/01/2003	01/04/2003	N/A	00092
Exh. 0017	Aerial photograph of first two carriages	31/01/2003	01/04/2003	N/A	00092

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0018	Aerial photograph of parked vehicles	31/01/2003	01/04/2003	N/A	00093
Exh. 0019	Aerial photograph of first two carriages	31/01/2003	01/04/2003	N/A	00094
Exh. 0020	Aerial photograph of train	31/01/2003	01/04/2003	N/A	00095
Exh. 0021	Photograph taken from rear of damage to one of the stanchions	31/01/2003	01/04/2003	N/A	00095
Exh. 0022	View south along the rail track leading to the crash, showing 60 speed board	31/01/2003	01/04/2003	N/A	00096
Exh. 0023	View south towards the accident site showing the 60 speed board	31/01/2003	01/04/2003	N/A	00096
Exh. 0024	View south towards the accident site leading to the curve	31/01/2003	01/04/2003	N/A	00097
Exh. 0025	View south of the curve leading to the accident site	31/01/2003	01/04/2003	N/A	00097
Exh. 0026	View south of the curve and the accident site	31/01/2003	01/04/2003	N/A	00097
Exh. 0027	View south of the curve and the crashed Tangara train	31/01/2003	01/04/2003	N/A	00097
Exh. 0028	View south of the accident site	31/01/2003	01/04/2003	N/A	00097
Exh. 0029	View of the rear of carriage 4	31/01/2003	01/04/2003	N/A	00098
Exh. 0030	Two components of guard's emergency brake handle from guard's compartment (C836821)	N/A	01/04/2003	N/A	00100
Exh. 0031	View of carriage 3 and carriage 4, from the east	31/01/2003	01/04/2003	N/A	00100
Exh. 0032	View of carriages 3 and 4 from east	31/01/2003	01/04/2003	N/A	00100
Exh. 0033	View north towards carriages 3 and 4, taken from rock cutting	31/01/2003	01/04/2003	N/A	00101
Exh. 0034	View of the front bogie of carriage 3, showing front of carriage 3 on its side	31/01/2003	01/04/2003	N/A	00102
Exh. 0035	View from east of carriage 2	31/01/2003	01/04/2003	N/A	00102
Exh. 0036	View from east of carriage 1	31/01/2003	01/04/2003	N/A	00102
Exh. 0037	View from north of carriage 1, taken from rock cutting	31/01/2003	01/04/2003	N/A	00102
Exh. 0038	View of the top of carriage 1, taken from rock cutting	31/01/2003	01/04/2003	N/A	00104
Exh. 0039	View of the top of carriage 1	31/01/2003	01/04/2003	N/A	00104
Exh. 0040	View of the front and west side of carriage 1	31/01/2003	01/04/2003	N/A	00104
Exh. 0041	View north of the front of carriage 1	31/01/2003	01/04/2003	N/A	00105
Exh. 0042	Close view of the front underside of carriage 1, front of train	31/01/2003	01/04/2003	N/A	00105
Exh. 0043	Close view of brake controller and horn, inside driver's cabin	31/01/2003	01/04/2003	N/A	00106

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0044	Close view of brake controller	31/01/2003	01/04/2003	N/A	00107
Exh. 0045	Close view of brake controller	31/01/2003	01/04/2003	N/A	00108
Exh. 0046	Close view of master controller and reverser	31/01/2003	01/04/2003	N/A	00110
Exh. 0047	View of the rear of the smashed driver's cabin, showing part of the vestibule in carriage 1 behind the driver's cabin	31/01/2003	01/04/2003	N/A	00111
Exh. 0048	Close view of the damage near the door to the driver's cabin, including data logger	31/01/2003	01/04/2003	N/A	00111
Exh. 0049	Interior view north of the lower deck of carriage 1	31/01/2003	01/04/2003	N/A	00112
Exh. 0050	Photograph of the removed datacard from carriage 4	31/01/2003	01/04/2003	N/A	00113
Exh. 0051	View south along track showing the commencement of the alphabetical police markers	31/01/2003	01/04/2003	N/A	00116
Exh. 0052	View south of police markers on track, with chalk line indicating outline of disturbed ballast	31/01/2003	01/04/2003	N/A	00117
Exh. 0053	View of the embankment and rock cutting, of debris	31/01/2003	01/04/2003	N/A	00117
Exh. 0054	View of the up main line after crane removal of carriages 1 & 2	31/01/2003	01/04/2003	N/A	00118
Exh. 0055	View north of the western sides of carriages 1 and 2	31/01/2003	01/04/2003	N/A	00118
Exh. 0056	View of damage to the rock cutting	31/01/2003	01/04/2003	N/A	00118
Exh. 0057	Photograph of inside of driver's cabin with arrow pointing to driver's seat	31/01/2003	01/04/2003	N/A	00120
Exh. 0058	Close-up of lower section of driver's seat	31/01/2003	01/04/2003	N/A	00120
Exh. 0059	Photograph looking down at carriage 1 at Maintain depot	31/01/2003	01/04/2003	N/A	00121
Exh. 0060	Photograph of carriage 1 showing buckling	31/01/2003	01/04/2003	N/A	00121
Exh. 0061	Photograph showing access to driver's cabin from western side	31/01/2003	01/04/2003	N/A	00122
Exh. 0062	Photograph showing close-up of driver's seat	31/01/2003	01/04/2003	N/A	00124
Exh. 0063	Photograph of western side of guard's compartment	31/01/2003	01/04/2003	N/A	00127
Exh. 0064	Photograph of external door on eastern side of guard's compartment	31/01/2003	01/04/2003	N/A	00127
Exh. 0065	Photograph of external door on western side of guard's compartment	31/01/2003	01/04/2003	N/A	00128
Exh. 0066	Photograph of driver's chair and controls in guard's compartment	31/01/2003	01/04/2003	N/A	00128
Exh. 0067	Photograph of driver's chair and controls in guard's compartment	31/01/2003	01/04/2003	N/A	00128

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0068	Photograph of controls and part from guard's brake handle part from on the console in guard's compartment	31/01/2003	01/04/2003	N/A	00129
Exh. 0069	Photograph of the driver's seat, the foot pad and heater in guard's compartment	31/01/2003	01/04/2003	N/A	00129
Exh. 0070	Photograph of master controller and reverser in guard's compartment	31/01/2003	01/04/2003	N/A	00129
Exh. 0071	Photograph of the brake controller and other controls in guard's compartment	31/01/2003	01/04/2003	N/A	00129
Exh. 0072	Photograph of the brake controller in guard's compartment	31/01/2003	01/04/2003	N/A	00130
Exh. 0073	Photograph of the keyhole into which the driver inserts his key	31/01/2003	01/04/2003	N/A	00130
Exh. 0074	Photograph of some of the controls on the console in guard's compartment	31/01/2003	01/04/2003	N/A	00130
Exh. 0075	Photograph of emergency button	31/01/2003	01/04/2003	N/A	00131
Exh. 0076	Photograph of some of the controls in the guard's compartment	31/01/2003	01/04/2003	N/A	00131
Exh. 0077	Photograph of some of the controls in the guard's compartment	31/01/2003	01/04/2003	N/A	00132
Exh. 0078	Photograph of guard's emergency brake handle on console	31/01/2003	01/04/2003	N/A	00132
Exh. 0079	Photograph of guard's seat and working area	31/01/2003	01/04/2003	N/A	00132
Exh. 0080	Photograph of guard's telephone	31/01/2003	01/04/2003	N/A	00133
Exh. 0081	Survey by Terrestrial Photogrammetry - Photographed on 31 January 2003 by Scientific Officer D Boyd, Forensic Services, Sydney	31/01/2003	02/04/2003	Neal D	00144
Exh. 0082	Photograph of the build-up of ballast	N/A	02/04/2003	Neal D	00193
Exh. 0083	Photograph of the build-up of ballast on the eastern or lower rail of the down main line	N/A	02/04/2003	Neal D	00193
Exh. 0084	Photograph of the build-up of ballast on the western side of the railway tracks	N/A	02/04/2003	Neal D	00193
Exh. 0085	Photograph of the build-up of ballast on the eastern side of the down main line	N/A	02/04/2003	Neal D	00193
Exh. 0086	Photograph of the western side of the tracks with a sign stating "Danger High Voltage Overhead Wiring Max Vehicle Height 4.0m"	N/A	02/04/2003	Neal D	00193
Exh. 0087	Copy of photograph produced by Mr Garling SC showing position of train in relation to stanchions	31/01/2003	02/04/2003	Neal D	00214

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0088	Spreadsheet of timeline analysis of run C311 prepared by Sergeant Smith [redacted]	02/02/2003	03/04/2003	Smith C	00278
Exh. 0089	Diagram of carriage 3 showing seating position of Mr Redshaw	07/02/2003	04/04/2003	Redshaw G	00394
Exh. 0090A	Statement dated 31 January 2003 of Gareth Redshaw	31/01/2003	04/04/2003	Redshaw G	00394
Exh. 0090B	Statement dated 7 February 2003 of Gareth Redshaw	07/02/2003	04/04/2003	Redshaw G	00394
Exh. 0091	Letter dated 7 March 2003 from Telstra to Mrs K Redshaw	07/03/2003	04/04/2003	Redshaw G	00437
Exh. 0092	Document titled Search Criteria 07:15:00 - 08:00:00 - 000 Calls to Waterfall Train Derailment	N/A	04/04/2003	Redshaw G	00438
Exh. 0093	Diagram of carriage 1 showing seating positions of [Name Suppressed] (Redacted)	27/02/2003	07/04/2003	[Name Suppressed]	00488
Exh. 0094	Statement dated 2 February 2003 of [Name Suppressed] (Redacted)	02/02/2003	07/04/2003	[Name Suppressed]	00504
Exh. 0095	Statement dated 31 January 2003 of Wayne Phillip Cooney	31/01/2003	07/04/2003	Cooney W	00508
Exh. 0096	Statement dated 31 January 2003 of William Lockett Rymill	31/01/2003	07/04/2003	Rymill W	00513
Exh. 0097	Plan drawn by Mr Aquilina	N/A	08/04/2003	Aquilina J	00586
Exh. 0098	Entries made on 31 January 2003 in respect of the main up line in the Waterfall railway station train register book	N/A	09/04/2003	Spargo G	00768
Exh. 0099	Stable Rostering Code dated 1 October 1987 for Driver's, Assistant Driver's etc - Freight Services, Operations	01/10/1987	09/04/2003	Boyd R	00903
Exh. 0100A	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009
Exh. 0100B	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009
Exh. 0100C	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009
Exh. 0100D	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009
Exh. 0100E	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0100F	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009
Exh. 0100G	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009
Exh. 0100H	Exhibits 100A to 100H: Photographs of components of guard's emergency brake in guard's compartment	28/02/2003	11/04/2003	Skinner M	01009
Exh. 0101	Selection of audio recordings of communications recorded in the Rail Management Centre after the accident	N/A	14/04/2003	Thorpe L	01079
Exh. 0102	Statement dated 26 June 2000 of Mr Zeides in the matter of C428 - Passed Signal WG542 at Stop	25/06/2000	15/04/2003	Nash J	01115
Exh. 0103	Internal memo dated 28 June 2000 from Mr Jim Nash, Chief Operations Inspector, CityRail, Wollongong to Mr Ben Numerawi, Crew Area Manager, Wollongong re C428 - Driver Herman Zeides - Safety Breach - Re-Certified	28/06/2000	15/04/2003	Nash J	01121
Exh. 0104A	Sketch plan of railway line as marked by Mr Nash	15/03/2003	15/04/2003	Nash J	01146
Exh. 0104B	Revised coloured sketch plan	N/A	2/05/2003	N/A	01638
Exh. 0105	State Rail Authority Decision Affecting Employee Mr Zeides dated 13 July 2000	20/07/2000	15/04/2003	Dawes J	01197
Exh. 0106	Internal memo dated 11 September 2000 from Mr J Dawes, Train Crewing Manager to Mr Zeides re Zeides Hermann (525641) Driver T/A Wollongong 25/6/00 C428 (6 Car Intercity Service) Passed Up Home Signal WG542 in the Stop Position	11/09/2000	15/04/2003	Dawes J	01198
Exh. 0107	Audiotape of 000 emergency number conversation on 31 January 2003 between Ms Spinelli of the Ambulance Service of New South Wales and Mr Gareth Redshaw	31/01/2003	15/04/2003	Spinelli L	01216
Exh. 0108	Ambulance Service of NSW - Sydney Operation Centre - Transcript of Audio Tapes 1 & 2 000 emergency number conversation on 31 January 2003 between Ms Spinelli and Mr Gareth Redshaw [redacted]	31/01/2003	15/04/2003	Spinelli L	01216
Exh. 0109	Statement dated 20 March 2003 of Michael Peter Drmota	20/03/2003	16/04/2003	N/A	01259

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0110	Statement dated 21 March 2003 of Ludmula Bozic	21/03/2003	16/04/2003	N/A	01259
Exh. 0111	Statement dated 1 April 2003 of Norman William Eric Coad	01/04/2003	16/04/2003	N/A	01259
Exh. 0112	Statement dated 2 April 2003 of Terence Faricy	02/04/2003	16/04/2003	N/A	01259
Exh. 0113	Statement dated 3 April 2003 of Robert Tye	03/04/2003	16/04/2003	N/A	01259
Exh. 0114	Statement dated 3 April 2003 of Daniel Gomes Soares	03/04/2003	16/04/2003	N/A	01260
Exh. 0115	Statement dated 25 March 2003 of Melissa Zeides	25/03/2003	16/04/2003	N/A	01260
Exh. 0116	Statement dated 1 April 2003 of Nathan Zeides	01/04/2003	16/04/2003	N/A	01260
Exh. 0117	Autopsy and medical and other records in respect of Mr Zeides [Confidential Exhibit] (64 documents)	N/A	16/04/2003	N/A	01267
Exh. 0118	Statement dated 17 April 2003 and annexures of Malcolm Black Kerr relating to the track and related infrastructure at the site of the Waterfall Rail Accident (27 documents)	N/A	28/04/2003	Kerr M	01300
Exh. 0119	Photograph bar-coded WRIC.022.001.0101, being Schedule “F” to Exhibit 118 depicting wheel marks on the high rail of the down main track	17/04/2003	29/04/2003	Kerr M	01367
Exh. 0120	Photograph P2012395 - Damaged sleeper on field side of down main track	31/01/2003	30/04/2003	Kerr M	01480
Exh. 0121	Photograph P2012396 - Damaged sleeper on field side of down main track	31/01/2003	30/04/2003	Kerr M	01482
Exh. 0122	Photograph P2012392 - Damaged sleeper on down main track	31/01/2003	30/04/2003	Kerr M	01482
Exh. 0123	Photograph P2012391 - Broken sleeper on up main track	31/01/2003	30/04/2003	Kerr M	01483
Exh. 0124	SK030B Wheel Trace Sections, diagram prepared by Mr Mau of tilting of train	29/04/2003	30/04/2003	Kerr M	01489
Exh. 0125	Diagram prepared by Mr Kerr of tilting of train	30/04/2003	30/04/2003	Kerr M	01490
Exh. 0126	Photographs attached to Mr Kerr’s statement Exhibit 118 (71 documents)	N/A	30/04/2003	Kerr M	01494
Exh. 0127	CCTV compilation of run C311on 31 January 2003	31/01/2003	30/04/2003	Chopra R	01498
Exh. 0128	CCTV images of Waterfall railway station (2 documents)	N/A	30/04/2003	Chopra R	01499
Exh. 0129	Raw estimates of average speed prepared by Mr Oliver and relevant data	N/A	30/04/2003	Oliver E	01509
Exh. 0130	Video taken by Mr Oliver from front of train	31/01/2003	30/04/2003	Oliver E	01523

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0131	Train report event log for 31 January 2003 taken from Westinghouse Train Describer	04/02/2003	30/04/2003	Oliver E	01550
Exh. 0132	Annexure 4A to the statement dated 22 April 2003 of Edward Howard Oliver titled 25A - 775A Occupied <70 Seconds	N/A	01/05/2003	Oliver E	01585
Exh. 0133	Annexure 2 to the statement dated 22 April 2003 of Edward Howard Oliver titled Train Performance Simulation Modelling	N/A	01/05/2003	Oliver E	01624
Exh. 0134	Computer print out provided by Department of Transport and verified by Mr Oliver	N/A	01/05/2003	Oliver E	01624
Exh. 0135	Statement dated 22 April 2003 of Edward Howard Oliver and annexures (5 documents)	N/A	01/05/2003	Oliver E	01674
Exh. 0136	Annexure 1 (Transits for the given track indications in the Down direction between W25 and WG775 signals) to the Second Statement dated 29 April 2003 of Gregory John Hockings Exhibit 142	29/04/2003	02/05/2003	Hockings G	01690
Exh. 0137	Annexure 2 (Comparison of average speeds for C311 on 28 -31 January 2003) to the Second Statement dated 29 April 2003 of Gregory John Hockings Exhibit 142	29/04/2003	02/05/2003	Hockings G	01697
Exh. 0138	C311 Average speed comparison for 28-31 January 2003	11/04/2003	02/05/2003	Hockings G	01698
Exh. 0139	C311 Average speed comparison for 28-31 January 2003	29/04/2003	02/05/2003	Hockings G	01699
Exh. 0140	C311 Average speed comparisons for 28-31 January 2003	11/04/2003	02/05/2003	Hockings G	01700
Exh. 0141	Statement dated 13 March 2003 of Gregory John Hockings	13/03/2003	02/05/2003	Hockings G	01718
Exh. 0142	Second Statement dated 29 April 2003 of Gregory John Hockings	29/04/2003	02/05/2003	Hockings G	01718
Exh. 0143	Final Report dated 5 May 2003 by Fred Mau titled Commentary upon Infrastructure Issues	05/05/2003	07/05/2003	N/A	01751
Exh. 0144	Documents referred to in the Final Report dated 5 May 2003 of Fred Mau Exhibit 144 (532 documents)	N/A	07/05/2003	Mau F	01752
Exh. 0145	Rail Infrastructure Corporation – Engineering Standards (593 documents)	N/A	07/05/2003	Mau F	01752
Exh. 0146	Photograph showing the relevant section of track from south looking north	N/A	08/05/2003	Mau F	01885
Exh. 0147	Photograph of approximate derailment location (Exhibit 143 - Figure 6)	N/A	08/05/2003	Mau F	01885
Exh. 0148	Freedom of Movement Diagram	N/A	08/05/2003	Mau F	01886

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0149	Standard Deviation Diagram Showing Vertical Roughness Profile	N/A	08/05/2003	Mau F	01886
Exh. 0150	B0068: Trailer Car on Tangent Track	N/A	08/05/2003	Mau F	01886
Exh. 0151	Staff Resumes including resume of Fred Mau	N/A	08/05/2003	Johnson D	01886
Exh. 0152	State Rail Authority annotated Tangara diagram, as marked by witness Timothy Sharp	N/A	09/05/2003	Sharp T	01946
Exh. 0153	Photograph of front of train, taken by Detective Sergeant Neal	31/01/2003	12/05/2003	Neal D	02029
Exh. 0154	Aerial Photograph of front of train - EXH 10 (200% Zoom In)	31/01/2003	12/05/2003	Jarvis C	02057
Exh. 0155	Doctor Chuah's notes on examination of Mr Zeides [Confidential Exhibit] (3 documents)	N/A	12/05/2003	N/A	02112
Exh. 0156	Folder containing medical and other documents relating to Mr Zeides [Confidential Exhibit] (28 documents)	N/A	13/05/2003	Chuah M	02143
Exh. 0157	State Rail Authority letter dated 19 January 1996 relating to the 5th revision of the Medical Practices and Procedures manual	19/01/1996	13/05/2003	Chuah M	02200
Exh. 0158	Sketch prepared by Dr Rainer of coronary artery circulation	N/A	13/05/2003	Rainer S	02208
Exh. 0159	Slide showing cross section of Mr Zeides' left anterior descending coronary artery	N/A	13/05/2003	Rainer S	02212
Exh. 0160	Slide showing cross section of Mr Zeides' left anterior descending coronary artery, dyed to show detail	N/A	13/05/2003	Rainer S	02213
Exh. 0161	Slide showing cross section of Mr Zeides' circumflex artery	N/A	13/05/2003	Rainer S	02214
Exh. 0162	Slide showing cross section of Mr Zeides' circumflex artery, dyed to show detail	N/A	13/05/2003	Rainer S	02214
Exh. 0163	Report dated 21 March 2003 of Dr John Gunning, Cardiologist to Mr Greg Keating of McClellands, Solicitors re Mr Zeides	21/03/2003	14/05/2003	N/A	02238
Exh. 0164	Opinion and report dated 30 April 2003 by Associate Professor Timothy John Lyons, Director of Forensic Medicine, Royal Newcastle Hospital, re Mr Zeides	30/04/2003	14/05/2003	N/A	02238
Exh. 0165	Folder of documents containing the report dated 7 May 2003 by Dr Graeme Peel and related documents (9 documents)	N/A	14/05/2003	N/A	02239

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0165A	Report dated 25 May 2003 by Dr Graeme Peel titled Review of State Rail Authority of New South Wales Medical Practices and Procedures with changes from EXH 165 tracked	25/05/2003	04/06/2003	Peel G	02982
Exh. 0166	Autopsy Report dated 26 February 2003 by Associate Professor Hilton in respect of Mr Zeides	26/02/2003	14/05/2003	Hilton J	02274
Exh. 0167	Medical records in respect of Mr Zeides from Wollongong Medical Centre [Confidential Exhibit] (3 documents)	N/A	14/05/2003	Hilton J	02321
Exh. 0168	24.12.92 - Waterfall - Heathcote - Set T9 - Constant Activation Wheel Slip Device Causing Run 11A - the 2042 Hours Waterfall to Bondi Junction Service to Overrun Heathcote Station - Driver R Goddard in Charge at Time of Incident	05/01/1993	14/05/2003	Goddard R	02331
Exh. 0169	Statements of Station Assistants at railway stations along the route taken on 31 January 2003 by C311 (13 documents)	N/A	15/05/2003	N/A	02375
Exh. 0170A	Video taken by Sergeant Mauer re Tangara train journey from Sydney terminal to Port Kembla railway station, being run C331, being the 14:08 hours service on 24 April 2003	N/A	15/05/2003	N/A	02376
Exh. 0170B	Transcript of Video Recording of Progress of Service C331, Being the 1408 Hours Service from Sydney Terminal to Port Kembla	14/04/2003	22/09/2003	N/A	In Chambers
Exh. 0171	Photograph of driver's blue backpack after searching it, beside carriage 1	31/01/2003	26/05/2003	Watson N	02433
Exh. 0172	Photograph 5: Photograph of down main line at kilometerage 40.580 near Waterfall, taken by Mr Stossel	N/A	26/05/2003	Stossel P	02441
Exh. 0173	Photograph 3: Photograph at kilometerage 40.580 near Waterfall, taken by Mr Stossel	N/A	26/05/2003	Stossel P	02443
Exh. 0174	Photograph 2: Photograph of an Inter Urban train from Sydney terminal station to Dapto approaching kilometerage 40.570 near Waterfall, taken by Mr Stossel	N/A	26/05/2003	Stossel P	02451
Exh. 0175	Photograph 1: Photograph of down main line facing in the up running direction kilometerage 40.590 near Waterfall, taken by Mr Stossel	N/A	26/05/2003	Stossel P	02453

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0176	Photograph 4: Photograph of down main line at signal WG 775 D near kilometerage 40.570 near Waterfall, taken by Mr Stossel	N/A	26/05/2003	Stossel P	02453
Exh. 0177	Photograph 6: Photograph standing on the up side near kilometerage 40.690 near Waterfall, taken by Mr Stossel	N/A	26/05/2003	Stossel P	02454
Exh. 0178	Folder 1 of material in relation to Mr van Kessel, titled William Van Kessel – Medical Treatment and History [Confidential Exhibit] (172 documents)	N/A	26/05/2003	N/A	02479
Exh. 0179	Folder 2 of material in relation to Mr van Kessel, titled William van Kessel – SRA Employment Record [Confidential Exhibit] (187 documents)	N/A	26/05/2003	N/A	02479
Exh. 0180	Photocopy of Constable Davidson's notebook entries made on 1 February 2003 re Mr van Kessel	01/02/2003	27/05/2003	Wardrop A	02547
Exh. 0181	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed	27/03/2003	27/05/2003	Wardrop A	02552
Exh. 0182	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed and profile	27/03/2003	27/05/2003	Wardrop A	02554
Exh. 0183	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed, profile and train speed	27/03/2003	27/05/2003	Wardrop A	02555
Exh. 0184	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed, profile and train speed	27/03/2003	27/05/2003	Wardrop A	02557
Exh. 0185	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed, profile and train speed	27/03/2003	27/05/2003	Wardrop A	02558
Exh. 0186	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed, profile and train speed	27/03/2003	27/05/2003	Wardrop A	02559
Exh. 0187	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed, profile, train speed and time (zig zag)	27/03/2003	27/05/2003	Wardrop A	02560
Exh. 0188	Display of MTRAIN simulation run for: Waterfall to Cawley, showing line and reference speed, profile, train speed, time (zig zag) and tractive effort	27/03/2003	27/05/2003	Wardrop A	02562
Exh. 0189	Train Performance Simulation Modelling - Figure 1: Presentation of Waterfall Derailment Time and Distance Measurements	23/05/2003	27/05/2003	Wardrop A	02565

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0190	Train Performance Simulation Modelling - Figure 2: Baseline, Gradient, Curvature, Speed Limit and Signal Location Diagram with Embedded Train Performance showing Normal Train Behaviour South of Waterfall	23/05/2003	27/05/2003	Wardrop A	02567
Exh. 0191	Train Performance Simulation Modelling - Description of Figure 2	23/05/2003	27/05/2003	Wardrop A	02567
Exh. 0192	Train Performance Simulation Modelling - Figure 3: Baseline, Gradient, Curvature, Speed Limit Diagram of the Rooty Hill - St Marys Test Site along the Down Western Main Line	23/05/2003	27/05/2003	Wardrop A	02569
Exh. 0193	Train Performance Simulation Modelling - Figure 4: Tractive Effort, Brake Effort, Motor Current and Braking Current versus Speed Curves for the Outer Suburban Tangara Set G7	23/05/2003	27/05/2003	Wardrop A	02570
Exh. 0194	Train Performance Simulation Modelling - Figure 5: Tractive Effort, Brake Effort, Motor Current and Braking Current Versus Speed Curves for the Outer Suburban Tangara Set G1	23/05/2003	27/05/2003	Wardrop A	02571
Exh. 0195	Train Performance Simulation Modelling - Figure 6.1: Distance versus Time Field and Mtrain Comparisons for the Coasting Trial (Run 1)	23/05/2003	27/05/2003	Wardrop A	02576
Exh. 0196	Train Performance Simulation Modelling - Figure 6.2: Distance versus Speed Field and Mtrain Comparisons for the Coasting Trial (Run 1)	23/05/2003	27/05/2003	Wardrop A	02576
Exh. 0197	Train Performance Simulation Modelling - Figure 6.3: Time versus Speed Field and Mtrain Comparisons for the Coasting Trial (Run 1)	23/05/2003	27/05/2003	Wardrop A	02577
Exh. 0198	Train Performance Simulation Modelling - Figure 7.1: Distance versus Time Field and Mtrain Comparisons for the Full Power Trial (Run 5)	23/05/2003	27/05/2003	Wardrop A	02577
Exh. 0199	Train Performance Simulation Modelling - Figure 7.2: Distance versus Speed Field and Mtrain Comparisons for the Full Power Trial (Run 5)	23/05/2003	27/05/2003	Wardrop A	02578

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0200	Train Performance Simulation Modelling - Figure 7.3: Time versus Speed Field and Mtrain Comparisons for the Full Power Trial (Run 5)	23/05/2003	27/05/2003	Wardrop A	02578
Exh. 0201	Train Performance Simulation Modelling - Figure 8.1: Distance versus Time Field and Mtrain Comparisons for the Retarded Power Trial (Run 6)	23/05/2003	27/05/2003	Wardrop A	02578
Exh. 0202	Train Performance Simulation Modelling - Figure 8.2: Distance versus Speed Field and Mtrain Comparisons for the Retarded Power Trial (Run 6)	23/05/2003	27/05/2003	Wardrop A	02578
Exh. 0203	Train Performance Simulation Modelling - Figure 8.3: Time versus Speed Field and Mtrain Comparisons for the Retarded Power Trial (Run 6)	23/05/2003	27/05/2003	Wardrop A	02579
Exh. 0204	Report dated 23 May 2003 of Alexander Wardrop titled Contribution of Train Performance Simulation Modelling to the Understanding of the Events Leading up to the Waterfall Accident, including attached tables (2 documents)	N/A	27/05/2003	Wardrop A	02581
Exh. 0205	Illawarrra Down Main 40.468km to 40.751km (mark numbers 55-242) (document referred to by Mr Kerr)	N/A	27/05/2003	N/A	02621
Exh. 0206	Letter dated 26 May 2003 from the Solicitor to the Special Commission to Professor O'Rourke re reports by Dr McCredie	26/05/2003	28/05/2003	O'Rourke M	02660
Exh. 0207	Letter dated 27 May 2003, being Professor O'Rourke's reply to Exhibit 206	27/05/2003	28/05/2003	O'Rourke M	02660
Exh. 0208	Document titled "Physics of Deadman's Safety Device" prepared and produced by Professor O'Rourke	01/04/2003	28/05/2003	O'Rourke M	02678
Exh. 0209	State Rail Authority of NSW Enginemen - Memo Book of Mr van Kessel	28/02/2003	29/05/2003	Van Kessel W	02748
Exh. 0210	Mr van Kessel's timesheet for 25 January 2003	25/01/2003	29/05/2003	Van Kessel W	02748
Exh. 0211	Mr van Kessel's timesheet for 31 January 2003	31/01/2003	29/05/2003	Van Kessel W	02748
Exh. 0212	Guard's roster for the fortnight ending 8 February 2003	26/01/2003	29/05/2003	Van Kessel W	02753
Exh. 0213	Statement dated 13 February 2003 of William van Kessel	13/02/2003	29/05/2003	Van Kessel W	02775

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0214	Report dated 25 May 2003 by Dr Graeme Peel: Review of State Rail Authority of New South Wales Medical Practices and Procedures	25/05/2003	29/05/2003	N/A	02837
Exh. 0215	Report dated 25 May 2003 by Dr Graeme Peel Report: Assessment of Driver Medical Status and Function and Related Crash Dynamics	25/05/2003	29/05/2003	N/A	02837
Exh. 0216	State Rail Authority guard training materials	N/A	03/06/2003	Van Kessel W	02841
Exh. 0217	Scale diagram dated 22 May 2003 prepared by Mr Mau: South Coast Railway 40.7km to Waterfall, location of speed boards and rough track	22/05/2003	04/06/2003	Van Kessel W	02972
Exh. 0218	Report dated 1 June 2003 by Dr Graeme Peel: Review of State Rail Authority of New South Wales Medical Practices and Procedures: Supplementary Report [Confidential Exhibit]	01/06/2003	04/06/2003	Peel G	03002
Exh. 0219	NUCARS simulation: Measured Results	25/06/2003	05/06/2003	Gurule S	03095
Exh. 0220	NUCARS simulation: Rigid Body Modes	25/06/2003	05/06/2003	Gurule S	03095
Exh. 0221	NUCARS simulation: Model Characterisation Test	25/06/2003	05/06/2003	Gurule S	03098
Exh. 0222	NUCARS simulation: NUCARS Application	25/06/2003	05/06/2003	Gurule S	03101
Exh. 0223	NUCARS simulation: Trailer Car Lead Bogie Vertical Wheel Forces (17.3 Km/h)	25/06/2003	05/06/2003	Gurule S	03104
Exh. 0224	NUCARS simulation: Trailer Car @ Speed Limit (60 Km/h)	25/06/2003	05/06/2003	Gurule S	03106
Exh. 0225	NUCARS simulation: COG Over High Rail Locations	25/06/2003	05/06/2003	Gurule S	03108
Exh. 0226	NUCARS simulation side-on animation by Mr Gurule with screen shots at: 40.000179 Km, 40.450012 Km, 40.644017 Km, 40.679019 Km, 40.697002 Km, 40.721005 Km & 40.736016 Km	N/A	05/06/2003	Gurule S	03112
Exh. 0227	NUCARS simulation front-on animation by Mr Gurule with screen shots at: 40.600202 Km & 40.732003 Km	N/A	05/06/2003	Gurule S	03113
Exh. 0228	NUCARS simulation: Curvature/Superelevation	25/06/2003	05/06/2003	Gurule S	03134
Exh. 0229	Two Certificates of Analysis dated 15 and 28 May 2003 by Virginia Friedman (2 documents)	N/A	05/06/2003	Friedman V	03137
Exh. 0230	Wheel guard from train G7	N/A	06/06/2003	Power G	03142
Exh. 0231	Photograph of side view of stone guard	N/A	06/06/2003	Power G	03143

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0232	Photograph of front view of stone guard and train wheel attached to axle	N/A	06/06/2003	Power G	03144
Exh. 0233	Photograph of front view of train G7 showing stone guard	N/A	06/06/2003	Power G	03145
Exh. 0234	Exhibit GP2 as referred to in the Statement dated 6 June 2003 of Geoffrey Power	06/06/2003	06/06/2003	Power G	03147
Exh. 0235	Letter dated 16 February 2001 from Mr Naylor to Mr Christie re Medical Surveillance of Train Driver's Suffering Psychiatric Disorders	16/02/2001	10/06/2003	Naylor R	03171
Exh. 0236	Letter dated 20 October 2000 from Mr Daindridge to Dr Couch re Composite International Diagnostic Interview (CIDI) Composite International Diagnostic Interview (CIDI)	20/10/2000	10/06/2003	Dandridge C	03190
Exh. 0237	Page 51 (Risk Factor Prediction Chart) of draft Annexe to the Code of Practice - Guidelines for Health Professionals Conducting Assessments for Rail Safety Workers (version 6 dated 10 April 2003)	10/04/2003	10/06/2003	Wills J	03240
Exh. 0238	Memorandum dated 24 September 1999 from Mr Couch to Mr Kayess re Train Crewing Transitional Safety Management Plan	24/09/1999	11/06/2003	Couch M	03280
Exh. 0239	Results Of CIDI Pilot Programme As Part Of The Periodic Medical Examination Of 81 Train Drivers	N/A	11/06/2003	Couch M	03281
Exh. 0240	Fitness for Work Assessment and Detection of Impaired Railway Workers	N/A	11/06/2003	Couch M	03281
Exh. 0241	Report dated June 2003 by Dr B Hocking titled Report on Autopsy Report and Medical Examinations	01/06/2003	11/06/2003	Hocking B	03285
Exh. 0242	Report dated June 2003 by Dr B Hocking titled Report on New South Wales State Rail Authority - Health Monitoring Systems for Rail Safety Workers	01/06/2003	11/06/2003	Hocking B	03285
Exh. 0243	Reference Paper dated May 2003 titled Development of Medical Standards for Health Assessment for Rail Safety Workers - Department of Infrastructure, Victoria	01/05/2003	11/06/2003	Hocking B	03344
Exh. 0244	Draft version for Industry comment dated May 2003 of Code of Practice for Health Assessment and Certification for Rail Safety Workers - Department of Infrastructure, Victoria	20/05/2003	11/06/2003	Hocking B	03344

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0245	Draft version for Industry comment dated May 2003 of Guidelines for Authorised Health Professionals conducting Health Assessments for Rail Safety Workers - Department of Infrastructure, Victoria being an Annexe to Exhibit 244	20/05/2003	11/06/2003	Hocking B	03344
Exh. 0246	Annexure "SMC-3" to the statement dated 29 May 2003 of Stephen Michael Corbin – being a diagram titled 'Waterfall to Port Kembla Overhead Wiring – OHW Attached to Portal Structure'	29/05/2003	12/06/2003	Corbin S	03352
Exh. 0247	Statement dated 29 May 2003 of Stephen Michael Corbin	29/05/2003	12/06/2003	Corbin S	03356
Exh. 0248	Statement dated 20 May 2003 of Ronald David Walsh	30/05/2003	12/06/2003	Walsh R	03377
Exh. 0249	Letter dated 30 May 1988 to Project Manager Tangara re Foot Operated Deadman (Operations)	30/11/1988	16/06/2003	Kippist D	03396
Exh. 0250	Letter dated 8 December 1988 to Project Manager Tangara re Foot Operated Deadman (Operation)	08/12/1988	16/06/2003	Kippist D	03396
Exh. 0251	Letter dated 8 August 1990 from Mr Bruce to Mr Janik re Contract No. Tangara 10/86 - Foot Operated Dead Man Safety Pedal	08/08/1990	16/06/2003	Kippist D	03409
Exh. 0252	Letter dated 13 December 1990 from Mr Janik to Mr Bruce re Foot Operated Deadman Safety Pedal	13/12/1990	16/06/2003	Kippist D	03412
Exh. 0253	Letter dated 27 February 1991 from Mr Bruce to Mr Janik re Foot Operated Deadman Safety Pedal	27/02/1991	16/06/2003	Kippist D	03413
Exh. 0254	Letter dated 28 March 1991 from Mr Janik to Mr Bruce re Foot Operated Deadman Safety Pedal	28/03/1991	16/06/2003	Kippist D	03415
Exh. 0255	Letter dated 28 March 1991 from Mr Bruce to Mr Janik re Contract No. Tangara 10/86 - Foot Operated Deadman Safety Pedal	02/05/1991	16/06/2003	Kippist D	03416
Exh. 0256	Photographs headed "Master Controller – Current Arrangement" from Report dated 1 February 1991 on Ergonomic Evaluation of Driver's Console Tangara Trains by the Ergonomics Unit, Worksafe Australia	01/02/1991	16/06/2003	Kippist D	03424
Exh. 0257	TMG International Final Report dated 1 July 1994 titled Standard for Driver Safety Systems Research and Justification: Page 3	01/07/1994	16/06/2003	Kippist D	03430
Exh. 0258	TMG International Final Report dated 1 July 1994 titled Standard for Driver Safety Systems Research and Justification: Page 15	01/07/1994	16/06/2003	Kippist D	03431

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0259	TMG International Final Report dated 1 July 1994 titled Standard for Driver Safety Systems Research and Justification: Page 20	01/07/1994	16/06/2003	Kippist D	03433
Exh. 0260	TMG International Final Report dated 1 July 1994 titled Standard for Driver Safety Systems Research and Justification	01/07/1994	16/06/2003	Kippist D	03434
Exh. 0261	CityRail Train Crewing Managers Office - General Order Number 4 dated 7 February 2003	07/02/2003	16/06/2003	Kippist D	03455
Exh. 0262	State Rail internal memorandum dated 6 February 2003 from Mr Hayes to Mr Barton, re Tangara Deadman Footpedal	06/02/2003	16/06/2003	Kippist D	03456
Exh. 0263	Annexure D to the Statement dated 13 June 2003 of Terrence Peter Hatton being a letter dated 22 March 1989 re Tangara - Cab Modifications	22/03/1989	16/06/2003	Hatton T	03498
Exh. 0264	Report titled Ergonomic Evaluation of Driver's Console - Tangara Cars	01/02/1991	17/06/2003	Stevenson M	03554
Exh. 0265	Memorandum dated 15 February 1994 from Mr Bruce to Mr Lai re TMG International Report into Standard for Driver Safety Systems	15/02/1994	18/06/2003	Bruce R	03626
Exh. 0266	Variation Order (VO No. 109) - Contract Tangara 10/86	21/08/1990	18/06/2003	Bruce R	03642
Exh. 0267	Letter dated 27 May 1992 from Mr Williams to Mr Janik re Contract No Tangara 10/86 - Driver's Desk Prototype - Product Group Mediation Item 2(d)	27/05/1992	18/06/2003	Bruce R	03643
Exh. 0268	Tangara Driver's Desk	12/06/1992	18/06/2003	Bruce R	03643
Exh. 0269	Contract Tangara 10/86: Tangara Driver's Desk	25/06/1992	18/06/2003	Bruce R	03643
Exh. 0270	Memorandum dated 1 February 1996 from Mr Inwood re Tangara Emergency Application Valve (Dump Value) Operating	01/02/1996	18/06/2003	Inwood D	03714
Exh. 0271	Memorandum dated 22 September 1998 from Mr Inwood to Mr Creighton re Deadman Failure - Tangara Sets, being Annexure E to the Statement dated 11 June 2003 of David Brian Inwood	22/09/1998	18/06/2003	Inwood D	03719
Exh. 0272A	Photograph taken by Mr Guselli of handle of red flag and markings on underside driver's desk - G7 6832 driver console 2	22/05/2003	19/06/2003	Guselli J	03744
Exh. 0272B	Photograph taken by Mr Guselli of part of the red flag and the handle - G7 6832 console 1	22/05/2003	19/06/2003	Guselli J	03750
Exh. 0273	Driver's emergency flag	N/A	19/06/2003	Guselli J	03745

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0274A	Photograph of underside of carriage 6831 driver's desk - G7 flag markings	01/04/2003	19/06/2003	Guselli J	03749
Exh. 0274B	Photograph of G7 6831 flag markings	27/03/2003	19/06/2003	Guselli J	03749
Exh. 0275	Photograph taken by Mr Guselli of a gum like substance - DSC00178	03/06/2003	19/06/2003	Guselli J	03752
Exh. 0276	Photograph taken by Mr Guselli of carriage 6132 of a gum like substance - DSC00177	03/06/2003	19/06/2003	Guselli J	03753
Exh. 0277	Photograph taken by Mr Guselli of a gum like substance in the corner underneath the driver's desk - DSC00135	08/06/2003	19/06/2003	Guselli J	03754
Exh. 0278	Photograph taken by Mr Guselli of cutting of the two red flags - DSC00133	08/06/2003	19/06/2003	Guselli J	03755
Exh. 0279A	Photograph taken by Mr Guselli of an object attached to the back wall of the underside of the driver's panel - D6153 - 25 June 2003	05/06/2003	19/06/2003	Guselli J	03801
Exh. 0279B	Photograph taken by Mr Guselli of carriage 6276 - DSC00110	27/03/2003	19/06/2003	Guselli J	03801
Exh. 0280	Photograph of a red flag among the wreckage in the driver's compartment of G7	N/A	19/06/2003	Guselli J	03801
Exh. 0281	Photograph of a red flag lying beside a fire extinguisher in the wreckage of G7	N/A	19/06/2003	Guselli J	03802
Exh. 0282	Photograph of a red flag in a circular receptacle held in a vertical position next to the fire extinguisher in G7	N/A	19/06/2003	Guselli J	03803
Exh. 0283	ATSB Report dated November 2001 re a collision on 5 June 2001 between suburban electric passenger train 6369 and the empty express electric train 6371 at Footscray, Victoria	01/11/2001	19/06/2003	N/A	03806
Exh. 0284	Final Report dated April 2001 of the Special Commission of Inquiry into the Glenbrook Rail Accident - Honourable Peter Aloysius McInerney	01/04/2001	19/06/2003	N/A	03808
Exh. 0285	Schematic diagram on driver incapacitation assessment process	19/06/2003	20/06/2003	Pitblado R	03870
Exh. 0286	Viner Robinson Jarman Pty Ltd Report dated November 1991 titled Risk Analysis of ATP on Inter-City Lines	01/11/1991	20/06/2003	N/A	In Chambers (03945)
Exh. 0287	Viner Robinson Jarman Pty Ltd Report dated September 1992 titled CountryLink Risk Analysis of Explorer Rail Car Operations	01/09/1992	20/06/2003	N/A	In Chambers (03945)

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0288	Viner Robinson Jarman Pty Ltd Addendum Notes on Vigilance Control	N/A	20/06/2003	N/A	In Chambers (03945)
Exh. 0289	Risk & Reliability Pty Ltd Report dated July 1999 titled Driver Safety Systems for Double Deck InterCity Carriages (DDIC) Risk Assessment First Issue	01/07/1999	20/06/2003	N/A	In Chambers (03946)
Exh. 0290	Risk & Reliability Pty Ltd Report dated February 2002 titled Risk Assessment of Ergonomics Upgrade of Double Deck Suburban and Tangara Crew Compartment and InterCity Guard Compartments	01/02/2002	20/06/2003	N/A	In Chambers (03946)
Exh. 0291	Letter dated 11 February 1994 from Mr Lai to Mr Coleman and Mr Anthony re Driver Safety System - Comments on Draft Report	11/02/1994	24/06/2003	Lai S	04056
Exh. 0292	TMG International draft report re Provision of Standard for Driver Safety Systems	N/A	24/06/2003	Lai S	04066
Exh. 0293	State Rail Authority internal memorandum dated 9 November 1996 from Mr May to Mr Smith and Mr Vella re DDIC Cab Ergonomic Redesign Vigilance vs Deadman	09/11/1998	24/06/2003	Lai S	04091
Exh. 0294	State Rail Authority internal memorandum dated 11 September 1997 from Mr Lai to Mr Smith re Provision of Train Stops - Intercity	11/09/1997	24/06/2003	N/A	04107
Exh. 0295	Facsimile letter dated 1 November 1991 from Mr Coleman to Mr Frankiewicz with attached letter and table titled Dead Man Foot Pedal Design for the Tangara Train (3 documents)	N/A	25/06/2003	Janik J	04153
Exh. 0296	Letter dated 14 January 1992 from Mr Williams to Mr Janik re Driver's Desk Mock-Up - Mediation Item 2D	14/01/1992	25/06/2003	Janik J	04158
Exh. 0297	Letter dated 4 February 1992 from Mr Janik to Mr Bruce re Driver's Desk Mock-Up - Mediation Item 2D	04/02/1992	25/06/2003	Janik J	04161
Exh. 0298	Letter dated 14 February 1992 from Mr Williams to Mr Janik re Mediation Item 2D - Driver's Desk Redesign	14/02/1992	25/06/2003	Janik J	04162
Exh. 0299	Letter dated 20 May 1992 from Mr Janik to Mr Bruce re Contract Tangara 10/86 Rev 2 - Driver's Desk Prototype Produce Group Mediation Item 2(d)	20/05/1992	25/06/2003	Janik J	04163

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0300	Contract No: Tangara 10/86 - Design, Manufacture, Supply, Testing & Delivery of Double Deck Suburban Electric Carriages - Volume 2 - Technical Specification - Revision 3	01/10/1986	25/06/2003	N/A	04208
Exh. 0301	Curriculum Vitae of Peter Sydney Wilkins	01/01/2003	25/06/2003	Wilkins P	04211
Exh. 0302	C.A.S.A. (Civil Aviation Safety Authority) Medical Examiner's Standards (8 documents)	N/A	26/06/2003	N/A	04236
Exh. 0303	Statement dated 16 June 2003 of Barry Vincent Lovat with annexures (13 documents)	N/A	27/06/2003	Lovat B	04300
Exh. 0304	Sinclair Knight Merz final report dated February 1996 titled Risk Reduction Study for Passenger Services Outside Signal Train Stop Limit Area Value Management Study and Economic Evaluation	01/02/1996	27/06/2003	Lovat B	04330
Exh. 0305	Freight Rail Engineering Traction and Rolling Stock Section draft Standard for Driver Safety Systems dated 1 March 1995	01/03/1995	30/06/2003	Lovat B	04428
Exh. 0306	Letter dated 22 August 1997 from Mr Henry to Mr Lovat re Risk Reduction Study for Passenger Services Outside Signal Train Stop Limit Area	22/08/1997	30/06/2003	Lovat B	04431
Exh. 0307	Letter dated 24 December 1997 from Mr Henry to Mr Creighton re Risk Reduction Study for Passenger Services Outside Signal Train Stop Limit Area	24/12/1997	30/06/2003	Lovat B	04431
Exh. 0308	Annexure ST3 to the Statement dated 17 June 2003 of Stanley John Taylor titled CityRail Tangara	11/05/1992	01/07/2003	N/A	04461
Exh. 0309	GHD Transmark Pty Ltd final report dated 1 March 1999 titled Train Stop Risk Study	01/03/1999	01/07/2003	May J	04508
Exh. 0310	Statement dated 10 June 2003 of Julian May	10/06/2003	02/07/2003	May J	04547
Exh. 0311	Statement dated 10 June 2003 of Julian May	10/06/2003	02/07/2003	May J	04615
Exh. 0312	Statement dated 27 June 2003 of Julian May	27/06/2003	02/07/2003	May J	04615
Exh. 0313	Train Management System download on 31 January 2003 at Hornsby Maintenance Centre from train G7	31/01/2003	02/07/2003	May J	04643
Exh. 0314A	Folder titled Statement dated 2 June 2003 of Arthur Smith Volume 1 (16 documents)	N/A	03/07/2003	Smith A	04697
Exh. 0314B	Folder titled Statement dated 2 June 2003 of Arthur Smith Volume 2 (18 documents)	N/A	03/07/2003	Smith A	04697

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0315	Submission dated June 1996 by the State Rail Authority to the Department of Transport for accreditation under the Rail Safety Act 1993	01/06/1996	04/07/2003	N/A	04767
Exh. 0316	Accreditation Application 2002, prepared by State Rail Safety Division, Version 1 dated 13 November 2002	13/11/2002	04/07/2003	N/A	04767
Exh. 0317	State Rail Authority Safety Management System - Version 3 dated 4 March 2002	04/03/2002	04/07/2003	N/A	04767
Exh. 0318	State Rail Authority of New South Wales - Compliance & Rail Safety - Annual Report 1994/95	01/01/1995	04/07/2003	N/A	04767
Exh. 0319	Submission by Mr Henry and Mr Christie seeking approval of Board of State Rail Authority in respect of Annual Safety Report 1999/2000 and attached Report	18/05/2001	04/07/2003	N/A	04768
Exh. 0320	Report dated 18 July 2003 by Dr Andrew McIntosh titled Deadman System and Driver Incapacitation, and documents referred to in the report (50 documents)	N/A	18/07/2003	N/A	In Chambers (04938)
Exh. 0321	Photograph DSCN2921 taken by Senior Constable Lee being a close-up of the spindle of the guard's emergency brake handle in train G7	N/A	21/07/2003	Lee M	04831
Exh. 0322	Photograph DSCN2660 taken by Senior Constable Lee taken from the left-hand side of the train looking into the driver's cabin and showing the data logger	N/A	21/07/2003	Lee M	04833
Exh. 0323	Photograph DSCN2771 taken by Senior Constable Lee of the master controller including the mechanisms under its handle	N/A	21/07/2003	Lee M	04838
Exh. 0324	Photograph of Mr Gudmann, Forensic Metallurgist, conducting an examination of the brake controller	N/A	21/07/2003	Lee M	04840
Exh. 0325	Photograph DSCN3381 taken by Senior Constable Lee of a bogie from carriage 2	N/A	21/07/2003	Lee M	04843
Exh. 0326	Photograph taken by Senior Constable Lee of the damage to the leading bogie brake calliper	N/A	21/07/2003	Lee M	04845
Exh. 0327	Photograph taken by Senior Constable Lee of Boston, the cadaver dog, working at the accident site	N/A	21/07/2003	Lee M	04851
Exh. 0328	Photograph DSCN2942 taken by Senior Constable Lee of the foot pedal assembly from carriage 6831	N/A	21/07/2003	Lee M	04858

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0329	Photograph DSCN2951 taken by Senior Constable Lee of the deadman switch assembly looking from the underside up to the foot pad	N/A	21/07/2003	Lee M	04859
Exh. 0330	Photograph DSCN3327 taken by Senior Constable Lee of the driver's chair in train G7	N/A	21/07/2003	Lee M	04861
Exh. 0331	Statement dated 19 May 2003 of Michael Patrick Lee	19/05/2003	21/07/2003	Lee M	04933
Exh. 0332	Photograph taken by Senior Constable Fox of the rear transverse door of the driver's cabin in carriage 6831 at the Maintrain Heavy Maintenance Depot, Auburn	N/A	21/07/2003	Lee M	04934
Exh. 0333	Dr McIntosh PowerPoint presentation slide titled Car 6832 Driver Console with 6831 Microswitch-Cam Mechanism Installed	21/07/2003	22/07/2003	McIntosh A	04945
Exh. 0334	Video excerpts of tests conducted on 27 May 2003 on an Outer Suburban Tangara train from Mortdale to Wollongong	27/05/2003	22/07/2003	McIntosh A	04969
Exh. 0335	Dr McIntosh PowerPoint presentation slide titled Summary of Results With Both Feet Placed on Pedal	21/07/2003	22/07/2003	McIntosh A	04975
Exh. 0336	Dr McIntosh PowerPoint presentation slide titled Summary of Results with Right Foot Placed on Pedal	21/07/2003	22/07/2003	McIntosh A	04976
Exh. 0337	Dr McIntosh PowerPoint presentation slide titled Estimate of proportion of SRA Tangara driver's that may be able to hold the deadman's pedal in the 'set' position while incapacitated	21/07/2003	22/07/2003	McIntosh A	04983
Exh. 0338	Schematic diagram titled Driver's seat cab measurements	N/A	22/07/2003	McIntosh A	05035
Exh. 0339	Folder containing Statement dated 23 June 2003 of Howard Lacy and annexures (21 documents)	N/A	23/07/2003	McIntosh A	05092
Exh. 0340	Folder containing Statement dated 21 July 2003 of Kent Victor Donaldson and annexures (33 documents)	N/A	24/07/2003	Lacy H	05209
Exh. 0341	State Rail Authority Vigilance Control Unit - Outer Suburban Trains - Project scope worksheets dated 28 February 2003	28/02/2003	24/07/2003	Lacy H	05210

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0342	State Rail Authority internal memorandum dated 28 February 2003 from Mr Gilbertson to Mr Lacy re Capital Investment Proposal - Vigilance Control Units for Outer Suburban Trains	28/02/2003	24/07/2003	Lacy H	05210
Exh. 0343	Capital Works Program Form CP - 1 Capital Investment Proposal re Cab Vigilance Project	28/02/2003	24/07/2003	Lacy H	05211
Exh. 0344	Annexure to the Report dated 5 June 2003 of Alexander Wardrop titled Examination of Emergency Stopping Opportunities prior to the Waterfall Accident - Figure 1: Baseline, Gradient, Curvature, Speed Limit and Feature Diagram in the Vicinity of Waterfall	N/A	25/07/2003	Wardrop A	05244
Exh. 0345	Annexure to the Report dated 5 June 2003 of Alexander Wardrop titled Examination of Emergency Stopping Opportunities prior to the Waterfall Accident – Figure 2 - Graphical Speed vs Distance Presentation of Successive Emergency Braking Trials Beyond the 380 Metres Right Hand Curve Starting at 39.55 K	N/A	25/07/2003	Wardrop A	05244
Exh. 0346	Supplementary Report No 2 dated 23 July 2003 of Alexander Wardrop - Figure 1: Graphical Speed vs Distance Presentation of Successive Emergency Braking Applications After the Vigilance System Has Been Reset at 38.87 Km	23/07/2003	25/07/2003	Wardrop A	05253
Exh. 0347	C.A.S.A. Designated Aviation Medical Examiners Listing – Sydney, Country NSW and Canberra ACT (3 documents)	N/A	28/07/2003	Peel G	05321
Exh. 0348	Annexure TS 2 to the Supplementary Statement dated 25 June 2003 of Tim Sharp being a Report titled State Rail Network Control Incident Information Management System Incident Report	17/06/2003	28/07/2003	Sharp T	05328
Exh. 0349	Report dated 29 July 2003 of Robert C Lauby titled Waterfall Accident Investigation - Report on the Investigation and the Investigation Process	29/07/2003	29/07/2003	Lauby R	05344
Exh. 0350	DVD titled Examination of G7	N/A	30/07/2003	Lauby R	05431
Exh. 0351	National Transportation Safety Board (NTSB) Organisational Chart	10/01/2002	30/07/2003	Lauby R	05499

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0352	National Transportation Safety Board (NTSB) Part 840 - Rules Pertaining to Notification of Railroad Accidents - Sec. 840.5 Inspection, Examination and Testing of Physical Evidence	01/10/2000	30/07/2003	Lauby R	05501
Exh. 0353	National Transportation Safety Board Washington DC 20594 - Safety Recommendation	27/11/2002	30/07/2003	Lauby R	05509
Exh. 0354	NSW Department of Transport - Transport Safety & Rail Safety Regulation - A Guide to the Waterfall Rail Safety Investigation - Version 1 - March 2003	01/03/2003	30/07/2003	Lauby R	05512
Exh. 0355	Geoffrey Power - PowerPoint presentation titled - Slide 1 - Overview - Carriage Recovery by Low Loader	N/A	31/07/2003	Power G	05531
Exh. 0356	Geoffrey Power - PowerPoint Presentation titled - Slide 2 - Overview - Carriage Recovery by Diesel Locomotive	N/A	31/07/2003	Power G	05532
Exh. 0357	Geoffrey Power - PowerPoint Presentation titled - Slide 3 - Overview - Unloading Car 6831 at Main Train	N/A	31/07/2003	Power G	05532
Exh. 0358	Geoffrey Power - PowerPoint Presentation titled - Slide 4 - Overview - Placing Cars for Examination at Main Train	N/A	31/07/2003	Power G	05533
Exh. 0359	Geoffrey Power - PowerPoint Presentation titled - Slide 9 - Overview - Security Guard Patrolling in Front of Fenced Compound	N/A	31/07/2003	Power G	05543
Exh. 0360	Report dated 28 July 2003 by Geoffrey Power and annexures (12 documents)	N/A	31/07/2003	Power G	05566
Exh. 0361	Halcrow Report dated 16 July 2003 titled An Overview of Electric Traction Systems and Comments on the Traction Characteristics of the G7 Outer Suburban Tangara - Appendix 1	16/07/2003	31/07/2003	Mellitt B	05574
Exh. 0362A	Professor Brian Mellitt slide titled Simple Inverter Demonstration	N/A	31/07/2003	Mellitt B	05575
Exh. 0362B	Professor Brian Mellitt slide titled Power Off	N/A	31/07/2003	Mellitt B	05579
Exh. 0363A	Professor Brian Mellitt slide titled Gate Controller Traction Inverter	N/A	31/07/2003	Mellitt B	05581
Exh. 0363B	Professor Brian Mellitt slide titled Gate Controller Traction Inverter Normal	N/A	31/07/2003	Mellitt B	05581

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0364	State Rail Authority Waterfall Derailment Rolling Stock Investigation Interim Report dated 13 June 2003 titled Rollingstock AC Traction System Test - Appendix 7 - Figure 1: Schematic Arrangements for the AC Drive	13/06/2003	31/07/2003	Mellitt B	05585
Exh. 0365	Halcrow Report dated 16 July 2003 titled An Overview of Electric Traction Systems and Comments on the Traction Characteristics of the G7 Outer Suburban Tangara	16/07/2003	31/07/2003	Mellitt B	05626
Exh. 0366	Tab 4 of Report dated 28 July 2003 of Greg Cox titled Waterfall Inquiry - Rollingstock Investigation - Summary of Key Points from Report: Examination of Marks on Wheels	28/07/2003	1/08/2003	Cox G	05634
Exh. 0367	Geoffrey Power - PowerPoint presentation titled Bogie & Wheelsets Pictures - Slide 2: Bogies - Removal of Rear Bogie	N/A	01/08/2003	Power G	05672
Exh. 0368	Geoffrey Power - PowerPoint presentation titled Bogie & Wheelsets Pictures - Slide 4: Wheel Profiles of 6831 with a 5 mm Offset Between Profiles	N/A	01/08/2003	Power G	05673
Exh. 0369	Geoffrey Power - PowerPoint presentation titled Bogie & Wheelsets Pictures - Slide 9: Bogies - Trammelling Bogie Frame No 1 Car 6831	N/A	01/08/2003	Power G	05676
Exh. 0370	Geoffrey Power - PowerPoint presentation titled Bogie & Wheelsets Pictures - Slide 10: Bogies - Bogie Weighing Machine Car 5866 Lead Bogie	N/A	01/08/2003	Power G	05677
Exh. 0371	Geoffrey Power - PowerPoint presentation titled Bogie & Wheelsets Pictures - Slide 13: Bogies - Wheel Back-to-Back Dimension Check	N/A	01/08/2003	Power G	05677
Exh. 0372	Geoffrey Power - PowerPoint presentation titled Bogie & Wheelsets Pictures - Slide 16: Bogies - Rocking Test and Feeler Gauge Testing	N/A	01/08/2003	Power G	05679
Exh. 0373	Geoffrey Power - PowerPoint presentation titled Bogie & Wheelsets Pictures - Slide 17: Wheel & Car Numbering Convention	N/A	01/08/2003	Power G	05680

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0374	Geoffrey Power - PowerPoint presentation titled Couplers Pictures - Slide 1: Couplers - Typical Intercar Coupler Drawbar with Energy Absorption Unit	N/A	01/08/2003	Power G	05684
Exh. 0375	Geoffrey Power - PowerPoint presentation titled Couplers Pictures - Slide 4: Couplers - Fractured Centre Piece Car 5816 No.2 End	N/A	01/08/2003	Power G	05686
Exh. 0376	Geoffrey Power - PowerPoint presentation titled Couplers Pictures - Slide 6: Couplers - Fractured Muff Couplings	N/A	01/08/2003	Power G	05687
Exh. 0377	Geoffrey Power - PowerPoint presentation titled Couplers Pictures - Slide 8: Couplers - Drawbar with an Energy Absorption Unit. Damage on Left End, Last Car Leading End	N/A	01/08/2003	Power G	05688
Exh. 0378	Geoffrey Power - PowerPoint presentation titled Data Logger Pictures - Slide 3: - Data Logger - Systems Connected	N/A	04/08/2003	Power G	05697
Exh. 0379	Geoffrey Power - PowerPoint presentation titled Data Logger Pictures - Slide 4: Damage to Car 6831 Around Data Logger and Speed Converter	N/A	04/08/2003	Power G	05701
Exh. 0380	Data Logger Unit	N/A	04/08/2003	Power G	05702
Exh. 0381	Geoffrey Power - PowerPoint presentation titled Data Logger Pictures -Slide 7 - Interior of Data Logger Unit	N/A	04/08/2003	Power G	05703
Exh. 0382	Geoffrey Power - PowerPoint presentation titled Data Logger Pictures Slide 6 - Data Logger Unit and Test Rig Set Up at Fischer Industries	N/A	04/08/2003	Power G	05708
Exh. 0383	Worley Report dated 11 July 2003 titled Independent Review of Data Logger Design and Installation Report	11/07/2003	04/08/2003	N/A	05712
Exh. 0384	Report dated July 2003 of Philip Pearce titled Data Logger Report	25/07/2003	04/08/2003	Pearce P	05753
Exh. 0385A	Report dated 24 June 2003 of Jeffrey Gudmann titled Metallurgical Examination of Emergency Brake Valve Exhibits From Car OD6832	23/06/2003	04/08/2003	Gudmann J	05791
Exh. 0385B	Report dated 4 July 2003 of Jeffrey Gudmann titled Metallurgical Examination of Master Controller From Car OD6831	04/07/2003	04/08/2003	Gudmann J	05792

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0385C	Report dated 8 July 2003 of Jeffrey Gudmann titled Metallurgical Examination of Brake Controller from Car OD6831	08/07/2003	04/08/2003	Gudmann J	05792
Exh. 0386	State Rail Authority Waterfall Derailment Rollingstock Investigation Rollingstock Train Control System Train Line Wiring Interim Report dated 13 June 2003 - EXH 386	13/06/2003	05/08/2003	Shepherd B	05825
Exh. 0387	State Rail Authority Waterfall Derailment Rollingstock Investigation Rollingstock Train Control System Driver's Desk - Ancillary Controls - Interim Report dated 18 June 2003	18/06/2003	05/08/2003	Shepherd B	05825
Exh. 0388	Eight reports variously dated 22, 25 and 30 July 2003 of Phillip Ian Pearce re the Traction System, with video segments and Curriculum Vitae (10 documents)	N/A	05/08/2003	Pearce P	05827
Exh. 0389	Statement dated 20 May 2003 of Tod Docherty	20/05/2003	05/08/2003	Docherty T	05856
Exh. 0390	Statement dated 20 May 2003 of Adrian Francis Samuel	20/05/2003	05/08/2003	Docherty T	05856
Exh. 0391	Report dated 4 August 2003 of Douglas Higgins titled Waterfall Investigation - Report into G7 Brake Systems	04/08/2003	05/08/2003	Higgins D	05867
Exh. 0392	Report dated 5 August 2003 of Douglas Higgins titled Report into Perceived Brake Surging (Tangara)	05/08/2003	05/08/2003	Higgins D	05867
Exh. 0393	Report dated 5 August 2003 of Peter de Bruyn titled Waterfall Accident Investigation - Review of G7s Maintenance History (7 documents)	N/A	06/08/2003	de Bruyn P	05925
Exh. 0394	Report dated July 2003 of Peter de Bruyn titled Reporting and Repair of Driver's Defects	01/07/2003	06/08/2003	de Bruyn P	05925
Exh. 0395	State Rail Authority 2002 Final [Safety] Audit Report - Executive Summary	03/05/2003	06/08/2003	de Bruyn P	05962
Exh. 0396	Second Statement dated 25 June 2003 of Ronald Stanley Creighton	25/06/2003	06/08/2003	Creighton R	05970
Exh. 0397	Memorandum dated 30 November 1998 from Mr Creighton to Mr Lai re DDIC Cab Ergonomic Redesign - Vigilance vs Deadman	30/11/1998	06/08/2003	Creighton R	05987
Exh. 0398	State Rail Authority internal memorandum dated 10 December 1998 from Mr Creighton to Mr Lai re DDIC Cab Ergonomic Redesign - Vigilance Vs Deadman	10/12/1998	06/08/2003	Creighton R	05987

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0399	Statement dated 8th April 2003 of Craig Alan Fox with index and annexures (9 documents)	N/A	07/08/2003	Fox C	06040
Exh. 0400	Two further annexures to statement dated 8 April 2003 of Craig Alan Fox (2 documents)	N/A	07/08/2003	Fox C	06043
Exh. 0401	Further Statement dated 25 July 2003 of Craig Alan Fox being a Certificate of Expert [Fingerprint] Evidence	25/07/2003	07/08/2003	Fox C	06043
Exh. 0402	Geoffrey Power - PowerPoint Presentation titled Train Control Systems - Slide 11: Table 10 Gate Controller Timing for LVD Events	N/A	07/08/2003	Power G	06078
Exh. 0403	Geoffrey Power - PowerPoint Presentation titled Trains Control Systems - Slide 14: Table 13 - Train Management System Records (Day of Derailment)	N/A	07/08/2003	Power G	06079
Exh. 0404	Statement dated 3 July 2003 of Graham Holden titled Review of GCU and TMS Data	03/07/2003	08/08/2003	Holden G	06105
Exh. 0405	Report dated 4 July 2003 of Graham Holden titled Review of GCU and TMS Data (corrected version of Exhibit 404)	04/07/2003	08/08/2003	Holden G	06106
Exh. 0406	State Rail Authority Safety Division Organisational Chart as at 2 June 2003	02/06/2003	11/08/2003	Herriman C	06125
Exh. 0407	Letter dated 26 February 2003 from Mr Deegan to Mr Lacy and Mr Cowling re Inquiries Under the Rail Safety Act	28/02/2003	11/08/2003	Herriman C	06182
Exh. 0408	Letters dated 14 May, 13 and 19 June 2002 passing between Mr Donaldson and Ms Herriman re recording of train defects (3 documents)	N/A	11/08/2003	Herriman C	06188
Exh. 0409	Statement dated 29 July 2003 of Catherine Herriman	29/07/2003	12/08/2003	Herriman C	06228
Exh. 0410	Report dated 13 June 2003 of Brian Hastings titled Tangara Fleet History	13/06/2003	12/08/2003	Edkins G	06236
Exh. 0411	Report dated 9 June 2003 of Dr Graham Edkins titled Human Factors Sub Group, and his curriculum vitae (2 documents)	N/A	12/08/2003	Edkins G	06239
Exh. 0412	Documents referred to by Dr Edkins in Exhibit 411 (8 documents)	N/A	12/08/2003	Edkins G	06240
Exh. 0413	Report dated 12 August 2003 of Dr Graham Edkins titled Key Principles of Effective Safety Management	12/08/2003	12/08/2003	Edkins G	06268

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0414	Rail Safety Group advisory documents regarding Deadman and Vigilance Operating Standard (2 documents)	N/A	13/08/2003	Edkins G	06330
Exh. 0415	Further documents referred to in the statement dated 21 July 2003 of Kent Victor Donaldson Exhibit 340 (3 documents)	N/A	13/08/2003	Donaldson K	06337
Exh. 0416	Report dated 8 November 2001 of Mark O'Hare titled Data Logger Procedures and Protocols for SRA Fleet Current Situation	08/11/2001	14/08/2003	Donaldson K	06464
Exh. 0417	Report dated 4 August 2003 Dr George Rechnitzer and Dr Andrew McIntosh titled Report on the Ejection of the Driver (redacted)	04/08/2003	14/08/2003	Retinite G	06481
Exh. 0418	Statement dated 30 July 2003 of Anthony John O'Donnell with annexures (16 documents)	N/A	15/08/2003	O'Donnell A	06542
Exh. 0419	Contract No: Tangara 10/86 - Design, Manufacture, Supply, Testing and Delivery of Double Deck Suburban Electric Carriages - Volume 1 Commercial Conditions	26/11/1986	15/08/2003	O'Donnell A	06544
Exh. 0420	Report 295 dated 10 July 2003 of Dr Jindong Yang titled Derailment Simulation for Waterfall Accident Investigation	10/07/2003	15/08/2003	Yang J	06577
Exh. 0421	Report 296 dated 12 August 2003 of Dr Jindong Yang titled Crash Simulation for Waterfall Accident Investigation	12/08/2003	15/08/2003	Yang J	06577
Exh. 0422	Report 286 dated 23 June 2003 of Dr Jindong Yang titled Finite Element Analysis of Tangara Train Coupler For Waterfall Accident Investigation	23/06/2003	15/08/2003	Yang J	06578
Exh. 0423	Object: Derailment Simulation Prepared by Dr Jindong Yang	N/A	15/08/2003	Yang J	06604
Exh. 0424	Object: Crash Simulation Prepared by Dr Jindong Yang	N/A	15/08/2003	Yang J	06604
Exh. 0425	Object: Driver Scenario Number 1 Simulation Prepared by Dr Jindong Yang	N/A	15/08/2003	Yang J	06604
Exh. 0426	Object: Driver Scenario Number 2 Simulation Prepared by Dr Jindong Yang	N/A	15/08/2003	Yang J	06604
Exh. 0427	Statement dated 31 July 2003 of Kenneth Linsley with annexures (40 documents)	N/A	15/08/2003	N/A	06618
Exh. 0428	Photograph of driver's foot heater within stainless steel casing	13/08/2003	18/08/2003	Linsley K	06657
Exh. 0429	Statement dated 15 August 2003 of Paul Gilbertson with annexure (2 documents)	N/A	18/08/2003	Gilbertson P	06672

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0430	Statement dated 12 August 2003 of Fiona Love	12/08/2003	18/08/2003	Love F	06710
Exh. 0431	State Rail Authority Omni and Dart records - William van Kessel - Trainee Results	N/A	18/08/2003	Love F	06710
Exh. 0432	Table titled Training of William van Kessel	N/A	18/08/2003	Love F	06710
Exh. 0433	State Rail Authority computer record of Mr William van Kessel's current competencies, in terms of his certification	24/11/2002	18/08/2003	Love F	06711
Exh. 0434	State Rail Authority internal memorandum dated 6 February 2003 from Mr Young to Mr Pondekas, Mr Millanta and Mr Mair re Tangara Foot Activated Deadman Pedal	06/02/2003	18/08/2003	Pondekas A	06730
Exh. 0435	Report dated 15 August 2003 of Alexander Wardrop titled Revised Examination of Vigilance System Stopping Opportunities Prior to the Waterfall Accident and related documents (3 documents)	N/A	18/08/2003	Wardrop A	06739
Exh. 0436	Australian Transport Safety Bureau Rail Accident Investigation Report dated April 2003 re a Collision Between Suburban Electric Passenger Train 1648 and Suburban Electric Empty Train 1025 at Epping, Victoria on 18 June 2002	01/04/2003	18/08/2003	N/A	06743
Exh. 0437	Findings dated 1 July 1969 of the [Melbourne] City Coroner re a Collision between the Southern Aurora and a Melbourne to Albury Goods Train near Violet Town on 7 February 1969	01/07/1969	18/08/2003	N/A	06743
Exh. 0438	Commission of Inquiry - Hinton [Canada] Train Collision - Report dated December 1986 of the Commissioner The Honourable Mr. Justice Rene P Foisy	01/12/1986	18/08/2003	N/A	06743
Exh. 0439A	Report dated 25 July 2003 of Dr Tom Hubble titled Waterfall Train Derailment - Results & Findings Arising from Geological Investigations of the Accident Site and Damaged Carriages	25/07/2003	18/08/2003	N/A	06744
Exh. 0439B	Report dated 22 August 2003 of Dr Tom Hubble titled Waterfall Train Derailment - Concrete Debris Recovered from Carriage C6831	22/08/2003	22/09/2003	N/A	In Chambers
Exh. 0440	Folder containing documents requested by United Goninan Ltd to be tendered (21 documents)	N/A	26/08/2003	N/A	06750

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0441	Statement dated 29 May 2003 of Julie Wills (pages 0006 - 0016 only)	29/05/2003	26/08/2003	N/A	06751
Exh. 0442	State Rail; Authority Final Notices of Accreditation, Accreditation Applications, Safety Management Plans and Annual Safety Reports – 1994 documents (10 documents)	N/A	26/08/2003	N/A	06804
Exh. 0443	State Rail; Authority Final Notices of Accreditation, Accreditation Applications, Safety Management Plans and Annual Safety Reports – 1996 documents (3 documents)	N/A	26/08/2003	N/A	06804
Exh. 0444	State Rail; Authority Final Notices of Accreditation, Accreditation Applications, Safety Management Plans and Annual Safety Reports – 1999/2000 documents (8 documents)	N/A	26/08/2003	N/A	06804
Exh. 0445	State Rail; Authority Final Notices of Accreditation, Accreditation Applications, Safety Management Plans and Annual Safety Reports – 2001 documents (5 documents)	N/A	26/08/2003	N/A	06804
Exh. 0446	State Rail; Authority Final Notices of Accreditation, Accreditation Applications, Safety Management Plans and Annual Safety Reports – 2002 documents (3 documents)	N/A	26/08/2003	N/A	06805
Exh. 0447	State Rail; Authority Final Notices of Accreditation, Accreditation Applications, Safety Management Plans and Annual Safety Reports – SRA NSW Annual Safety Reports and Extracts (7 documents)	N/A	26/08/2003	N/A	06805
Exh. 0448	Summary of End Forces which the Tangara Train was Designed to Withstand	01/03/2004	15/03/2004	Heumiller D	07203
Exh. 0449A	Photograph of Tangara Trailer Car Showing External Passenger Operated Door Release Buttons and External Emergency Door Release Cover	12/03/2004	15/03/2004	Heumiller D	07229
Exh. 0449B	Photograph of Tangara Motor Car Showing External Passenger Operated Door Release Buttons and External Emergency Door Release Cover	12/03/2004	15/03/2004	Heumiller D	07229
Exh. 0450	Mr Heumiller's Recommendations for the Structures of Future Trains	01/03/2004	15/03/2004	Heumiller D	07252
Exh. 0451	Videotape Documentary Concerning the Silver Spring, Maryland Rail Accident on 16 February 1996	04/02/2004	15/03/2004	N/A	07266

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0452	Report Dated 12 March 2004 titled Crashworthiness of the Tangara and Other Trains by Mr Neil Saville, Design Manager Outer Suburban Cars, United Goninan Limited	12/03/2004	15/03/2004	N/A	07267
Exh. 0453	Tangara Access and Egress Design Study Report Dated 10 July 2003 by Ms. Wendy Gamble, Engineer of Interfleet Technology Limited	10/07/2003	15/03/2004	N/A	07268
Exh. 0454	Audio Recordings of Conversations Relevant to the Accident	31/01/2004	16/03/2004	Taylor W	07287
Exh. 0455	Transcript of EXH. 454	31/01/2004	16/03/2004	Taylor W	07287
Exh. 0456	Waterfall Rail Accident Emergency Response Investigation Report Dated 23 September 2003 By Ms Jocelyn Guy, Department of Aviation, University of New South Wales	23/09/2003	16/03/2004	Guy J	07366
Exh. 0457	Incident Management Protocol Between State Rail Authority and the NSW Police Service for the Management of Responses to Incidents on or Near Railway Tracks in the Sydney Metropolitan Area Dated February 2000	01/02/2000	17/03/2004	Guy J	07414
Exh. 0458	StateRail Network Incident Management Plan Dated December 2002	01/12/2002	17/03/2004	Guy J	07418
Exh. 0459	Network Incident Management Plan (Response to Rail Incidents) Final Draft Issue 1.0 Dated November 2003	01/11/2003	17/03/2004	Guy J	07419
Exh. 0460	RailCorp Incident Response Plan (Response to Rail Incidents) Draft Issue 1.1 Dated December 2003	01/12/2003	17/03/2004	Guy J	07419
Exh. 0461	Exercise Blue Rattler 23 May 1997 Final Exercise De-Brief Reports	23/05/1997	18/03/2004	Donaldson K	07562
Exh. 0462	Paper for Information of the Board of the State Rail Authority - Suburban Cars: Door Security Policy Dated 18 January 1990	18/01/1990	18/03/2004	Donaldson K	07566
Exh. 0463	CityRail Internal Memorandum Dated 6 December 1990 from Mr Barry Douse, General Manager, Illawarra Line to Mr.R.I.Bruce, Project Manager, Tangara Re: Tangara Emergency Door Release	06/12/1990	18/03/2004	Donaldson K	07567
Exh. 0464	State Rail Authority Internal Memorandum Dated 20 December 1990 from Mr R.I.Bruce, Project Manager, Tangara to General Manager , Illawarra Line Re: Tangara Emergency Door Release	20/12/1990	18/03/2004	Donaldson K	07568

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0465	State Rail Authority Internal Memorandum Dated 3 May 1991 by Mr. R.I.Bruce, Project Manager, Tangara to Community Relations Unit Re: Commuter Council Meeting Briefing Papers Tangara - Emergency Egress Between Carriages	03/05/1991	18/03/2004	Donaldson K	07569
Exh. 0466	Conclusions and Recommendation in State Rail Authority Final Risk Analysis Re External Emergency Release on Double Deck Suburban and Intercity Car Doors Dated November 1993	01/11/1993	18/03/2004	Donaldson K	07570
Exh. 0467	CityRail Passenger Door Policy	19/04/1993	18/03/2004	Donaldson K	07571
Exh. 0468	Passenger Fleet Maintenance Memorandum Dated 10 June 1997 from Mr Barry Lovat, Manager, Technical Support and Supply to Mr Arthur Smith, Chief Operations Manager Re: Suburban and Intercity Cars Emergency Door Releases	10/06/1997	18/03/2004	Donaldson K	07572
Exh. 0469	No Exhibit	N/A	N/A	N/A	N/A
Exh. 0470	Letter Dated 18 January 2001 from Mr.John Hall, Executive Director, Transport Safety Bureau to Mr.R.Christie, Acting Chief Executive, State Rail Authority Re: Escape from Trains in Case of Emergency	18/01/2001	18/03/2004	Donaldson K	07577
Exh. 0471	Letter Dated 30 March 2001 from Mr Barry Camage, Acting Executive Director, Safety, State Rail Authority to Mr John Hall, Executive Director, Transport Safety Bureau Re: Emergency Egress of Passengers from Trains	30/03/2001	18/03/2004	Donaldson K	07580
Exh. 0472	Final Inquiry Report Interurban Train Incident Linden-Woodford, NSW 25 July 2000	25/07/2000	18/03/2004	Donaldson K	07586
Exh. 0473	Final Report Passenger Train Collision with a Derailed Coal Train at Hexham NSW 12 July 2002	01/12/2002	18/03/2004	Donaldson K	07590
Exh. 0474	Audio Recording of a Conversation Between a Train Driver and a Train Controller	16/03/2004	22/03/2004	Doak B	07636

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0475	Record of Interview Conducted on 19 March 2004 Between Mr Joe Settineri Assistant Manager, Rail Management Centre and Mr Stephen Harris, Train Controller Re: An Incident on 23 February 2004 Concerning a Person on the Line at Arncliffe	19/03/2004	22/03/2004	Doak B	07645
Exh. 0476	Incident Management Report Dated 23 February 2004 Concerning the Same Incident as EXH. 475	23/02/2004	22/03/2004	Camage B	07689
Exh. 0477	Department of Transport Internal Memorandum Dated 7 November 2001 From Mr Alan Lidbetter, Transport Safety Officer to the Director General /Coordinator General of Rail Re: Emergency Management Exercise Wombat 2001	07/11/2001	22/03/2004	Lidbetter A	07719
Exh. 0478	State Rail Authority Train Services Safety Improvement Program #6 : Implementation of Emergency Evacuation Initiatives; Program Charter Version 1.0 Dated 14 October 2003	14/10/2003	23/03/2004	Hall B	07764
Exh. 0479	Ladbroke Grove Rail Inquiry Report - Executive Summary and Recommendations and Southall Rail Inquiry Report - Crashworthiness and Means of Escape (Chapter 11) and Recommendations (Chapter 17)	N/A	24/03/2004	N/A	07840
Exh. 0480	Undated letter from Mr John Hall, Executive Director, Transport Safety Bureau, Department of Transport to Mr R Christie, Acting Chief Executive, State Rail Authority (see exhibit 470)	31/01/2001	24/03/2004	Owen H	07842
Exh. 0481	Letter dated 23 February 2001 from Mr Owen Henry, Executive Director, Safety, State Rail Authority to Mr J Hall, Executive Director, Transport Safety Bureau, Department of Transport, re Passenger Escape from Trains During Emergencies	23/02/2001	24/03/2004	Owen H	07847
Exh. 0482	Enclosed Documents Pertaining to Passenger Egress from Trains and Emergency Signage	N/A	24/03/2004	Owen H	07857
Exh. 0483	Statement of Robert Norman Hayden Dated 4 July 2003 and Annexures	N/A	29/03/2004	Hayden R	08150
Exh. 0484	Ministry of Transport Waterfall Railway Safety Investigation Final Report	N/A	31/03/2004	Donaldson K	08292
Exh. 0485	Curriculum Vitae of Dr. Andrew McIntosh	31/03/2004	01/04/2004	McIntosh A	08303

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0486	Report Dated 31 March 2004 By Dr. Andrew McIntosh titled Review of Driver Safety Systems and Devices	31/03/2004	01/04/2004	McIntosh A	08304
Exh. 0487	Report Dated 9 May 2003 by Qest Consulting Engineers Pty Limited titled Risk Assessment of Driver Vigilance Systems on Tangara Intercity Trains for State Rail	09/05/2003	01/04/2004	McIntosh A	08310
Exh. 0488	Railcorp Safety Reform Agenda Charter - Draft	N/A	19/04/2004	Medlock P	08390
Exh. 0489	Curriculum Vitae of Mr Nicholas Bahr	N/A	20/04/2004	Bahr N	08435
Exh. 0490	RailCorp - Safety Reform Agenda - Draft	N/A	20/04/2004	Medlock P	08467
Exh. 0491	2001 - 2003 State Rail Authority Priority Hazard List Incident Data Base and Analysis	N/A	20/04/2004	Medlock P	08494
Exh. 0492	Tables of Quotations and Charts from Safety Climate Review of RailCorp	N/A	22/04/2004	Edkins G	08615
Exh. 0493	List of Elements used in ITSRR Safety Management Systems Review	N/A	27/04/2004	Edkins G	08684
Exh. 0494	RailCorp Accreditation Safety Milestones	16/04/2004	28/04/2004	Edkins G	08769
Exh. 0495	RailCorp Organisational Chart and Corporate Safety and Environment - Level 3 Chart	N/A	29/04/2004	McPherson F	08832
Exh. 0496	RailCorp Salary Band Information - Level 2 Positions	21/04/2004	29/04/2004	McPherson F	08833
Exh. 0497	Letter Dated 1 January 2004 from Mr John Lee, Director General, Ministry of Transport to Mr Vince Graham, Chief Executive Officer, RailCorp Re: Provisional Accreditation	01/01/2004	29/04/2004	N/A	08892
Exh. 0498	Letter Dated 3 December 2003 from Ms McPherson and Others to Mr Vince Graham, Acting Chief Executive State Rail Authority Re: RailCorp Provisional Accreditation Application	03/12/2003	30/04/2004	Prestwidge K	08941
Exh. 0499A	Draft Summary of Safety Case Approach for Consideration in Victoria	24/03/2004	10/05/2004	Ross A	08970
Exh. 0499B	Towards a Safety Case Approach for Rail Safety, A Summary of Issues, Published By The Department of Infrastructure Victoria, May 2004	01/05/2004	17/05/2004	Ross A	09182
Exh. 0500	Statement of Kent Victor Donaldson Dated 15 April 2004 and Annexures	N/A	10/05/2004	Donaldson K	08987
Exh. 0501	Statement of Elizabeth Mary Coombs dated 11 May 2004	11/05/2004	11/05/2004	Coombs E	09050

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0502	Report By Nicholas J Bahr, Audit Director on the Stage 2 Safety Management Systems Review Part 1 Audit Methodology	12/05/2004	13/05/2004	Bahr N	09070
Exh. 0503	Report By Nicholas J Bahr, Audit Director on the Stage 2 Safety Management Systems Review Part II Audit Findings	12/05/2004	13/05/2004	Bahr N	09072
Exh. 0504	Mr Laubys Fault Tree Diagram of the Waterfall Rail Accident	28/07/2003	13/05/2004	Bahr N	09080
Exh. 0505A	First Folder of Documents Identified by Mr Bahr	N/A	13/05/2004	Bahr N	09123
Exh. 0505B	Second Folder of Documents Identified by Mr Bahr	N/A	13/05/2004	Bahr N	09124
Exh. 0506	Comments By the Legal Representation Office on Behalf of Passengers and Families to the ITSRR Response Dated 4 April 2004 and RailCorp's Response Dated 8 April 2004 to the Notice under Paragraphs 2 and 3 of the Terms of Reference	08/05/2004	13/05/2004	N/A	09180
Exh. 0507	Safety & Environment - Reporting & Coordination	N/A	17/05/2004	Hedley B	09191
Exh. 0508	RailCorps Progress Report on Implementation and Actions Taken Arising from the Special Commission of Inquirys Interim Report - Current as at 30 April 2004	30/04/2004	17/05/2004	Hedley B	09197
Exh. 0509	RailCorps Progress Report on Implementation and Actions Taken Arising from the Rail Safety Regulators Report in Respect of the Waterfall Rail Accident - Current as at 30 April 2004	30/04/2004	17/05/2004	Hedley B	09197
Exh. 0510	Statement of David Stanely Edwards dated May 2004	01/05/2004	18/05/2004	Edwards D	09205
Exh. 0511	Documents Referred to in Mr Edwards Statement - (EXH 510)	N/A	18/05/2004	Edwards D	09205
Exh. 0512	Two Diagrams of Pacific National SHE (Safety, Health & Environment) and SHE Committees and Risk Management Process	N/A	19/05/2004	O'Donnell S	09251
Exh. 0513	Response Dated 4 April 2004 by the Independent Transport Safety and Reliability Regulator to the Notice Under Terms 2 and 3 of the Commission's Terms of Reference	04/04/2004	19/05/2004	N/A	09295
Exh. 0514	Curriculum Vitae of Mr Ross Bunyon	N/A	28/05/2004	N/A	09411
Exh. 0515	Evidence of Dr Edkins and RailCorp Comments	28/04/2004	31/05/2004	Walsh C	09522

Exhibit No	Description	Document Date	Date Tendered	Witness	Transcript Reference
Exh. 0516A	Documents Submitted By the Independent Transport Safety and Reliability Regulator in Response to Dr Edkins' Evidence together with Further Material Submitted on 19 March 2004	N/A	31/05/2004	Walsh C	09522
Exh. 0516B	ITSRR's Summary of Exhibit 516A and ITSRR's "Navigation Chart" of Exhibit 516A	N/A	19/07/2004	N/A	In Chambers
Exh. 0517	Independent Transport Safety and Reliability Regulator Staff Numbers as at 12 May 2004	12/05/2004	31/05/2004	Walsh C	09578
Exh. 0518A	Safety Management Systems Expert Panel Report and documents referred to therein	06/7/2004	06/07/2004	N/A	In Chambers
Exh. 0518B	Safety Audit Document re ITSRR With an Accompanying Explanatory Memorandum and Safety Audit Document re SRA/RailCorp With an Accompanying Explanatory Memorandum	N/A	06/07/2004	N/A	In Chambers
Exh. 0519	Letter Dated 19 July 2004 from Solicitor to the Special Commission of Inquiry to the Solicitors for RailCorp, Mallesons Stephen Jaques and Letter Dated 22 July 2004 from Mallesons Stephen Jaques and Enclosures	N/A	23/07/2004	N/A	09586
Exh. 0520	Peer Review of the Safety Management System Expert Panel Report	N/A	10/08/2004	N/A	In Chambers

ANNEXURE F

DIRECTIONS GIVEN ON 5 FEBRUARY 2004

1. The granting of leave to appear to any party is, in each case, subject to review having regard to the obligations of proper compliance with any Summons, request made and directions given by the Special Commission of Inquiry.

2. The Inquiry will sit normal Court hours Monday to Thursday and from 10.00 am to 1.00 pm on Friday, or as the Commissioner may otherwise direct.

3. A full transcript of the proceedings is to be taken.

4. All witnesses are to be called and exhibits tendered by Counsel Assisting the Special Commission of Inquiry.

5. All parties granted leave to appear are to cross-examine by leave.

6. Each holder of public office, rail entity and corporation granted leave to appear is not later than 10 February 2004, to provide to the Special Commission of Inquiry the name and position of the officer responsible for compliance with any Summonses to Produce (hereafter referred to as "responsible officer").

7. On return of Summonses to Produce, each responsible officer shall certify in writing that full search has been made for the items required to be produced by the Summons and that all such items are produced together with a list thereof and, if not so produced, their whereabouts or alternatively what searches have been undertaken, when where and by whom and a list of the items being produced and what further searches are necessary and how long they will take.

8. Further public hearings shall commence on a date to be fixed, but not before 8 March 2004.

ANNEXURE G

NSW POLICE STRIKE FORCE BRANDTS

Dennis Green, Detective Chief Inspector, Commander

Dean Smith, Detective Senior Sergeant, Senior Investigator

Nathan Marzol, Detective Sergeant, Senior Investigator

Craig Smith, Sergeant, Analyst

Gregory Butler, Detective Senior Constable, Team Leader

Peter Meagher, Detective Senior Constable, Team Leader

Kathryn Davies, Detective Senior Constable, Investigator

Erica Nuttall, Detective Senior Constable, Investigator

Rodney Pistola, Detective Senior Constable, Investigator

Matthew Skinner, Detective Senior Constable, Investigator

Kairna Gassman, Detective Senior Constable, Investigator

Steven Watkins, Senior Constable, Investigator

Melanie Wallace, Senior Constable, Investigator

Daniel Hickey, Constable, Investigator

Allyson Cook, Constable, Investigator

Jason Ronczka, Constable, Office Manager

Tanya Greenway, Constable

David Neal, Detective Sergeant, Crime Scene Examiner

Michael Lee, Detective Senior Constable, Specialist Vehicle Examiner

ANNEXURE H

Railway Safety

Good Practice in Training

A guide to the analysis, design, delivery and management of training

Authorised by

Brian Alston
Controller Railway Group Standards

RS/220
Issue 1
October 2002

Published by:
Railway Safety
Evergreen House
160 Euston Road
London NW1 2DX

This page has been left blank intentionally

CONTENTS

This page has been left blank intentionally

PREFACE

Issue Record

This document will be updated when necessary by distribution of a complete replacement.

Issue	Date	Comments
One	October 2002	Original Document

Content

Approved by:

Richard Evans, Principal Operations Specialist, Railway Safety

Enquiries to be directed to Railway Safety – Tel: 020 7904 7518.

Application

Railway Safety Good Practice Guides are non-mandatory documents providing information relating to the control of hazards and often set out a suggested approach, which may be appropriate for Railway Group members to follow.

Health and Safety Responsibilities

In issuing this document, Railway Safety makes no warranties, express or implied, that compliance with all or any document published by Railway Safety is sufficient on its own to ensure safe systems of work or operation. Each user is reminded of its own responsibilities to ensure health and safety at work and its individual duties under health and safety legislation.

Supply

Controlled and uncontrolled copies of this document may be obtained from Railway Safety, Evergreen House, 160 Euston Road, London, NW1 2DX.

Glossary

CAI	Computer Aided Instruction
CBA	Cost Benefit Analysis
CBT	Computer Based Training
DIF	Difficulty, Importance and Frequency (Analysis)
EO	Enabling Objective
FOC	Freight Operating Companies
HTA	Hierarchical Task Analysis
KSA	Knowledge, Skills and Attitudes
MMI	Man Machine Interface
NOS	National Occupational Standards
NTO	National Training Organisation
OJT	On-the-Job Training
OTA	Operational Task Analysis
PPE	Post Project Evaluation
QC	Quality Control
RACOP	Railway Safety Approved Code of Practice
RFTD	Ready For Training Date
RGS	Railway Group Standard
RITC	Railway Industry Training Council
SPAD	Signals Passed At Danger
TD	Training Design
TDA	Training Definition Analysis
TNA	Training Needs Analysis
TO	Training Objective
TOA	Training Options Analysis
TOC	Train Operating Company

1 Introduction

1.1 Foreword

Challenging demands are being made of railway training personnel to review and update the training and assessment their trainees receive. The review may require companies to scrutinise their training processes as a whole, making sure that training needs are adequately defined, that training is delivered to consistent standards, that assessments are effectively conducted to ensure competence, that people involved with training and assessment have the necessary skills, tools and support to do their jobs, and that the whole process is continually monitored and updated as required.

This will inevitably mean additional work for the busy, committed professionals who currently manage, deliver or support training. With this in mind, the following 'good practice guide' has been developed to provide information and practical guidance to anyone who needs to understand, manage or contribute constructively to the analysis, design, delivery or assessment of training.

It is unlikely that any one individual will be involved or responsible for all stages of the training process described in this document. It may be useful, however, for training personnel to understand how activities they are involved with relate to preceding stages, and impact on those that follow.

2 Identifying training requirements

2.1 Introduction

Before buying or building a training course it is important to identify *what* needs to be trained, and *how* this training should be delivered and assessed. This will help to ensure that:

a) the right things are trained effectively

b) unnecessary training is avoided

c) assessment is rigorous and appropriate to the competence being tested

d) training media are appropriate and cost-effective.

It is the job of a training needs analysis (TNA) to identify the training requirements of an individual or team and determine how best to meet those needs by determining the most appropriate solution.

A robust TNA process is suggested, which comprises four distinct, but closely related, phases:

a) Operational Task Analysis

b) Training Definition Analysis

c) Training Options Analysis

d) Final Report.

Whilst each phase of the TNA is a separate activity, the relationship between phases should be considered at all times. Where changes are identified, modifications should be reflected in the appropriate phase, and its impact on subsequent phases reassessed. The TNA should be managed and guided by a Steering Group of suitably qualified and competent individuals. This group should have the authority to approve and implement the recommendations of the TNA.

The TNA process described in the following paragraphs is illustrated at Appendix A.

2.2 The scoping study

Training cannot exist independent of the organisation which it serves. For this reason, it is necessary for the TNA to consider the particular operational and cultural needs, constraints and other influences on the organisation and individuals within it. The identification of issues to be considered by the TNA is achieved through the conduct of a scoping study.

The scoping study should include, but not be confined to, the following activities:

a) defining the detailed purpose of the TNA

b) identifying who is to be responsible for conducting the TNA

c) determining the composition of the Steering Group to manage the TNA, along with the roles and responsibilities of members

d) identifying and confirming the availability of appropriate subject matter experts

e) identifying the target audience, their composition, geographical distribution and particular needs, including provision for trainees with special needs

f) determining what initial assumptions and constraints should be made

g) determining how the study will be conducted

h) identifying the equipment, personnel and geographical areas to be considered

i) identifying and obtaining relevant documentation.

These activities allow the TNA to progress within prescribed boundaries and help to ensure that it produces meaningful recommendations for the training of those personnel being analysed. The following example illustrates the role of the scoping study in constraining the TNA:

> *The scope of the TNA may require the analysis of train drivers of a specific traction unit driving over certain specified routes. The TNA should not, therefore, consider the needs of drivers of other traction units, even if these are driven over the indicated routes or include the same set of drivers.*

The purpose of the Steering Group is to manage the TNA from the train operator's perspective, giving guidance and direction to the analyst on policy and good practice as required. It is important that the Steering Group takes ownership of the TNA, as this will permit the implementation of the recommendations to be carried forward more effectively. Consequently, it is important that the personnel comprising the Steering Group have sufficient authority and experience to represent the views and wishes of company policy makers and budget holders.

2.3 Operational task analysis

Operational task analysis (OTA) is the first stage of the TNA. The purpose of the OTA is to produce a statement of all the tasks and sub-tasks required to be conducted by an individual, in the conduct of their duties. Accompanying these should be a statement detailing the conditions under which they could be expected to be performed, and a defined standard to which they should be carried out.

A number of steps may typically be required during an OTA. These are detailed in paragraphs 2.4 to 2.7.

2.4 Hierarchical task analysis

A hierarchical task analysis (HTA) is conducted to establish the tasks required to be performed by the individual being analysed. The job is initially broken down into duties or units, with each unit representing an area of work. For example, one unit might be to 'prepare to undertake duty'. Each unit should then be broken down into elements; an element being an activity which has a defined start and end, but which falls within a work area. Each element is in turn defined as a number of performance criteria. Performance criteria are those physical actions that are required to enable the effective completion of either all or part of the element. Where appropriate, these may be further divided into sub-levels of performance criteria.

2.5 Interactions – cues and responses

Once the HTA has been completed, the analysis of the elements can begin. The identification of cues – events which prompt some action - and responses is used to flesh out the work done in the HTA and can provide further detail of complex activities. The types of cues that are most commonly considered are sound- and vision-based, although touch, smell and movement/acceleration may need to be considered. When considering the appropriate responses to a cue, the nature, location and speed of response, and the necessary operation of equipment interfaces, should be assessed.

2.6 Conditions and standards

The list of elements is given more useful definition when each is accompanied by a set of conditions and standards. Each element should have identified for it, all of the conditions under which an individual may be expected to perform that activity. For example, the condition 'at any time' would be inappropriate if the element being considered were only performed during the day.

Similarly, the standards associated with each element define the level of competence the individual should be expected to demonstrate. Standards should identify how well the element needs to be performed in terms of procedure, accuracy and time. The standard should be achievable, measurable, consistent and not open to interpretation.

2.7 Training priority assessment

The HTA, together with identified conditions and standards establishes a basis for all further analysis by identifying what the individual will be required to achieve in the operational environment. In order to assess where the emphasis in training should lie and what performance criteria are likely to require more training than others, a training priority (or DIF) analysis should be conducted.

When assessing the training priority associated with each performance criteria, consideration of the difficulty, importance and frequency (DIF) of conducting the activity should be made. A proposed algorithm for the assessment of training priority is provided at Appendix B, which also contains some suggested definitions.

Importance assessment should consider the consequences of failure for each activity. For example, if the result of failure is that the train stops 10m short of a signal rather than 20m, then the importance may be relatively low; however if the consequence of failure is that a SPAD may result, then the importance is most likely to be very high. If necessary, this information may be used to overrule the DIF analysis results.

DIF analysis generates a score which can be used to give an indication of training priority. Training priorities are ranked from 1 to 5, where 5 represents a task that is relatively simple, unimportant and conducted so frequently that formal training may not be required, whilst a score of 1 indicates a task that is both difficult and infrequent, and sufficiently important to warrant comprehensive training.

These priorities should only be used to give an indication of where the emphasis in training should lie, rather than as a definitive guide to how much training should be delivered.

2.8 Training definition analysis

The purpose of the Training Definition Analysis (TDA) is to complete the identification of the training content requirements, by defining the underpinning knowledge required to support competence, and considering the implications of not training. In addition, the TDA assesses the degree of fidelity, or realism, required to be provided in the training environment. The steps required to undertake the TDA are contained in paragraphs 2.9 to 2.12.

2.9 Underpinning knowledge

Each element analysed during the OTA will have been broken down into its constituent performance criteria. In order to competently conduct the element, a level of technical knowledge is likely to be required. This underpinning knowledge is best associated with the element, rather than the performance criteria, but any additional, specific knowledge related to each performance criteria should be identified. Underpinning knowledge items are those elements of theory, understanding or mental processes which are required to enable the individual to conduct the element or performance criteria being trained.

Once the underpinning knowledge required for each performance criteria is known, the consequences of not training each performance criteria should be assessed, and a decision to formally train, or not, made. If the decision not to train is made, for any or all of the performance criteria, the result should be recorded and the reasons for the decision clearly stated.

The remaining combination of underpinning knowledge and performance criteria represents the objectives to be analysed in the Training Options Analysis (TOA).

2.10 Assessment methods

Since competence in the workplace is one of the principal goals of the training system, it is important that, wherever possible, assessment is conducted in the workplace. This is not always possible, as opportunities for demonstrating performance and procedural knowledge may not emerge in a controllable manner. This does not remove the need to assess each element, together with its associated underpinning knowledge and performance criteria, in order to ensure competence. The method of assessment should be selected to ensure that the conditions under which competence is tested is as close to the actual working environment as is reasonable and safe to achieve.

Underpinning knowledge can usually be assessed using a variety of methods and media to ensure awareness of rules and procedures, and to permit their application in practical, real-world situations.

Where performance is being assessed, the assessment must be designed to ensure competence, not simply awareness of procedures. Where competence cannot be demonstrated in the workplace in a controlled manner, such as with some activities relating to abnormal, degraded or emergency conditions, a suitable alternative should be found that allows demonstration and testing of performance, and observation of the response by the trainee to realistic environmental and train system cues.

When identifying assessment methods for competencies, together with their associated performance criteria and underpinning knowledge items, consideration should be given to the requirements of the relevant RGS and national occupational standards.

2.11 Mapping to National Occupational Standards

National Occupational Standards (NOS), where defined, identify in broad terms the minimum acceptable performance standards to be achieved by personnel before being deemed competent in a work role.

If the format of the performance and knowledge requirements identified during the TNA is structured in a manner consistent with NOS, it will be a simple task to map the units, elements and performance criteria identified during the analysis onto those standards. This approach can be used as a quality control to ensure that the analysis is comprehensive. Furthermore, it will facilitate the acquisition of nationally recognised qualifications, if desired, by personnel completing training and assessment derived from this analysis.

2.12 Fidelity

The purpose of the fidelity analysis is to consider each performance criteria to assess the extent to which the training environment should replicate the operational environment to enable training to be effective. The fidelity analysis is conducted in three main categories - physical, functional and environmental - each of which is further divided into three sub-categories. The definition of these categories is presented in Table 1.

Fidelity Category	Sub-category	Definition
Physical	Layout Look Tactile	Position of controls etc. relative to each other and to the user Shape, colour, luminescence and size of the interface Feel and movement of the interface during use
Functional	Format Content Response	Format of the data displayed or action taken Frequency, text, colour, audio etc of the data Data change rates and display response times

Environmental	Sound	Background noise, conversation and resonance
	Motion	Incidental movement of the platform/equipment or system
	Ambience	Heat, light, smell, smoke, humidity etc.

Table 1 – Definitions of Fidelity Elements

Decisions made at this stage can have a significant impact on the nature and cost of training solutions, therefore careful consideration should be given to the degree of realism required in each category to support effective training. To assist this process and permit consistent analysis, a scorecard is provided, against which each of the fidelity sub-categories may be measured for each performance criteria. The scorecard is presented at Table 2.

Indicator	Definition	Impact	Fidelity Factor
None	Not applicable	Has no impact on training.	0
Low	Replication not important	Little impact would be made on training except to add realism.	1
Medium	Replication moderately important	Significant impact would be made on training. There are some elements which require exact replication.	2
High	Exact replication important	Has a significant impact and is essential to training.	3

Table 2 – Fidelity Factor Scorecard

2.13 Training options analysis

Identifying an effective, efficient training solution often requires a detailed understanding of how people learn, together with an appreciation of the impact that different training media and methods can have on the learning process. In the last twenty-five years the workplace has undergone a technological transformation, driven in large part by the availability of affordable computer equipment. This has resulted in changes in work practices and inevitably to the training needs of the workforce. The technological revolution has also introduced new training media and methods, which mean that traditional classroom- and workplace-based training may no longer be entirely effective or efficient. The increasing diversity of available media options does, however, present a challenge to anyone involved with the procurement or design of a cost-effective training solution.

The purpose of the TOA is to identify suitable media for the delivery of training, assess their relative merits as training systems, identify their costs and associated risks and recommend training solutions based on these criteria. This process is illustrated in Figure 1, and further described in paragraphs 2.14 to 2.17.

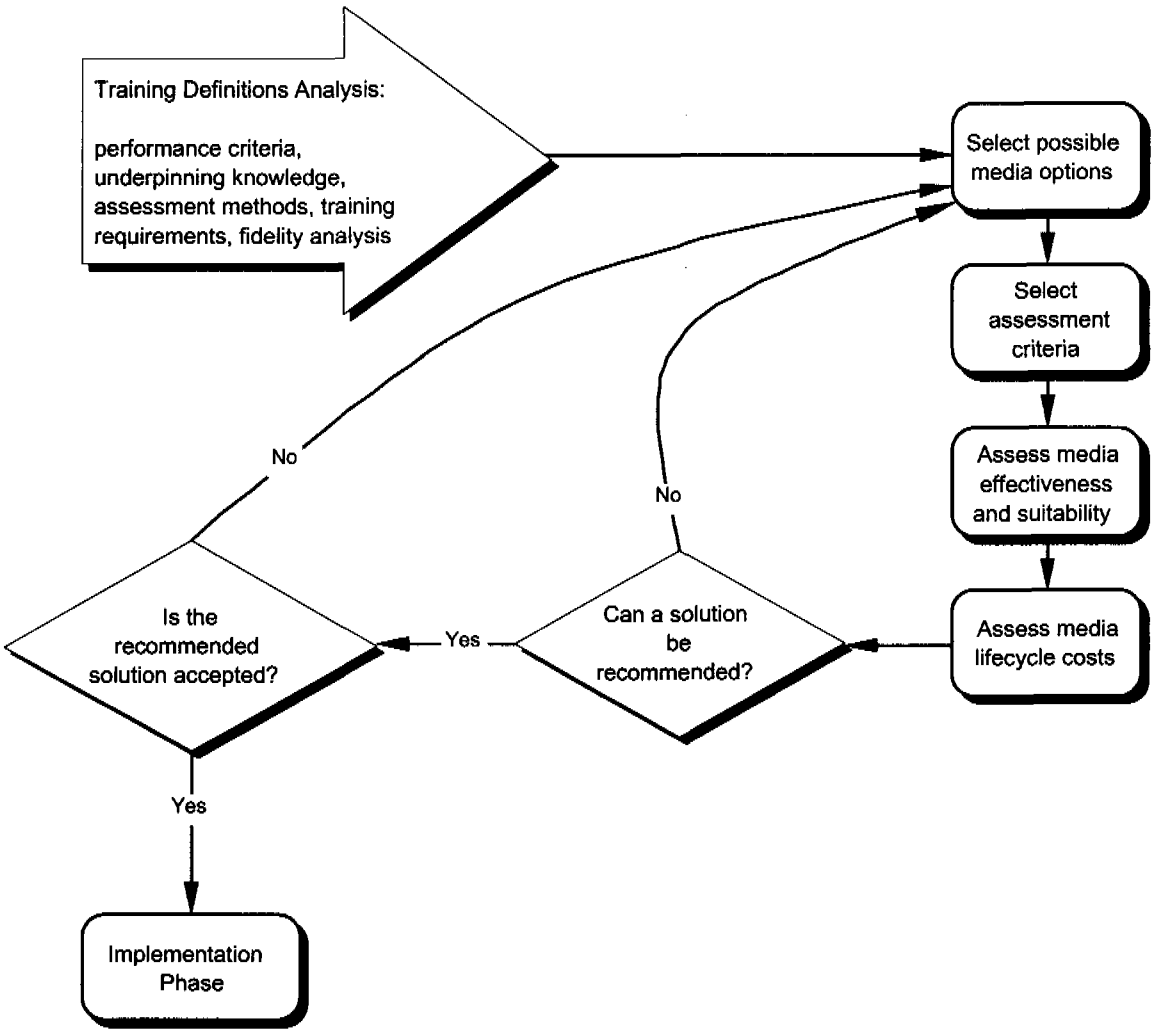


Figure 1 – Training Options Analysis Process

2.14 Media Selection and Definition

Analysing and comparing each of the different types of training media available would be a complex, expensive and time-consuming exercise. Conversely, selecting a training solution on the grounds that it is available, currently perceived to be the 'best' by peers, or other factor in isolation, may result in a sub-standard, incomplete or inefficient training solution.

By making an initial filter of suitable media, the media selection process can be simplified without significantly reducing its effectiveness. The selection of media at this stage should be based on relevant and known criteria, including the:

a) analysed fidelity requirements

b) nature of the training to be conducted

c) number of students required to be trained each year

d) location of the training sites.

Each of these criteria may be used to dismiss inappropriate media. For example, if the training solution is to be deployed to a number of training sites, procurement of a single, high-fidelity simulator at one site only may be unsupportable, and the cost of such a device

may preclude procurement of several equipments. In this case, the training philosophy of the company would need to be revised before the option could be considered further. Conversely, if practical skills training is being addressed, basic computer-based training or traditional classroom-based 'chalk and talk' may be of limited value, without substantial investment in supporting devices.

It is possible that different individuals may interpret media definitions quite differently (what is computer based training?), which may result in confusion. It is therefore important that the media selected are accurately defined and their role and purpose described in sufficient detail to avoid ambiguity. Identification of the possible advantages and disadvantages of each media option should be listed, together with an assessment of the fidelity that it is intended to possess. A non-exhaustive list of media types, together with outline definitions, advantages and disadvantages, is provided in Appendix C.

Having identified a subset of media options for further consideration, each should be assessed to objectively determine its capability to meet requirements. This assessment should be based on selection criteria, defined and prioritised in advance, which are relevant to the company and its operations. Some suggested selection criteria are presented at Table 3.

Criteria	Factors	Importance
Meeting Objectives	The ability to meet performance criteria Suitability for meeting learning requirements	
Fidelity	Ability to meet physical, functional and environmental fidelity requirements	
Assessment	Validity and reliability of assessment Degree of student feedback, monitoring and control available	
Usability	Adaptability to different learning styles and abilities Skill required to use the media (both trainee and trainer) Suitability for both group and individual needs if relevant Use of media in different locations at the same time Suitability for use by trainees with special needs	
Flexibility	Adaptability to modify/add extra hardware and software Ability to modify courseware for changes to operational or learner requirements Capability to interface with other equipment and media Ability to store and playback scenarios	
Management	Ease of providing information for planning and admin Number of trainers required Number of support staff required Limitations on class size	
Risk	Dependency on single supplier Chances of overspend or delays Changes to operational equipment Training equipment availability	

Table 3 – Media Selection Criteria

A number of approaches are commonly used to assess the potential capability of training media to meet the requirements identified. Whichever process is used should be

transparent and auditable, and applied consistently. For complex training developments, it may be beneficial to obtain assistance from the user community, training specialists and training media developers.

Where several media options present incomplete, complementary capabilities, these may be combined into a single option, and its capability reassessed.

2.15 Media risk assessment

When procuring new training, there may be certain risks specific to the medium used. These may include the likelihood of being ready on time, the risk that the costs may escalate or additional facilities be required to support it, issues of reliability, reliance on a single provider or the ability to respond to changing requirements.

It is important that risks associated with each media type are defined, and mitigating actions identified and implemented if the medium is selected. A matrix for identifying, evaluating and controlling media procurement risks is presented at Appendix D.

2.16 Media cost

The cost of training media procurement may be significant and the benefit of any outlay should therefore be carefully assessed before a firm commitment to invest in training is undertaken. It is important to consider all of the costs associated with each media option over the intended life cycle of the equipment, and not just the upfront purchasing costs. It is also important that when considering the cost of media a clear and consistent approach is taken to ensure that a fair comparison is made. Where a cost item is to be considered for one media option, that item should be considered for all options. The following represent some of the areas that should be considered when judging costs:

a) the number of media units required

b) the cost of each unit

c) anticipated unit maintenance costs

d) instructional staff required

e) maintenance or support staff required

f) facilities required to support the media units

g) the frequency and cost of updates, modifications and replacements

h) the location of the media units

i) the use of the media units

j) time available for maintenance

k) trainer costs

l) student costs.

2.17 Cost benefit appraisal

A balance should be drawn between the cost of a media option and its effectiveness in meeting the training requirement. Some options may be ruled out because their cost exceeds the available budget. Others may be removed from consideration because they are assessed to be ineffective, inefficient, or unacceptably risky solutions. Remaining options should be assessed to determine the most acceptable balance between effectiveness and cost, with other factors such as risk and environmental impact accounted for. Selection and recommendation by the Steering Group of the most appropriate option will in part be driven by the company, but so long as minimum training effectiveness standards are ensured, an adequate solution should result.

2.18 Final report

Each phase of the TNA should be supported by appropriate documentation and reports (driven in part by the requirements of the company). The TNA process concludes by issuing a further document, summarising all its activities in a final report. The report provides a single source justifying and explaining all processes and decisions, and also forms an essential input into the training design process. Paragraphs 2.19 to 2.23 detail the anticipated content of the final report, as follows:

a) an executive summary

b) conclusions of the study's findings

c) recommendations from the TOA

d) a proposed implementation strategy

e) a strategy for the post project evaluation.

2.19 Executive summary

The executive summary is provided to enable the reader to understand why the study was undertaken, what the key findings and major recommendations were, and what will happen next. It should be short - typically not more than 2 or 3 sides of paper.

2.20 Conclusions

The conclusions section draws together the key points of the report and presents them either as important items from which recommendations can be drawn, or as items which should be highlighted for further study.

2.21 Recommendations

Recommendations should be drawn primarily from the conclusions. The main thrust of the recommendations should be toward the training required to be delivered (answering the question posed) but if there are other pertinent recommendations to be made (eg some problems may not have a training solution, and will need to be addressed through reorganisation or systems design), they may be presented here. As well as recommending the methods and media required for training, personnel tasked with taking the project forward should be identified, where known.

2.22 Implementation

To increase the chances of the recommended solution being realised, an implementation strategy is necessary to identify what is to be delivered, by whom, where and when. It should be derived from, and add clarification to, the recommendations. It should identify what infrastructure needs to be in place before the training solution is delivered, when the solution is to be delivered, what criteria should be met for acceptance and how the system should be set to work and trialled in the training environment. It is not always possible to deliver a project plan with the implementation strategy, but inclusion of identified milestones should be included.

2.23 Post-project evaluation strategy

In order to assess the effectiveness of the analysis a post-project evaluation (PPE) should be conducted once the training equipment has been installed, piloted and used for a period. It is the first element in the feedback loop that ensures an effective and efficient training process. It will highlight any deficiencies or areas for further analysis and will enable the company's analysis processes to be refined.

The PPE section of the report should identify who is to be responsible for conducting the PPE, when it should be conducted, how long it should take, what is to be reviewed, the format of the report and who it should be delivered to.

3 Designing a Training Programme

3.1 Introduction

Once the TNA has reported and been approved, a training course should be structured to develop and confirm the competencies required. The course should identify its constituent modules, define what training is to be delivered with which media, equipment and support.

It is important to remember that the purpose of the training is to deliver individuals competent in the workplace. The elements defined in the HTA, together with their associated conditions and standards, represent the goals to be attained in order to ensure competence. The training course must, therefore, be designed to develop the knowledge and level of performance of the trainees so that they reach the competence conditions and standards identified in the elements by the conclusion of the training.

If necessary, the conditions and standards of the performance criteria may need to be amended to reflect the capabilities of the training solution. The difference between the workplace competence required, and the training output standard available, would then need to be addressed once the training course had completed, either through further training, or by structured, supervised on-job experience.

3.2 Course design

The aim of course design is to structure the development of competencies, through delivery of knowledge and performance, for the benefit of the trainee. The training should be concerned with progressively loading information and skills development phases, to enable the trainee to progress to the next level or module of training at minimal risk.

3.3 Underpinning knowledge

Underpinning knowledge refers to those items of retained knowledge and learnt cognitive ability that are required in support of the associated competence element. Whilst not all underpinning knowledge may be required prior to the development of the practical performance, it is likely that a significant amount will be needed in order for the performance development to progress effectively.

Consideration should be given to listing the knowledge items in a progressive and logical manner, in order to enable the performance development process to start as soon as possible, and to then allow competence to be demonstrated in the training environment in the shortest timescale.

3.4 Performance criteria

The development of competent performance is the second area where training is likely to be required. There are three main means by which required levels of performance may be acquired and developed:

a) Formal training (either in-house or contracted off-site) – in which a performance criteria is broken down, taught and practiced in an environment separate from any form of interaction with other equipment.

b) Simulator training - where a performance criteria is learnt in its entirety and practiced in relation to certain other systems for cue and response elements of the task.

c) On-the-job training (OJT) - in which performance development is embedded within the operational context, under supervision, learnt and developed in relation to other events and actions that may occur.

Each of these approaches has its own advantages and disadvantages and should be considered in light of the recommended and available training media. The progression of the performance criteria development throughout the course, using the various learning

environments and media, should be considered and prioritised alongside the underpinning knowledge for each element.

3.5 Module development

The knowledge and performance criteria elements, having been defined, should be grouped together into modules which develop the trainee as a whole and not just in one specific area. The modules of the model driver training programme in the GO/RC3551 are an example of this holistic development. This approach is more likely to retain the trainees' interest and enthusiasm far more effectively than a concentration in one area at the expense of all others.

Additional benefits of an integrated approach to knowledge and performance development include:

a) the avoidance of a 'use it then lose it' philosophy, where individuals cram for a module, then forget it once the module has been tested

b) enabling the trainee to see the relevance of training as they progress

c) the opportunity to use a variety of different media and methods to stimulate and retain the trainees' interest.

Each module should be viewed objectively to ensure that all the competencies identified by the TNA are contained within the training course as a whole. Additionally, the modules and their content should be assessed for their ability to develop the required competencies in a logical and progressive manner, taking the output of the previous modules and ensuring that the current module builds on them to bridge the gap into later ones.

The output of the module design process should be a list of modules detailing:

d) the module number

e) the title of the module

f) the anticipated duration of the module

g) an overview of the purpose of the module

h) identification of the media to be used within the module

i) training guidance on the development of the module and identification of any supporting documentation, such as rulebook references

j) identification of elements or performance criteria to be addressed within the module.

The output of the module design process should be assessed, modified and accepted by personnel within the company who are experienced in the design, delivery and assessment of training, as well as experienced in the management of the personnel requiring training.

3.6 Training design

The training design process should be relatively straightforward, if the preceding activities have been effective. For those areas of training requiring specialist media development, appropriate support may be required. The provider of the training solution will need to know as a minimum:

a) what is to be taught (element, performance criteria or underpinning knowledge with appropriate details)

b) the context of the training (what competence the training is developing and how it will be applied)

c) the required training outcomes (what level of competence is required by the end of the training)

d) how many trainees will require access at any one time and throughout a year

e) how the trainees' performance is to be assessed

f) the location that training is to be conducted in

g) how the training materials are to link in with the rest of the training.

For those areas where procured training aids are not being used, in-house training design will need to be conducted. This will entail, within each module, identification of the performance criteria and knowledge required, together with the conditions and standards appropriate to the module. The performance and knowledge will need to be broken down further into smaller steps that are easier to achieve and which will form the building blocks of the course. Once identified, the course can be structured to logically provide the outputs required of that module through careful development of interlinked knowledge and performance development. For example, fundamental knowledge training may be delivered, followed by basic performance training, which may be further developed through more detailed knowledge, then additional performance training as required to develop competence.

Once the structure has been defined, the module can be divided into more manageable sections, or lessons, each with clearly defined objectives. The requirements of each lesson and the supporting information the trainer will require should be contained in the training documentation, an example of which can be found in Appendix E.

Alongside the production of the training documentation should be the development of the assessment methods to be used for each module of the course. This may include a mixture of methods to deal with performance criteria, knowledge and overall competence. Further guidance on assessment is given in Section 5 of this document.

Each module should have a set of training documentation plus a clear identification of the competence assessment methods to be used, stating what performance, knowledge and competence is to be addressed by each method and what evidence is to be sought. An example of a competence assessment form is presented at Appendix F.

3.7 Training environment

Alongside the training design activities, the training environment should be prepared. The time, cost and effort required to achieve this may range from procuring and preparing a basic training aid such as an overhead projector, ensuring access to facilities by trainees with identified (during the scoping study) special needs is provided, through to the acquisition and installation of a complex simulators in a custom-built facility. Whatever the requirements are, the training environment should be prepared in parallel with the training design and media procurement process.

Where media is being procured, the development of the training environment should be conducted in liaison with the media provider. This will ensure that it will be accommodated, work, have the necessary facilities available to enable the trainees to use it, fit into the course as a whole and interface, where necessary, with any other training media to be used.

3.8 Validation of the training course

In order to ascertain the effectiveness of the proposed training, it is useful to run a pilot course. The pilot course should assess the effectiveness of:

a) the content of the lessons forming the modules

b) the content of the modules forming the course

c) the effectiveness of the training at delivering the required competences

d) the suitability and effectiveness of the media employed

e) any further development or improvements that should be made.

The trainees for the pilot course should be taken from a cross-section of sources, including newly qualified personnel, experienced personnel, trainers and managers.

The trainees on the pilot course should be assessed using the identified and appropriate assessment methods. This will enable an assessment to be made, not only of the training but of the assessment methods as well. Once validated and accepted, the course is ready for delivery to new trainees.

4 Training Delivery

4.1 Introduction

Once the course has been piloted and validated, several activities need to be performed. Trainers need to prepare and collate course documentation, handouts, lesson plans and teaching notes. The training environment and media need to be prepared and the students informed of any requirements that may be expected of them.

4.2 Student pre-course preparation

It is important that students should know what is expected of them when they attend training. It is likely that the requirements placed on them at the beginning of one module or lesson may differ from that of the next module or lesson. The requirements can be divided into three main areas, these being:

a) reading

b) equipment

c) dress.

Each of these areas is expanded upon in paragraphs 4.3 to 4.5. Trainees should be informed in sufficient time to allow them to come prepared to meet the requirements of the training to be conducted. These requirements could be defined in a timetable that will articulate what is expected for each module, day and lesson. Where students have either not been informed or have been given insufficient notice, the training organisation should be prepared to meet the requirements of the training in terms of equipment and possibly dress.

4.3 Reading

Reading may either be pre-course notes, to give an awareness and familiarisation of the course, or may be necessary to underpin knowledge and information concerning the training. For example, a section of the rulebook may be being trained and the students may be required to read it prior to starting training.

4.4 Equipment

Trainees may need to use various drawing instruments, calculators, pens, paper or books, and they should be informed accordingly. Where they have not been given sufficient notice, the training organisation should supply the necessary items.

4.5 Dress

All trainees should be informed of the standards of dress that will be expected of them each day. Where there are additional dress requirements, these should be communicated to them in sufficient time for them to comply. The additional items of dress may include luminous jackets, safety boots, safety hats, overalls etc. The trainer should set an example by not only having the correct clothing, but by the overall standard of his or her appearance, as this will help to imbue a sense of professionalism and pride in the work.

4.6 Trainer pre-course preparation

It is important for the trainer to be well prepared for training, as their example will have a significant and lasting effect on the trainees. A poorly prepared trainer may lead the trainees to believe that the training is unimportant, or that the trainer does not want to be there. This will serve to undermine the purpose of the training, which is to provide competent, safe and professional staff.

There are a number of areas which the trainer should check, to make sure the course runs smoothly. These are discussed in paragraphs 4.7 to 4.11.

4.7 Documentation and lesson plans

All training documentation should be checked to ensure that it is current and consistent throughout. Lesson plans should be consistent with the training documentation and any changes that have been made to the training documentation should be reflected in the trainer's own personal lesson plans and teaching notes. This will assist in ensuring that the training meets the requirements laid down in the company training documentation.

4.8 Handouts

All required handouts should be collated, prepared and checked for their validity against the last modification to the training documentation. The quality, quantity and content of handouts should be checked.

4.9 Types of lesson and interaction

Where it is within the remit of the trainer to adapt the format of the lesson or module, consideration should be given to the type of training to be conducted, the preferred training and learning styles of the trainer and trainees, and the degree of interaction sought. The level of interaction between the trainees and the trainer is to some extent constrained by the style of lesson being employed, as illustrated in Table 4.

Lesson Type	Level of Interaction
Lecture	A formal lecture involves trainees sitting listening to the trainer describing process, procedures or theory. Trainees can be expected to take their own notes. Questions are usually only expected when they are invited by the trainer.
Lesson	A lesson allows more verbal interaction with the trainees than a lecture in that they can ask questions when they wish and respond to those posed by the trainer. However, the trainer imposes a formal structure and approach to the training, controlling interaction as necessary.
Discussion	An open forum with trainees participating freely, with structure, direction and stimulus coming from the trainer. Interaction is not only permitted but is essential for the success of the training.
Practical (Classroom)	Within the classroom, interaction can be more varied, combining verbal, written and practical demonstration by students or the trainer.
Practical (Workplace)	The workplace environment can offer significant opportunities for interaction in the form of practical demonstration of procedures, question and answers, and role play. Because groups being trained in this way are often relatively small, training can be better focused on the needs and abilities of individuals in the group, but this does place additional demands on trainers.
Computer Based Training	Interaction during CBT lessons is typically limited, or may be replaced by interaction with the training materials. Delivery of CBT lessons may require careful planning to ensure additional interaction is provided as required.
Simulation	Levels of interaction may vary, depending on the type of simulation and the trainer's control of it. A communications or full mission simulator may have the trainer playing role and interacting directly with trainees, whereas a more basic simulator may have limited computer-controlled responses to student inputs.
On Job Training	Probably the form of training with the greatest interaction potential. Generally one-to-one with the trainee justifying their actions to the trainer/mentor and gleaning knowledge, advice and experience from them directly.

Table 4 – Lesson type and associated opportunity for interaction

4.10 Content
The content of the training to be undertaken should accurately reflect the requirements as detailed in the training documentation, and not be driven by the preferences of the trainer.

4.11 The training environment
In order to deliver effective training, the training environment should be prepared prior to any training taking place. There is little benefit in preparing a lesson using a media that is either not available or not suitable for the numbers requiring training.

The classroom or training environment should be configured to enable the maximum access and interaction between the trainees and the trainer, the training material and any equipment to be used. A clear view of the trainer and training aids is essential, as may be the ability and space to take notes. Whilst the environment should have been designed to fully meet the requirements of trainees with special needs (refer 3.7), facilities required by the trainees should be available and in good working order.

A poorly lit or heated training environment can be a distraction to a trainee. The guidelines on working practices for office workers should also apply to trainees in classrooms or enclosed training environments. Realism should be maintained when training in an operational environment such as a cab, depot, station or yard.

All training aids and equipment should be checked and prepared prior to commencement of training. Poor, incomplete or dysfunctional training aids not only detract from the flow of the training, but also highlight the lack of preparation by the trainer. A training equipment preventative maintenance policy, correctly implemented, will help to ensure that breakdowns of equipment are avoided.

Safety is an attitude that needs to be promoted continually during training, and necessary safety precautions need to be taken to ensure any risks are kept to a minimum. The training environment should, as far as practicable, be a safe environment. All training environments should be checked by the trainer prior to use, and at regular intervals by the Health and Safety representative. Where a safety concern has been highlighted, it should be made as safe as possible and approval for training to be delivered in that environment sought from the Health and Safety representative. A company's safety policy should extend to cover the training environment to the same extent as the operational workplace. Safety equipment should be supplied by the company for the training environment, as required.

It is recognised that working with or near trains contains risk, and it is not always possible to make this a totally safe environment. The training, and control of training, should aim to deliver safe individuals whilst minimising the risk to all concerned. Where there are risks that cannot be controlled directly, the trainer should be aware of them and direct trainees appropriately.

The attitude and actions of the trainer in respect of safety issues is important. Instructions by the trainer which he or she fails to follow can lead not only to dangerous practices by the trainees but also to reduce the credibility of the trainer.

4.12 Delivery of training
A principal aim of company training is to deliver competent personnel to their place of employment. It is therefore important that the training provided is effective, consistent and assessed. The assessment of training is covered in the next section of this document. The effectiveness of the training is largely dependent on the media used and the ability of the trainer. The trainer's competence should be monitored on a periodic basis to ensure standards are maintained. Consistency of training content is controlled through the validity, accuracy and use, by all trainers, of the training documentation.

The appropriate methods of training delivery will vary depending on the media, trainer preferences, content and location of training. Each trainer should be experienced in delivering a variety of training sessions, and should be able to adapt the training style and method to suit the needs of trainees, including those with special needs. Whichever training approach is being used, each session should address certain key elements, as outlined below in sections 4.13 to 4.18.

4.13 Revision

Prior to any training being delivered, it is always beneficial to conduct a short review of previous training. Use of a questions and answer session, or open discussion supported by contributions from the trainer, can be particularly effective. This serves to motivate the trainees to retain what has been taught, rather than employ a habit not uncommon in modular training of retaining knowledge only until it is no longer required. It also enables the trainer to assess the trainees' readiness for the subsequent training, by assessing their understanding of what has already been delivered.

4.14 Introduction

After conducting the revision exercise, it is important to explain to trainees what the purpose of the current training session is. This might include a short briefing explaining the background to the training, an overview of the content covered, and an explanation of what the trainee should be able to do on completion of the training event.

4.15 Questioning

The policy on students asking questions should be defined by the trainer, who may wish to control interruptions and limit student interaction to identified intervals within the lesson. Questions, both from the trainees and posed by the trainer, are an important means of reviewing progress and maintaining interest, so they should be encouraged when possible.

4.16 Safety

Any safety issues relating to the training itself, or to the environment in which the training is being delivered, should be explained by the trainer, together with the actions to be followed in the event of an incident. Trainees should not be permitted to undertake potentially hazardous training, without first receiving the necessary general or specific safety training, and being provided with (and correctly using) any necessary safety equipment or clothing.

4.17 Content

The training content should be delivered in a manner which is interesting, varied, as easy to understand as possible, and in accordance with the training documentation, trainer's notes or lesson plan. The trainer should frequently check that the content is being understood by the whole class, and review content, or adapt the training style and pace, as required.

4.18 Consolidation

On conclusion of the lesson, the trainer should conduct a short review of its content, and lead a further question and answer session to consolidate its key points.

5 Assessing competence

5.1 Introduction

Assessment is used primarily to ensure that trainees have achieved or exceeded minimum defined levels of competence and supporting knowledge. It may also be used to assess the effectiveness of the training materials, when piloting new training.

Whilst final competence assessments must be conducted at the end of training, other forms of assessment should be employed, to regularly monitor the trainees' performance and understanding, and to provide feedback to trainees on their progress. The benefit of this is twofold: firstly, any individual shortcomings can be identified and addressed; and secondly, the quality of the training being delivered can be monitored, and the quality of output ensured.

5.2 Effective Assessment

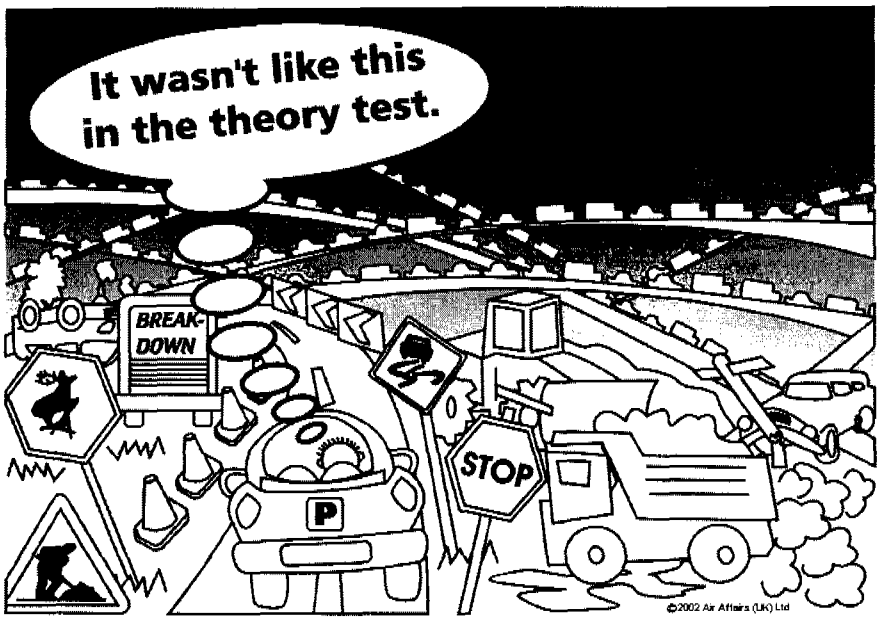


Figure 2 – Discovering too late the need for appropriate assessment

When developing a formal assessment strategy, it is important that the following points are considered, in order to make assessment as effective as possible:

a) ensure that every key point, and all competencies required to be developed in training, are assessed in accordance with requirements defined during the TNA

b) ensure that the assessment methods employed are appropriate to the material trained and in accordance with methods identified as suitable in the TNA.

Competence assessment documentation (an example of which is presented at Appendix F) should be produced for each module of training produced. This should identify what evidence needs to be collected during assessment. It should also define the means by which evidence should be acquired, to confirm that a satisfactory level of competence has been developed during the module (and, taken together, during the course as a whole).

Trainers must be sensitive to trainees' reactions on receiving their assessment results. Some will have their confidence developed by successfully completing assessment. Others will be disappointed that they have not done as well as they expected. In all cases,

it may be necessary to offer feedback and further information, to advise trainees where they performed well, and where they need to improve.

5.3 Continuous assessment

Effective trainers employ continuous assessment throughout a course. It involves informal monitoring of students' performance through monitoring of their participation, response and demonstrated understanding.

5.4 Course module assessment

As already indicated, it is important to assess training appropriately. This applies both to competencies, and to modules which train underpinning knowledge and/or performance criteria in support of those competencies.

5.5 Progressive assessment

When a module or section of the course is of a significant duration, interim assessments of trainee development may be employed to ensure that progress is being made. For example, in train driver training, the development of competence during practical handling experience may require regular assessment, enabling appropriate action to be taken where development in certain areas is significantly delayed.

5.6 Initial competence assessment

Formal competence assessment should be performed by a competent (as defined in Railway Group Standards) assessor who has not been directly involved in delivering training to the person being assessed.

Assessment should ideally take place in the working environment, against the criteria and standards identified. Where this is not possible, a suitable alternative should be used. For example, when assessing emergency procedures, assessment in the operational environment may be impossible, and a form of simulation, perhaps the same equipment that was used for training, may be appropriate for assessment purposes.

It is important that records are made and retained of the methods and results of assessment, along with any supporting evidence.

5.7 Competence reassessment

Reassessment should be conducted regularly, to comply with Railway Group Standards where provided, or at periods identified to permit effective mitigation of the effects of skill fade. Reassessment should be conducted against the current standards.

5.8 Dealing with failure

Where a trainee fails to meet the required standards of the assessment, a process should be employed which:

a) identifies the reasons for, and severity of, the failure

b) identifies which areas need to be addressed

c) assesses the requirement for additional training

d) agrees an action plan

e) identifies a review and reassessment strategy.

The agreed action plan should be formulated in consultation with the:

a) trainee

b) trainee's line manager

c) assessor

d) training and development manager.

Depending on the nature, cause and severity of the failure, a number of actions may be agreed, and could include one or a combination of the following:

a) additional briefings

b) additional mentoring for a defined period

c) additional, tailored training

d) retraining of specific training modules

e) complete retraining.

These mechanisms only relate to problems where the cause of failure is competence based. Where the underlying cause is not easily addressable by further training, advice should be sought before any action is agreed. In all cases, records should be kept of the nature, cause and severity of the failure, actions taken, the agreed review plan and the re-assessment date.

Reassessment should be conducted against the same criteria, and using the same strategy, as the initial assessment.

6 Evaluating and updating a training course

6.1 Scheduled evaluation

The evaluation of training is an essential part of the training cycle. Evaluation is used to ensure the effectiveness of new training materials, and to facilitate the maintenance and revision of existing training.

A process for evaluating training courses on a regular basis should be established and implemented. The process should involve students, trainers, assessors and managers, and should analyse the effectiveness of not only the content of training and assessment, but also the method and quality of their delivery.

6.2 Feedback

In addition to the scheduled evaluation of training materials, processes should be developed to respond to ad hoc feedback from within or outside the organisation. Internal feedback may typically come from trainers, trainees, managers or internal auditors. External feedback may come from external auditors, assessors, customers and other sources.

Feedback may be driven by observation of performance during or after training, or may specifically relate to training content, delivery or assessment. It may also be driven by observation of issues and events apparently unrelated to training, such as excessive wear and tear to equipment, environmental impact assessments, or efficiency studies.

A process should be developed which identifies personnel responsible for receiving and collating feedback, assessing potential training implications (to content, methods and media, or assessment procedures), and for implementing change.

Appendix G illustrates the training process, together with suggested feedback pathways between phases.

6.3 Legislation or policy changes

Training may require evaluation and revision following changes to legislation or company policy, or in response to formal Inquiry findings. Processes should be developed to determine the implications of any change on existing training, to manage revisions to training courses, and to ensure appropriate re-training and assessment of personnel as required.

7 Trainers' needs

7.1 Development needs of trainers

The quality of training personnel is an essential component in an effective training system.

Trainers should typically develop and maintain competence in the following principal performance areas:

a) Training skills – the ability of the trainer to impart knowledge and develop competence, consistently and in accordance with the company's defined requirements, effectively using the full range of media identified and available for the purpose.

b) Assessment skills – the ability of the trainer or assessor to conduct formal or informal assessments against defined standards and performance criteria, consistently and impartially.

c) Technical skills – trainers should have adequate, current competence in the materials being trained. This is important both to permit them to develop flexible and responsive training, and to ensure the credibility of trainers.

d) Pastoral skills – trainers may be the principal point of contact for trainees who encounter problems during training. These may relate to their work or training performance or personal issues. Trainers must therefore be able to respond sensitively to issues observed or reported by trainees, and to implement appropriate actions to resolve or mitigate them.

The training needs of trainers should be identified, addressed and managed using formal and rigorous processes, consistent with those described above for meeting trainees' development needs.

7.2 Resource needs of trainers

In addition to providing trainers with the necessary skills to conduct effective training, the company should ensure that they are provided with the necessary support and resources to meet demand for their services. The following factors may need consideration in this respect:

a) annual trainee throughput and class size

b) maximum contact time allowed between a trainer and the students

c) time required by trainers, outside of training, to maintain competence

d) documentation a trainer will be required to produce

e) training design, development and evaluation tasks trainers are required to perform

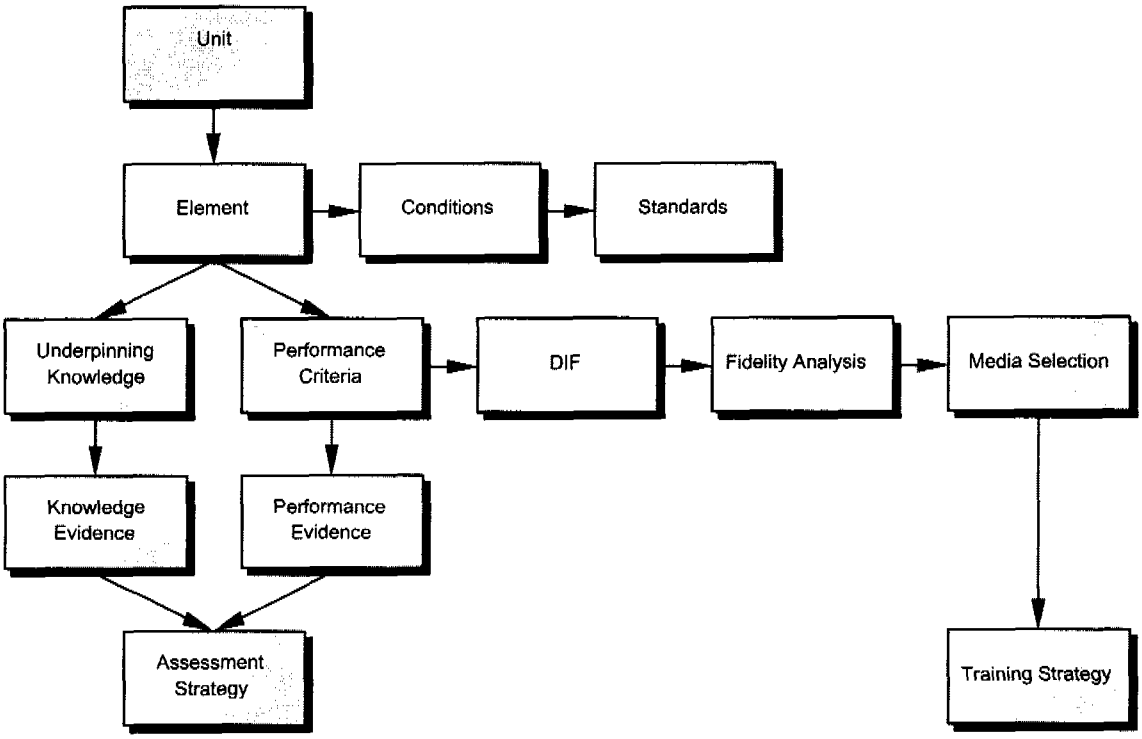
f) the maximum supportable student-trainer ratio for the training media being used

g) necessary preparation, assessment and marking time.

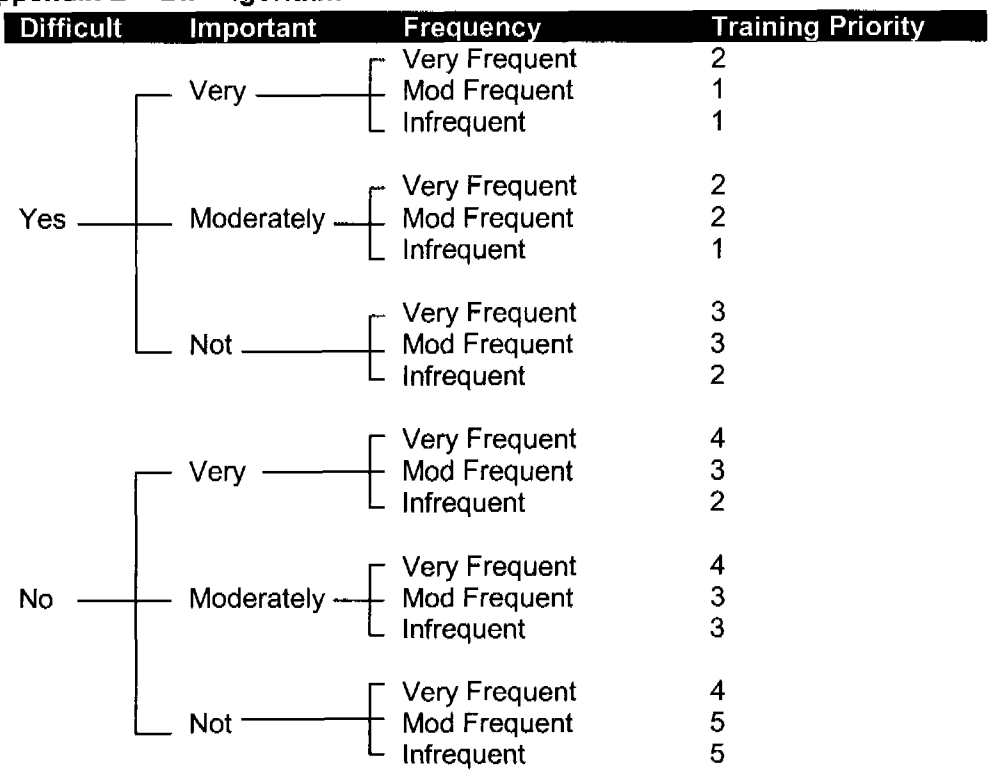
8 Bibliography

- Training For Competence: A Handbook for Trainers and FE Teachers – Laurie Field and Dennis Drysdale.
- The Assessment of Performance and Competence – L. Walklin.
- The Evaluation of the National Competence Awards – N. Evans.
- Competency Based Education and Training – J. Burke.
- BR 8420 TG 1 RNSETT Training Guide 1 – The RN Instructions for the Conduct of Training Needs Analysis.
- BR 8420 TG 2 RNSETT Training Guide 2 – Analysis and Design of Training.

Appendix A – Proposed TNA Process



Appendix B – DIF Algorithm



Key to training levels

Training Priority 1 – Very high priority. Very high training standards required to ensure skill retained without frequent practice on the job.

Training Priority 2 – High Training Priority. Training standards must be equivalent to the level required to do the task competently without further training or practice.

Training Priority 3 – Moderate training priority. Training standards may be below those required to do the job efficiently, using on-job training to develop competence.

Training Priority 4 – Low training priority. Training standards may be well below competent task performance. Formal training merely provides basis for subsequent on job training and practice.

Training Priority 5 - Formal training not required. Task can be picked up easily on the job.

The training priorities identified at this stage are only a guide to the likely priorities to be accepted and may subsequently be amended when other factors such as the consequences of failure, trainee throughput, existing facilities and policies are taken in to account.

The following definitions of difficulty, importance and frequency are offered as possible help when conducting a DIF analysis:

a) Difficulty – An assessment of the complexity of the task, for a trained individual (on the basis that a novice will find all tasks difficult).

b) Importance – An assessment of the consequence of failure. Where the implications of error may be life threatening or cause significant disturbance to operations, the task is likely to be considered to be very important. Where a failure can be easily rectified, then it may be classified as unimportant.

c) Frequency – if a task has to be performed many times a day it should be regarded as frequent, if it is to be conducted between once a day and once a week it may be regarded as moderately frequent, and if less than once a week it may be regarded as infrequent. This measure may require customisation, depending on the overall nature of tasks.

Appendix C – Training Media Definitions

Name	Definition	Advantages	Disadvantages
CBT	Training controlled, delivered and possibly assessed by computer. It usually has a structured format and will direct trainees' progress, providing text, diagrams, sound, photos and videos as required.	Consistency of delivery Reduced trainer requirement Allows self-paced training Can provide objective assessment Can be distributed Delivers defined training Easily replicable	Initial expense No scope for discussion No scope for student questions Lead time for up-dates Poor for developing manual performance skills
CAL	Training delivered and possibly assessed by a computer but managed and delivered by an trainer using and controlling the computer to deliver information and scenarios in a consistent format.	Some consistency of delivery Can provide objective assessment Scope for discussion Scope for questions Trainer able to deliver some modifications Easily replicable	Initial expense Not distributable without trainer Lead time for software updates Poor for developing manual performance skills
Chalk and Talk	Training controlled and delivered by a qualified trainer using standard classroom equipment including overhead projection, whiteboards and PowerPoint presentations.	Low initial expense Scope for discussion Scope for questions Modifications quickly incorporated	Through life costs may be expensive May require several trainers Training suffers as class size increases Not distributable Difficult to control consistency Assessment may be subjective Difficult to conduct self-paced training Difficult to replicate Poor for developing manual performance skills
Linear Video	VHS videotape which can be used to impart knowledge and procedural skills and place them in the operational context. Training still largely under the control of an individual, and delivered in a formal setting.	Consistent delivery Easily replicable Runs on cheap equipment Scope for questions with trainer Scope for discussions with trainer Illustrates the bigger picture Easily distributable	Poor for developing manual performance Initial cost can be expensive Updates costly Cannot conduct assessment Fixed pace of instruction Limited shelf life

Name	Definition	Advantages	Disadvantages
DVD	Non-linear video which can be used to impart knowledge and procedural skills and place them in the operational context. Training still largely under the control of an individual, and delivered in a formal setting. Key points can be readily located and revisited.	Consistent delivery Easily replicable Runs on cheap equipment Scope for questions with trainer Scope for discussions with trainer Gives bigger picture Easily distributable Can be incorporated into computer or PowerPoint presentations Can be easily interrupted and a different start point found	Poor for developing manual performance skills Initial cost can be expensive Cannot conduct assessment Fixed pace of instruction Can be expensive to update
Part Task Trainer	A mock-up of a real item, or part item, of equipment which can be used in support of a specific performance criteria or competence where performance is complex or intricate. It can be either computer-based or replicated real equipment. It will require a trainer.	Good for teaching performance and/or procedures Scope for questions with trainer Scope for discussions with trainer Can be self paced Many units reduce cost price	Initial cost can be expensive Updates costly May have a limited shelf life Does not allow for the bigger picture to be viewed Difficult to maintain training consistency Not easily distributable May need expensive equipment to support. Limited value for knowledge training
Static Simulation	A simulation of the real equipment with cues given to the trainee through the equipment (vision, sound, dial movement etc) and responses made by the equipment to student input. Control is supplied by the trainer who configures and controls the scenarios.	Consistent standards of delivery Objective training Good for teaching performance and/or procedures Realistic pace for trainee response Easily configurable and controllable Can replicate emergency or unusual scenarios safely Teaches entire competencies Can be interrupted and restarted Can be stopped for training points	Expensive to procure Expensive to maintain Expensive to update Typically allows for individual training only Poor for delivering underpinning knowledge Not distributable May require special facilities Limited scope for discussions Limited scope for questions May require several trainers

Name	Definition	Advantages	Disadvantages
		Can be used for assessment	
Dynamic Simulator	A simulation of the real equipment with cues given to the trainee through the equipment (vision, sound, motion, dial movement etc) and responses made by the equipment to student input. Control is supplied by the trainer who configures and controls the scenarios.	Consistent standards of delivery Objective training Good for teaching performance and/or procedures Realistic pace for trainee response Easily configurable and controllable Can replicate emergency or unusual scenarios safely Teaches entire competencies Can be easily interrupted and restarted Can be stopped for training points Can be used for assessment	Expensive to procure Expensive to maintain Expensive to update Typically allows for individual training only Poor for delivering underpinning knowledge Not distributable May require special facilities Limited scope for discussions Limited scope for questions May require several trainers
Electronic Performance Support System (EPSS)	A laptop computer or other portable device which has some CBT elements as well as a relational database which can be used to follow, learn or practice a procedure, operationally or in training. Information is presented in text, graphical, pictorial or video forms. It may be keyboard, mouse, touch screen or voice activated and capable of reacting to voice inputs as required.	Consistency of delivery Minimal trainer requirement Allows self-paced training Can provide objective assessment Can be distributed Delivers defined training Easily replicable Allows for on-job training Delivers information and training when and where required Easily updateable	Initial expense No scope for discussion / questions Not distributable Lead time for updates Limited anecdotal evidence Poor for developing none IT manual performance Poor for prompting immediate responses
Static Real Equipment	Can be used to deliver procedural training. The physical fidelity is excellent, but the environmental fidelity may be limited by the inability to represent motion.	Good for teaching performance and procedures Easily configurable and controllable Can replicate unusual /emergency scenarios safely Can be easily interrupted and	Expensive to procure Expensive to maintain Expensive to update Environmental risks need to be managed Limited in training role Typically allows for individual training only Inconsistent conditions

Name	Definition	Advantages	Disadvantages
		restarted Can be stopped for training points	Limited consistency of delivery May need one trainer per equipment Not distributable
Operational Real Equipment	The use of the real equipment in the real environment. It will respond to all cues and interactions in the correct manner and in the correct timescale.	Distributable Good for teaching performance and procedures Realistic pace for trainee response Easily controllable Teaches entire competencies Can be used for assessment	Expensive to procure Expensive to maintain Expensive to update Typically allows for individual training only Environmental risks need to be managed Limited in training role Inconsistent training conditions Limited consistency of delivery May need one trainer per equipment Cannot replicate emergency or unusual scenarios safely Cannot be easily interrupted and restarted Cannot be stopped for training points
Stimulated Real Equipment	The use of real equipment stimulated to perform and react as it would in the real environment. The equipment has the highest fidelity and will respond to the inputs received by the stimulating source and the operator.	Consistent standards of delivery Good for teaching performance and procedures Realistic pace for trainee response Easily configurable and controllable Can replicate unusual /emergency scenarios safely Teaches entire competencies Can be interrupted and restarted Can be stopped for training points Can be used for assessment	Expensive to procure Expensive to maintain Environmental risks need to be managed Typically allows for individual training only Expensive to update Likely to require more than one trainer

Appendix D – Suggested Media Risk Analysis Format

Media[1]	*CBT*		
Risk No[2]	*1*	**Risk Title**[3]	*Obsolescence*
Risk Description[4]	**Assessed Risk (Low/Medium/High)**		*High*
The CBT may become obsolete due to the equipment it is describing having a limited operational timescale. When the equipment leaves operational service the CBT content may not be appropriate to the replacement equipment specifically or the procedure in general.			

Mitigating Actions[5]	**Cost**[6]
Option 1: Make the CBT content generic in nature with only limited equipment specific content and provide either real or replica equipment to train on. *Option 2: Ensure that the equipment-specific content is easily replaceable i.e. photos, diagrams and video can be removed. And text can be amended.*	*~ no additional cost for CBT* *~ £30k for additional equipment.* *~ £15k approx*

Anticipated Impact[7]	**Anticipated Modified Risk (Low/Medium/High)**
Option 1: Will still be useable to a certain degree but will have reduced overall training effectiveness. *Option 2: By replacing the photos, diagrams and video clips and amending the text the usability of the system life extends and is likely to be effective for longer.*	*Low* *Low*

The information contained in the above table is an example only and should not be applied to any training equipment procurement without assessing the situation and equipment being procured, and the company's operation.

[1] The selected media for which risk is being assessed.
[2] This should be a unique identifier, either for the media, or for all risks for all media.
[3] E.g. delivery timescales, escalating cost, need for additional facilities, reliability, reliance on a single provider or the possibility of a changed requirement etc.
[4] This should elaborate on the Risk Title to amplify the area where the risk exists in relation to the specific media. It is possible that Risk Title may have more than one risk associated to it and a form should be completed for each risk within that area.
[5] List what actions should be taken to reduce or control the risk or its impact.
[6] This should be an estimate of the cost of the mitigating action(s).
[7] This should describe how the intended actions will impact on the identified risk and either reduce or control its effect.

Appendix E – Suggested Training Documentation Format

Module No		**Module Title**	
Lesson No		**Lesson Title**	
Facilities Required			
Training Media Required			
Max Student Trainer Ratio		**Additional Staff Required**	
Duration of Instruction			
Safety Issues			
Performance Criteria			
Underpinning Knowledge			
Additional Information / documentation			
Last Update:	**Responsibility:** **Contact No:** **Signature:.....**		**Next Update due:**

Appendix F – Competence Assessment Documentation

Module No[8]		Module Title[8]	
Element(s)[9]			
Conditions		Standards	

Performance

Criteria[10]	Evidence[11]

Assessment

Method[12]	Conditions[13]	Standards[14]

Knowledge

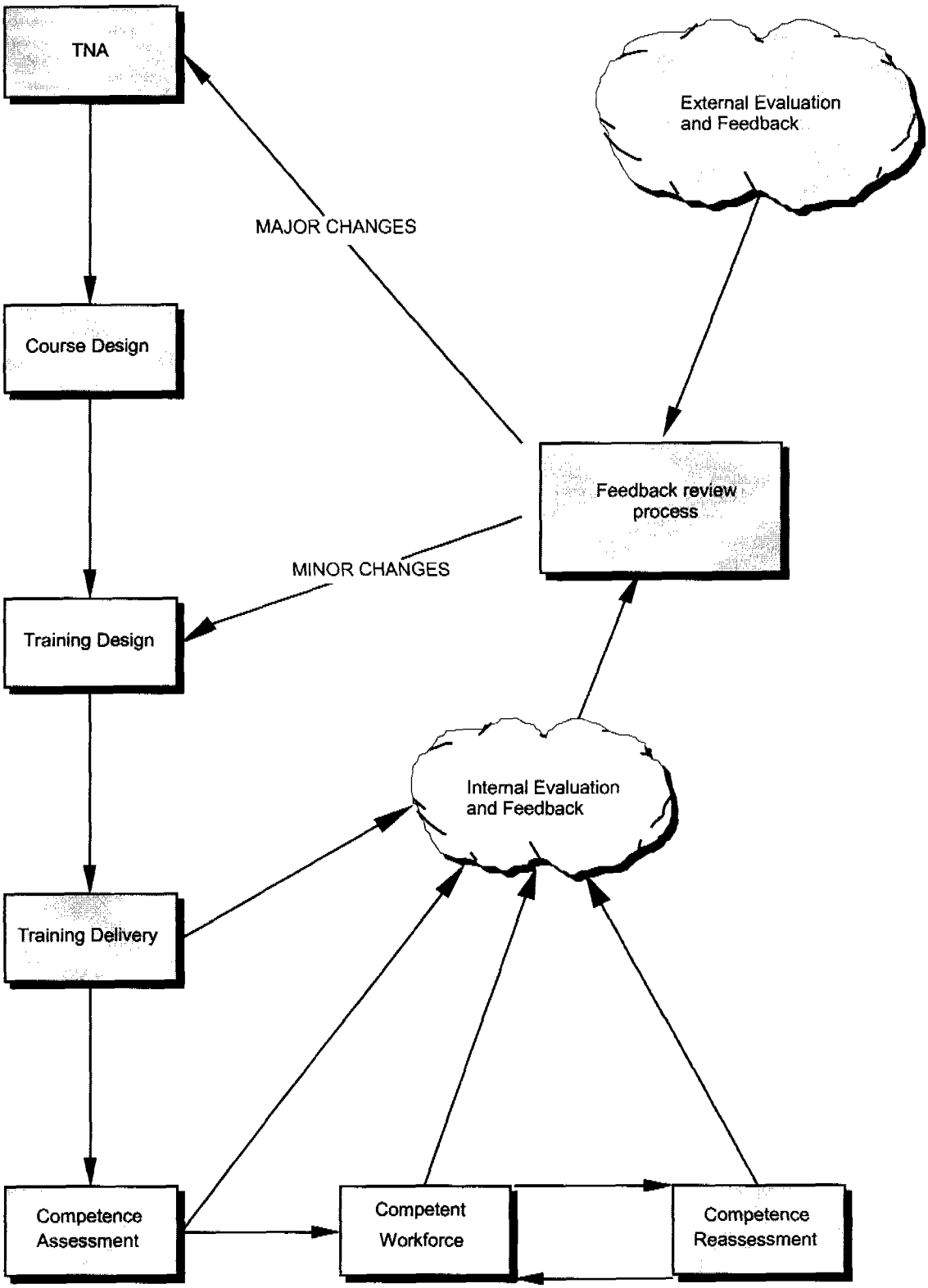
Underpinning[15]	Evidence[16]

Assessment

Method[12]	Conditions[13]	Standards[14]

[8] Taken directly from the relevant training documentation
[9] A list of the elements, together with associated conditions and standards, which constitute the module being assessed.
[10] The performance criteria drawn from the elements and module which are to be assessed should be listed
[11] The evidence of performance criteria required to demonstrate competence, with the methods identified.
[12] The method used to assess the performance or knowledge elements should be identified here. Reference should be made to the requirements of the relevant Railway Group Standard and any national occupational standards, or other mandated methods for assessment.
[13] The conditions under which the assessment is to be conducted should be identified, especially where they differ from those associated with the list of contributing elements.
[14] The standards to be achieved in the assessment should be identified, especially where they differ from those associated with the contributing elements.
[15] The items of underpinning knowledge to be assessed should be listed.
[16] The evidence required to demonstrate adequate underpinning knowledge, with the methods identified.

Appendix G – The Training Process (showing feedback pathways)



ANNEXURE I

DRAFT RAIL SAFETY (SAFETY MANAGEMENT SYSTEMS) REGULATION

PART 1. PRELIMINARY

1. Name of regulation

This Regulation is the Rail Safety (Safety Management Systems) Regulation yyyy.

2. Commencement

This Regulation commences on dd mmm yyyy.

3. Definitions

In this Regulation:

PART 2. SAFETY MANAGEMENT SYSTEMS

4. Safety management system

1. It is a condition of the accreditation of a railway operator that it must establish and maintain a safety management system which is predicated upon achieving continuous improvement to the organisation's safety performance and comprises, at a minimum, the following:

2. Organisational development

   (a) Organisational policy, strategic direction and practical objectives which are translated into coherent specific policies, strategic directions and practical objectives for each division, region or other sub-unit of the organisation.

(b) Establishment of the responsibilities, accountabilities and authorities of individual members of the executive, management and other levels of the organisation for achieving the matters set out in sub-clause 4(2)(a).

(c) Establishment of an effective management system for the organisation and its sub-units which, at a minimum, covers:

(i) the internal influences which may affect the risk exposure of the organisation;

(ii) the external influences, such as interfaces, which may affect the risk exposure of the organisation; and

(iii) the need for the organisation to comply with any relevant legislative or regulatory instruments.

(d) A consistent, coherent and documented process for making decisions regarding the organising, planning and implementation of programs designed to address issues arising from establishing the organisation's risk profile.

(e) A consistent, coherent and documented process for validating the decisions made under sub-clause 4(2)(d) above that will achieve the desired results in terms of improved safety performance.

(f) A consistent, coherent and documented set of performance measures which the organisation will use to determine whether it has effectively delivered the outcomes anticipated by its activities under sub-clause 4(2)(c).

3. Implementation

(a) Establishment of a comprehensive register of controls to address the matters identified in sub-clause 4(2)(c) so that any risk the organisation is exposed to is effectively addressed.

(b) Identification of the resources, both physical and human, which are required to effectively mitigate any risk identified in sub-clause 4(2)(c) and ensures that such resources are made available under all contingencies.

(c) Assignment of direct responsibility, as documented by the rail operator and endorsed and approved by the ITSRR, to specific members of the

executive, management or other layers of the organisation for the implementation of identified controls.

4. Monitoring

(a) Collection, analysis and dissemination to all levels of the organisation of data which effectively indicates the performance of the organisation in addressing matters identified under sub-clause 4(2)(c).

(b) Establishment of the necessary processes, such as but not limited to internal and external audits and inspections, to verify that controls it has established to address risks identified under sub-clause 4(3)(a) are being properly implemented.

(c) Conduct of thorough and impartial investigation and analysis of all safety related incidents which involve the organisation to determine what actions the organisation is required to implement to address identified safety deficiencies in the organisation's operations. The outcomes of such investigations must be disseminated to all levels of the organisation.

(d) Establishment of consistent, coherent, comprehensive and documented processes to rectify any perceived or actual deficiencies in the safety management programs of the organisation to address risks identified under sub-clause 4(2)(c).

5. Confirmation

(a) Establishment of processes to ensure that any corrective actions arising out of monitoring/review action or otherwise are properly programmed and implemented.

(b) Establishment of appropriate processes to ensure that any change occurring either internally or externally to the organisation which may effect its risk profile or the manner in which it manages safety are managed effectively.

(c) Establishment of systems to clearly identify changes to the railway operations which may require it to seek a variation to its accreditation and

an effective and documented process to ensure such changes are notified to the ITSRR at the earliest opportunity.

6. Integration

(a) Establishment of processes to ensure the integration of any safety reforms within its existing business processes.

7. Communication

(a) Establishment of processes to inform, advise and disseminate information regarding the organisation's safety performance to:
   (i) external organisations which may have the capacity to effect the capacity of the accredited organisation to deliver safety outcomes; and
   (ii) internal sub-units or other organisations which may have the capacity to effect the capacity of the accredited organisation to deliver safety outcomes.

(b) Establish processes to thoroughly consider opinions, advice, comments or recommendations of the consulted bodies and establish processes for ensuring that any acceptance, rejection or otherwise of the consulted organisation's views must be documented.

8. Ensure that the railway operator's safety management system complies with any guidelines which may be issued by the ITSRR from time to time and published in the Government Gazette.

PART 3. ANNUAL SAFETY REPORT

5. Annual safety report

1. It is a condition of the accreditation of a railway operator that it must prepare and submit to the ITSRR on the anniversary of its

accreditation an Annual Safety Report which contains the following:

(a) A comprehensive assessment of its safety performance over the previous 12 months including:

(i) each of the performance measures identified under sub-clause 4(2)(f), particularly in relation to whether they have been achieved or otherwise during the 12 month period;

(ii) where the performance measures have not been achieved, a detailed explanation of the circumstances which have led to the performance measures not being achieved;

(iii) an assessment of the performance of each of the members of the accredited operator's executive, management or other relevant layers of the organisation in meeting their individual accountabilities as assigned by the safety management system under sub-clause 4(3)(c);

(iv) the results of all activities undertaken to monitor the performance of the organisation under its safety management system;

(v) the current status of all corrective actions which have been identified as required during the 12 month period along with the current status of any corrective actions which have been carried forward from previous annual safety reports.

2. In developing its Annual Safety Report an accredited operator must comply with any guidelines established by the ITSRR and published in the Government Gazette.

PART 4. ANNUAL SAFETY MANAGEMENT PLAN

6. Annual safety management plan

1. It is a condition of the accreditation of a railway operator that it must prepare and submit to the ITSRR on the anniversary of its accreditation an Annual Safety Management Plan which addresses the priorities, objectives and programs the railway proposes to undertake

during the succeeding 12 months to improve its safety. At a minimum, the plan must contain the following:

(a) Any adjustments to its program of safety activities or priorities for action as detailed in the previous year's annual safety management plan which have resulted from the analysis of its safety performance as reported in the Annual Safety Report required under Part 3 of this regulation.

(b) Any adjustments to its program of safety activities or priorities for action which have resulted from developments in its operations over the previous 12 months.

(c) Any adjustments to its program of safety activities or priorities for action which have resulted from the completion of specific programs over the previous 12 months.

(d) The specific programs which it proposes to undertake to address safety related matters including:

(i) the safety benefits which will accrue from the implementation of the program;

(ii) identification of the member of the executive, management or other layer of the organisation with specific responsibility for ensuring the program will be implemented;

(iii) identification of the resources to be allocated to implementing the program;

(iv) identification of the performance measures identified for the program.

2. In developing its Annual Safety Management Plan an accredited operator must comply with any guidelines established by the ITSRR and published in the Government Gazette from time to time.

PART 5. TRANSITIONAL PROVISIONS

7. Initial Safety Management Plan

1. A person who is an accredited operator under the Rail Safety Act 2002 must, within six months of the commencement of this regulation, develop and submit to the ITSRR for approval an initial Safety Management Plan which:
    (a) Provides a comprehensive analysis of the current status of its capacity and capability to manage safety.
    (b) Provides a comprehensive management plan to implement the requirements of this regulation and the time frames which this will take.

2. Once the ITSRR has accepted this initial Safety Management Plan, the organisation must implement it in accordance with the regulation.

ANNEXURE J

TESTS AND EXAMINATIONS UNDERTAKEN ON G7

1. Brake system

Underframe mounted braking equipment

- Inspection of the condition of the underframe mounted braking equipment and isolating cocks on each of the cars of G7.

- Inspection of the condition of all internally mounted brake equipment, including the position of all isolating cocks and any other items of operating equipment.

EP brake

- Brake controller (electrical portion) (car 6831).
  - Upper portion damaged, could not undergo functional testing.
    - Comprised electrical components of brake controller, including cams and cam following limit switches.
    - Electrical continuity tests performed.
    - Visual and electrical examinations of electrical portion of brake controller conducted.
  - Lower portion intact.
    - Comprised pneumatic components of the brake controller, including the auto brake pilot valve and emergency brake valve.
    - Subjected to factory test regime at manufacturer's premises.
    - Took into account the higher brake pipe pressure which resulted from the use of a non-Tangara pilot valve cam.

- Code conversion unit.
  - Testing of code converter unit in accordance with test document no. FSR5218, test certificate for C28276, where possible (car 6831).

- Supply strainers.
  - Testing of all EP supply strainers.
  - Tested to determine if they restricted the air supply to the motor car EP brake units.
  - Tested at Maintrain using compressed air supply.

- EP brake unit—factory testing.
  - Damaged and undamaged were tested.
  - One damaged had damaged sub-component (seven step relay) that could not be repaired; was tested with overhauled sub-component.
    - Damaged sub-component was visually and electrically examined.
  - Sub-components (WG triple valves) from cars 6831 (#1 end) and 5816 (#1 end) were tested on a computerised test bench.

- Testing of brake valves on manifold, and of individual components, where required (all cars).

Auto brake system

- Brake controller (see brake controller section, below).
  - Pneumatic portion tested.

- Auxiliary brake unit.
  - Comprises lock out magnet valve and auto brake relay valve.
  - Electrically and pneumatically tested at premises of Knorr Bremse.

- Brake pipe.
  - Not tested as part of examination, function inferred by other facts.

- Supply check valves.
  - Tested to determine if restricted or blocked the supply of air to the auto brake.
  - Tested at Maintrain, Auburn using compressed air supply.
  - Tested main reservoir check valves and brake pipe check valves (on all cars).
  - Tested all supplementary reservoir check valves (all cars).

- Auto Brake Units—factory testing.
  - Three of four were tested normally.
  - Fourth had damaged sub-component, and was tested with overhauled sub-component.
    - Damaged sub-component visually examined.
  - Damage assessments conducted for each.
  - Remedial work conducted where necessary and possible.
  - Triple valve from unit from car 5816 was tested separately.
  - Fractured seven step valve and variable ratio relay valve from car 5816's unit were visually and electrically examined at Maintrain, Auburn.

- Guard's emergency brake valve (emergency cock).
  - Driver's car valve (emergency cock) tested: (car 6831).
  - Guard's car valve (emergency cock) visually examined (handle detached in accident): (car 6832).

Brake equipment isolating cocks

- The position of the brake equipment isolating cocks was visually examined at Maintrain.

Brake actuator, callipers and discs

- Inspection and testing of bogie-mounted brake equipment: all cars.

- Tested friction brake components comprising the pneumatic brake cylinders, combined pneumatic and park brake cylinders, brake linkages, callipers, disc pads and discs.

- Brake components were first function tested while mounted on the bogies, at Maintrain, by measuring the calliper forces when compressed air was connected to the brake cylinder line. Calliper forces were measured using a force transducer connected to a laptop computer.

Wheel slide protection system

- Testing of and data extraction from wheel slip control units: all cars.

- Wheel slide unit.
  - All four units subjected to post overhaul testing at premises of manufacturer, Knorr Bremse.

- Dump valve.
  - All 16 units subjected to post overhaul testing at premises of manufacturer, Knorr Bremse.
  - Testing of anti-skid valves for all cars.

Park brake system

- Park brake on button (driver's desk) (car 6831).
  - Visually inspected.
  - Switch block visually examined for mechanical and electrical defects.
  - Internal electrical contacts were visually examined for electrical defects.
  - Electrical wiring from the switch to the power supply was tested electrically.

- Park brake on button (guard's desk) (car 6832).
  - Electrical continuity testing.

- Park brake control valve.
  - Tested for all cars at Maintrain, post overhaul.

- Park brake actuator.
  - Park brake actuators from cars 5866 and 6832 function tested at Maintrain while mounted on bogies.
  - Park brake actuators from cars 6831 and 5816 factory tested at premises of manufacturer, Knorr Bremse, after being removed from bogies.
  - Spring park brake.
    - Tested in cars 5866 and 6832 at Maintrain, Auburn, by visual observation of calliper clamping onto brake disc.
    - Tested in cars 6831 and 5816 at Knorr Bremse by measuring the actuator force using force transducer with readings recorded from digital display.

- Functional tested on both bogies of cars 5866 and 6832 at Maintrain.
- Factory tested on both bogies of cars 6831 and 5816 at Knorr Bremse.

- Park brake cylinders
  - Testing of park brake cylinders, in accordance to the Knorr Bremse test code DW-UD-60-01-EN (all cars).

Electric brake system (function of the traction system)

- Tested availability of electric brake effort.

Brake related train wires (see train wiring section, below)

- Set of critical train lines examined.

Brake related control circuits (see also driver's console section, below)

- Examination by electrical and visual inspection.
- Indicator lights.
  - Electrically tested in driver's desk.

Driver's desk brake cylinder gauge

- Dual needle brake cylinder gauge from driver's desk tested, using compressed air supply and a calibrated pressure gauge at Maintrain.

2. Deadman system

- Testing of all electrical and pneumatic components of deadman's system (all from car 6831 except control governor and control governor 2).

- Deadman solenoid and emergency application valve (car 6831).
  - Electrically and pneumatically tested at premises of Knorr Bremse.
  - Energised and de-energised solenoid valve.
  - Units' components also separately tested.
  - Full testing of deadman solenoid valve and emergency application valve (car 6831), in line with test specification, Ct-262 Westcode Deadman solenoid valve Sydney Tangara cars.
    - Combined separate testing of deadman solenoid valve and emergency application valve.
    - Combined separate testing of deadman solenoid valve.
    - Combined separate testing of emergency application valve; tested with 16L reservoir.
    - Combined separate testing of emergency application valve; re-tested with 8L reservoir.

- Deadman handle (master controller) (car 6831).

- Limit switch and handle visually and electrically examined at Maintrain.
- Electrical testing included continuity and insulation tests of the deadman circuit from the terminal strip to the switch and the tail of the attached loom.
- The handle was also rotated by hand to ensure the free and correct operation of the cam and cam following limit switch.

- Deadman switch (master controller) (car 6831).
  - Insulation tested across its contacts at 500V DC (Megger tested) with the handle released.
    - Occurred after the master controller was removed.
  - Tested for full functionality.
    - Open circuit (devices released and deadman pedal fully depressed): 500V DC insulation test across terminals.
    - Closed circuit (handle turned, pedal switch depressed to midpoint): 10V applied via digital multimeter (DMM) across terminals and via wires.
  - Tested to prove operation of each master controller micro switch.

- Deadman pedal (car 6831).
  - Tested in car 6831 prior to removal (although fully depressed position was not checked at that time, due to the need to inspect the switch for damage before depressing the pedal).
  - Testing of force to operate deadman pedal—force required to engage, retain engagement, and disengage; force applied to centre of foot plate; force manually applied and varied. Use of outside party to rig up continuity. Use of Mecmesin force measurement system and recording of force display.
  - Electrical and mechanical testing of deadman foot pedal (cars 6831 and 6832), to determine the electrical switch functionality and to determine the force and displacement characteristics of each pedal.
  - Tested for full functionality.
    - Open circuit (devices released and deadman pedal fully depressed): 500V DC insulation test across terminals.
    - Closed circuit (handle turned, pedal switch depressed to midpoint): 10V applied via digital multimeter (DMM) across terminals and via wires.

- Deadman pedal limit switch (car 6831).
  - Electrically inspected.

- Deadman pedal plate assembly (car 6831).
  - Damaged; visually inspected.

- Deadman handle and pedal (car 6831).
  - Incorporated into a test rig with relays and air components (control governor, deadman relay, and deadman valve) drawn from the train, so that functionality could be proven in a practical manner, replicating installation in G7.

        - Governors from car 6832 were used, since those from car 6831 were too badly damaged.
        - Air was provided to the governor at around 500 kPa and the pressure varied to test the governor action.
        - Test rig designed by Halcrow and reviewed by State Rail Authority and D Higgins of the Special Commission – it conformed to the State Rail Authority Tangara schematic drawings 4-70-01087, 88 and 97, which are the control schematics and trailer air brake schematic.
        - Train management system (TMS) functions were provided by a switch box.
        - A spare master controller was utilised to provide the reverser and notching functions.
    - Test rig testing.
        - Deadman facility was tested for pedal and handle operation with air and 120 V DC available.
        - Train 10 km/h relay was given simulated TMS control feed as appropriate.

- Control governor (traction) and CG2 (park brake control) (car 6831).
    - Tested on the test bench.
    - Up to 450 kPa against their normal operation pressure of 350 kPa.

- Deadman treadle (car 6831).
    - Non invasive inspection of deadman treadle, with determination of the physical condition of the micro switch and lever connection.
    - Testing of deadman treadle while fitted to another Tangara train, measuring the operating forces using the deadman treadle test apparatus.

- Deadman diodes (car 6831).
    - Visual Inspection and testing of three diodes associated with deadman circuit—using multimeter, tested forward and reverse diode characteristics.

- Deadman-related indictors on driver's desk (car 6831).
    - Tested electrical status of bulbs in driver indicator cluster on driver's instrument panel.

3. Traction system

Traction-related components

- Tested gate control units (GCU's) (see Gate Control Unit section, below).

- Tested all the transistors (IGBTs) in each of the four power inverters.
    - Inspection of IGBTs to check the condition of the semi conductors in the VVVF Inverter modules.
- Tested all the traction motors, speed transducers.
    - Tested for traction motor turning, winding resistance, insulation resistance, and free rotation.

- Tested speed probes.
    - Tested signals produced, end gaps measured and phase relationship noted.

- Tested all 16 traction motor speed sensors.

- Tested two GCU interface units.

- High tension equipment was tested as part of the test rig.

- Inspection of TMS equipment and unit connections.

- TMS data downloading.
    - TMS Mode 1 fault record memory downloaded by State Rail Authority.
    - TMS Mode 3 fault record memory downloaded by Mitsubishi.

- Tested the functionality of the pantograph valves.

How testing occurred

- Comprehensive test rig constructed to simulate the traction systems of G7.
    - Used as much equipment from G7 as possible.

- Detailed set of tests constructed and documented in test schedule.

- Tests categorised as normal mode tests, train line error tests and special scenario tests.

- Expected results of the tests were predetermined before the tests so that they could be reconciled as each test was completed.

- Testing team included staff from Halcrow, Mitsubishi Australia, Mitsubishi Japan, State Rail Authority and the Special Commission of Inquiry.

GCU data downloading

- Downloading of fault log data from GCU's, under controlled conditions, prior to and after testing (cars 5816 and 5866, and spare GCU).

GCU testing

- Three GCUs (two from G7 and one spare unit provided by Mitsubishi).
    - 69 groups of tests for each GCU.
    - More than 980 tests for train line error combinations were tested for each GCU.
    - Tested for tractive and braking effort demand readings.
    - Tested for response to valid and invalid command signals.
    - Tested for response to return of controllers to off position, as well as release of the deadman circuit, and activation of the emergency brake.
    - Tested for signals displayed regarding emergency brake.

- Inspection of brake blending signals from load sensors for each brake notch and five different load settings.
- Inspection of GCU EPROM contents, with comparison to manufacturer's master software.

GCU test rig and testing details

- Use of test rig and test procedure (from Halcrow Rail).
  - Used low tension relays from G7.
  - Pneumatic feed was provided to the electro pneumatic switches.
  - Control governors were not utilised, but their functions were provided by a switch on the test rig control panel.
  - Utilised a switch panel placed between the GCU and the train lines to provide essential functions, such as:
    - Lamps to indicate status of each train line.
    - Tristate switches, allowing each train line independently to be placed in one of three conditions: (a) condition normal; (b) condition low; and (c) condition high.

- State Rail Authority commissioned a set of expected results against which the GCU testing was reconciled.

- Exhaustive combination of traction and braking sequence tests.

- Special test scenarios.
  - Special scenario one: False fed seven wire; simulated a seven wire false feed, to determine whether each of the following would recover control of the train:
    - Moving master controller to OFF.
    - Dropping the deadman handle.
    - Controller to OFF and reverser to OFF.
    - Reverser to ISOL.
  - Special scenario two: False fed seven wire; simulated a seven wire false feed to determine the effect on braking.

- Supplementary testing of GCU (car 5866).
  - Operation in reverse.
  - Brake wire false feed mid sequence.
  - Brake wire lost mid sequence (including intermittent loss).

- Checksum testing.
  - To ensure that all chips had checksums matching their labels, and that each chip checksum matched that of the corresponding chip in each of the other five chipsets.
  - Chipset extraction.
    - Six sets of devices were tested:
      - A Master set.
      - A set from the spare GCU.
      - Two sets from car 5816.
      - Two sets from car 5866.

4. Train lines (wiring)

Summary of train line testing

Inspection and testing was undertaken for G7's wires and connections in the inter-car couplers; terminations in the boxes which connect to the coupler cables; connections through the train; and connections to on-train equipment.

- Inspection and testing of the wires and connections was limited to those associated with braking, traction, auxiliary services, and/or driver-guard communication.

- Testing consisted of electrical continuity and electrical performance (resistance and insulation) tests.
    - Test criteria for resistance below 5 Ohms.
    - Test criteria for insulation resistance above 10,000,000 Ohms, using 500 volt insulation tester.
    - Testing for insulation resistance to ground and to all other wires was conducted using high voltage (Megger) tests.

- Test rigs were constructed to facilitate connections to coupler wiring.

Initial testing by visual inspection

- Inspection of train line wiring at the couplers and the coupler junction boxes (all cars).

- Identification of damage to wiring (all cars).

- Survey included removal of junction box covers for visual examination, disconnection and inspection of plugs and sockets connecting inter-car jumpers to junction boxes and a general examination of cable ducting (all cars).

- No visual inspection of car internal wiring occurred—this wiring ran inside members and beneath sealed surfaces.

Basic electrical testing

- DC Insulation tests—application of 500V or 1000V DC between a wire and earth or between two wires to measure insulation resistance (Megger test).

- Continuity tests—low voltage test applied between two points in the same wire or circuit.

Electrical tests on couplers

- Electrical testing of train coupling connections from coupling face to cannon connector pin (for end car couplings) and across inter car coupling cannon connectors (not including power connections across couplings.

- Tested before car wiring tests.

- ELTEC contractors engaged by State Rail Authority to undertake the testing.

- Test panel constructed by ELTEC, comprising two main terminal strips, one to be used for each jumper cable.

- Continuity tests carried out first, followed by insulation testing.
    - Insulation testing was done by first testing between each cable and an earth terminal connected to the coupler body. Then, each cable was tested against every other cable, in turn, at 500V DC.

Electrical tests on train wiring

- Low voltage continuity testing of train lines and connections (all cars) and continuity testing of park brake push-button circuit from positive feed to train line (car 6832).

- Continuity testing was conducted with both ends of the train connected to the test panels, all the pins removed, so that no cable was connected to any other by the test panels.

- Testing of electrical insulation (wire to ground and wire to wire) (all cars).

- Insulation testing was conducted on wires of concern, consisting of those wires associated with traction, braking, emergency action, and communication.
    - Insulation tester was itself tested.
    - During testing, all low resistances were checked again to earth and to the wire group without the group earthed.

- ELTEC contractors engaged by State Rail Authority to undertake the testing.

- Two test panels constructed by ELTEC, using Faston shorting terminals.

Electrical tests on relays

- Electrical testing of continuity of low tension control circuits and relays (prior to removal), including test of control positive circuit breaker (car 6831).

- The relays in the circuits of concern (i.e., those affected by the wires of concern) were withdrawn from the train and tested—most were functionally tested in the traction GCU tests.

- Some relays from car 6831 were tested informally.
    - Pick-up test (voltage started at zero and incremented at a low rate, slowing further at around 50 volts).
    - Drop-out test (starting with relays energised, the voltage was slowly decremented until the relays dropped out, i.e., moved from energised to de-energised state).

5. Data logger

On-train testing

- Visual examination of the new wiring work on the train that had occurred during installation of the data logger units.

- Investigation of data logger modification works for any evidence that they compromised the integrity of the train system.

- Continuity and insulation resistance check of the wiring connected to the data logger terminal strip.

Inspection

- Limited, non-intrusive visual inspection, in which no wiring was disconnected and no fasteners were removed (aside from the lid retaining screws).

Data download

- Basic functional testing and download of data.

- Conducted at Fischer Industries Pty Limited.

Factory testing

- Conducted at Fischer Industries Pty Limited's Artarmon factory.

- Use of Fischer Industries' test rig that had been used for testing at the manufacture stage.

- Data logger wiring continuity testing.

- Testing of data logger units to determine whether they compromised the integrity of the train systems being monitored, using the Fischer Industries Pty Limited Mkll Data Logger Service/Repair Procedure.

- Test and inspection procedure involved:
    - Low voltage (multimeter) insulation test between chassis and negative and between chassis and digital '0'.
    - Fault log check.
    - Functional test of all digital input channels using test rig and logger internal test function.
    - Functional test of all analogue input channels using test rig, multimeter and logger internal test function, and test for cross-talk between analogue channels.
    - Speed/distance/time function check and power-off speed to channel isolation test.
    - Keypad test.

- Input impedance measurement (low voltage—multimeter).
- Visual examination of internal construction and condition.

6. Wheels and bogies

Visual examination of the wheels

- Search for indications of markings, with particular attention to the flange and running surface of each wheel.

Examination of car body suspension

- Inspection of bogies to determine the functionality against the functional specifications before their removal—involving major components: bogie frames, supports and brackets, primary suspension fixtures and conical bonded rubber springs.
- Testing included visual examination and dimensional measurement of bogies and wheelsets.
- Tested to determine functionality against functional specifications.
- Included:
  - Measurement of wheels.
  - Inspection of lock wires, tabs, and pins.
  - Inspection of axleboxes.
  - Inspection of axlebox hangers.
  - Inspection of bump stop clearance.
  - Trammelling of the bogie frames.
  - Weighing of the bogies.
  - Inspection of anti-roll bar.
  - Inspection of traction beam assembly.
  - Inspection of wheel back-to-back dimensions.
  - Inspection of wheelsets and axles.
  - Inspection of traction motors and gearboxes.
    - Inspection of traction motor gear box alignment via WN drive inclination.
  - Inspection of primary suspension.
  - Inspection of rail guard assembly, No. 7 wheel of car 6831.
  - Bogie rocking tests.

Analysis of the secondary suspension systems

- The following suspension components were first inspected in situ before their removal from the bogies, and then subjected to detailed examination and testing to determine functionality against functional specifications:
  - Air springs / air bags.
  - Primary springs.
  - Anti-roll bar.
  - Balance valves.

- Levelling valves.
- Limit switches.
- Lateral dampers.
- Lateral bump stops.
- Lateral shock absorbers (Kayaba OD63 dampers).

7. Couplers

Summary

- Examined the following components related to the coupling of G7's cars:
  - Centre pieces.
  - Muff couplings.
  - Energy absorption units.
  - Elastomeric cushions.
  - Draftgear shells.
    - Included vertical swing testing.
  - Pillow blocks.
  - Train line wiring at the couplers and the coupler junction boxes (all cars).

Electrical tests on couplers

- Electrical testing of train coupling connections from coupling face to Cannon connector pin (for end car couplings) and across inter car coupling cannon connectors (not including power connections across couplings.

- Tested before car wiring tests.

- ELTEC contractors engaged by State Rail Authority to undertake the testing.

- Test panel constructed by ELTEC, comprising two main terminal strips, one to be used for each jumper cable.

- Electrical testing of train coupling connections from coupling face to Cannon connector pin (for end car couplings) and across inter car coupling cannon connectors (not including power connections across couplings.

- Continuity tests carried out first, followed by insulation testing.
  - Low voltage continuity testing of train lines and connections (all cars) and continuity testing of park brake push-button circuit from positive feed to train line (car 6832).
  - Testing of electrical insulation (wire to ground and wire to wire) (all cars).
  - Insulation testing was done by first testing between each cable and an earth terminal connected to the coupler body. Then, each cable was tested against every cable, in turn, at 500V DC.

Metallurgical analysis

- Metallurgical analysis of muff couplings.

8. Access/egress documentation

An assessment was conducted of Tangara/G7 access/egress designs, with comparison to functional specifications.

9. Driver's console

Testing of driver's desk—ancillary controls

- Limited to those controls that could have caused or contributed to the accident.

- Examination of all controls on the driver's desk relating to traction, braking and communications, including:
    - Indicators.
    - 120V electrical supply.
    - Park brake controls.
    - Reset and shutdown buttons.
    - Pantograph controls.
    - Gauges—brake pressure, speedo, ammeter.

- Prior to testing, the equipment was subjected to an endoscopic investigation to avoid confusion over the disturbance during its removal from G7.

- First step: to determine the mechanical condition of each switch or instrument.

- Then: complete an electrical continuity test of the wires to the train equipment.
    - If the wire showed a breakage, the point of the breakage was located, where possible, and the continuity of the wire from that point was also tested.
    - Where a wire did not show electrical continuity of less than 5 Ohms or where insulation resistance was not greater than 10 Meg Ohms, it was subjected to further investigation.
    - Electrical testing included:
        - Ancillary controls/bulbs on the driver's desk indicator cluster.
        - Other buttons, gauges, speedometer, and ammeter.

- Specific controls tested included:
    - Driver's lamp cluster, including:
        - Park brake indication.
        - Wheel slide indication.
        - Electric brake indication.
        - Deadman foot pedal operation.
        - Door open indication.
        - Head light failure indication.
    - Electrical supply to switches (auxiliary controls control positive—ACCT).
    - Train saloon lights.
    - Lamp test.
    - Park brakes "on".
    - Park brakes "off".
    - Reset (cab).

- Car uncouple.
- Pantograph “up”.
- Pantograph “down”.
- Driver-guard bell.
- Train management shutdown.
- Train radio emergency button.
- Speedometer.
- Ammeter.
- Brake pressure gauges.

10. Forensic metallurgical examinations

Metallurgical examination of the damaged master controller of car 6831

- Master controller examined in situ amongst remains of driver’s cabin area of car 6831.
  - Visually and internally, with the aid of a boroscope.

- Master controller examined after its removal from car 6831.

- Detailed visual and higher magnification stereoscopic examinations of master controller components performed after its disassembly by Mitsubishi technicians.
  - Performed in conjunction with an assessment of an equivalent model reconditioned undamaged master controller, for comparison.

- Crown wheel (CW) and bevel pinion (BP) gear sets of the power controller and reverser mechanisms removed by Mitsubishi technicians and subjected to higher magnification stereoscopic examination of the operational range of the gear teeth following cleaning by solvent degreasing.

- The connecting plate of the spring mechanism of the master controller’s deadman assembly was removed to facilitate a higher magnification stereoscopic examination.

Metallurgical examination of the damaged brake controller of car 6831

- Brake controller examined in situ amongst remains of driver’s cabin area of car 6831.

- Brake controller examined after its removal from car 6831.

- Detailed visual and higher magnification stereoscopic examinations of brake controller components performed after its disassembly by a Knorr Bremse representative.
  - Performed in conjunction with an assessment of an equivalent model reconditioned undamaged brake controller, for comparison.

- Crown wheel (CW) and bevel pinion (BP) gear sets of the brake controller mechanism removed by Maintrain technicians and subjected to higher magnification stereoscopic examination of the operational range of the gear teeth following cleaning by solvent degreasing.

Metallurgical examination of the components relating to the emergency brake controller of car 6832

- Examinations occurred with regard to:
  - The door section from the cabin of car 6832 that related to the emergency brake controller.
  - The valve assembly of the emergency brake controller from car 6832.
  - The socket bolt and handle.

- Visual examination performed at the Maintrain site, Auburn.

- Examination at higher magnifications (up to x40) of the bore of the socket bolt of the handle assembly, with use of a stereomicroscope.

11. Master controller

Inspection of the master controller

- Inspection was conducted during the dismantling of the master controller, and confirmed that the unit was a standard Tangara G-set master controller.

- Visual inspection determined:

  (1) position of master controller prior to removal activities;
  (2) position of reverser prior to removal activities.

Electrical testing of master controller

- Inspection and testing for position; switches were tested for insulation (switch to switch and open circuit contact testing).

- Electrical testing determined:

  (1) electrical power position of master controller post removal bench test;
  (2) status of deadman electrical contact prior to removal from train;
  (3) electrical status of reverser post removal bench test.

- Master controller switches tested for continuity.

- After disassembly of the controller, the switches and their internal wiring were each held in their open position and insulation tested, using the following instruments:
  - Megger, type MJ20. Serial number 61516.
  - State Rail Authority plate TE17, reference 0210950A.
  - Calibrated 2/11/2002, next calibration due 2/11/2003.

- Tested electrical contacts of the micro switches.

- Tested the sequence of operation of the micro switches.

Forensic testing

- Forensic locksmith determined:
  (1) effect of incident on controller setting positions post removal forensic examination of gears, levers and cams.

Metallurgical testing

- Metallurgical testing of the parts after disassembly of the master controller.

12. Brake controller

Summary

Visual and forensic examinations were conducted on the brake controller. Pneumatic testing occurred while the brake controller was mounted on the test rack, in accordance with Test Specification, CT-252 Westcode EP brake controller Sydney Tangara cars. The brake controller's micro switches were visually examined and electrically tested.

13. Maintenance

Investigation of G7's maintenance history

- The Special Commission of Inquiry oversaw a collaborative review of G7's maintenance, performed as follows:
  - State Rail Authority commenced an internal review of the maintenance and operational history of G7, immediately after the accident.
  - Interfleet Technology, hired by State Rail Authority, compiled a summary history report on the Tangara fleet, spanning the period from inception of the Tangara contract to the present, including the evolution of the Outer Suburban Tangara and of the AC traction set G7.

- The investigation of records was approached with the following purposes:
  - To describe G7 and explain its differences from other Tangara sets.
  - To describe the history of the development of the maintenance regime for G7.
  - To describe the maintenance regime for G7 and any differences between G7 and DC powered trains.
  - To provide details and summarise any irregularities of the maintenance inspections of G7.
  - To provide details and summarise any irregularities of the faults and defects recorded and/or reported for G7—including comparison of G7 to other Tangara sets.
  - To provide the details of and summarise any irregularities of the train management system download for G7.

- To describe the operational history of G7, including details of any reported incidents from February 2000 and a summary of all incidents dating back to G7's entry into service in 1998.

- Particular concentration was assigned to areas of relevance to Special Commission of Inquiry:
  - The G7 set.
  - Bogies.
  - Brake systems.
  - Driver safety apparatus and system.
  - Traction system.
  - Maintenance (with details of G7's maintenance history).

14. Crashworthiness

An assessment was conducted of the crashworthiness performance of G7, according to functional specifications, engineering design drawings, and the structural requirements of the procurement specifications.

15. Additional tests

Low-voltage sense relays

- Testing of low-voltage sense relays (cars 6831 and 6832).

Speedometers

- Testing of speedometers to determine if operational and within calibration (cars 6831 and 6832).

Communication equipment

- Inspection of train radio for functionality and data extraction.
- Testing of the PA/Comm system.

Forensic examinations

- Forensic inspection of windscreen glass, with regard to fracture patterns.