

**Final Report**

# **Interstate Rail Network Audit**

---



**AUSTRALIAN RAIL TRACK CORPORATION LTD**

April 2001

## Table Of Contents

---

- ▶ Executive Summary
- ▶ Study Objectives
- ▶ Audit of ATC Performance Targets
- ▶ Improving Rail's Competitive Position
- ▶ Performance Targets and Investment Costs
- ▶ Investment Appraisal
- ▶ Investment Plan
- ▶ Attachment A - Performance Scenario Evaluation Results
- ▶ Attachment B - Optimisation

## **Appendices (under separate cover)**

---

- A. Evaluation Methodology
- B. Audit of ATC Performance Targets
- C. Competitive Analysis and Performance Targets
- D. Operational and Engineering Cost Estimates
- E. Evaluation Results
- F. Capacity Analysis
- G. Greenhouse Gas Analysis

# Executive Summary

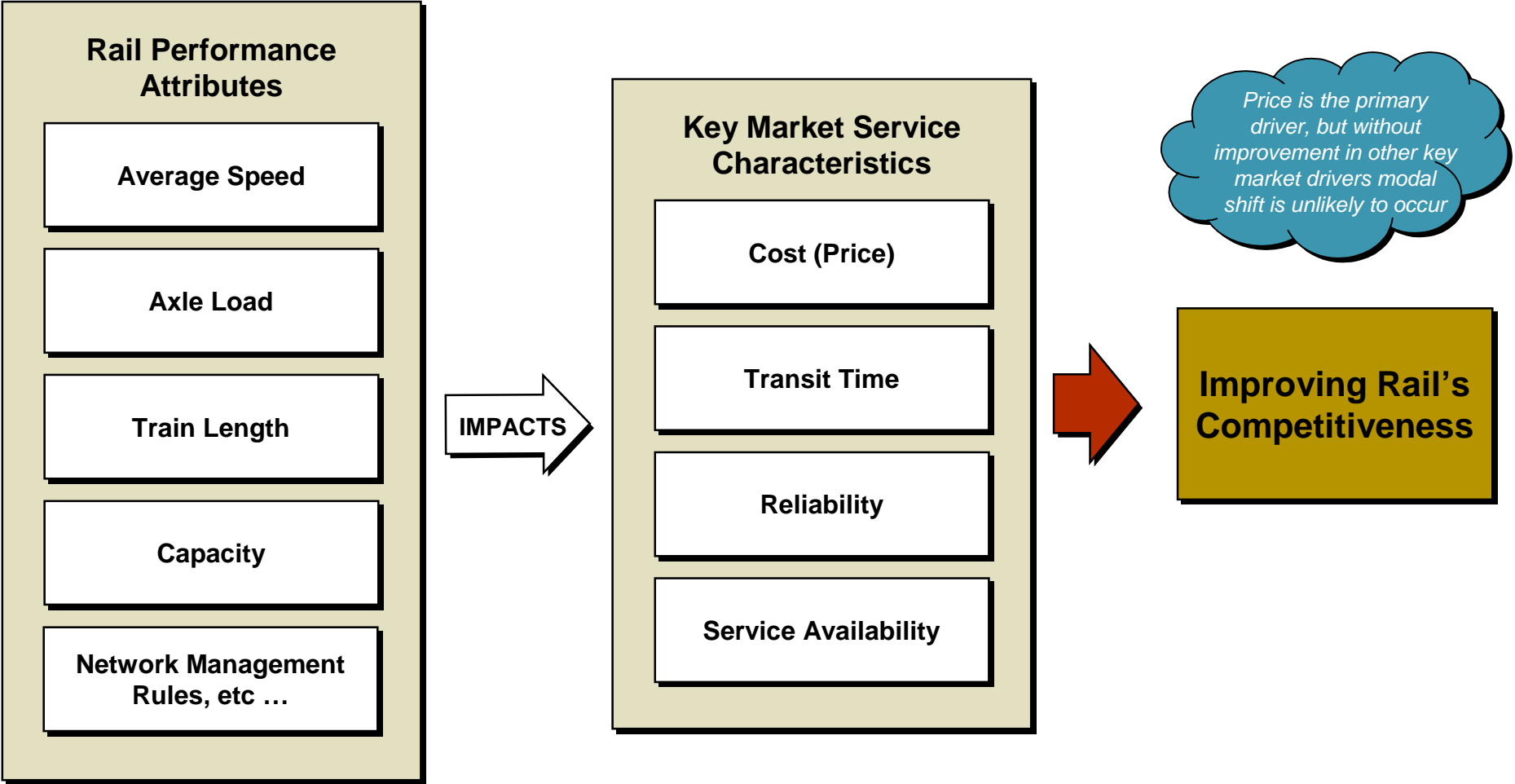
---

## ATC targets do not meet market performance benchmarks in all corridors

---

- ▶ The ATC targets are a uniform set of track infrastructure objectives which have the effect of standardising train lengths, maximum and average line speeds and axle loads across jurisdictions promoting above rail productivity
  - Movement towards the ATC targets has generated significant benefits in some corridors
  - But, in terms of average speed, the ATC targets:
    - ▶ Are not value adding in the Sydney - Melbourne corridor where higher speeds are required to improve rail's market position
    - ▶ Are higher than the present market requirements for the Sydney - Brisbane corridor
- ▶ The ATC targets do not address all of the service characteristics relevant to improving or sustaining rail's competitive market position

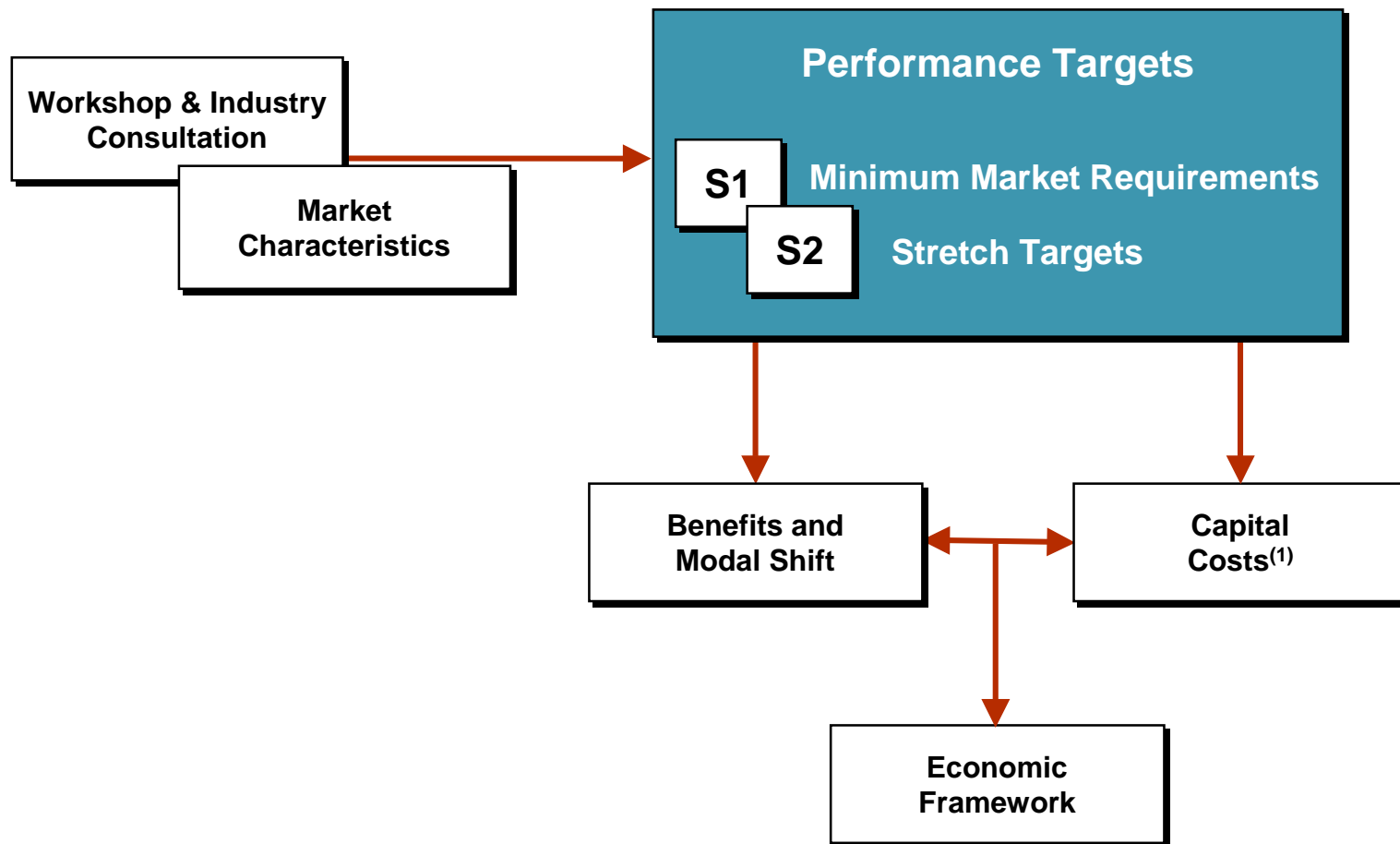
# Improvements in rail’s package of price and service is the key to increasing competitiveness



Note: This Audit has concentrated on line-haul infrastructure condition, management and use  
Other factors such as terminal performance impact on price and service

## Executive Summary

# Two market based performance targets were developed, representing minimum market requirements (S1) and stretch targets (S2)



Note: (1) The capital costs include a mix of operational and infrastructure investments to achieve targets

# Investment to achieve the S1 targets is clearly justified

## S1 Performance Target Evaluation Results

	S1 Investment
Improvement in interstate intermodal market share from base case	31%

Evaluation Results	Undiscounted Capital Costs (\$M)	337
	BCR	3.7
	Benefits (\$M)	1,138
	NPV (\$M)	832

Notes: Excludes the marginal Mel - Adl Investments  
 Mel - Bne investment is the sum of Mel - Syd and Syd - Bne  
 Adjustments have been made for the specific projects found in both the Mel - Per and Syd - Per investments



# The additional investment required to move from S1 to S2 performance levels produces negative incremental returns ...

## S1 and S2 Performance Target Evaluation Results

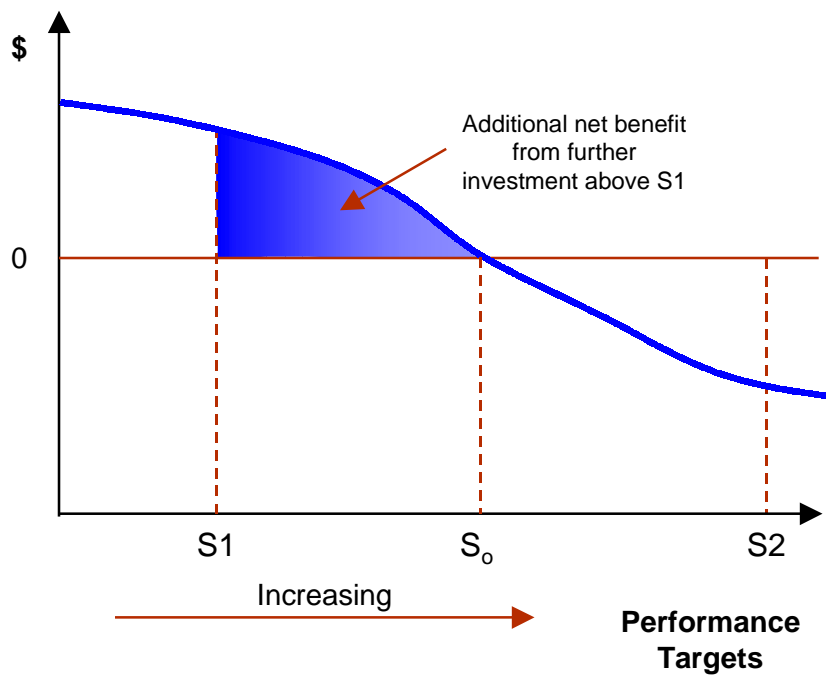
		S1 Investment	S2 Investment	Incremental S1 → S2
Improvement in interstate intermodal market share from base case		31%	59%	
Evaluation Results	Undiscounted Capital Costs (\$M)	337	2,251	1,914
	BCR	3.7	1.2	0.6
	Benefits (\$M)	1,138	2,061	923
	NPV (\$M)	832	323	(509)

Notes: Excludes the marginal Mel - Adl Investments  
 Mel - Bne investment is the sum of Mel - Syd and Syd - Bne  
 Adjustments have been made for the specific projects found in both the Mel - Per and Syd - Per investments

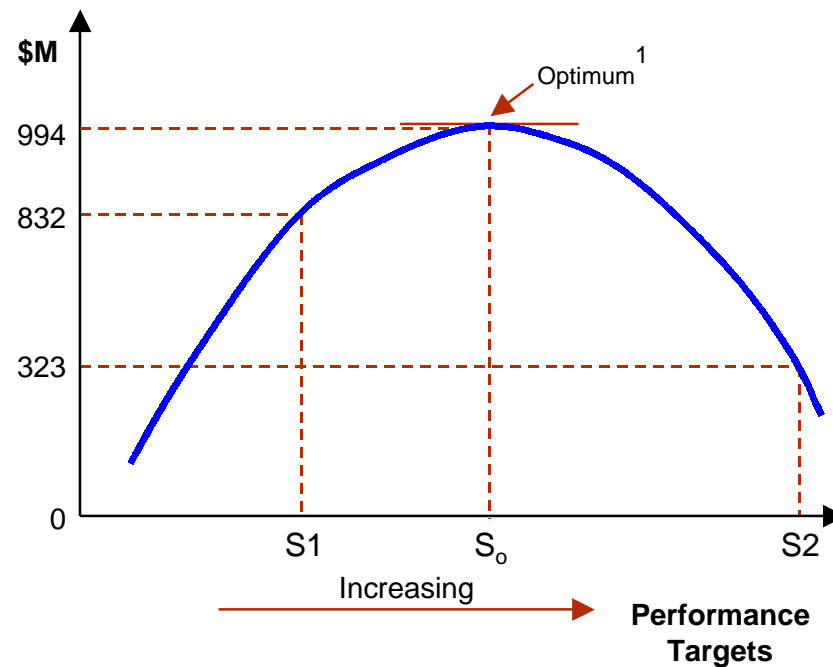
## Executive Summary

... but additional net benefits and modal shift to rail can be achieved through further investment beyond S1

Incremental NPV



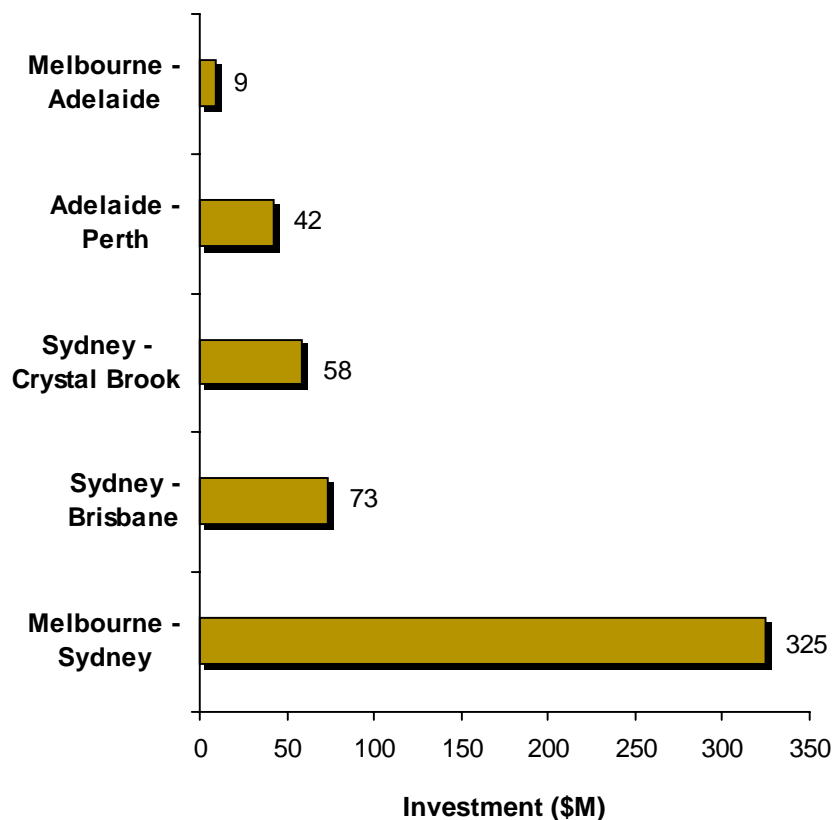
NPV



Note: (1) Based on maximum NPV

# An optimal level of investment was derived based on the maximum NPV beyond S1 (S<sub>0</sub>)<sup>1</sup>

**Optimised Investment Spend by Line Segment (\$M)**



**Optimised Investment Evaluation Results**

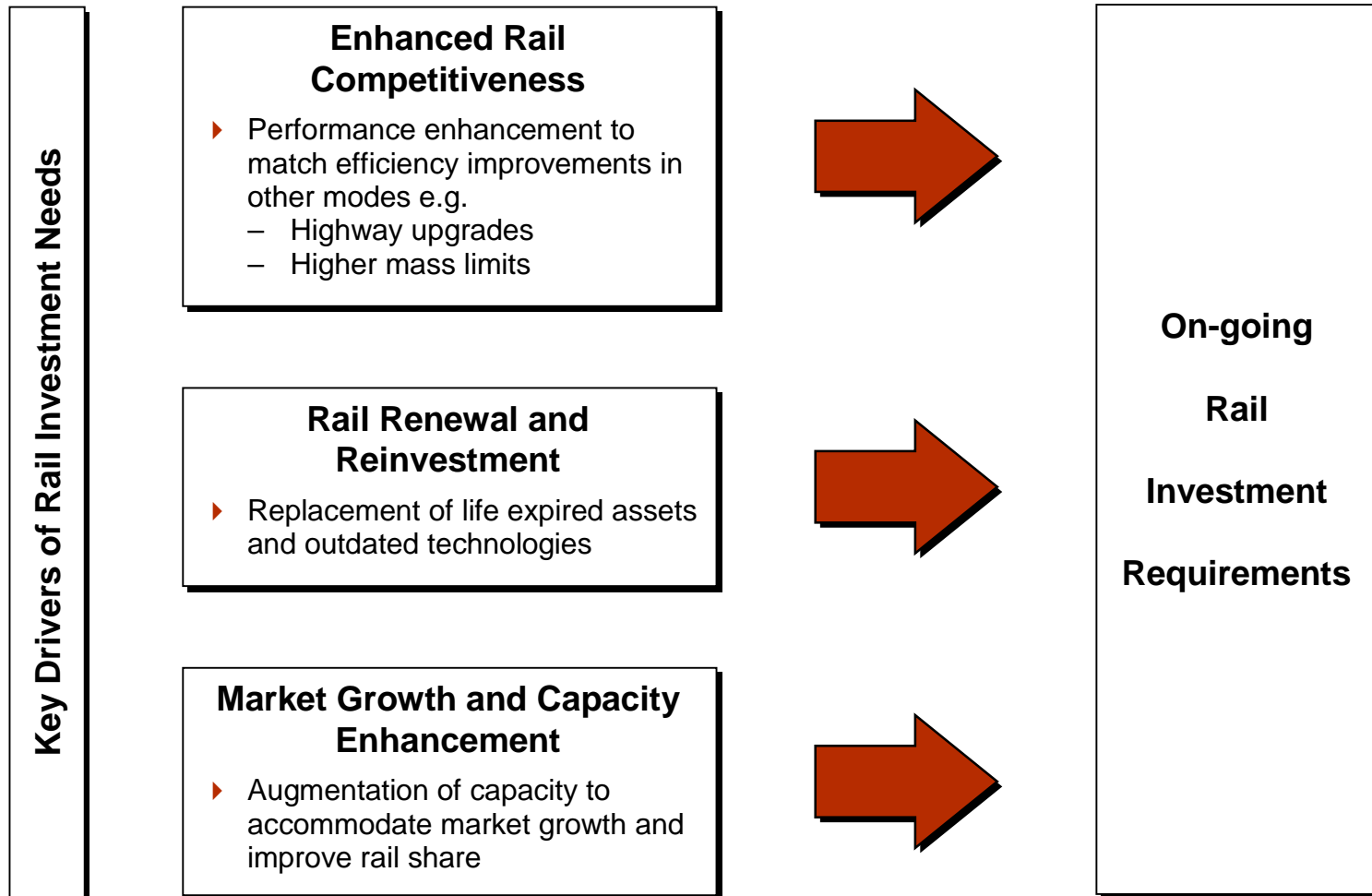
	<b>S<sub>0</sub> Investment</b>
Improvement in interstate intermodal market share from base case	38%

<b>Evaluation Results</b>	Undiscounted Capital Costs (\$M)	507
	BCR	3.2
	Benefits (\$M)	1,453
	NPV (\$M)	994

Note: (1) For the purposes of this study, an optimal investment has been defined as the NPV maximising investment

## Executive Summary

# The optimal investment addresses the present needs for improved rail capabilities, enhancing the ability of rail to self-fund ongoing investment requirements



# On an NPV ranked basis, priority should be given to the upgrade of the North-South corridors

## Optimised Investment (S<sub>o</sub>)



	North-South		East-West	
	Syd - Bne	Mel - Syd	Syd - Per	Mel - Per
Improvement in corridor intermodal market share from base case	59%	77%	12%	6%
Corridor intermodal market share	30%	20%	73%	74%

Evaluation Results	Undiscounted Capital Cost (\$M)	73	325	78	31
	Cumulative Undiscounted Capital Cost (\$M)	73	398	476	507
	NPV (\$M)	410	247	239	98
	BCR	7.2	1.8	4.4	4.5

Note: Investment adjusted to account for the specific projects completed within the Syd - Per investment

## Executive Summary

# These investments would support a substantial tonnage shift to rail on the North - South corridors, representing around 111,000 truck trips per annum

## Estimated Reduction in Truck movements - S<sub>o</sub> (2000)

Corridor	No. of Truck Trips Saved Per Annum	Trucks removed from the total fleet
Syd - Bne	60,000	259
Mel - Syd	51,000	311
<b>Total North - South</b>	<b>111,000</b>	<b>570</b>
Syd - Per	11,000	169
Mel - Per	6,000	72
<b>Total East - West</b>	<b>17,000</b>	<b>241</b>
<b>TOTAL</b>	<b>128,000</b>	<b>811</b>



Externality Benefits
▶ Reduce greenhouse gas emissions
▶ Reduce road accidents
▶ Noise and air pollution savings
▶ Deferred road maintenance expenditure

# Of the investment required, \$155M in funding has already been committed under previous programs

Additional Investment Funding (\$M)

Market	Optimised Investment Costs	Funding Committed in Principle	Additional Investment Funding
Syd - Bne	73	20	53
Mel - Syd	325	132	193
Syd - Per	78	3	75
Mel - Per	31	–	31
<b>Total</b>	<b>507</b>	<b>155</b>	<b>352</b>

# The recommended investment would not detract from future investment on the Melbourne - Brisbane inland route

## Inland Pre-feasibility Evaluation Results

Evaluation Results	Inland Route
Undiscounted Capital Costs (\$M)	1,510
BCR	1.4
Benefits (\$M)	1,905
NPV (\$M)	584

Discussion
<ul style="list-style-type: none"> <li>▶ A decision to invest in the Inland Route would require a more detailed market assessment</li> <li>▶ Regardless, investment of \$398 million on the existing route is justified for traffic moving in and out of Sydney, irrespective of the decision about the inland route</li> <li>▶ The Inland route analysis is largely based on Maunsell McIntyre’s pre-feasibility market estimates (alignment A2M option)</li> </ul>



**Executive Summary**

# **The success of the investment plan requires a single set of consistent management priorities and actions and complementary above rail improvements**

---

- ▶ Corridor investments should be undertaken in their entirety
  - Any piecemeal or partial investment on a corridor will dilute the benefits
  
- ▶ Infrastructure management will need to be co-ordinated and seamless
  - Operators should be able to negotiate through access arrangements with ease and certainty and not be impeded by multiple jurisdictions
  - Train pathing and timetables should be set on a total market basis to ensure maximum benefits are obtained by all parties
  - Train management should be co-ordinated over the whole corridor to maximise opportunities for recovering train delays and to ensure train control decisions take account of network impacts
  
- ▶ Operators' performance must be improved
  - Improved overall rail performance will require on-going improvements in above and below rail performance and terminal efficiencies

## **Study Objectives**

---

## **Rail's competitiveness has consistently declined on a significant portion of the interstate network**

---

- ▶ Up until 1997, the market share of non-bulk freight carried by rail has steadily fallen as a result of improvements in road productivity
- ▶ Road efficiency improvements have exceeded rail in areas including:
  - Technical efficiency of road vehicles compared to rail rollingstock
  - Infrastructure investment allowing mass limit and transit time improvements
  - Harmonisation of regulation across jurisdictions
- ▶ Since 1997 some works have been undertaken to improve the track infrastructure which has arrested the decline in selective corridors
  - These works have been concentrated on the Melbourne to Perth corridor and between Melbourne and Albury

## Study Objectives

# In 1997 a number of reforms were initiated, including the establishment of track performance targets, to address rail's declining share of the interstate freight market

- ▶ In September 1997, Australian State and Federal Transport Ministers agreed to implement reforms to operate interstate rail as a single network, including reforms to investment and access regimes
- ▶ As part of these reforms, the Australian Rail Track Corporation (ARTC) was formed to create a single point of contact for access to the interstate network and to manage investment
- ▶ The Australian Transport Council (ATC) approved a range of track performance targets for the interstate rail network (the ATC targets)
  - These were to be achieved within 5 years

### ATC Track Performance Targets

- ▶ Less than 2% of track subject to temporary speed restrictions
- ▶ At axle loads up to 21 tonnes
  - Maximum speed of 115kph
  - Average speed of 80kph
- ▶ At axle loads of 21-25 tonnes
  - Maximum speed of 80kph
  - Average speed of 60kph
- ▶ Train lengths
  - 1500m North-South
  - 1800m East-West

## Study Objectives

# This study has been commissioned to review network performance against ATC standards and market needs and to establish a business case for future investment

- ▶ The Audit of the interstate network was initiated by the Federal Minister for Transport in response to a suite of reports relating to road and rail industries in Australia
  - Planning not Patching (the Neville Report – Roads)<sup>1</sup>
  - Tracking Australia (the Neville Report, Rail)<sup>1</sup>
  - Revitalising Rail (the Smorgon Report)<sup>2</sup>
  - Progress in Rail Reform (the Productivity Commission Report)<sup>3</sup>
- ▶ The ARTC was given responsibility for the Audit
  - Booz-Allen & Hamilton was appointed as the Prime Consultant
  - Various engineering consultants provided operational and engineering inputs

Note: (1) *The House of Representatives Standing Committee on Communications, Transport and Microeconomic Reform*  
 (2) *The Rail Projects Taskforce*  
 (3) *The Productivity Commission Report*

### Study Objectives

- ▶ Determine the extent to which ATC (Australian Transport Council) targets have been met and what influence they have had in retaining or gaining market share
- ▶ Determine what is required to gain a commercially sustainable shift in modal share by corridor
- ▶ Establish a framework from within which engineering consultants are to provide costed operational, engineering management and investment support initiatives
- ▶ Conduct an economic and financial evaluation of the costed infrastructure investment initiatives provided by the engineering consultants
- ▶ Establish the business case for investment on the Interstate Rail Network which encourages modal shift to rail
- ▶ Evaluate the potential for cash flows from investment to attract potential private investors

## Study Objectives

# The Audit has been conducted with reference to six key interstate markets

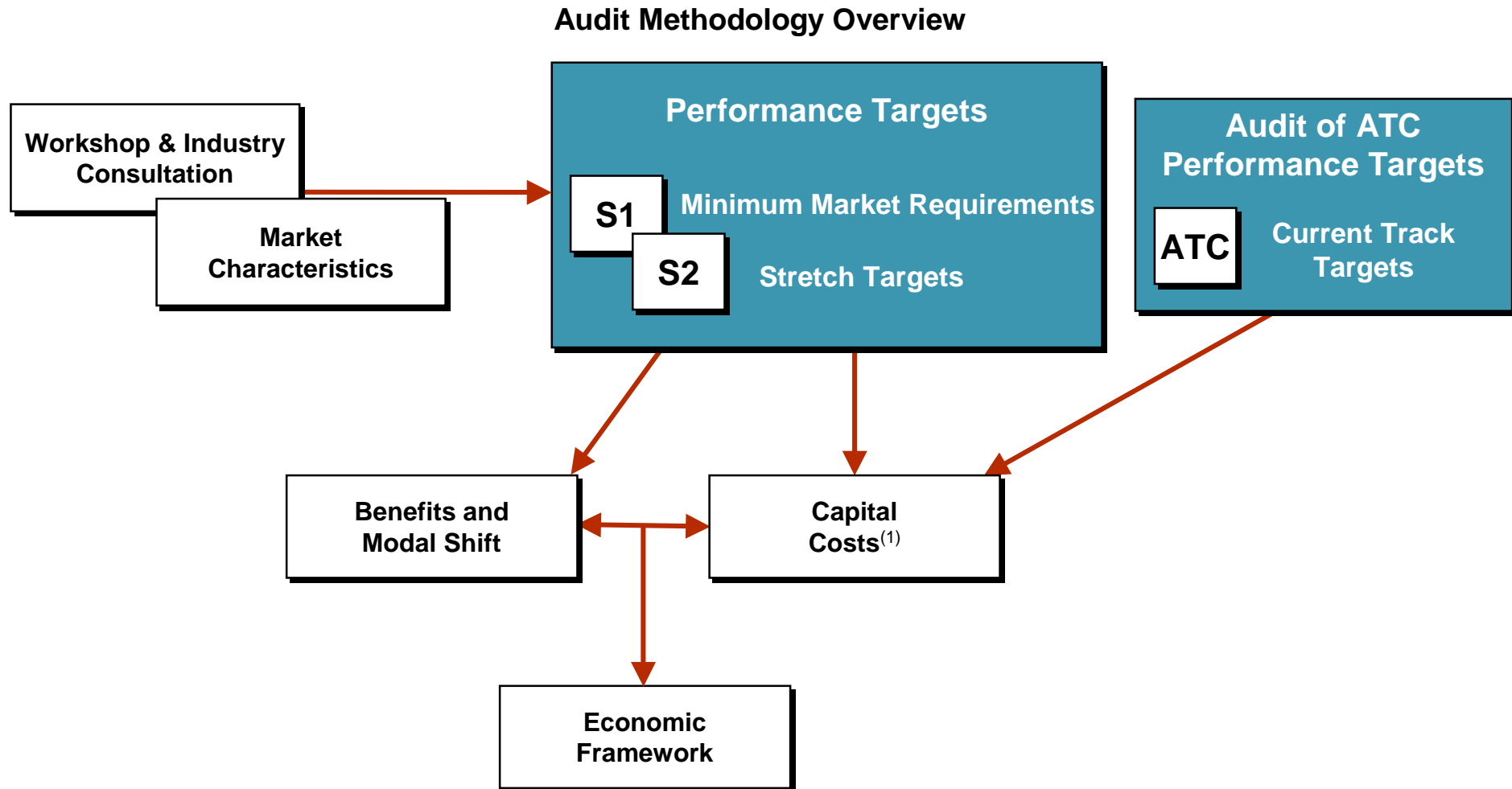
- ▶ The Adelaide – Perth market, where rail already enjoys high market share, was not seen as a critical investment priority
- ▶ The proposed Inland route between Melbourne and Brisbane was reviewed because of the productivity and capacity issues surrounding the existing North-South interstate corridors

### Interstate Markets Reviewed

North - South
1. Melbourne - Sydney
2. Sydney - Brisbane
3a. Melbourne – Brisbane
East - West
4. Melbourne - Adelaide
5. Melbourne - Perth
6. Sydney - Perth
Inland
3b. Melbourne - Brisbane

## Study Objectives

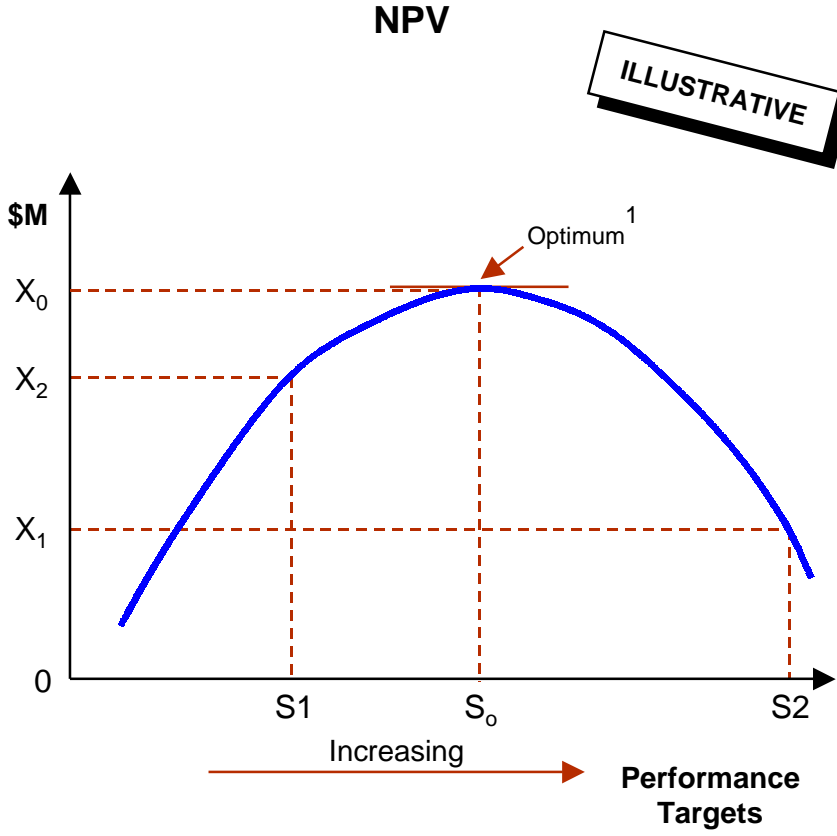
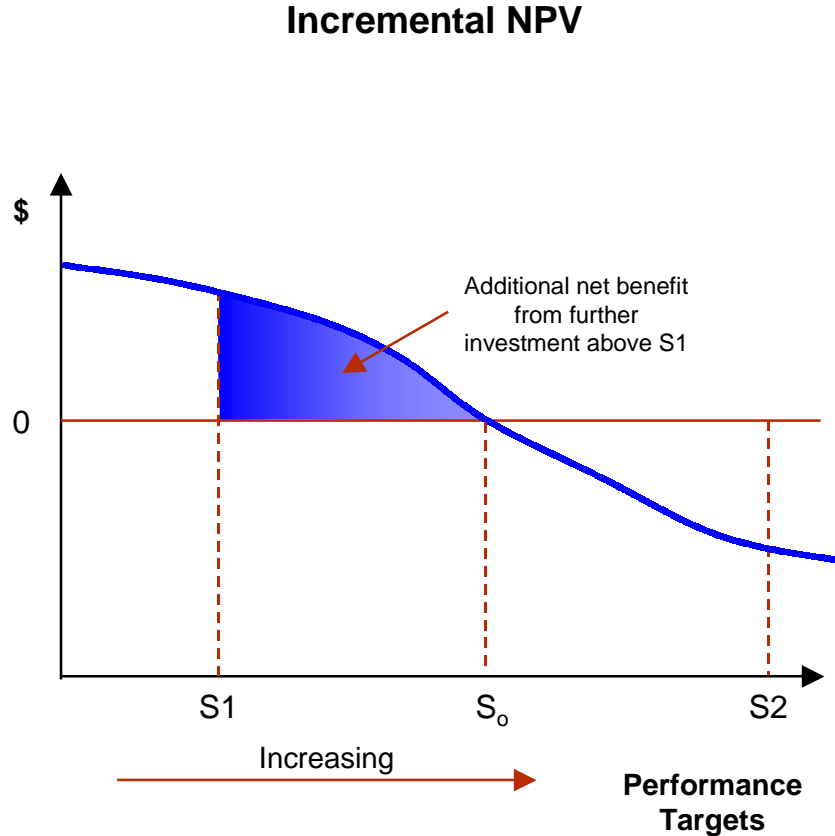
**In addition to the ATC targets, two market based performance targets were developed, representing minimum market requirements (S1) and stretch targets (S2)**



Note: (1) The capital costs include a mix of operational and infrastructure investments to achieve targets

Study Objectives

# The S1 and S2 performance targets were the bookends between which an optimal level of investment could be derived<sup>1</sup>



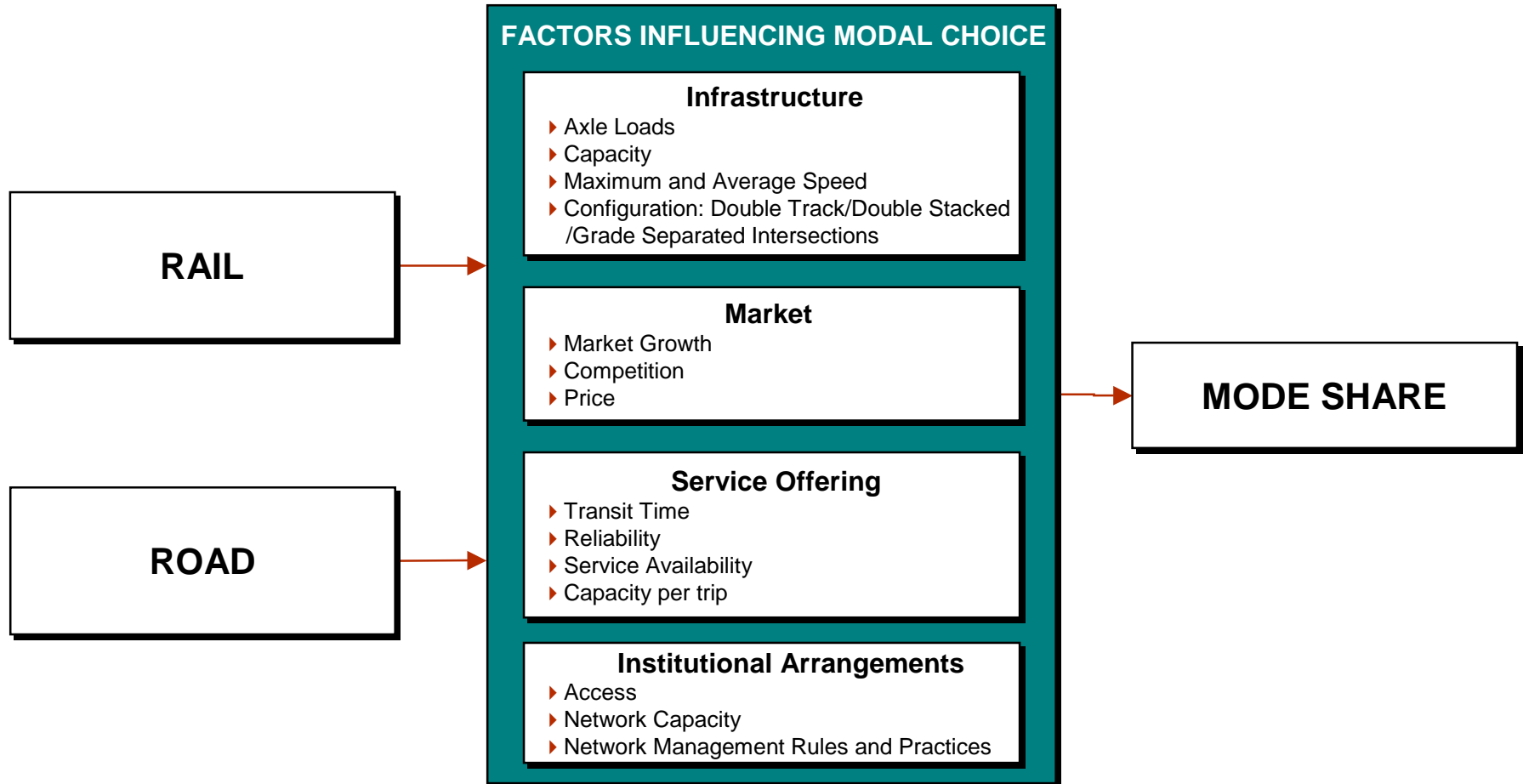
Note: (1) For the purposes of this study, an optimal investment has been defined as the NPV maximising investment



# **Audit of ATC Performance Targets**

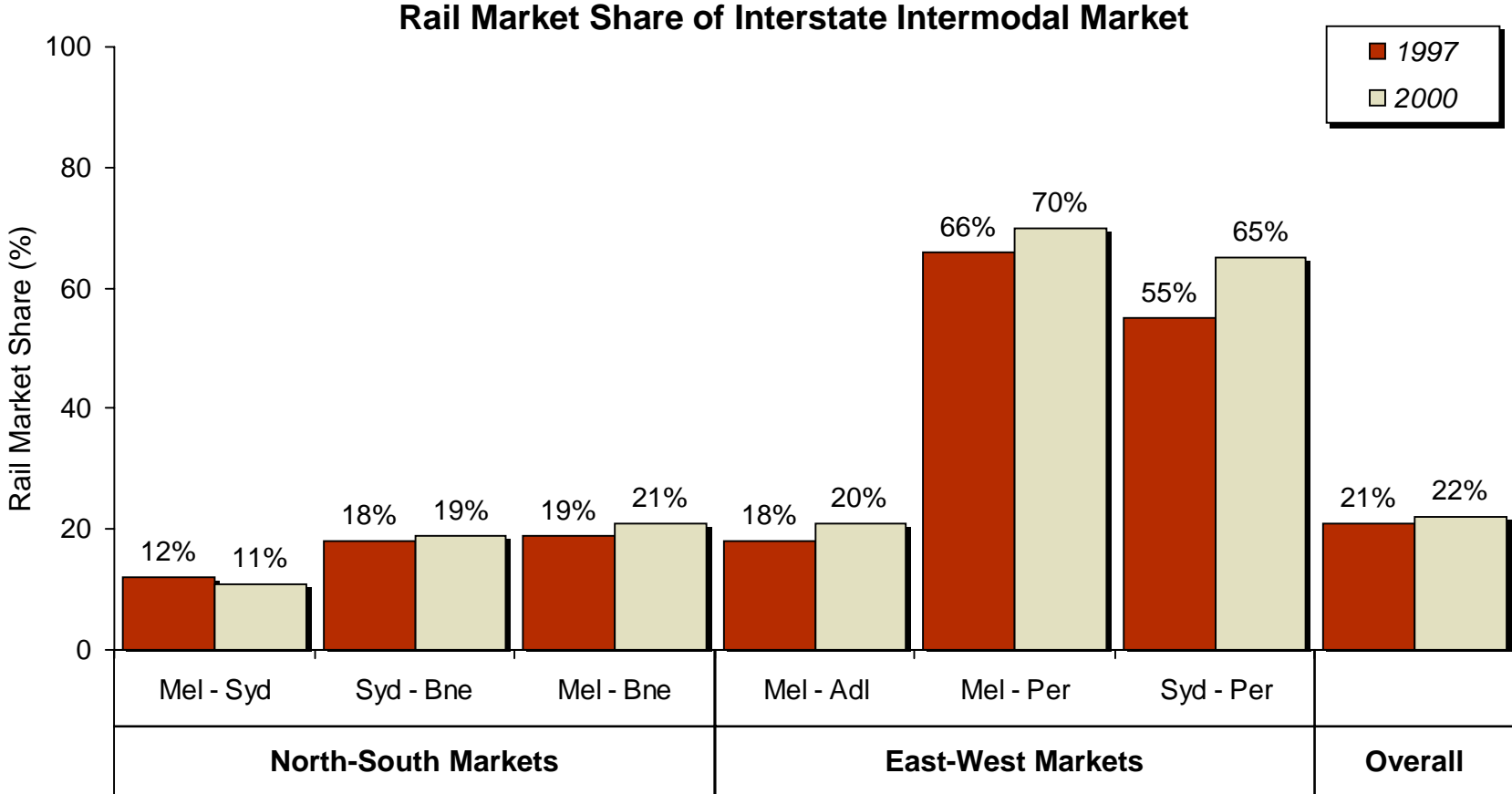
---

## The Audit seeks to identify the influence that track improvements have had and could have on improving rail market share



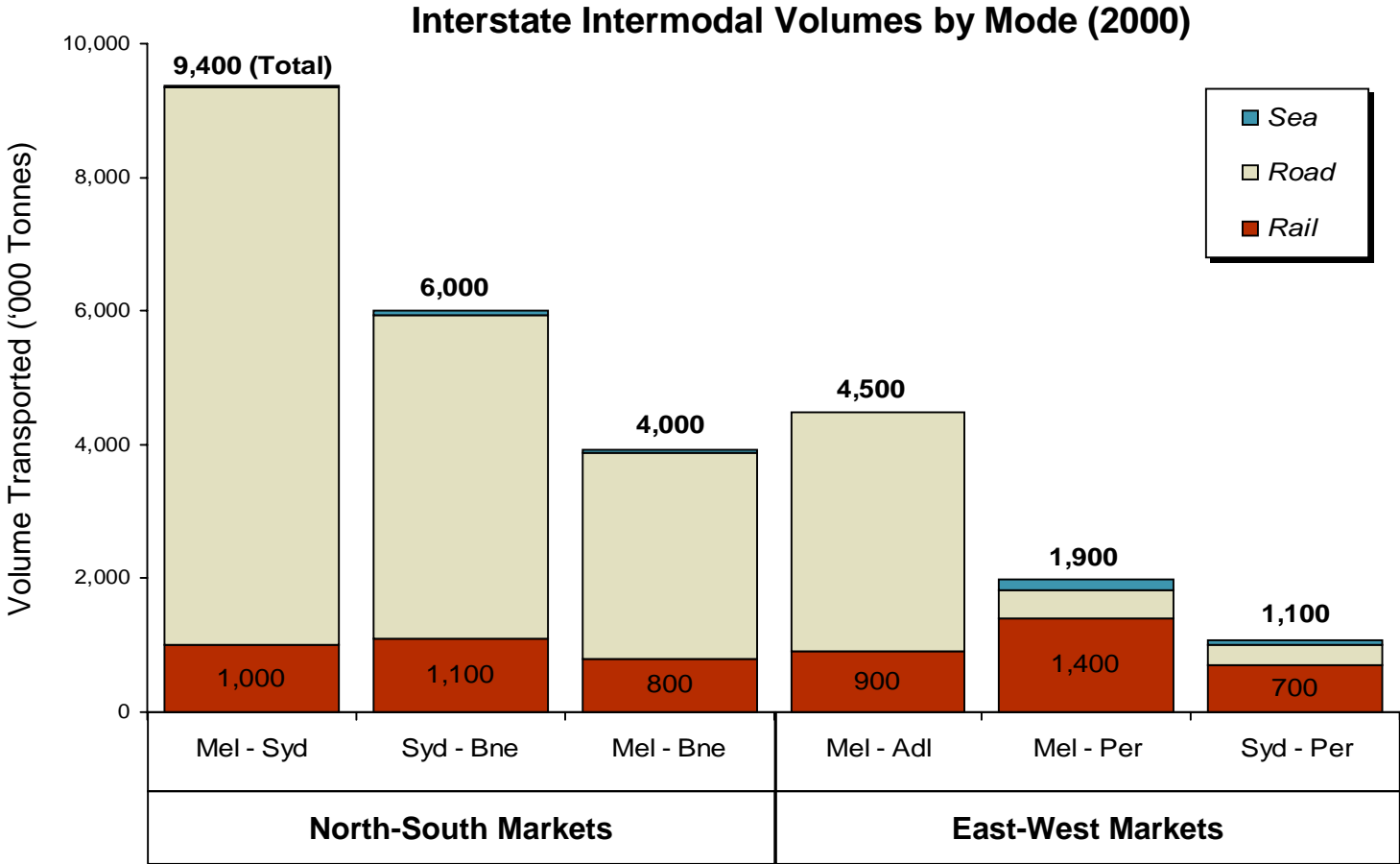
*Note: No Single variable alone can account for changes in market share due to the inter-relationship of all variables  
Other factors such as terminal performance influence modal choice*

# Between 1997 and 2000, rail improved its share in the majority of interstate markets and marginally overall



Source: Rail – ARTC, RAC, Rail Operators, BAH Database  
 Road – Culway counts: VicRoads, WA Main Roads, RTA, SA Transport  
 Other Studies – BTCE, NTDT Flows, ABS

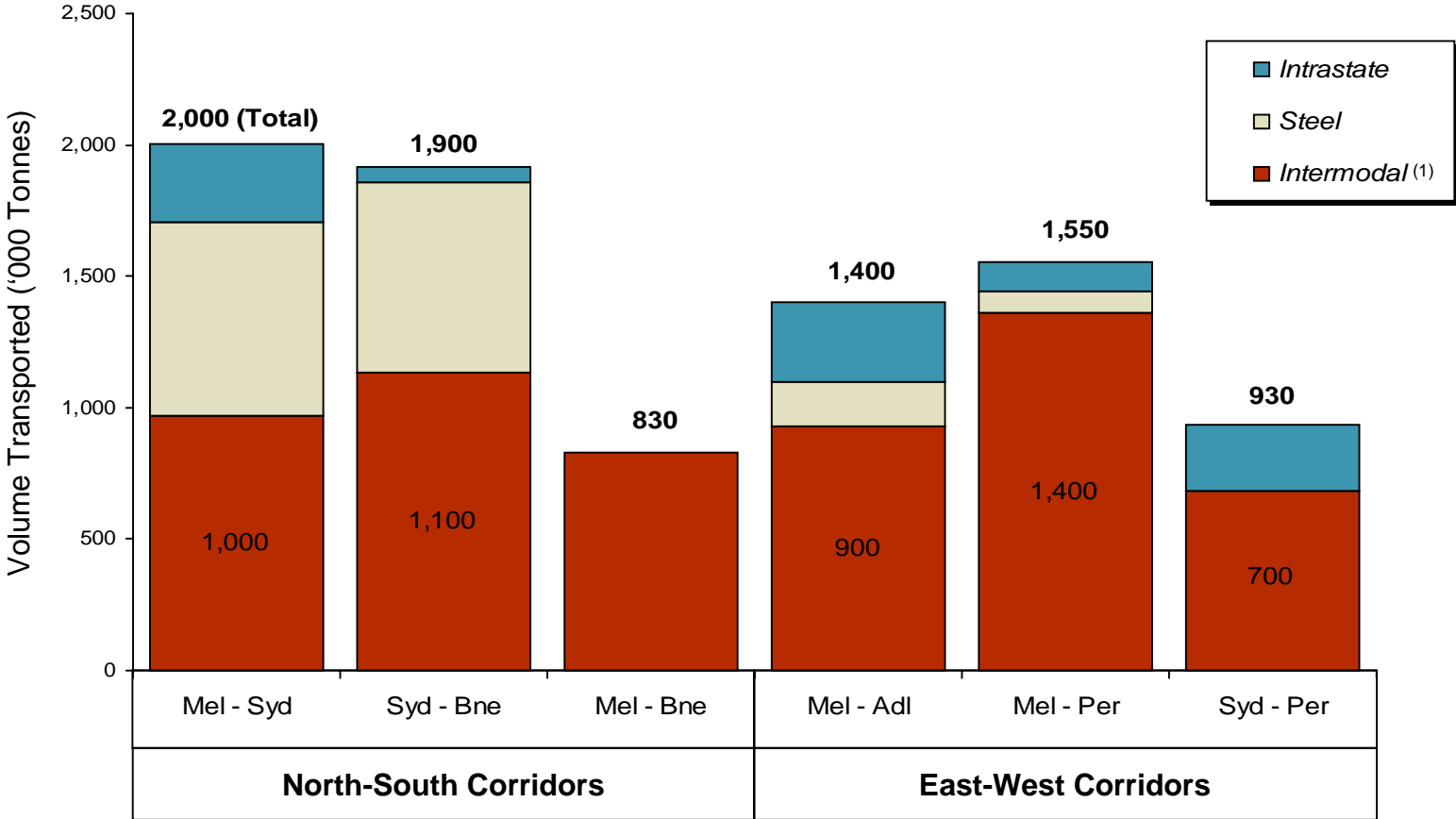
# By 2000 the volume of interstate intermodal traffic transported by rail was around 6 million tonnes



Source: Rail – ARTC, RAC, Rail Operators, BAH Database  
 Road – Culway counts: VicRoads, WA Main Roads, RTA, SA Transport  
 Sea – BTE Information Paper 43  
 Other Studies – BTCE, NTDT Flows, ABS

# Interstate intermodal traffic represents the majority of total tonnage carried on the interstate rail corridors

### Comparison of Corridor Rail Volumes (2000)















Note: (1) Intermodal traffic includes both interstate and landbridging traffic

## Audit of ATC Performance Targets

## In the North-South corridors, the ATC targets have generally not been met

### Infrastructure Improvements Against ATC Targets – 1997 to 2000 (North-South)

ATC Target	Measure	Mel - Syd	Syd - Bne	Mel - Bne
Track subject to Temporary restrictions	<2%			
Average speed for Axle Loads up to 21t	80kph			
Average speed for Axle Loads over 21t	60kph			
Train Length	1500m			



*Achieved ATC Target*



*Some Improvement*

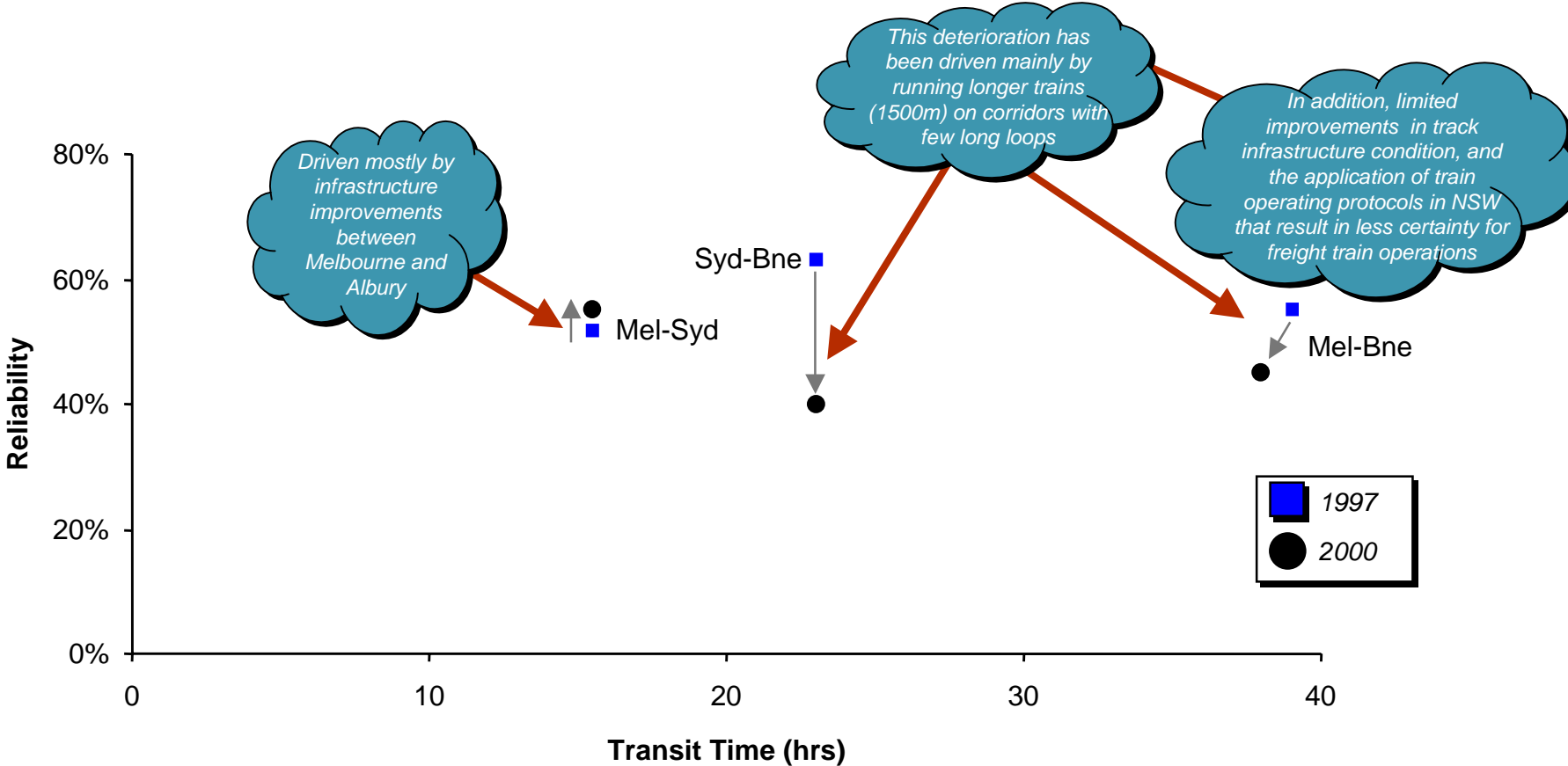


*No Improvement*

Note: Further detail is contained in Appendix B

# Overall, reliability in the North-South corridors has deteriorated

Change in Transit Time & Reliability – 1997 to 2000 (North-South)



Source: ARTC & RIC Reliability and Transit Time Data

## Audit of ATC Performance Targets

## In the East-West corridors, there has been more progress towards achieving the ATC targets

### Infrastructure Improvements Against ATC Targets – 1997 to 2000 (East-West)

ATC Target	Measure	Mel - Adl	Mel - Per	Syd - Per
Track subject to Temporary restrictions	<2%	●	◐	◐
Average speed for Axle Loads up to 21t	80kph	◐	◐	◐
Average speed for Axle Loads over 21t	60kph	●	◐	◐
Train Length	1800m	○	◐	◐



Achieved ATC Target



Some Improvement



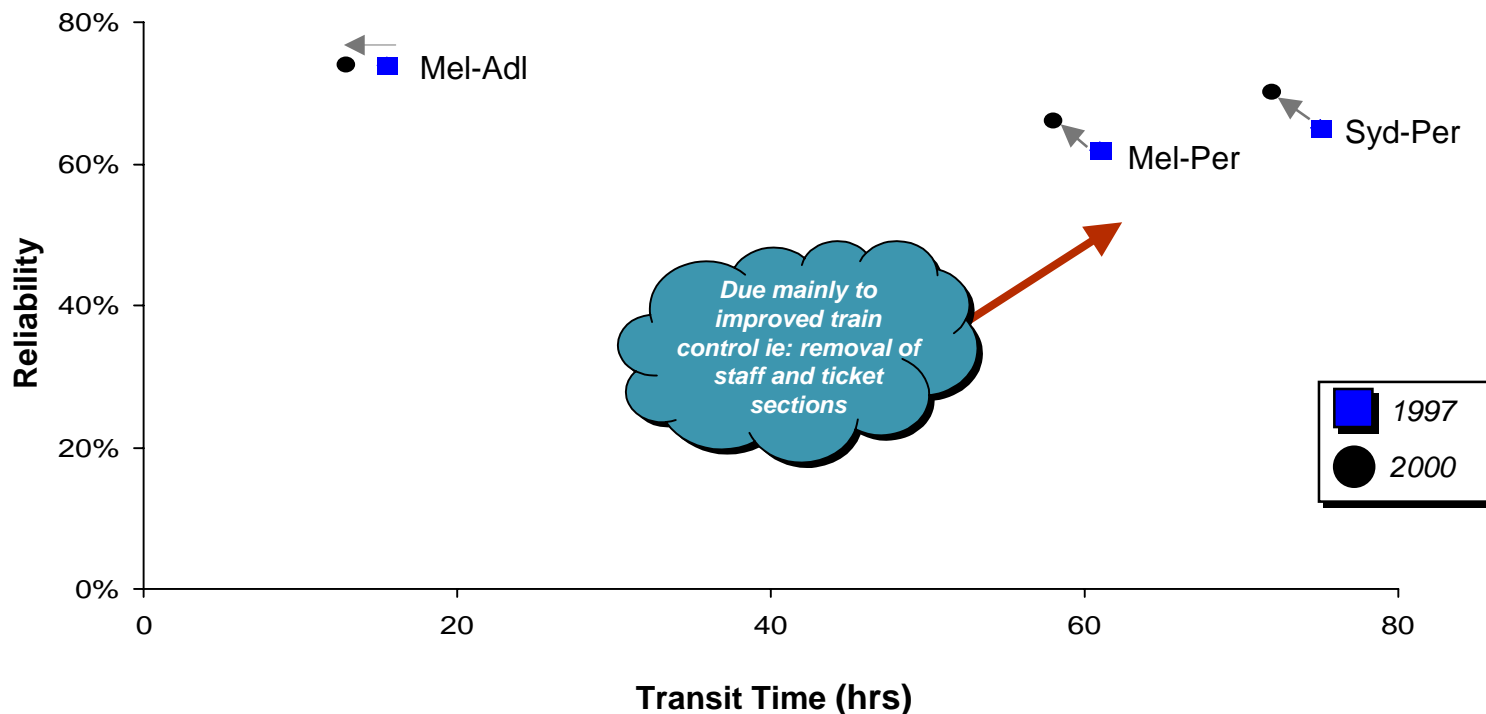
No Improvement

Note: Further detail is contained in Appendix B



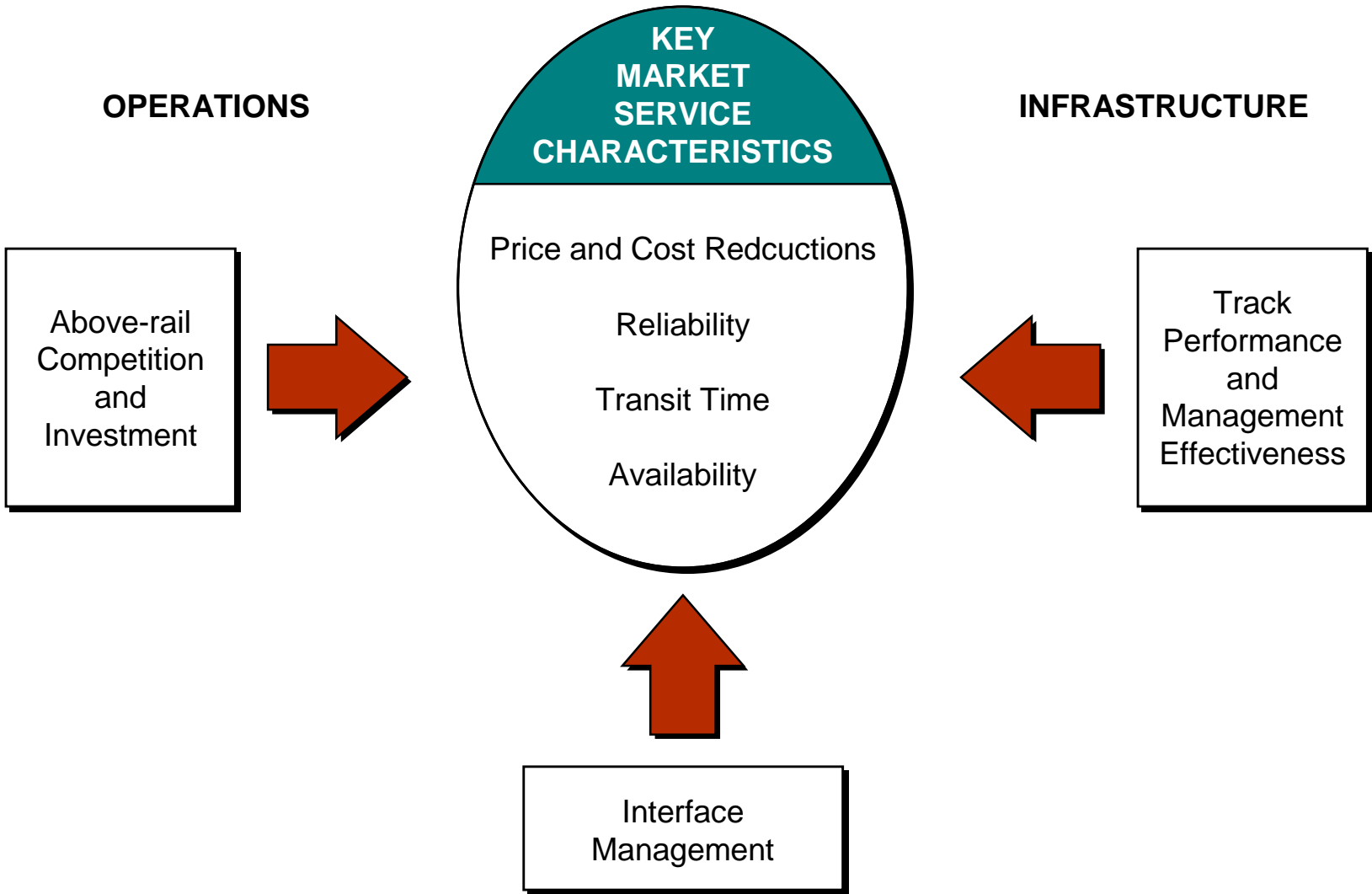
# This has contributed to an improvement in reliability and transit time

Change in Transit Time and Reliability – 1997 to 2000 (East-West)



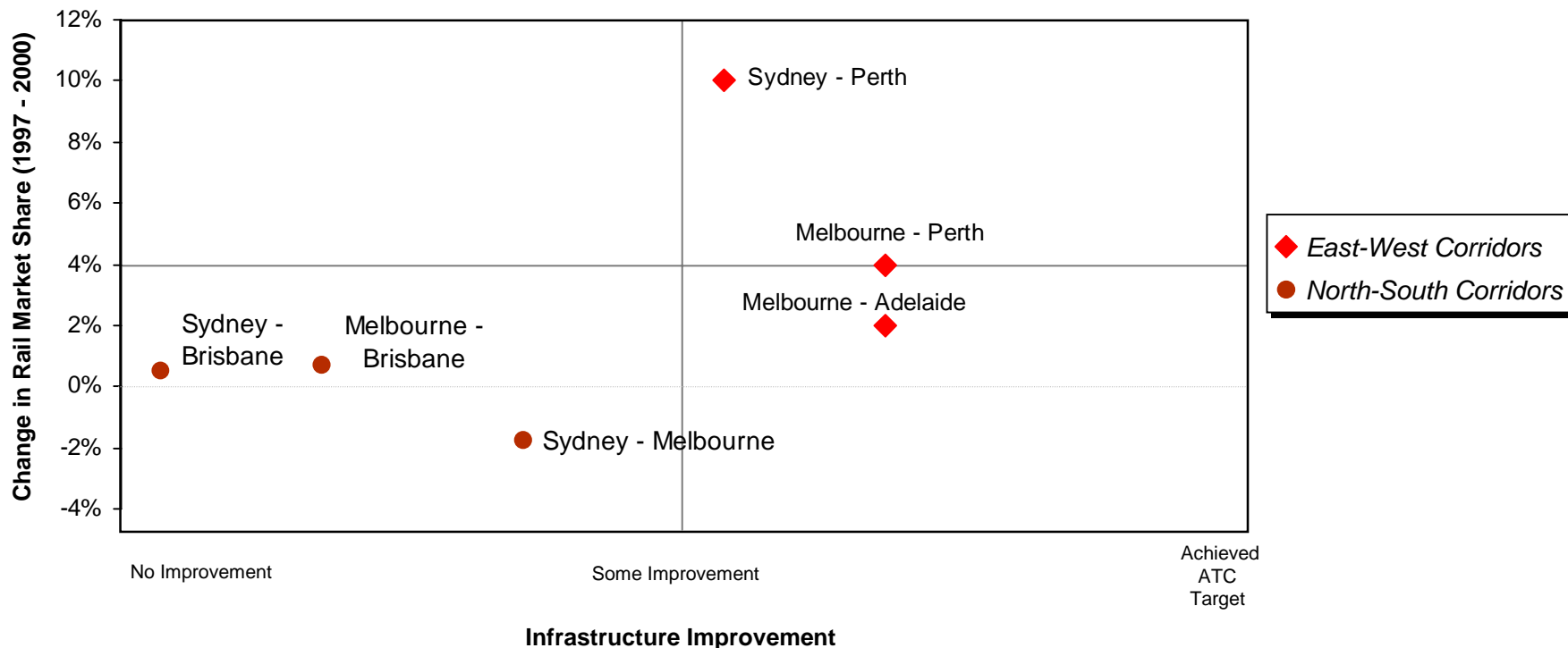
Source: ARTC Reliability and Transit Time Data

# Infrastructure improvement alone is not sufficient to ensure increased rail market share ...



# ... but without improved infrastructure, rail is unlikely to materially improve its competitive position in key interstate markets

**Infrastructure Improvement and Change in Rail Market Share (1997 - 2000)**



Source: Rail – ARTC, RAC, Rail Operators, BAH Database  
 Road – Culway counts: VicRoads, WA Main Roads, RTA, SA Transport  
 Other Studies – BTCE, NTDT Flows, ABS

# Performance targets should address all of the service characteristics that impact on modal choice - the ATC targets address only a subset


Discussion
<ul style="list-style-type: none"> <li>▶ The ATC targets are aimed at infrastructure improvements only</li> <li>▶ The targets are a set of improvements uniformly applied across all corridors yet each corridor will justify different service characteristic improvements</li> <li>▶ The targets cover only a limited number of important characteristics               <ul style="list-style-type: none"> <li>– A more complete set of targets are required to holistically address market needs</li> </ul> </li> </ul>

ATC Targets	Price & Cost Reductions	Influence on Service Characteristics		
		Transit Time	Reliability	Service Availability
Reduced Temporary Speed Restrictions	✓	✓	✓	✓
Increased Average Speed	✓	✓	✓	✓
Increased Train Lengths	✓			
Axle Loads	✓			

# Improving Rail's Competitive Position

---

# Rail’s competitiveness is influenced by the overall package of price and service characteristics ...

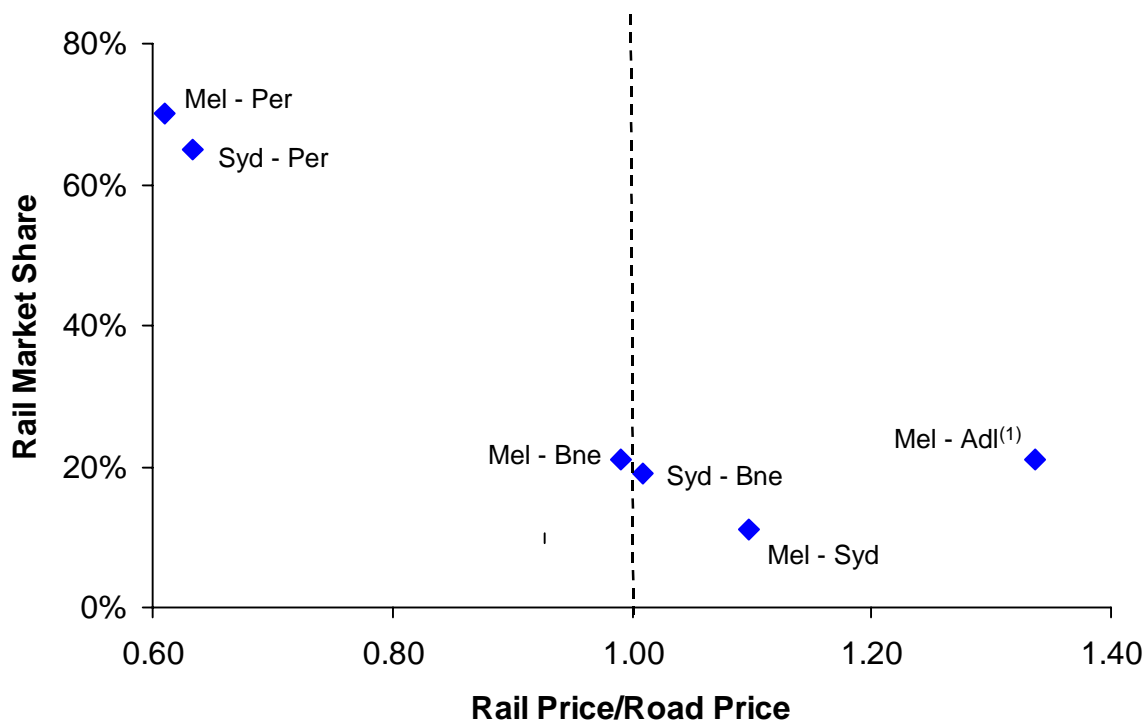


Key Market Drivers		Qualitative Evidence
Price		<ul style="list-style-type: none"> <li>▶ Price is the primary driver</li> </ul>
Service Characteristics	Transit Time	<ul style="list-style-type: none"> <li>▶ Transit time is factored into overall delivery times to customers</li> </ul>
	Reliability	<ul style="list-style-type: none"> <li>▶ Freight forwarders factor reliability ‘risk’ into their decisions</li> <li>▶ Reliability impacts on pickup and delivery costs (ie: trucks waiting longer than expected bear additional costs)</li> <li>▶ Reliability is a critical factor as operators want to work to tight time windows</li> <li>▶ Rail is perceived as less reliable than road – when a train gets delayed the impact is much greater</li> </ul>
	Service Availability	<ul style="list-style-type: none"> <li>▶ Pushing back cut off times after 6.00pm would help to shift tonnes to rail</li> <li>▶ Rail services need to be scheduled to best utilise pickup and delivery resources</li> <li>▶ Preference for goods to arrive before opening of business and shipped out after close of business</li> </ul>

Note: (1) Further detail regarding the price and service characteristics can be found in Appendix C

## ... but cost savings, which enable price reductions, are critical to achieving market share improvements in some corridors

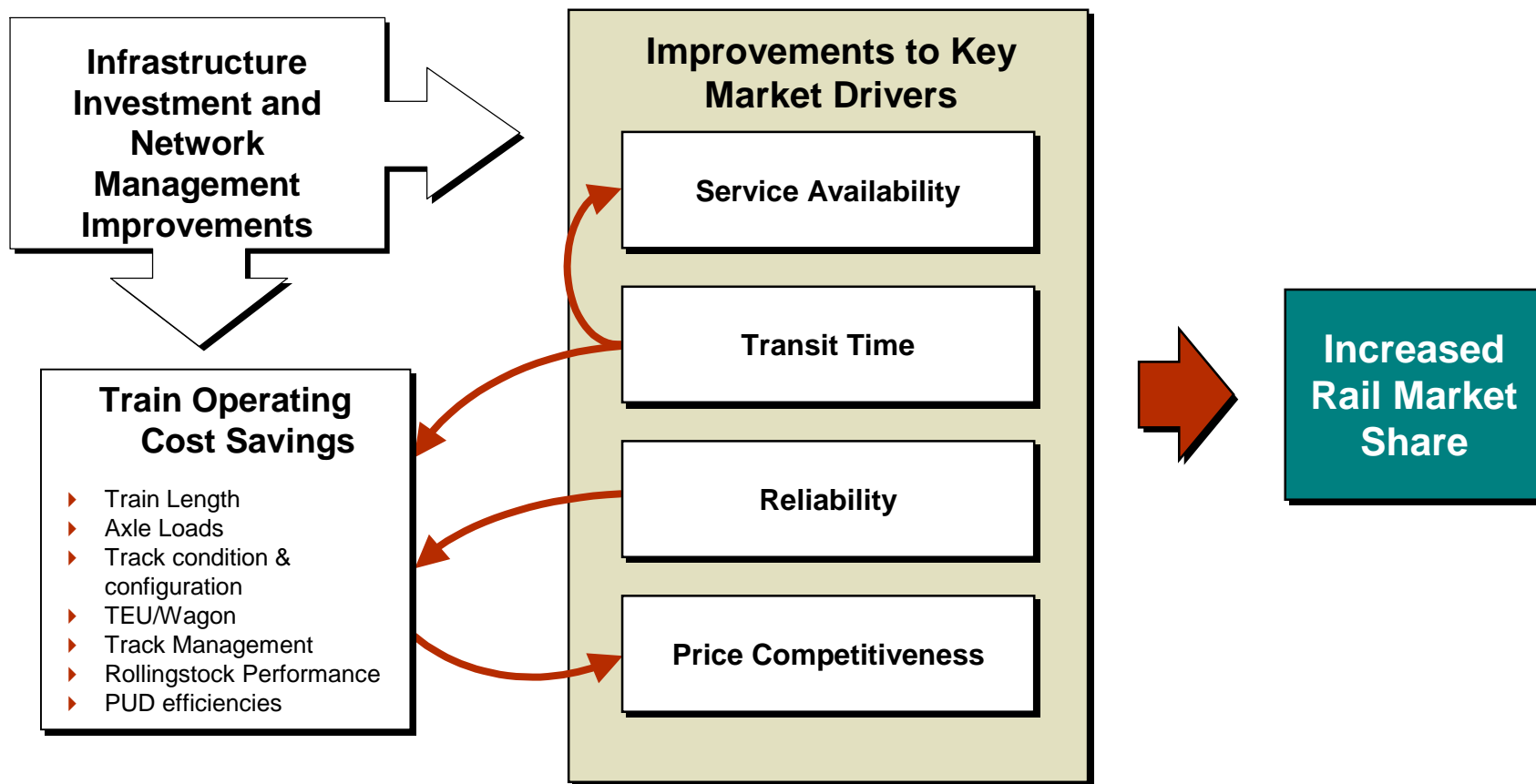
Road and Rail Rates and Market Share<sup>(2)</sup>



Note: (1) Mel - Adl Market Share larger than expected due to its larger proportion of landbridging volumes

(2) Intermodal Interstate Market

## Targeted infrastructure investment and network management improvements can drive increases in rail market share



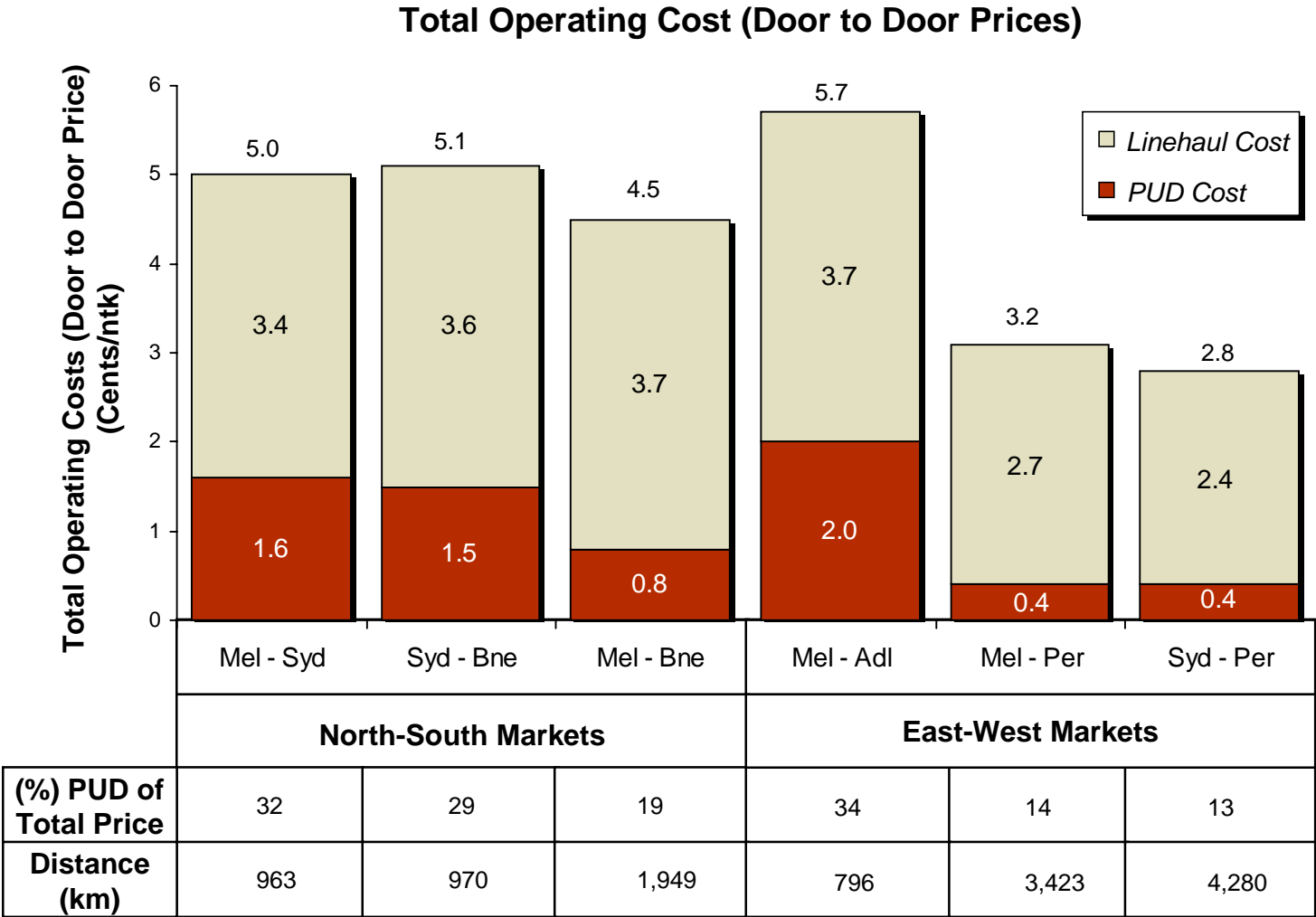


# Currently rail has inferior service characteristics to road across all corridors



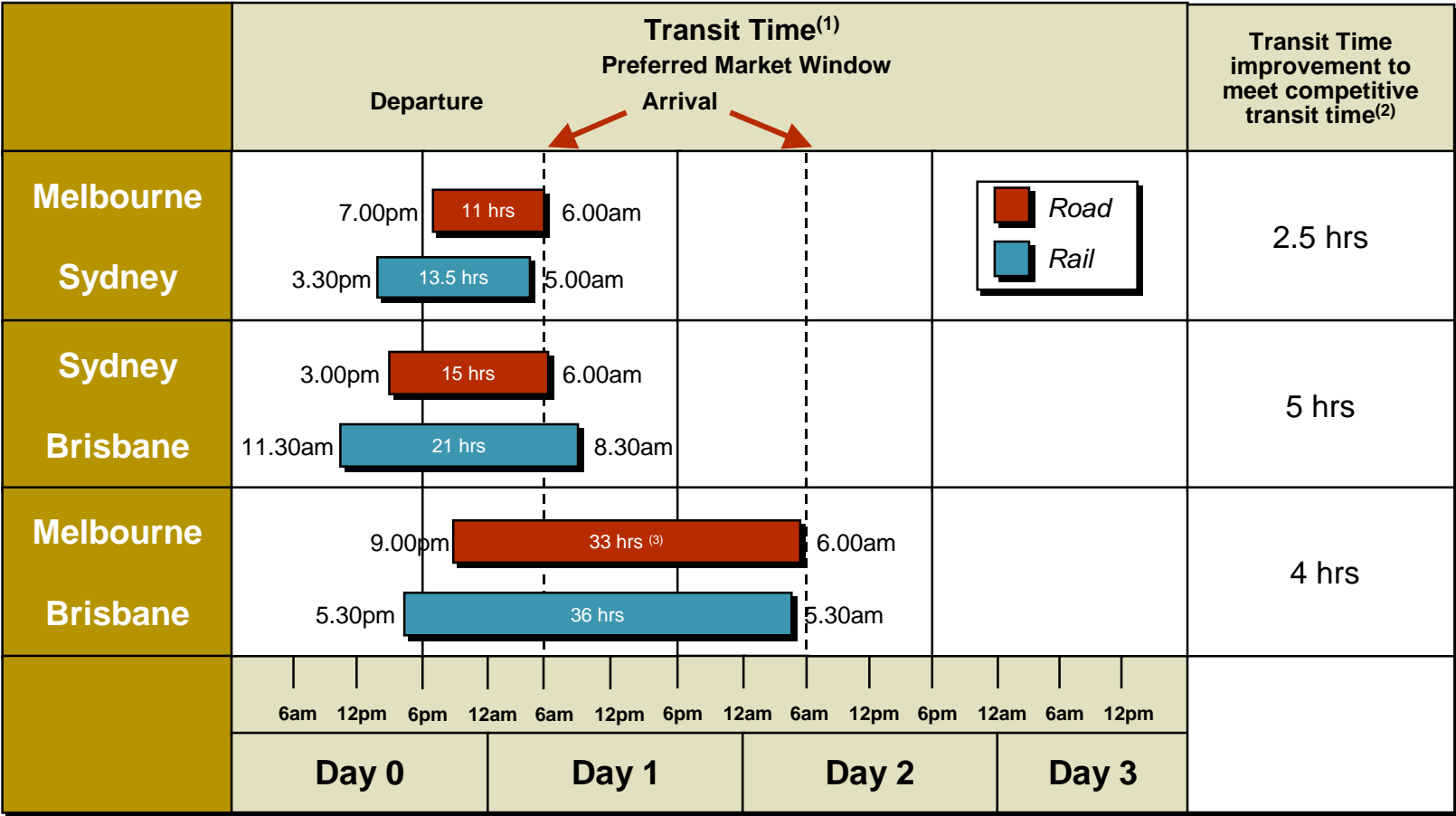
Source: Booz-Allen estimates; Industry data  
 Notes: (1) Transit time: Actual Line-haul transit time (does not include pickup and delivery for rail door to door services) shows legal road transport time. Industry Sources suggest that road transit times can be a lot less if not undertaken legally (ie: Melbourne - Brisbane - 22hours) or if multiple drivers are used  
 (2) On-time reliability: % of services arriving within 15 minutes after schedule  
 (3) Service availability: Extent to which a mode can offer services at the times at which the market demands  
 (4) Further detail regarding the above competitive analysis can be found in Appendix C

# The impact of operating cost improvements on price are greater in the longer haul corridors as PUD are a lower proportion of total costs



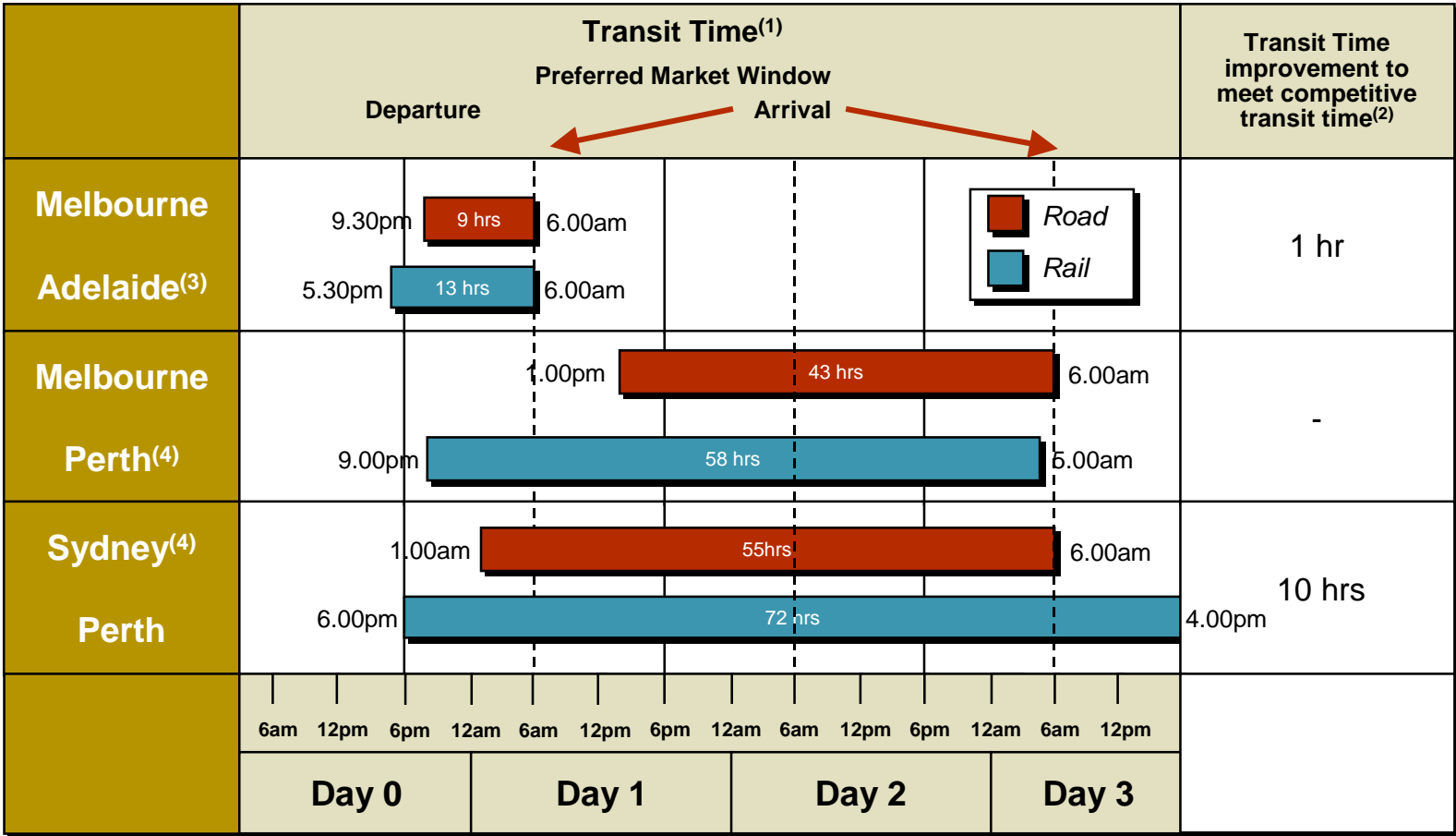
Source: BAH analysis  
Industry Sources

# Reductions in rail transit times are required on the North-South to satisfy preferred market times



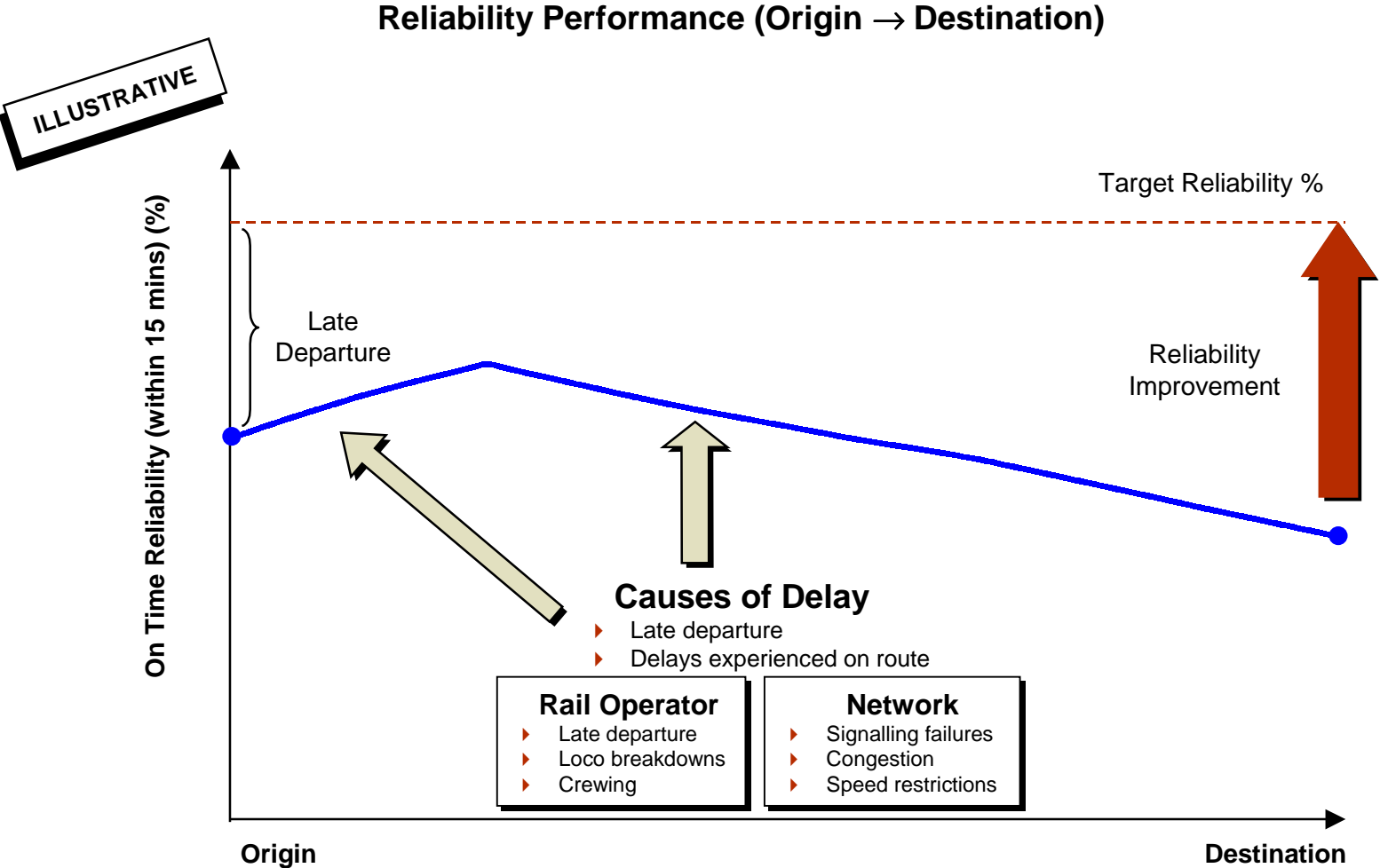
Note: (1) Excludes pick-up and delivery time for rail; 6.00am arrival is the preferred morning delivery window  
 (2) Booz-Allen & Hamilton analysis based on industry consultation of preferred transit time improvements on a corridor by corridor basis  
 Transit time improvements will enable rail to push back cut off time and increase service availability  
 (3) The 9pm cut-off and 2nd day 6am arrival reflects a 'legal' one driver operation and does not equate to the actual transit time which is less than 33 hours

# Transit time reductions are not critical on the Melbourne - Perth corridor, although some reductions are needed Sydney - Perth



Note: (1) Excludes pick-up and delivery time for rail; 6.00am arrival is the preferred morning delivery window  
 (2) Booz-Allen & Hamilton analysis based on industry consultation of preferred transit time improvements on a corridor by corridor basis  
 Transit time improvements will enable rail to push back cut off time and increase service availability  
 (3) Time difference 1/2 hours  
 (4) Time difference 2 hours

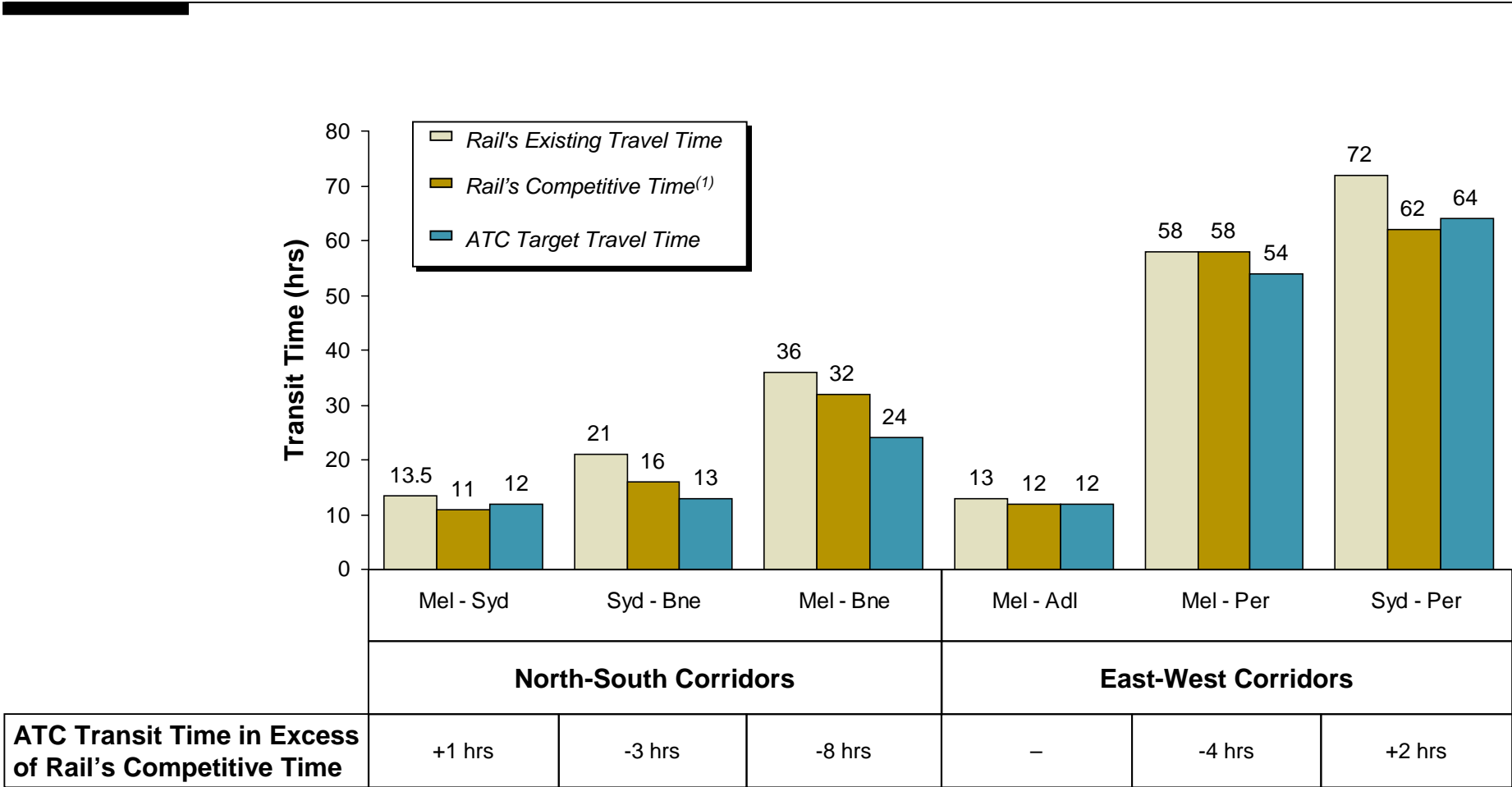
# The reliability improvements will need to address both network and operator causes of delay



## **Performance Targets and Investment Costs**

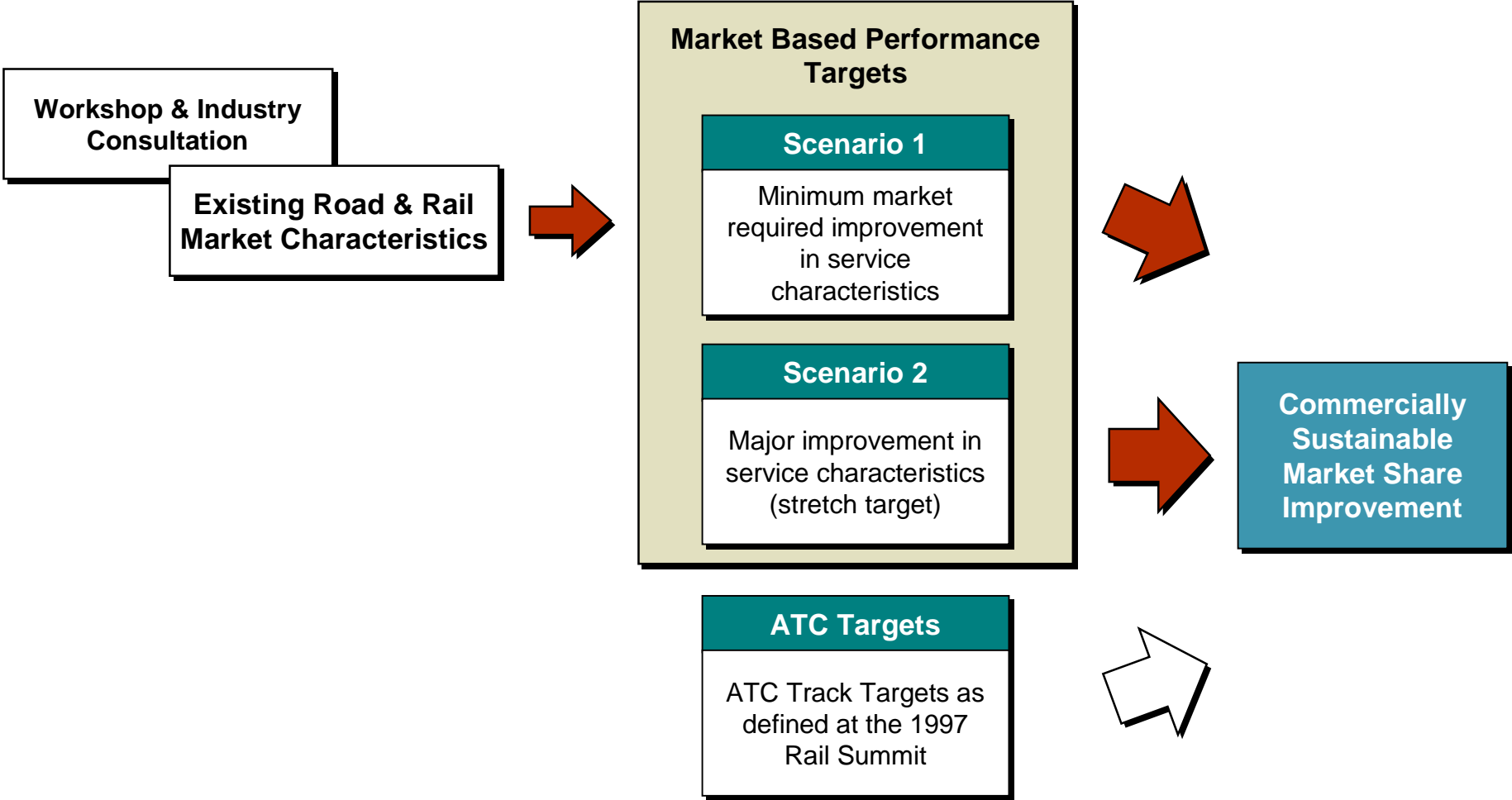
---

# The ATC implicit transit time targets do not align with rail’s market demand in most corridors



Note: (1) Booz-Allen & Hamilton analysis based on industry consultation of preferred transit time improvements on a corridor by corridor basis

# An industry workshop identified two market scenarios which could deliver a wide range of market share outcomes









Note : (1) Appendix A contains a detailed evaluation methodology



## Performance Targets and Investment Costs

# Service improvements in the existing North-South corridors would generate significant market share growth

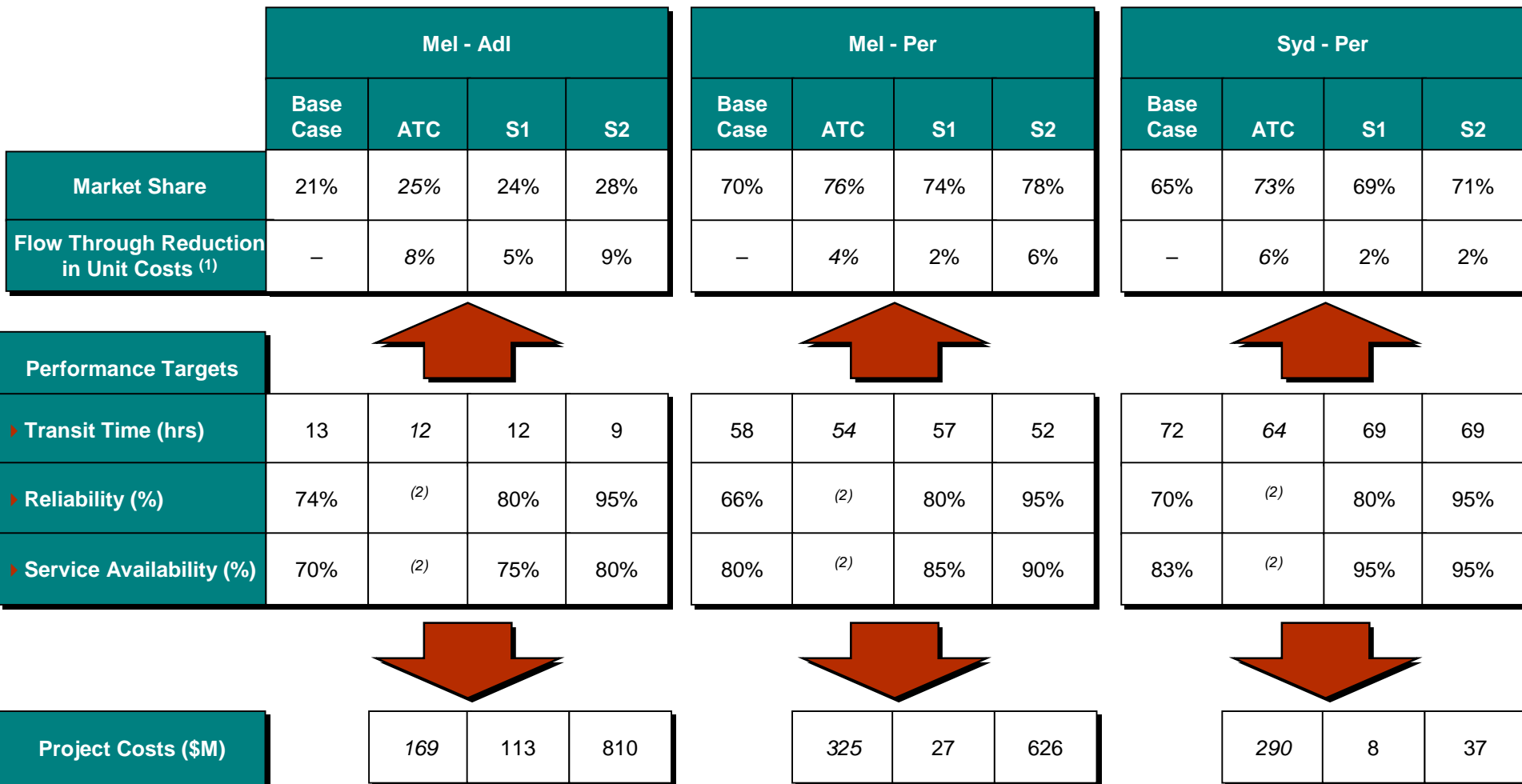
	Mel - Syd				Syd - Bne				Mel - Bne			
	Base Case	ATC	S1	S2	Base Case	ATC	S1	S2	Base Case	ATC	S1	S2
<b>Market Share</b>	11%	12%	19%	26%	19%	43%	27%	36%	21%	35%	32%	39%
<b>Flow Through Reduction in Unit Costs <sup>(1)</sup></b>	–	1%	5%	8%	–	10%	5%	8%	–	13%	6%	9%
<b>Performance Targets</b>												
<b>▶ Transit Time (hrs)</b>	13.5	12	11	9	21	14	19	16	36	28	32	27
<b>▶ Reliability (%)</b>	55%	(2)	75%	95%	50%	(2)	75%	95%	45%	(2)	80%	95%
<b>▶ Service Availability (%)</b>	50%	(2)	70%	85%	25%	(2)	50%	70%	60%	(2)	85%	90%
<b>Project Costs (\$M)</b>												
	32	249	908		2,539	53	694		2,571	287	1,614	

Note: (1) In practice the proportion of total operator savings passed onto the customer may vary from corridor to corridor – factors such as competition and price will influence this

(2) Reliability and Service Availability targets not set by ATC objectives

Performance Targets and Investment Costs

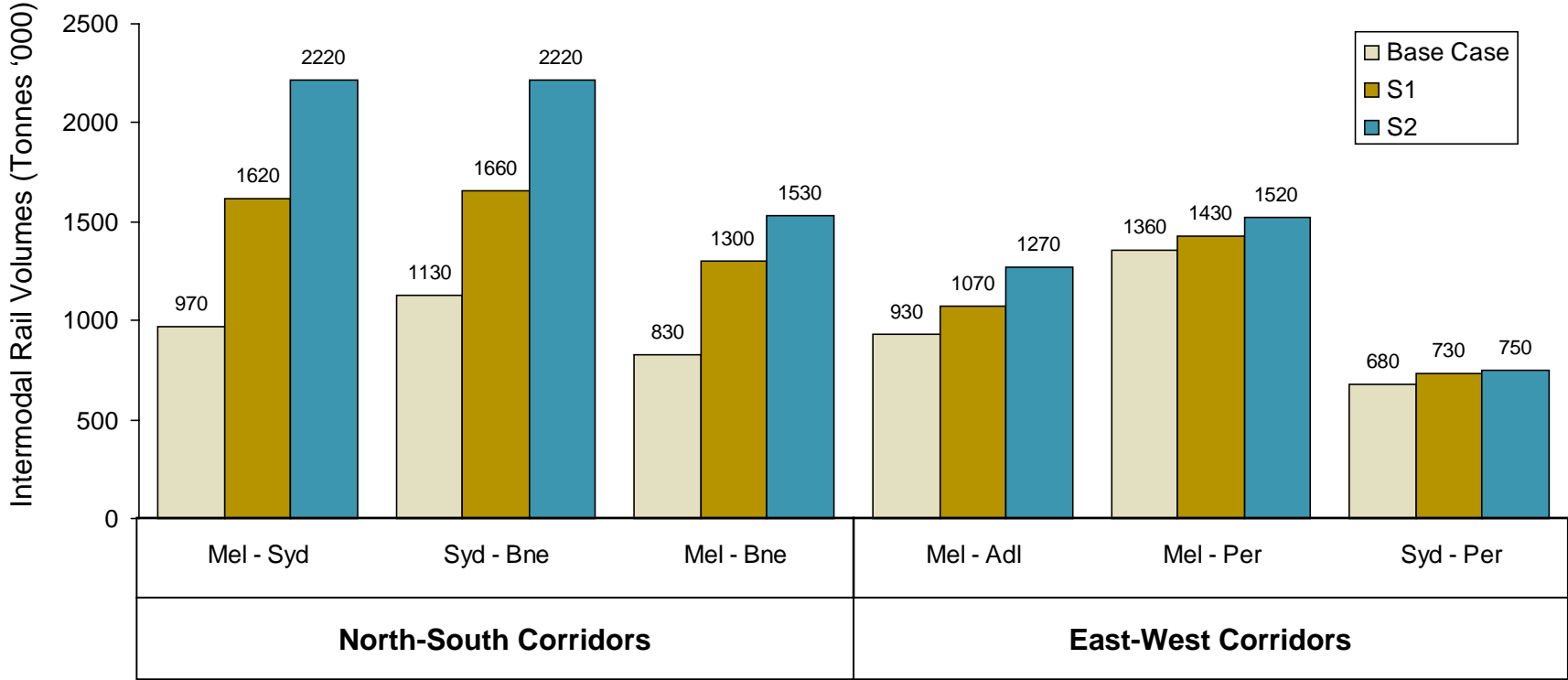
# Performance improvements in the East-West corridors would offer modest market share improvements



Note: (1) In practice the proportion of total operator savings passed onto the customer may vary from corridor to corridor – factors such as competition and price will influence this  
 (2) Reliability and Service Availability targets not set by ATC objectives

# These market share increases translate into significant intermodal volume increases in North-South markets

Interstate Intermodal Rail Volume by Scenario (2000)



## Performance Targets and Investment Costs

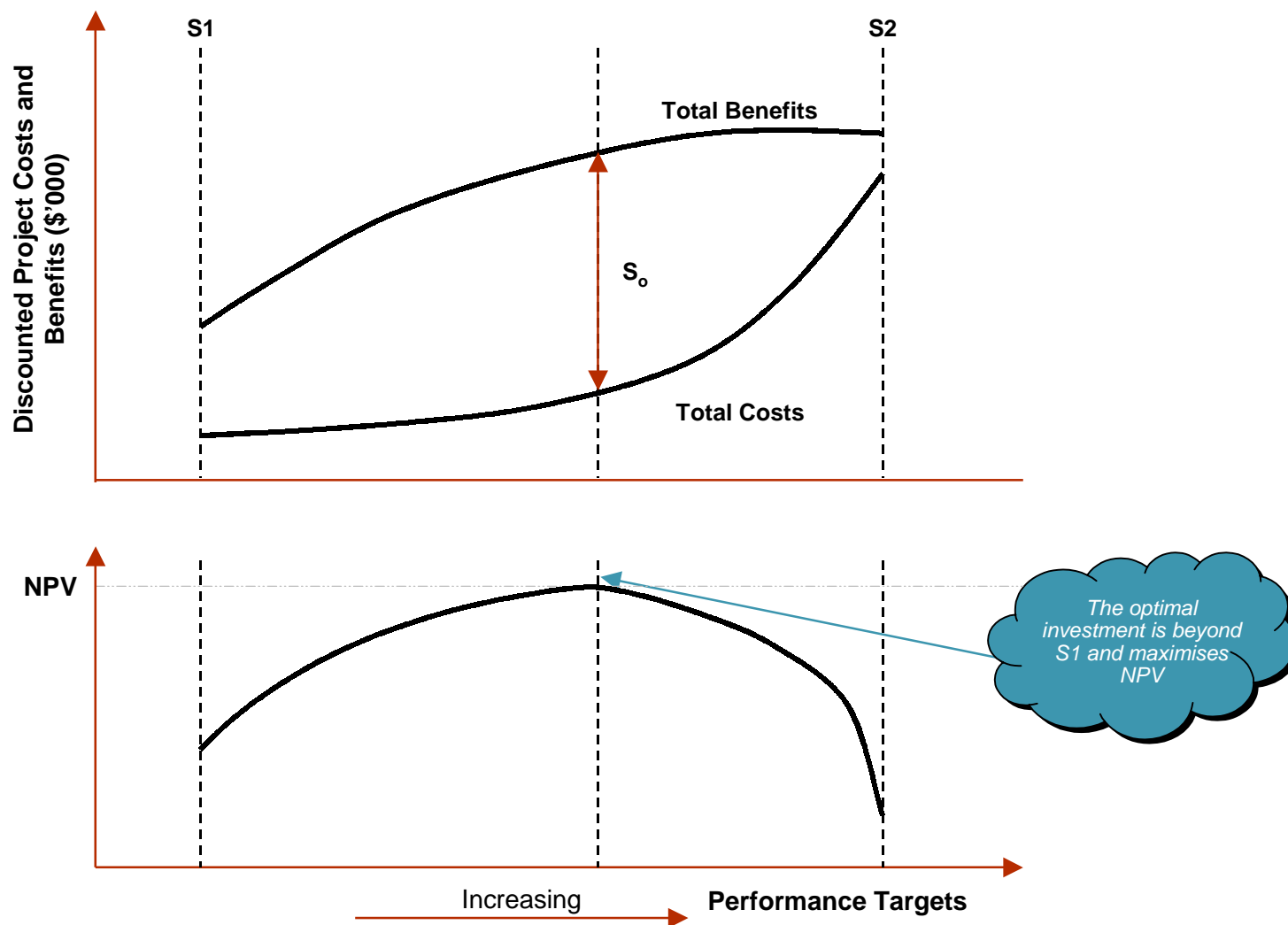
# The engineering consultants were asked to determine the best mix of operational, track management and investment measures to achieve the S1, S2 and ATC targets

North-South (Existing)	North-South ( Inland)	East-West
<ul style="list-style-type: none"> <li>▶ Corridors:               <ul style="list-style-type: none"> <li>– Melbourne - Sydney</li> <li>– Sydney - Brisbane</li> <li>– Melbourne - Brisbane</li> </ul> </li> <li>▶ Consultant: Maunsell McIntyre</li> </ul>	<ul style="list-style-type: none"> <li>▶ Corridor:               <ul style="list-style-type: none"> <li>– Melbourne - Brisbane (Parkes - Brisbane, A2M Route Option)</li> </ul> </li> <li>▶ Consultant: Ove Arup</li> </ul>	<ul style="list-style-type: none"> <li>▶ Corridors:               <ul style="list-style-type: none"> <li>– Melbourne - Adelaide</li> <li>– Melbourne - Perth</li> <li>– Sydney - Perth (via Cootamundra)</li> </ul> </li> <li>▶ Consultant: GHD</li> </ul>

*Note: The detailed investment cost estimates are contained within Appendix D*

*For the Inland route analysis, only an S2 option was assessed*

## These market based performance targets were used as the “bookends” to generate the optimal level of investment



## Future network capacity and the upgrade of life expired signalling systems remain issues for investment decisions

- ▶ A preliminary assessment of a Communications Based Safeworking System (CBSS) and the proposed Inland route has been undertaken in recognition of these issues

### 1. Current Signalling System

- ▶ There is a near term need to replace the life expired safeworking systems currently in place
- ▶ Any investment decision to replenish the existing system now may only be a short term solution
  - Investing in outdated technology may require re-investment in 5-10 years time
- ▶ Major enhancement works are required to transform the existing technology to meet future market needs

### 2. Future Network Capacity

- ▶ Reliable saleable capacity is already limited
- ▶ Congestion on the North-South rail corridors is expected to constrain volume growth beyond this investment assessment period
- ▶ Future investment decisions will need to address capacity constraints
- ▶ Further detail of network capacity can be found in Appendix F

Note : (1) Issues surrounding current network capacity are discussed in Appendix F

## CBSS addresses capacity and signalling replacement

---

- ▶ Communications Based Safeworking System (CBSS) is a generic term for advanced safeworking technologies based on a reliable communications backbone
  - CBSS is a next generation technology intended to replace the life expired safe working systems currently in place and generate substantial efficiency and performance benefits
- ▶ By reducing the headway required between trains, CBSS will increase capacity on existing track infrastructure
- ▶ CBSS would eliminate the need for replenishing the existing technology and reduces the need for major capacity enhancement works
- ▶ CBSS provides an opportunity to standardise safeworking systems across the entire interstate network

## There are other benefits from CBSS which have not been considered in this study

---

- ▶ Benefits to the infrastructure owner through:
  - Project cost savings on infrastructure works<sup>(1)</sup>
  - Avoiding capital investments to upgrade and maintain existing safeworking systems
  - Reduction in trackside maintenance
  - An ability to create track capacity to facilitate growth in revenue and delay costly infrastructure capacity works<sup>(1)</sup>
  - Reduction in operating costs associated with current legacy systems
  - Improved safety and reduced accident costs
  
- ▶ Benefits to the rail operator through:
  - Fuel savings due to improved path management
  - Improved reliability
  - Fewer opportunities for accidents
  - Improved safety and standardised safeworking systems
  
- ▶ For this evaluation, the network improvements with and without a CBSS system have been assessed

*Note: (1) Benefits included in this evaluation*





## Performance Targets and Investment Costs

# The proposed inland route would help to alleviate future capacity constraints in the North-South corridors and generate additional operating benefits

### Reasons for Assessing the Inland Route

- ▶ Continued volume growth on the existing Melbourne - Brisbane route will further exacerbate existing congestion
- ▶ An inland route will “free-up” capacity for traffic remaining on the existing route (Melbourne - Sydney and Sydney - Brisbane traffic)
- ▶ Lower transit time and an opportunity for double stacking on the inland route offers reduced operating costs and greater market potential

	Mel - Bne (Inland) <sup>(1)</sup>	
	Base Case	S2
Market Share	21%	54%
Flow Through Reduction in Unit Costs <sup>(2)</sup>	–	25%
		
Performance Targets		
▶ Transit Time (hrs)	36	27
▶ Reliability (%)	45%	95%
▶ Service Availability (%)	60%	90%
		
Project Costs (\$M)	–	1,510

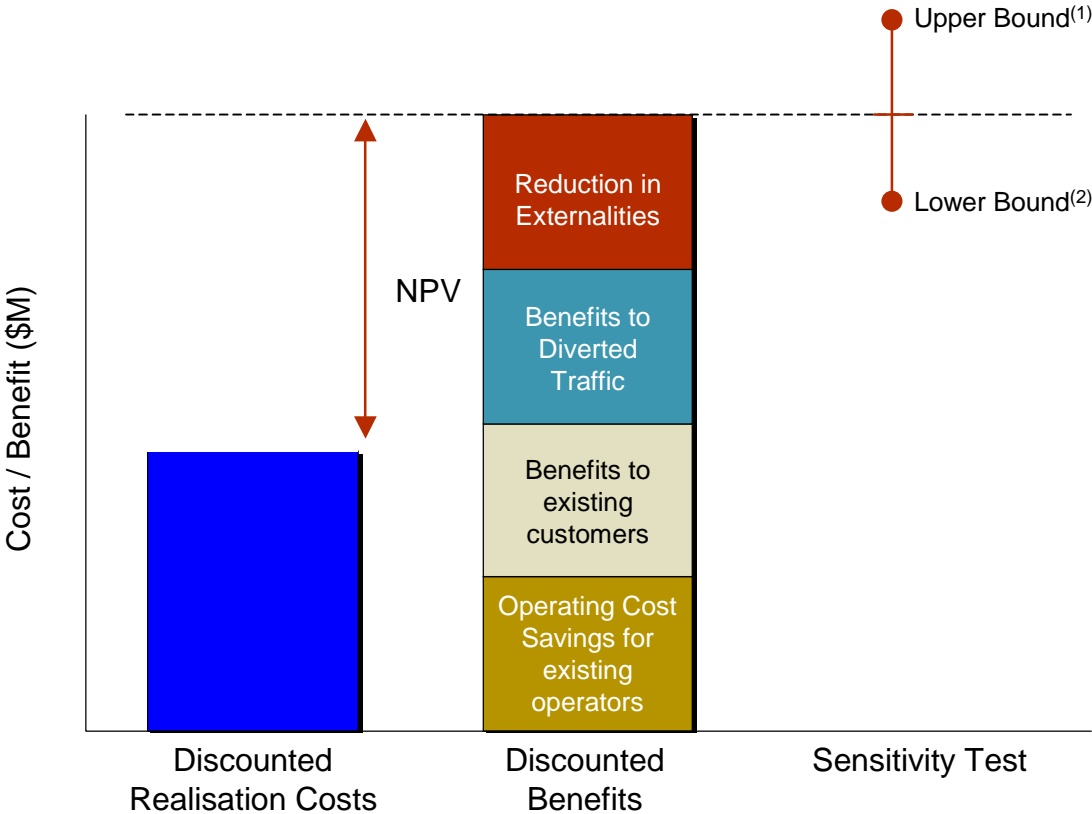
Note: (1) Market data and transit time obtained from AIRE

(2) In practice the proportion of total operator savings passed onto the customer may vary from corridor to corridor – factors such as competition and price will influence this

# Investment Appraisal

---

# The Economic Evaluation adopts a conventional cost benefit analysis estimating the benefits to all users of the corridor

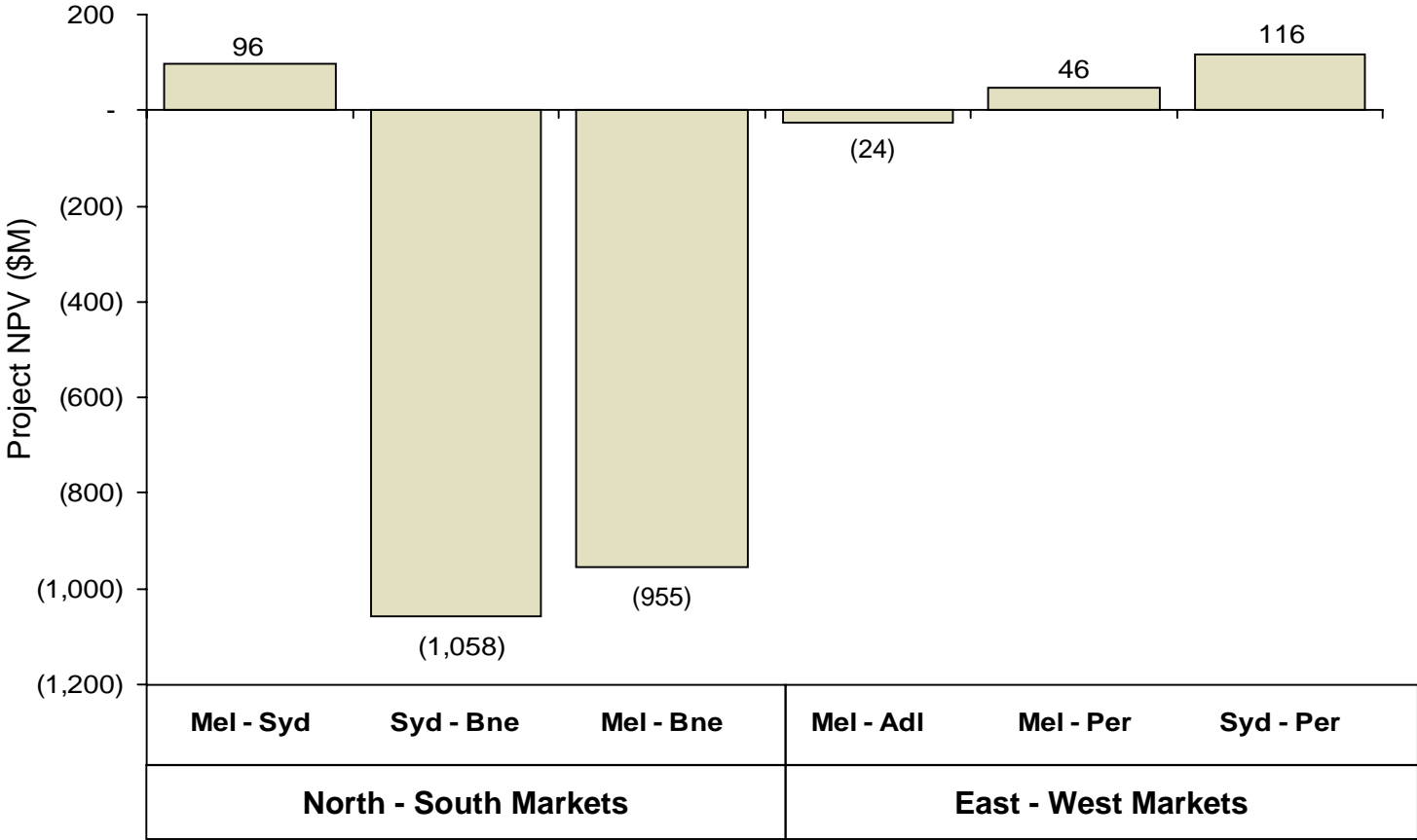


Key Assumptions	
▶	Evaluation period 25 years
▶	Discount Rate 7%
▶	Efficient road and rail operating costs
▶	All taxes have been removed from rates and inputs
▶	The freight market is competitive which implies cost savings are passed through to the consumer
▶	Construction for Scenario 1 and the optimal investment ( $S_0$ ) complete by 2005, and for Scenario 2 by 2010
▶	Asset life 50 years
▶	Benefits ramp up over construction period
▶	Capacity constrained in 2005 in Base Case and 2010 in project cases in the North-South (without CBSS)
▶	CBSS alleviates the capacity constraint in the North-South
▶	Benefits have been assumed to accrue to all users of the corridor

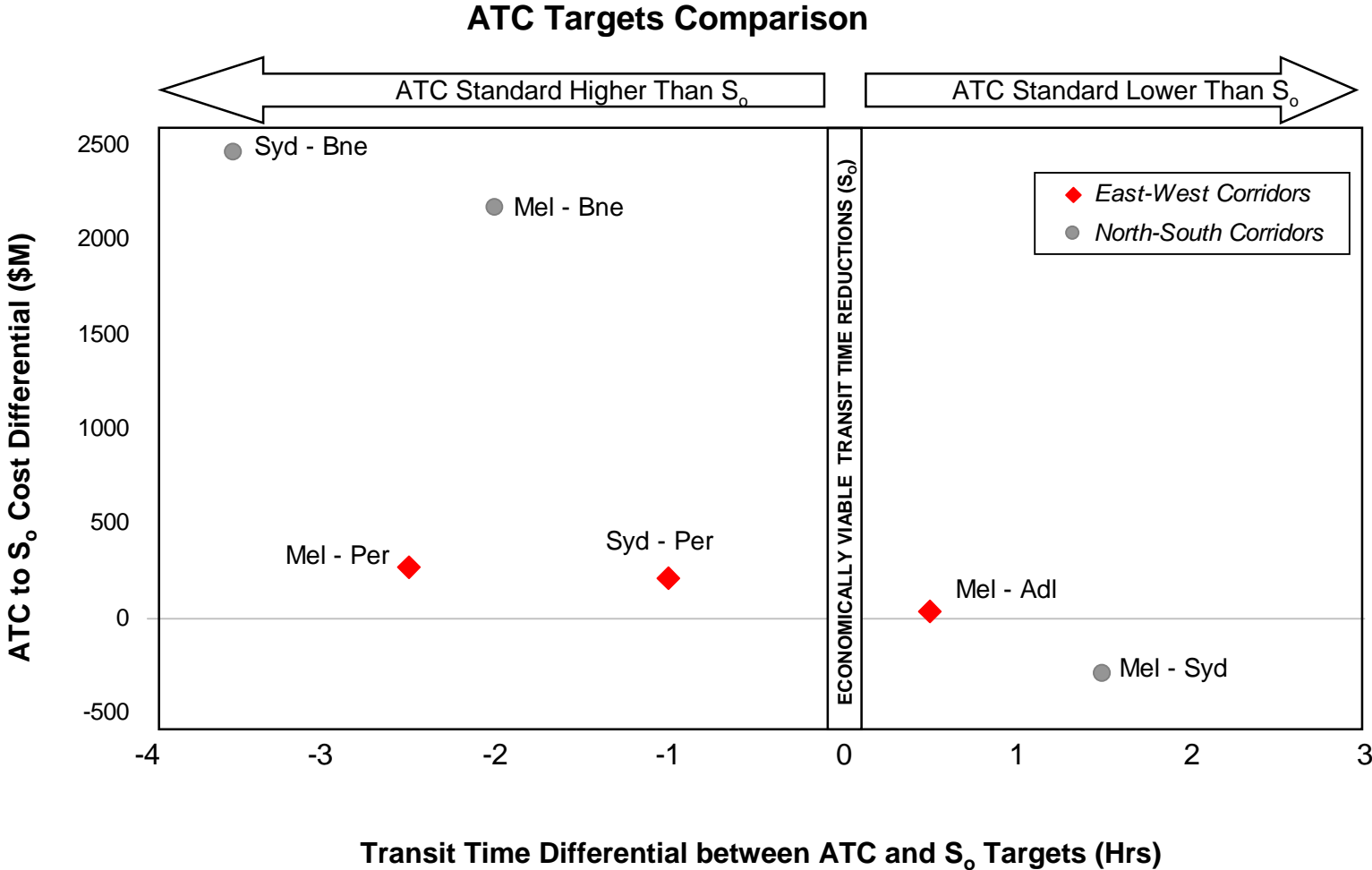
Note: (1) 20% reduction in capital costs  
 (2) 30% reduction in diverted traffic benefits and 20% increase in capital costs  
 Details of primary corridor results and optimisation levels are found in Attachments A and B to this report respectively.  
 Details of the evaluation results for each Performance Scenario is found in Appendix E

# The investment required to achieve ATC performance targets is not justified in all corridors, particularly north of Sydney

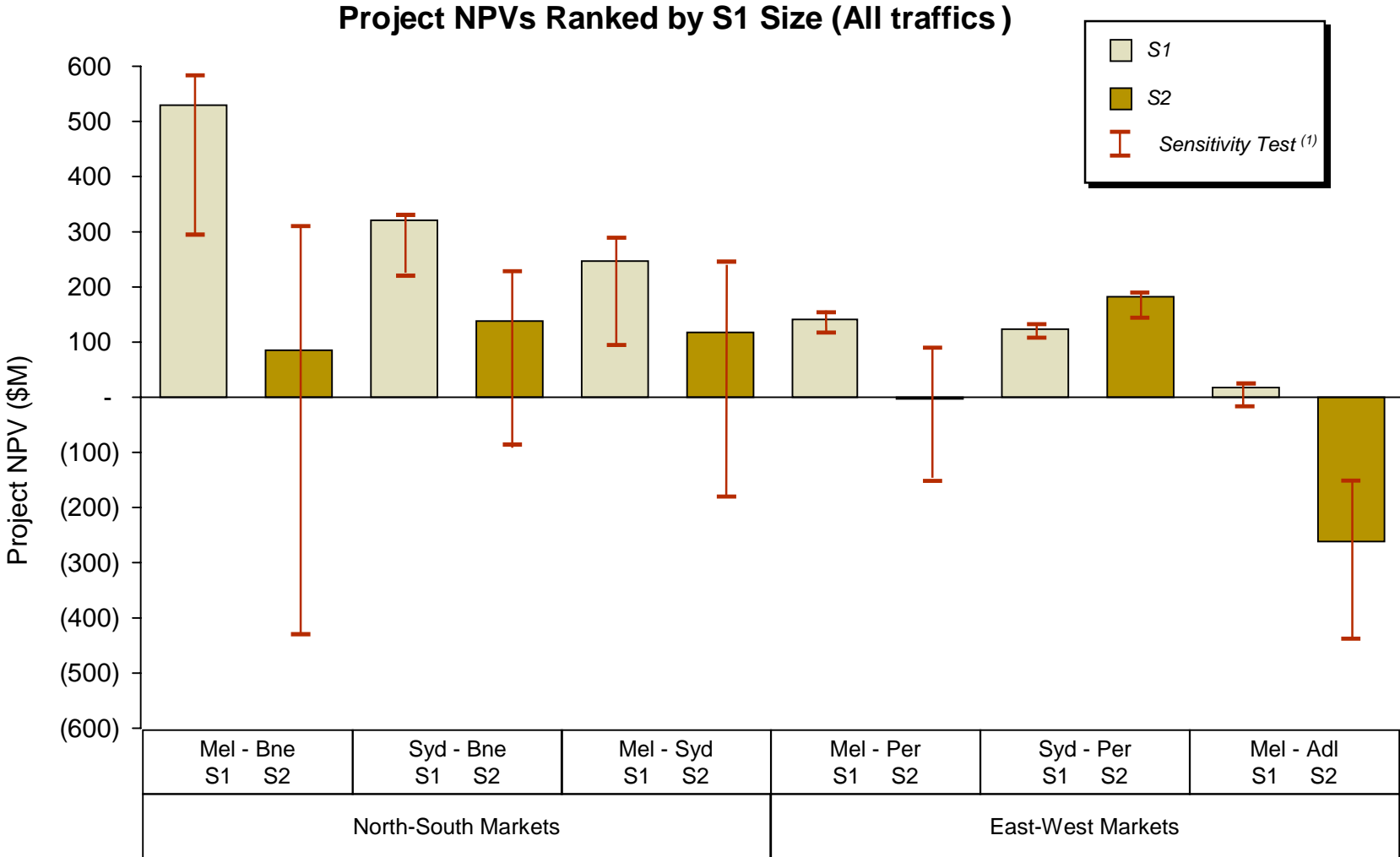
ATC Performance Target Investments (\$M NPV)



# In some corridors, the uniform ATC targets go beyond an economically optimal level



# Except for Sydney – Perth, Scenario 1 investments return higher NPVs than Scenario 2



Note: (1) Upper Bound - 20% reduction in capital costs; Lower Bound - 30% reduction in diverted traffic benefits and 20% increase in capital costs

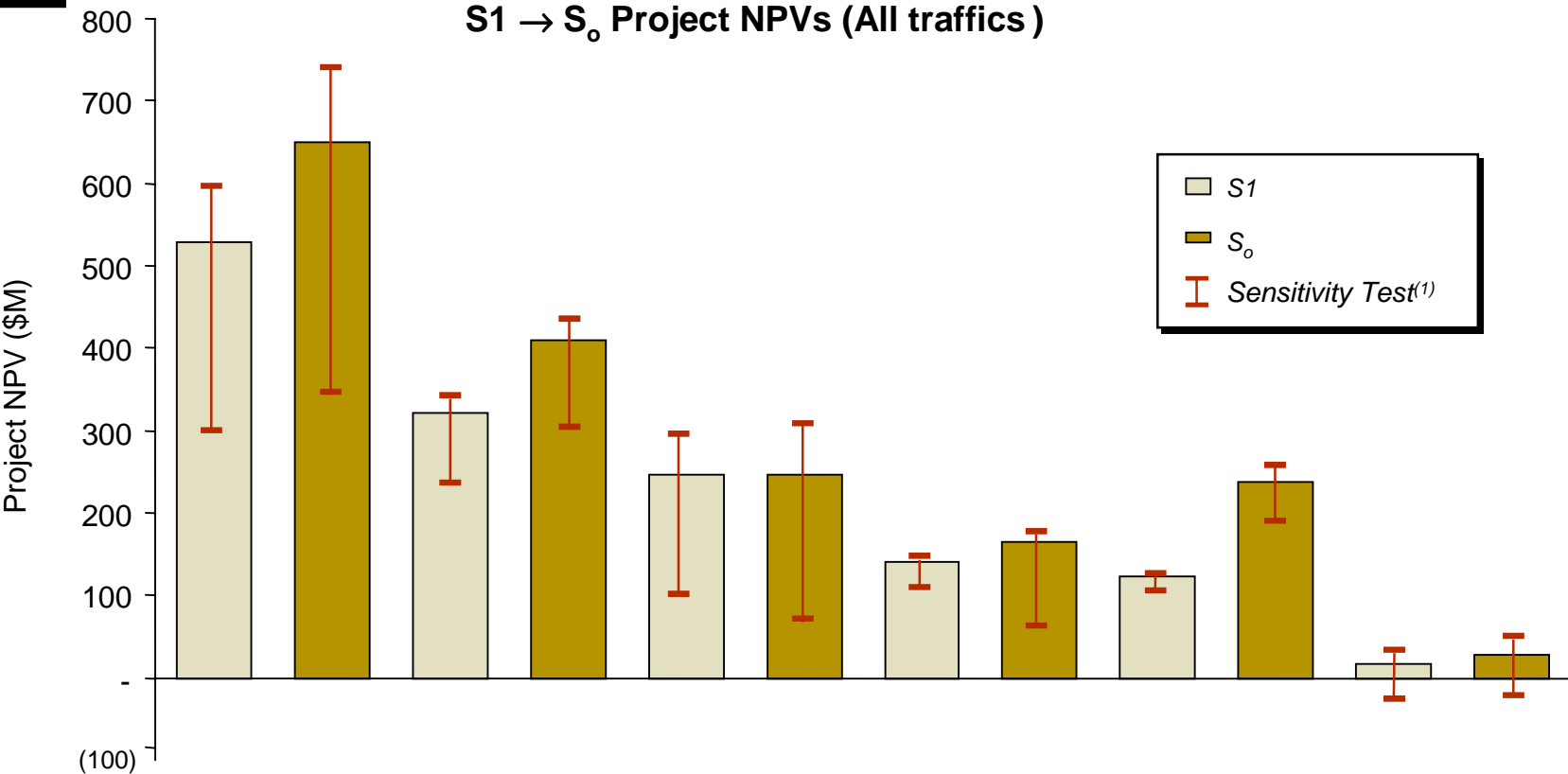
# In aggregate, the additional \$1.9B investment required to reach S2 cannot be economically justified ...

## S1 and S2 Performance Target Evaluation Results

		S1 Investment	S2 Investment	Incremental S1 → S2
Improvement in interstate intermodal market share from base case		31%	59%	
Evaluation Results	Undiscounted Capital Costs (\$M)	337	2,251	1,914
	BCR	3.7	1.2	0.6
	Benefits (\$M)	1,138	2,061	923
	NPV (\$M)	832	323	(509)

*Note: Excludes the marginal Mel - Adl Investments  
 Mel - Bne investment is the sum of Mel - Syd and Syd - Bne  
 Adjustments have been made for the specific projects found in both the Mel - Per and Syd - Per investments*

# ... but some additional investment beyond S1 is economically supportable



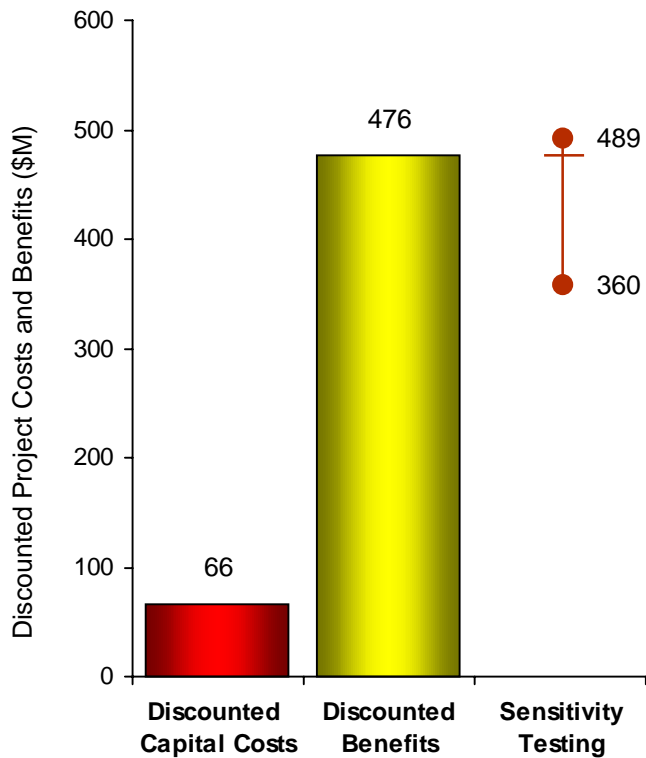
Capital Spend (\$M)	287 → 398	53 → 73	249 → 325	27 → 52	8 → 78	113 → 133
% Additional Increase in tonnage S1 - S <sub>0</sub>	8%	10%	6%	1%	4%	2%
	Mel - Bne	Syd - Bne	Mel - Syd	Mel - Per	Syd - Per	Mel - Adl
	North-South Markets			East-West Markets		

Note: (1) Upper Bound - 20% reduction in capital costs; Lower Bound - 30% reduction in diverted traffic benefits and 20% increase in capital costs



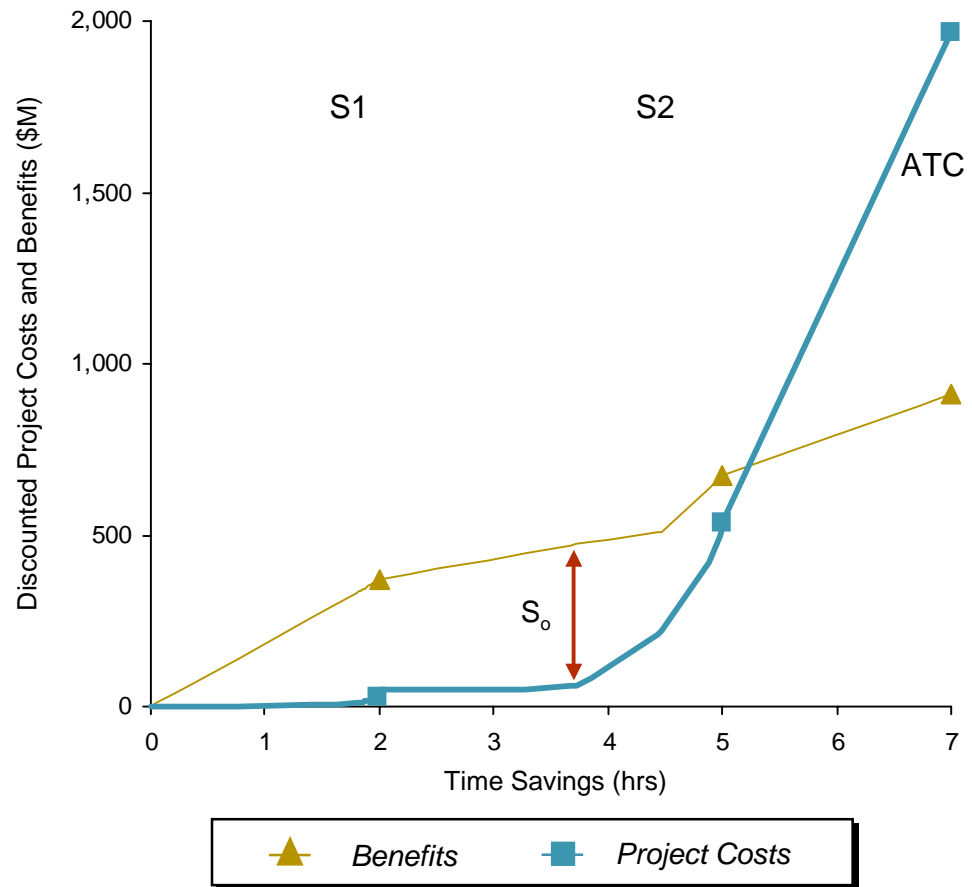
# Investment in the Sydney - Brisbane corridor generates the strongest returns

$S_0$  Evaluation Results

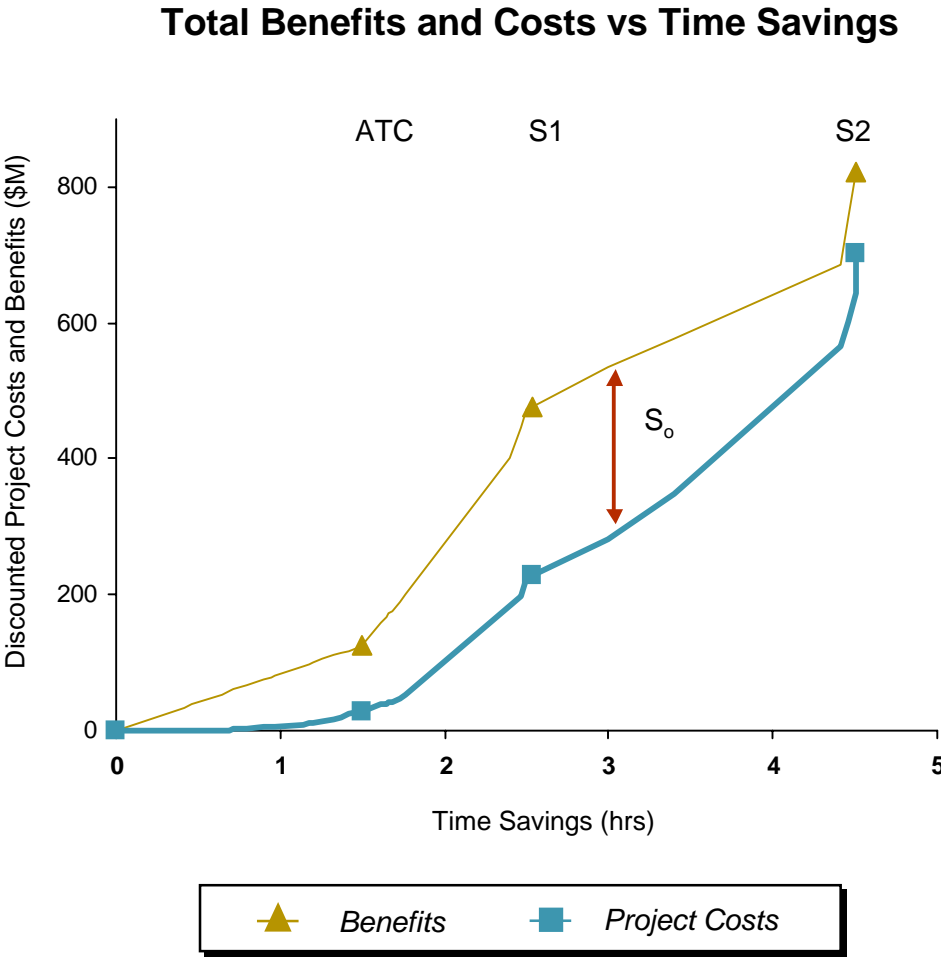
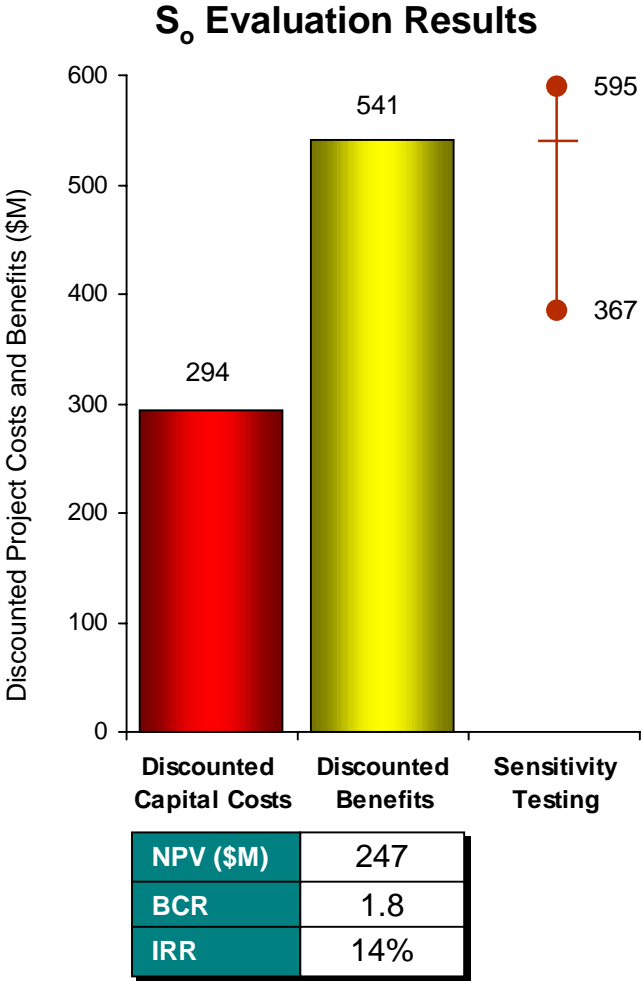


NPV (\$M)	410
BCR	7.2
IRR	53%

Total Benefits and Costs vs Time Savings

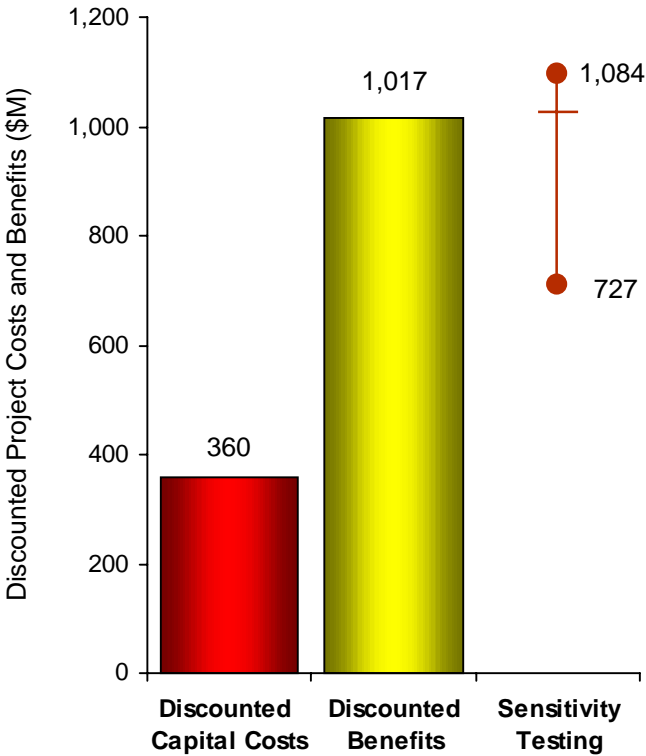


# Investment in the Melbourne – Sydney corridor generates a relatively low BCR but brings substantial absolute benefits



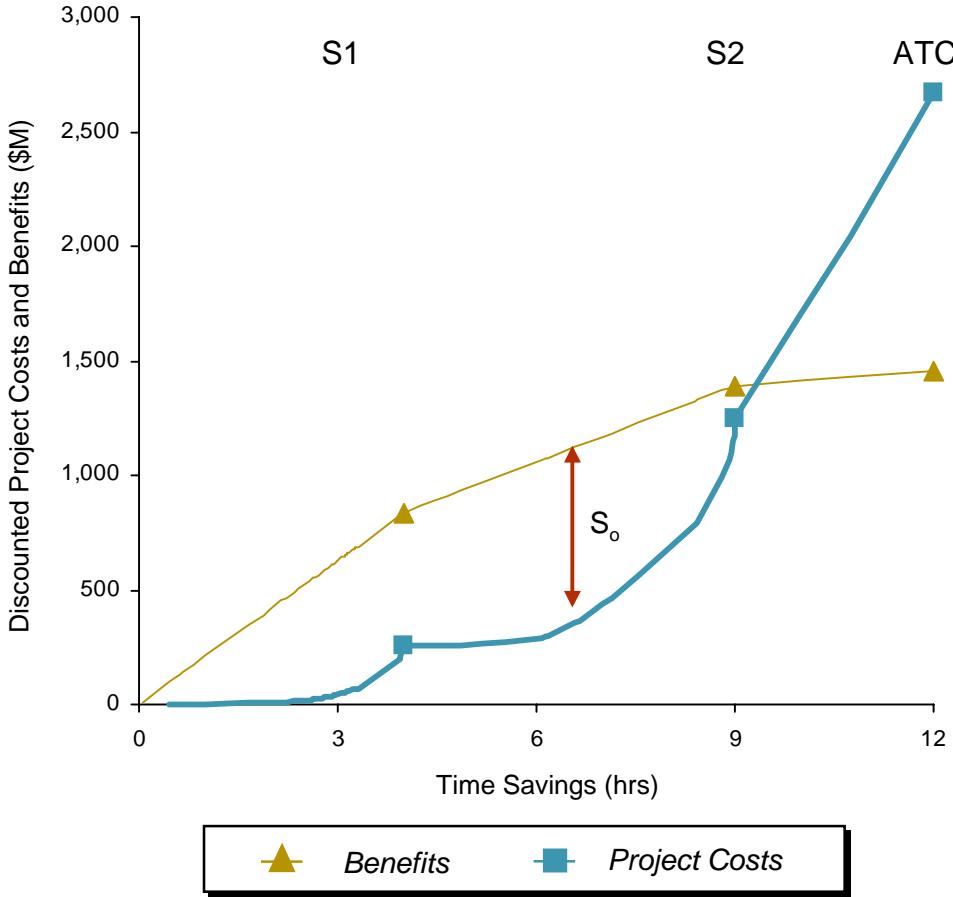
# Taken together (Melbourne - Brisbane), the Sydney - Brisbane and Melbourne - Sydney corridors generate strong benefits

### S<sub>0</sub> Evaluation Results



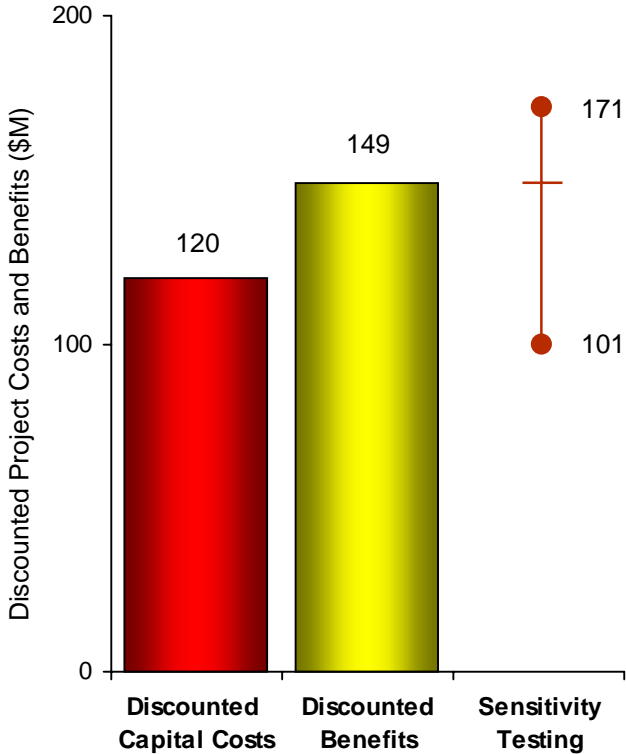
NPV (\$M)	657
BCR	2.8
IRR	22%

### Total Benefits and Costs vs Time Savings



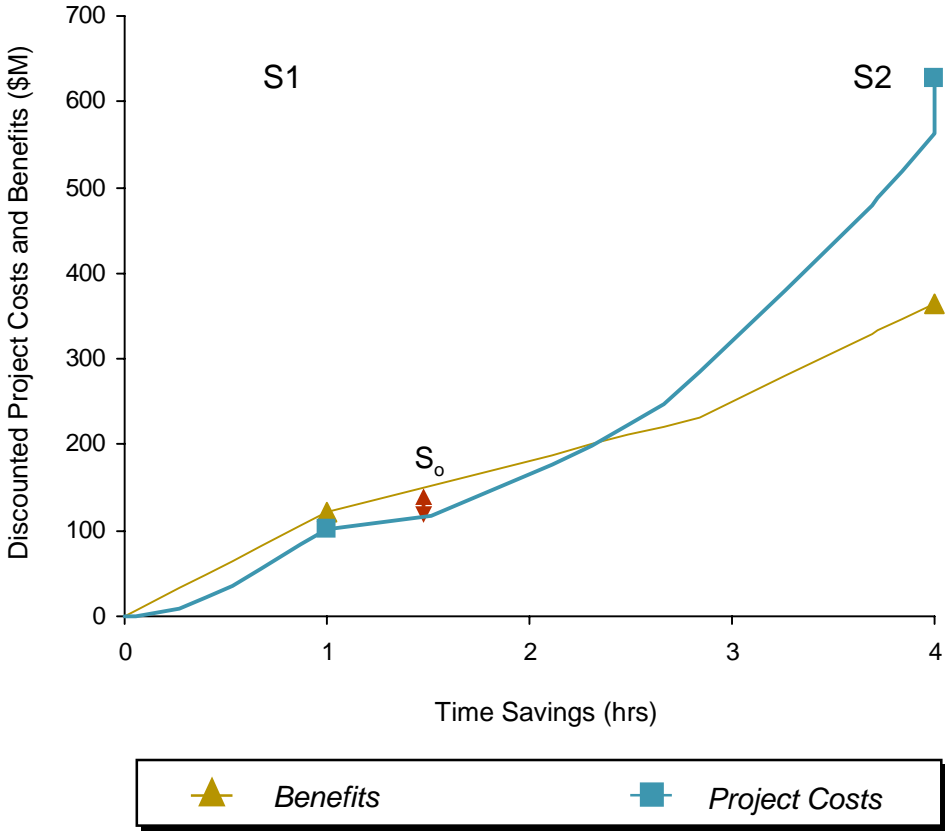
# Investment in the Melbourne – Adelaide corridor is marginal ...

### S<sub>0</sub> Evaluation Results



NPV (\$M)	28
BCR	1.2
IRR	9%

### Total Benefits and Costs vs Time Savings



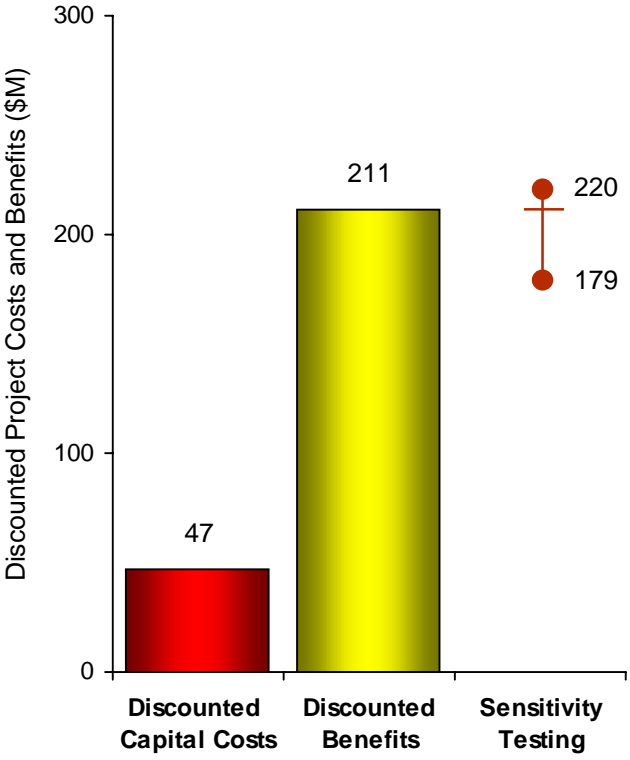
## **... and in isolation is not justified**

---

- ▶ Substantial funding has recently been spent on upgrading the track and service performance characteristics of the corridor
- ▶ The investments evaluated in this study do not provide the incremental benefits beyond recent works to justify the investment
- ▶ Funding is best spend on corridors where returns and benefits are greater
- ▶ The Melbourne - Adelaide corridor is partly upgraded with a total of \$9 million included on the line segment from the Melbourne - Perth optimised investment

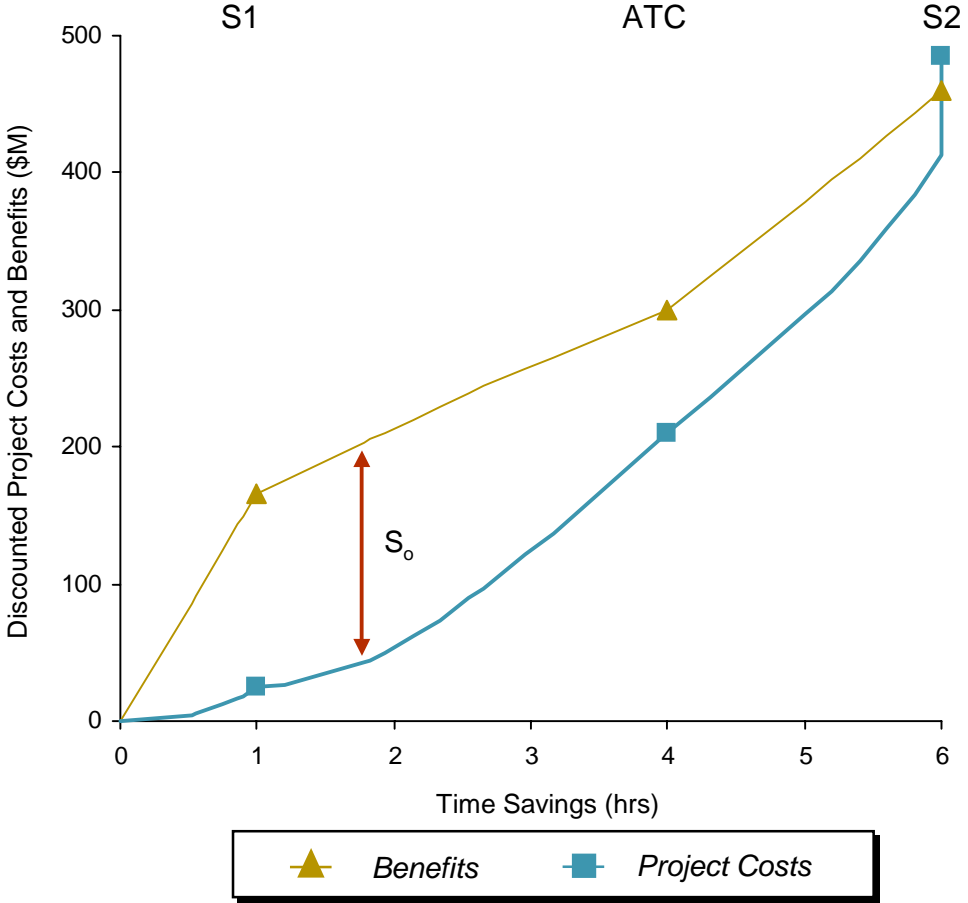
# However, investment in the overall Melbourne - Perth corridor generates good returns for modest levels of investment

### S<sub>0</sub> Evaluation Results



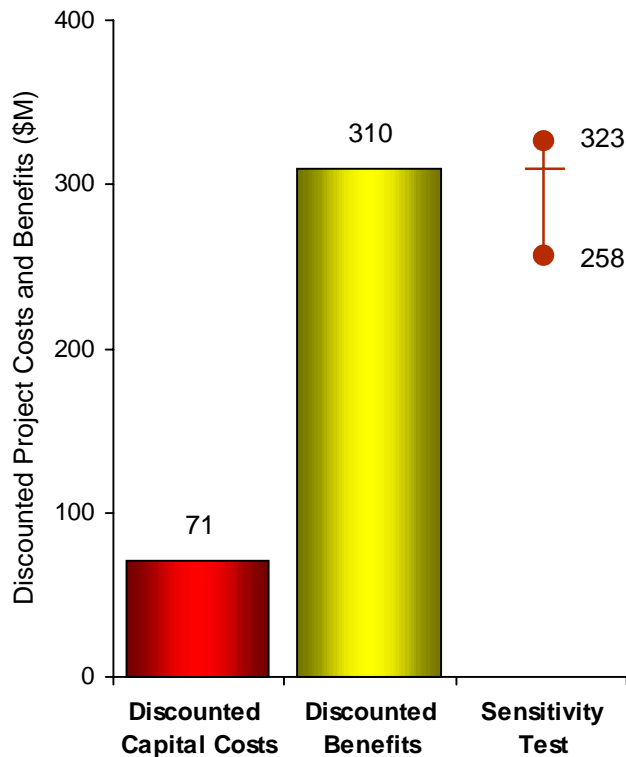
NPV (\$M)	164
BCR	4.5
IRR	33%

### Total Benefits and Costs vs Time Savings



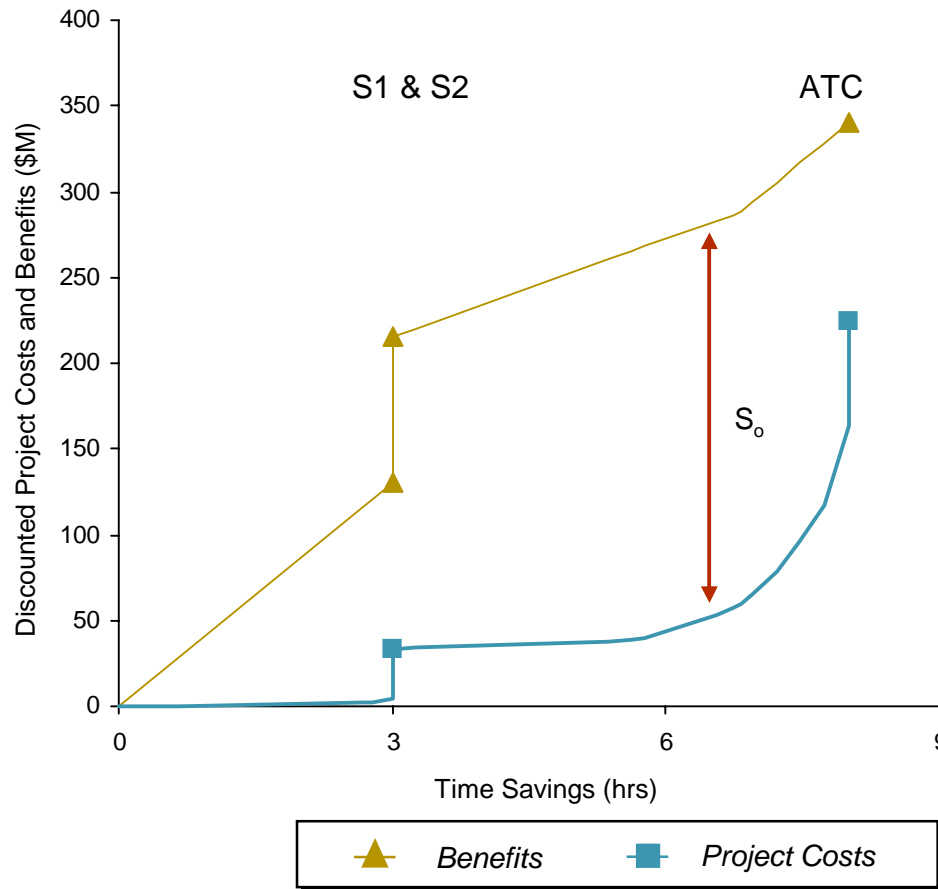
# Similarly, Sydney – Perth generates strong returns for modest levels of investment

**S<sub>0</sub> Evaluation Results**



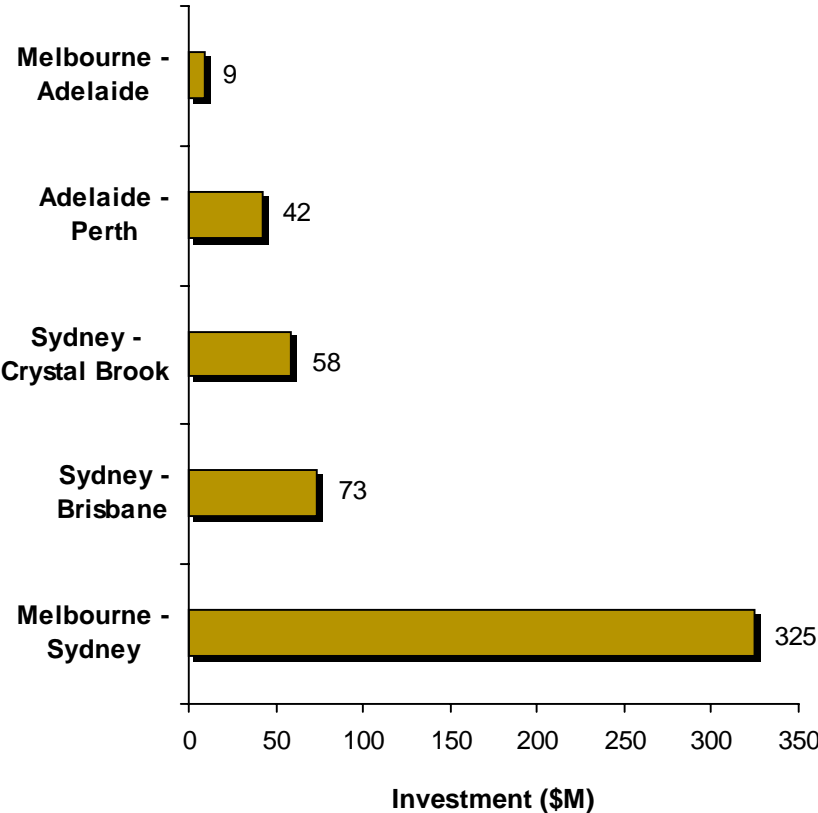
NPV (\$M)	239
BCR	4.4
IRR	32%

**Total Benefits and Costs vs Time Savings**



# Collectively, the optimised investments can deliver strong positive returns and modal shift to rail

**Optimised Investment Spend by Line Segment (\$M)**



**Optimised Investment Evaluation Results**

	<b>S<sub>0</sub> Investment</b>	
Improvement in interstate intermodal market share from base case	38%	
<b>Evaluation Results</b>	Undiscounted Capital Costs (\$M)	507
	BCR	3.2
	Benefits (\$M)	1,453
	NPV (\$M)	994



# Rail operators and customers are likely to be the largest financial beneficiaries of the optimised investments

## Distribution of Financial Benefits (\$M)

Corridor	Optimised Investment ( $S_o$ )			
	Track Owner	Rail Operators	Customers	Society
Syd - Bne	0 - 28	149 - 210	127 - 192	90 - 134
Mel - Syd	0 - 32	176 - 225	144 - 198	111 - 149
Syd - Per	0 - 11	38 - 69	185 - 208	70 - 81
Mel - Per	0 - 10	26 - 35	65 - 73	32 - 36

### Discussion

- ▶ The financial analysis identifies the chief beneficiaries of the investment
- ▶ As it is not possible to estimate the extent of benefit internalisation by the rail operators, a range of results for the four entities identified has been presented
- ▶ The range represents where the benefits:
  - Are not internalised and passed on to customers through price reductions
  - Are internalised by the track owners and operators
- ▶ Further detail on the method of apportionment of project benefits is contained within Appendix E

*Note: Where the track owner and rail operator benefits are not internalised, the benefit to customers is at the higher end of the range. Conversely, where the track owner and rail operator benefits are internalised, the benefit to customers is at the lower end of the range*

## The implementation of CBSS notionally improves the return of the optimised investment ...

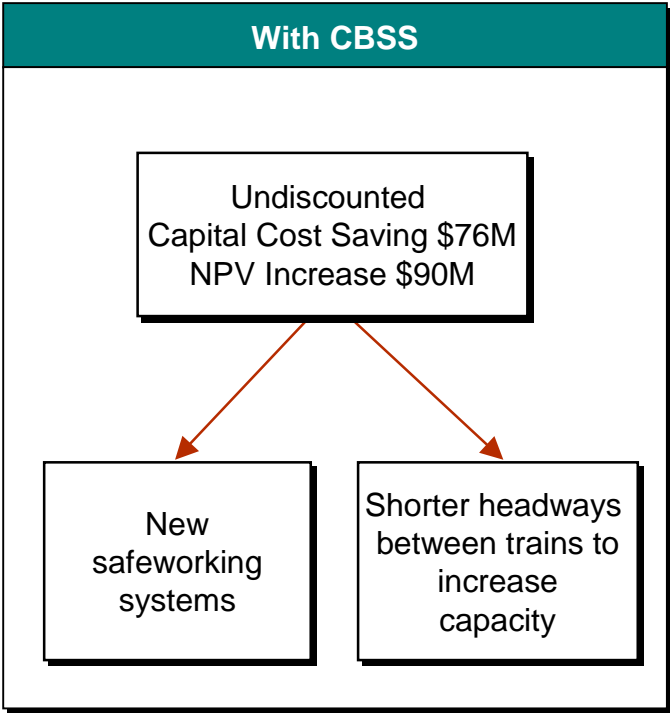
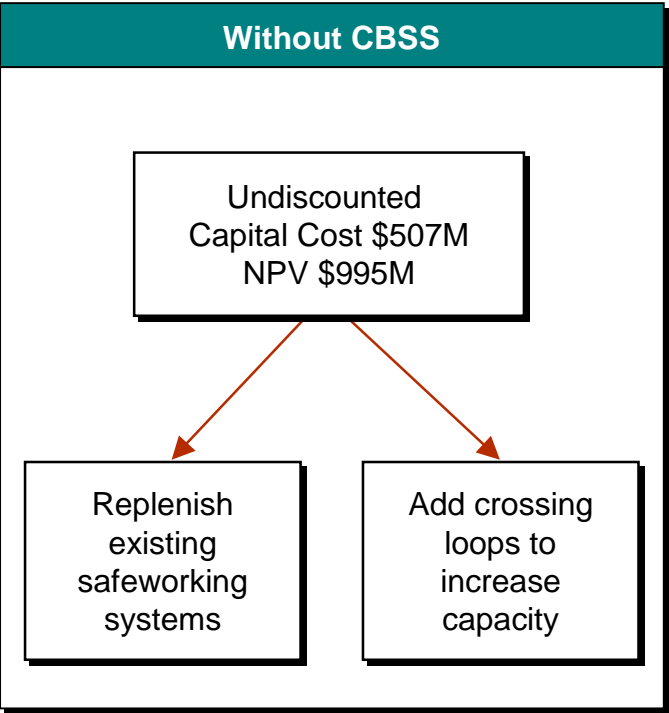
---

The implementation of CBSS has implications for the optimised investment by :

- ▶ Reducing the cost of signalling projects under the optimised investment
- ▶ Removing capacity constraints and generating additional benefit
- ▶ Improving NPV of the optimal investment by \$90M
  - This captures the marginal impact of CBSS on the optimised investment however, does not consider the full costs and benefits of system implementation

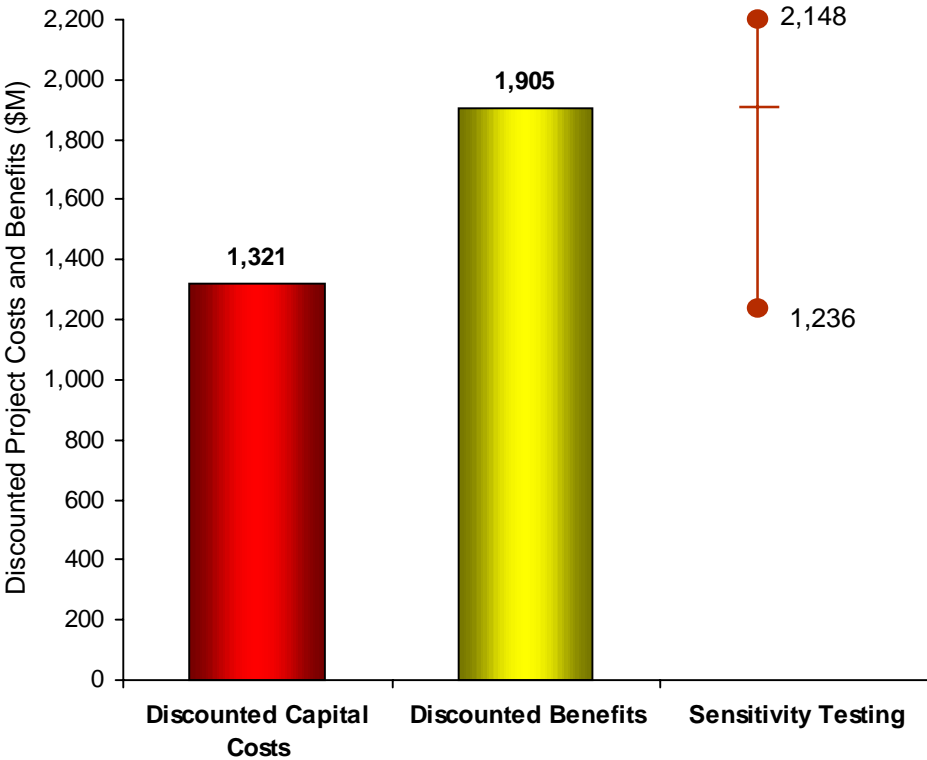
# ... by creating saleable capacity and decreasing the scope of infrastructure works

▶ Excludes the cost of implementing CBSS  
▶ Does not consider the full benefits of CBSS



# Based on pre-feasibility estimates, the proposed inland route generates a positive return on investment

### Inland Prefeasibility Evaluation Results



NPV (\$M)	584
BCR	1.4
IRR	11%

Note: (1) Scenario 2 with double stacking

## Investment Appraisal

# The optimised investment is beneficial irrespective of a decision on the inland route but further detailed market analysis needs to be undertaken

---

The key assumptions used in the analysis include:

- ▶ Market figures are largely based on Maunsell McIntyre's pre-feasibility estimates (Alignment A2M option)
- ▶ Capital spend estimates provided by Ove Arup
- ▶ Market estimate adjustments:
  - No inland diversion for the Sydney to Brisbane corridor
  - Melbourne - Sydney volumes remain unchanged
  - Total NTK's on the inland route reduce from Maunsell's estimate of 12 billion NTK's to 11.3 billion NTK's
- ▶ Construction completed by 2005

# Investment Plan

---

# On an NPV ranked basis, priority should be given to the upgrade of the North-South corridors

## Optimised Investment (\$<sub>o</sub>)



	North-South		East-West	
	Syd - Bne	Mel - Syd	Syd - Per	Mel - Per
Improvement in corridor intermodal market share from base case	59%	77%	12%	6%
Corridor intermodal market share	30%	20%	73%	74%



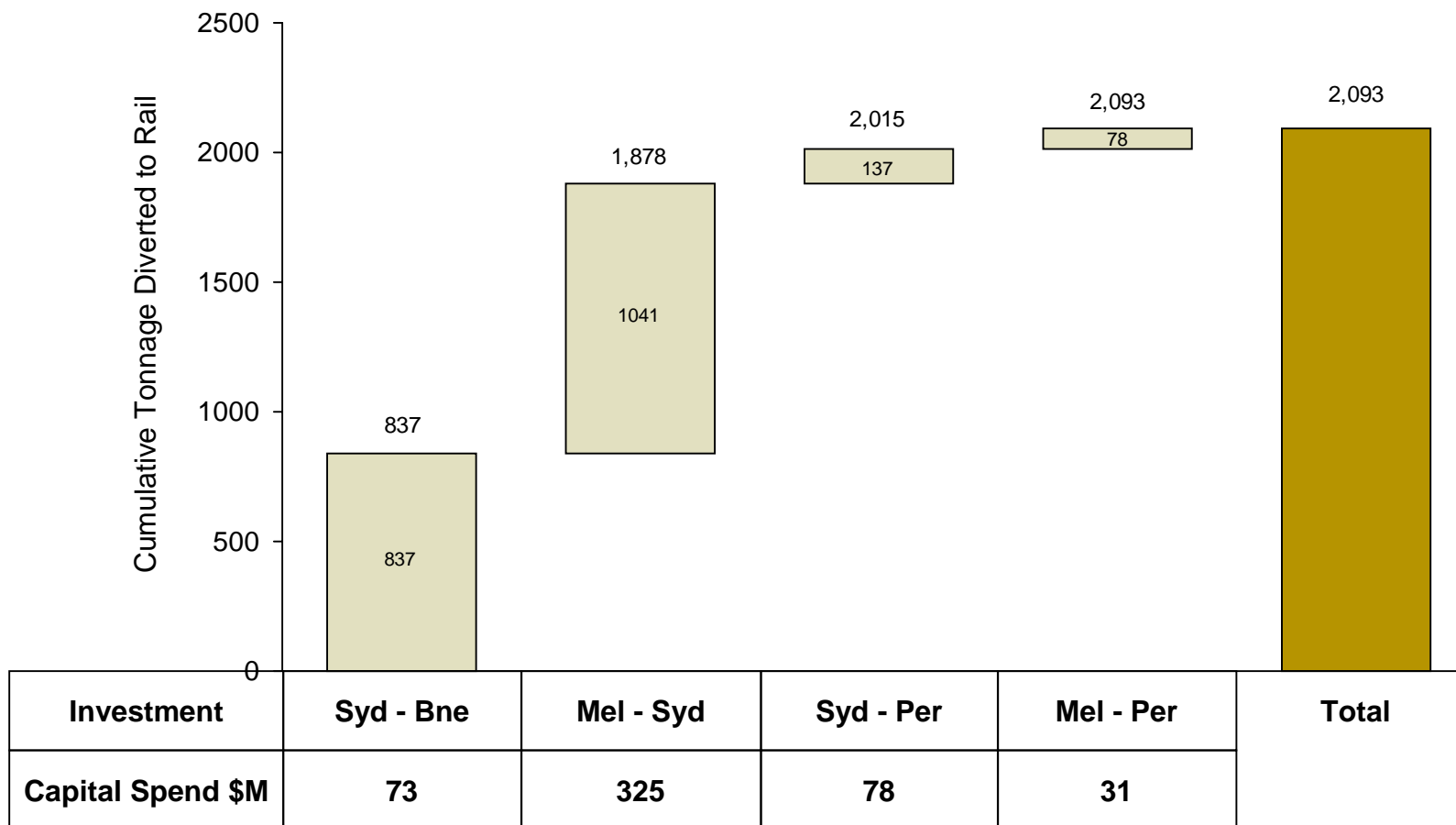
Evaluation Results	Undiscounted Capital Cost (\$M)	73	325	78	31
	Cumulative Undiscounted Capital Cost (\$M)	73	398	476	507
	NPV (\$M)	410	247	239	98
	BCR	7.2	1.8	4.4	4.5

Note: Investment adjusted to account for the specific projects completed within the Syd - Per investment

## Investment Plan

# These investments would create the competitive improvement necessary to support a substantial tonnage shift to rail on the North-South corridors

Cumulative Tonnage Diverted to Rail - S<sub>o</sub> (2000)





## The diverted tonnage represents around 128,000 truck trips per annum

### Estimated Reduction in Truck movements - S<sub>o</sub> (2000)

Corridor	No. of Truck Trips Saved Per Annum	Trucks removed from the total fleet
Syd - Bne	60,000	259
Mel - Syd	51,000	311
<b>Total North - South</b>	<b>111,000</b>	<b>570</b>
Syd - Per	11,000	169
Mel - Per	6,000	72
<b>Total East - West</b>	<b>17,000</b>	<b>241</b>
<b>TOTAL</b>	<b>128,000</b>	<b>811</b>



Externality Benefits
▶ Reduce greenhouse gas emissions
▶ Reduce road accidents
▶ Noise and air pollution savings
▶ Deferred road maintenance expenditure

Note: A separate analysis of greenhouse gas savings from these investments is provided in Appendix G

## Investment Plan

# In the North-South the optimised investments are likely to be required in the near future to address congestion and reliability concerns

## North-South Optimised Investment Spend

Corridor	Investment (\$M)	Major Project Works (\$M)
Syd - Bne	73	▶ Crossing Loops (1500m) 31
		▶ Hornsby Stn Works 20
Mel - Syd	325	▶ Sydney Freight Priority Project 146
		▶ Deviations 73
		▶ Crossing Loops (1500m) 32

Discussion
<ul style="list-style-type: none"> <li>▶ The optimised investment accommodates increased volumes and postpones capacity constraints that would otherwise occur in the near future</li> <li>▶ Significantly improves rail's price and service package in each corridor <ul style="list-style-type: none"> <li>– Reduces transit time</li> <li>– Improves reliability</li> </ul> </li> <li>▶ Provides sufficient 1500m train paths to cater for market demand</li> </ul>

## In the East-West, the optimised investment maximises the service potential of the existing infrastructure

### East-West Optimised Investment Spend

Corridor	Investment (\$M)	Major Project Works (\$M)
Syd - Per	78	▶ National train planning and operations management 20
		▶ Vertical clearance works 15
Mel - Per	31	▶ National train planning and operations management 15
		▶ Curve Speeds 13

Discussion
<p>The optimised investments:</p> <ul style="list-style-type: none"> <li>▶ Generally consists of relatively minor works, enhancing the performance of the existing infrastructure</li> <li>▶ Generate strong BCR's</li> <li>▶ Largely improves rail's package of price and service characteristics in the Sydney - Perth corridor <ul style="list-style-type: none"> <li>– Providing 1,800m train paths and double stacking between Parkes and Perth</li> </ul> </li> </ul>

**Investment Plan**

# **The success of the investment plan requires a single set of consistent management priorities and actions and complementary above rail improvements**

---

- ▶ Corridor investments should be undertaken in their entirety
  - Any piecemeal or partial investment will dilute the benefits
  - Maximum benefits for the infrastructure projects will occur if conducted in conjunction with CBSS
  
- ▶ Infrastructure management will need to be co-ordinated and seamless
  - Operators should be able to negotiate through access arrangements with ease and certainty and not be impeded by multiple jurisdictions
  - Train pathing and timetables should be set on a total market basis to ensure maximum benefits are obtained by all parties
  - Train management should be co-ordinated over the whole corridor to maximise opportunities for recovering train delays and to ensure train control decisions take account of network impacts
  
- ▶ Operators' performance must be improved
  - Improved overall rail performance will require on-going improvements in both above and below rail performance

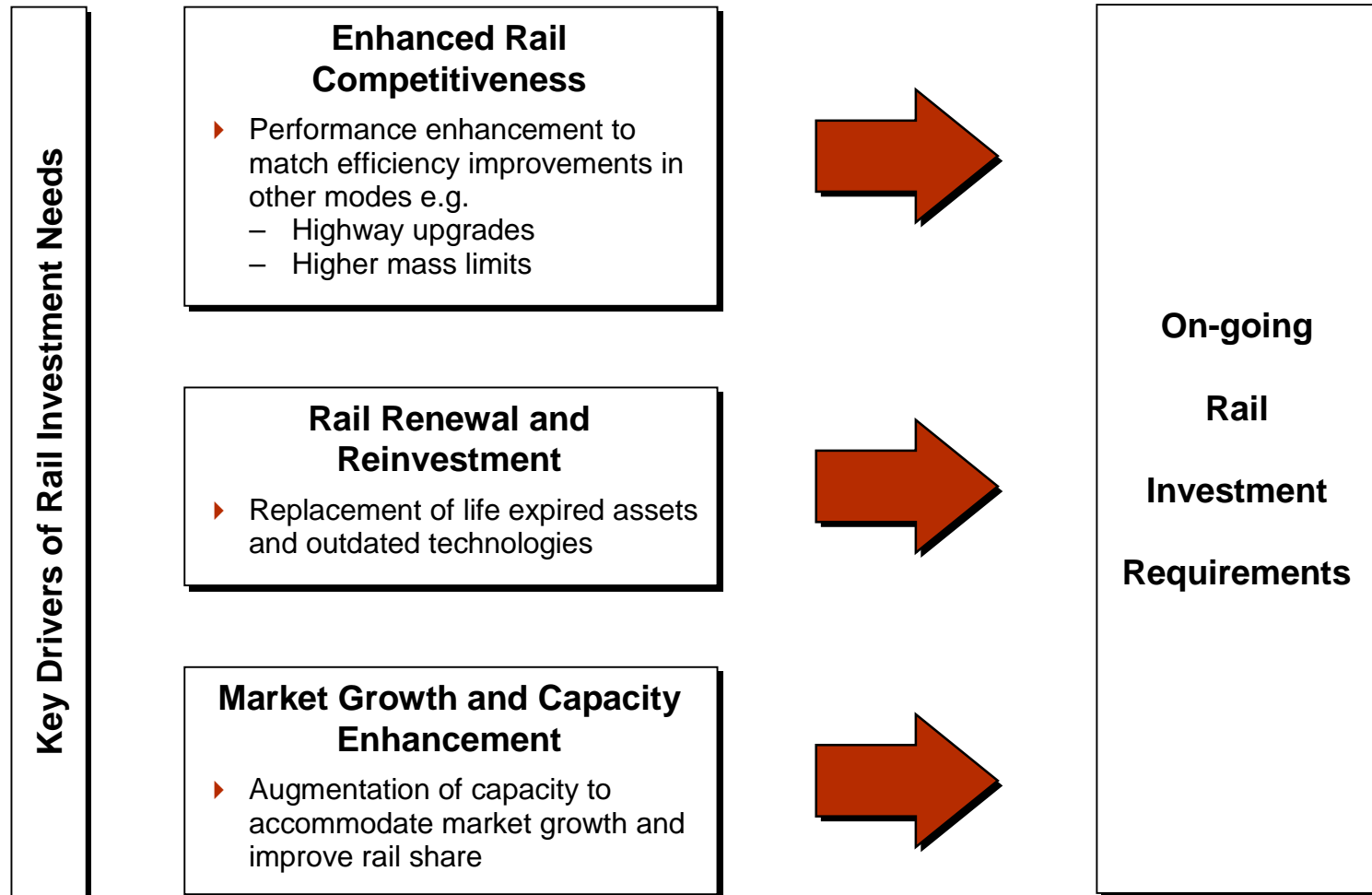
# Of the investment required, \$155M in funding has already been committed under previous programs

## Additional Investment Funding (\$M)

Market		Projects Committed	Funding Committed in Principle (\$ M)	Optimised Investment Costs (\$ M)	Additional Investment Funding (\$ M)
North-South	Syd - Bne	Extension of Crossing loops between Sydney & Brisbane	20	73	53
	Mel - Syd	Extension of Crossing loops between Albury & Sydney Provision for dedicated freight track through Sydney	132	325	193
East-West	Syd - Per	Extension of Crossing loops between Parkes & Broken Hill	3	78	75
	Mel - Per	–	–	31	31
<b>Total</b>			<b>155</b>	<b>507</b>	<b>352</b>

## Investment Plan

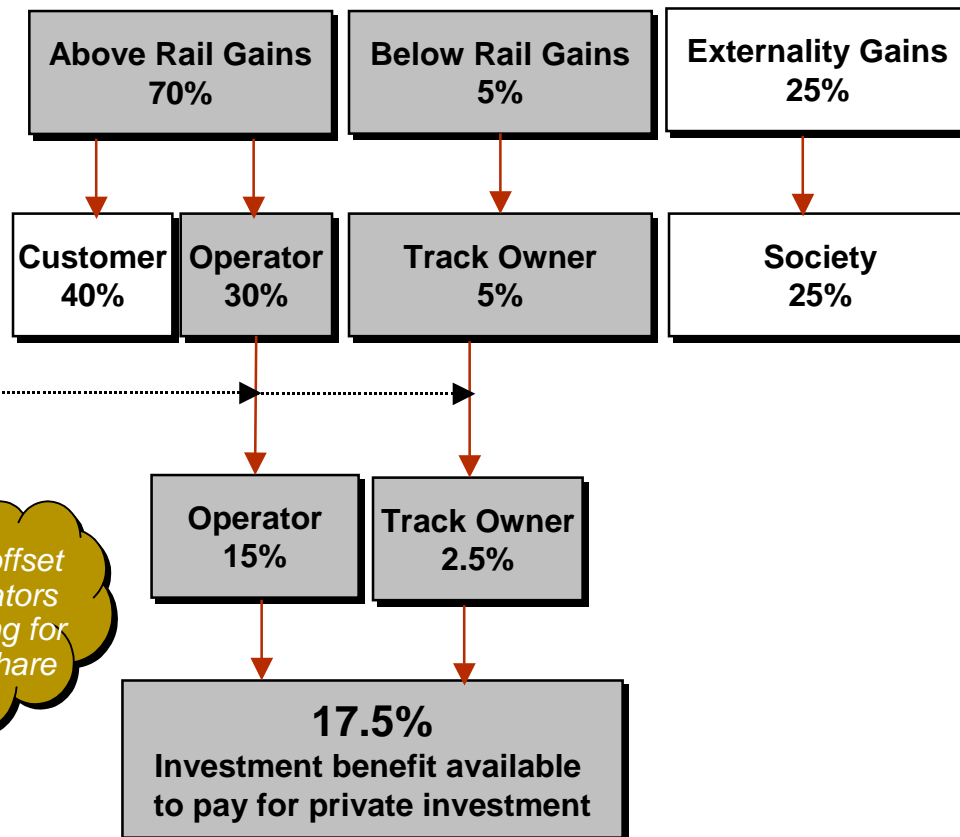
# The optimal investment addresses the present needs for improved rail capabilities, enhancing the ability of rail to self-fund ongoing investment requirements



## Investment Plan

# However, there are limited opportunities for private financing in the short term because of limited internally generated additional cash flows

## Distribution of Financial Benefits



- ▶ Institutional arrangements for track management are a further impediment to private sector financing. This is due to:
  - the lack of consistency and coherence in the conduct of the institutions, and
  - segmented product quality and control

Together this increases the risk of gaining and retaining market outcomes

- ▶ However, with market share improvements emerging from the successful implementation of this investment plan, a platform from which rail can attract private sector investment in the future is possible

## Attachment A : Performance Scenario Evaluation Results

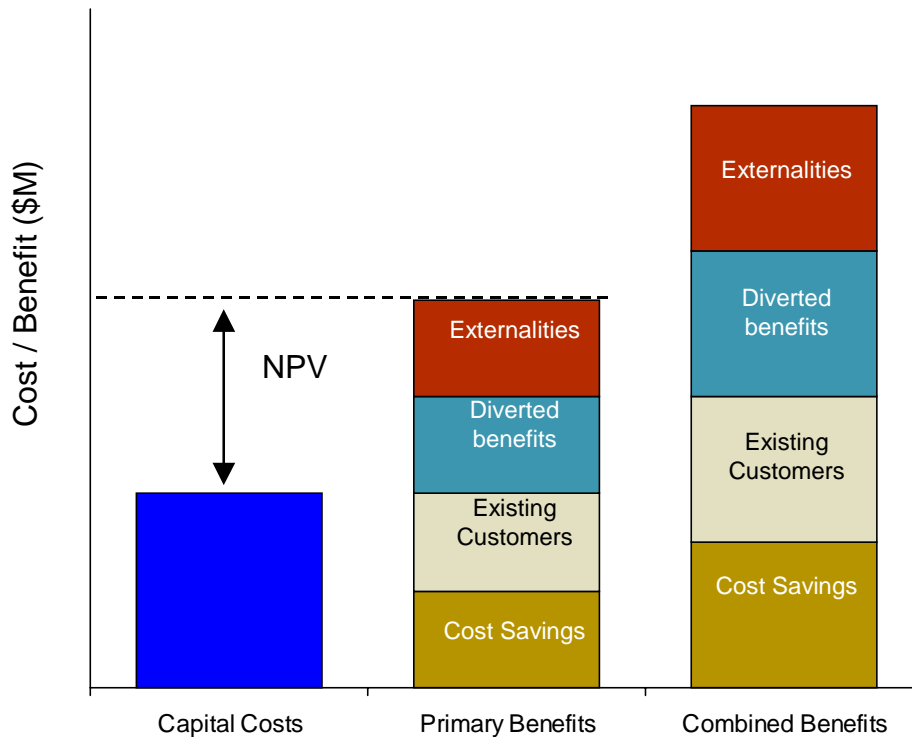
---

▶ North-South

▶ East-West



## The evaluation estimates the benefits to the primary user and to all users of the market corridor separately

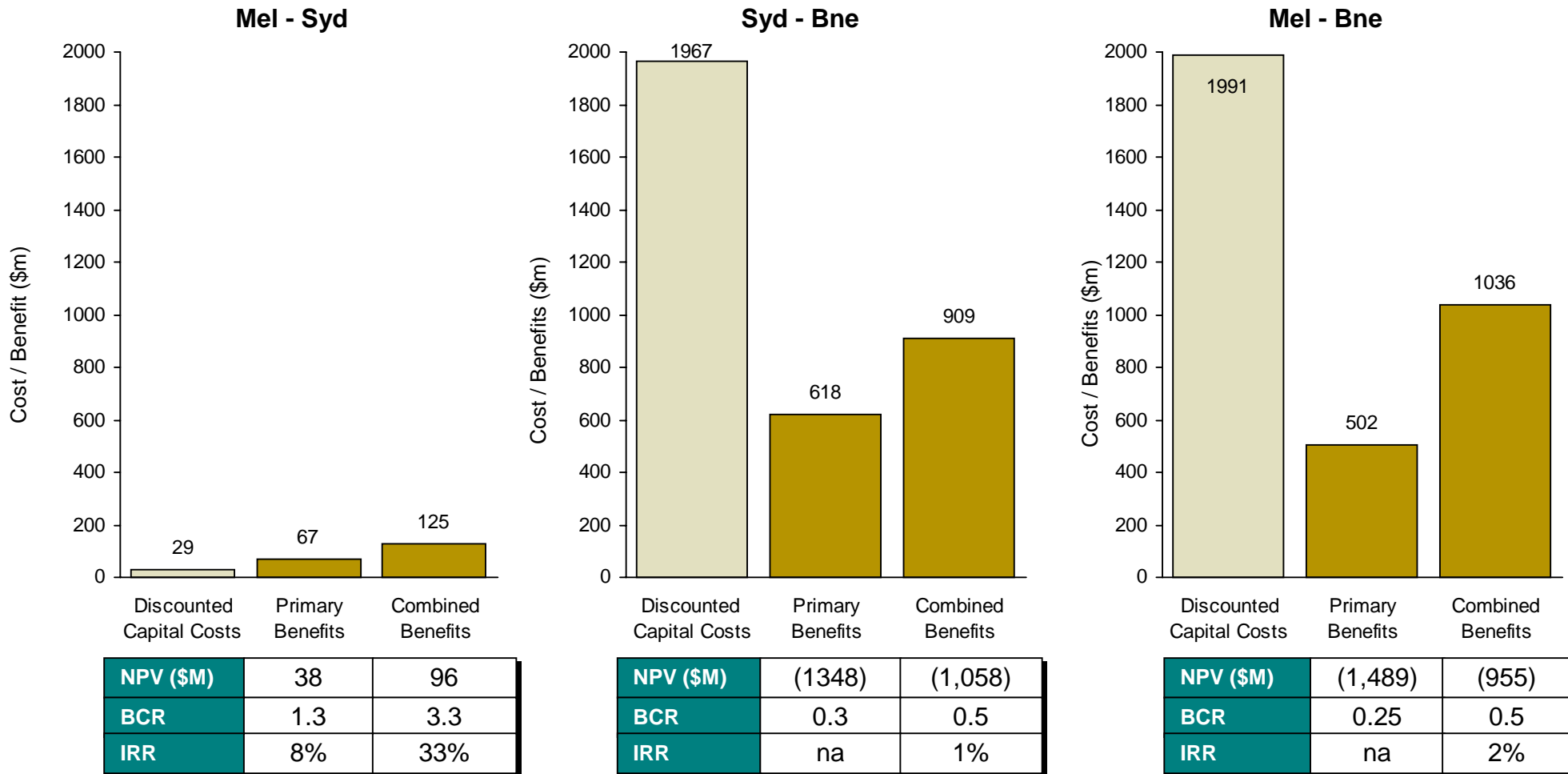


### Definition

- ▶ The primary benefits are the total economic benefits that accrue to the traffic that travels the length of the market corridor
  - The Primary traffic for the Melbourne - Brisbane market is Melbourne - Brisbane movements which does not include Melbourne - Sydney and Sydney - Brisbane movements
- ▶ Combined benefits are the benefits which accrue to all users of the market corridor
  - Includes all Melbourne - Brisbane, Melbourne - Sydney and Sydney - Brisbane segment movements

# The cost of achieving the ATC targets is high for most of the North South corridors

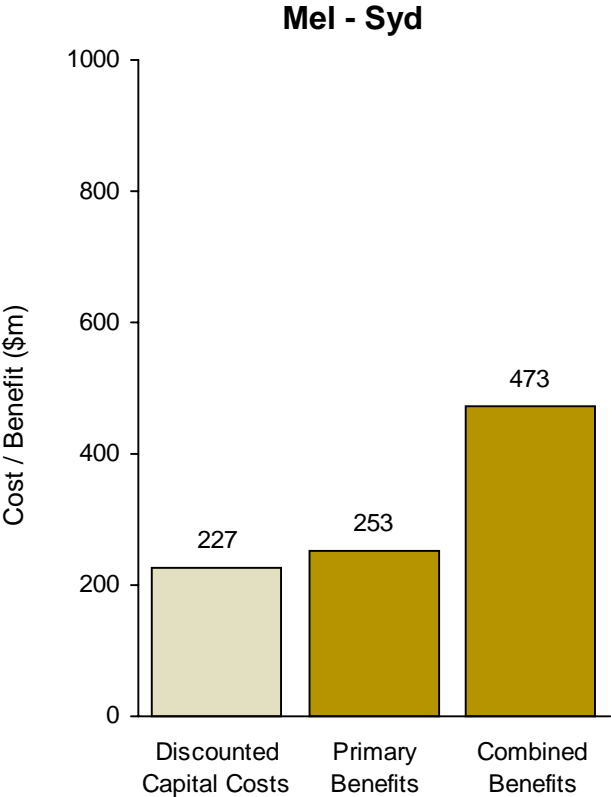
## North - South ATC Evaluation Results



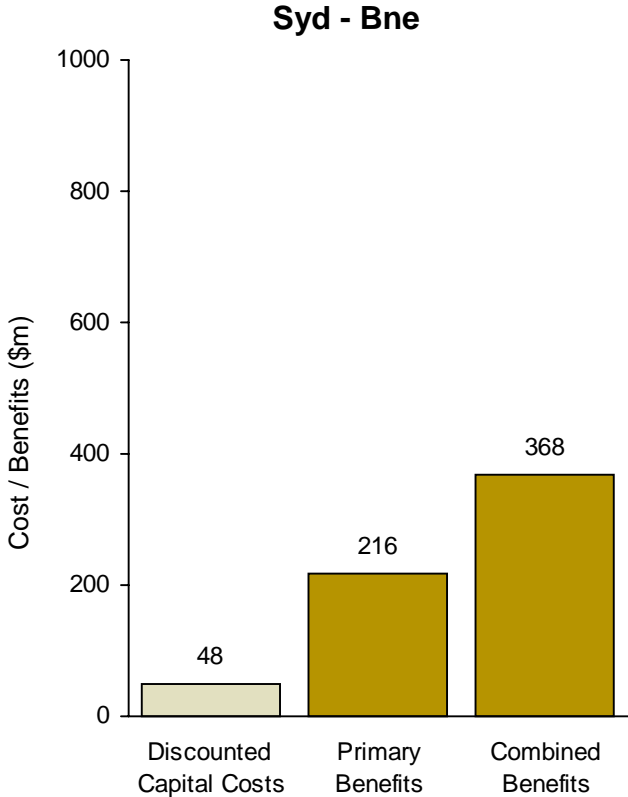
Note: Mel-Bne is not the sum of Mel-Syd and Syd-Bne as the performance targets of the two market segments do not exactly equate to the performance targets set for Mel-Bne

# Scenario 1 returns a positive NPV for all market corridors

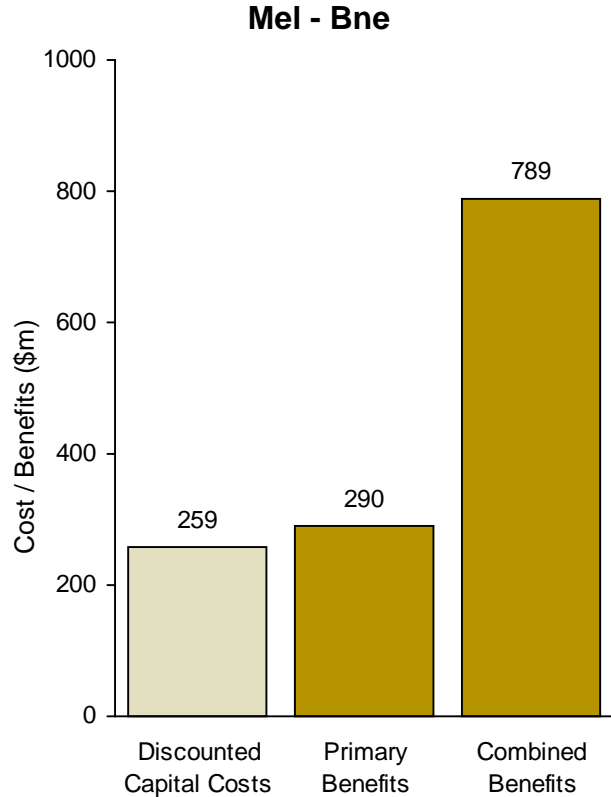
## North - South Scenario 1 Evaluation Results



<b>NPV (\$M)</b>	27	246
<b>BCR</b>	1.1	2.1
<b>IRR</b>	8%	16%



<b>NPV (\$M)</b>	168	320
<b>BCR</b>	4.5	7.7
<b>IRR</b>	34%	56%

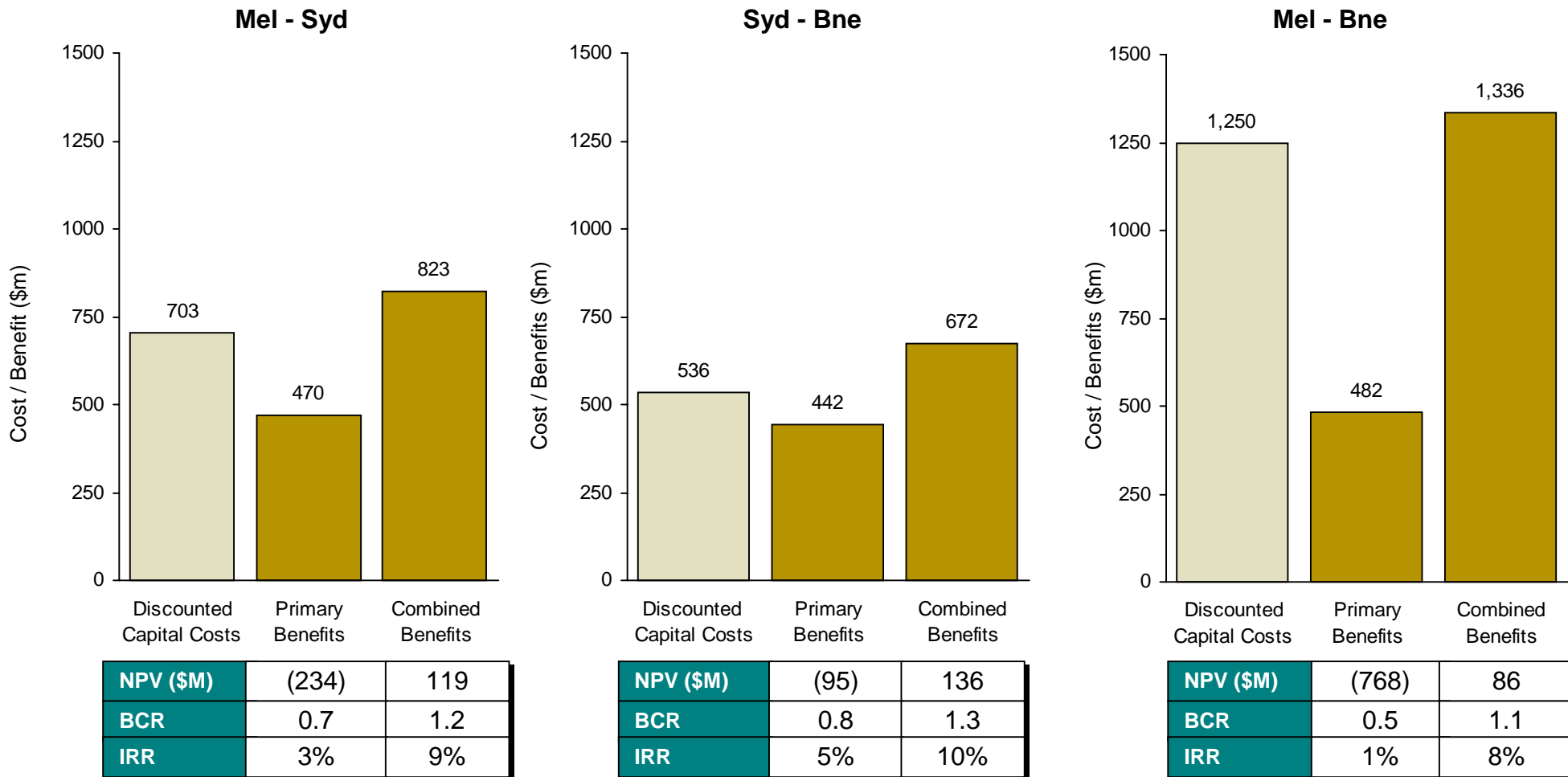


<b>NPV (\$M)</b>	30	530
<b>BCR</b>	1.1	3.0
<b>IRR</b>	8%	24%

Note: Mel-Bne is not the sum of Mel-Syd and Syd-Bne as the performance targets of the two market segments do not exactly equate to the performance targets set for Mel-Bne

# While the return on investment under Scenario 2 is marginal in these markets

## North - South Scenario 2 Evaluation Results

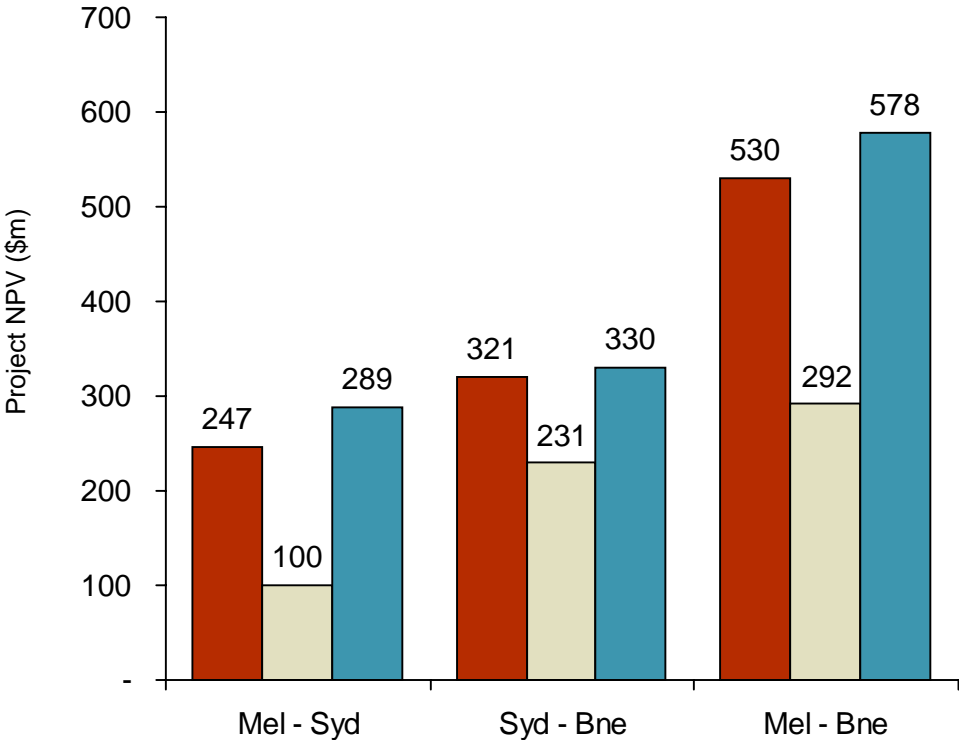


Note: Mel-Bne is not the sum of Mel-Syd and Syd-Bne as the performance targets of the two market segments do not exactly equate to the performance targets set for Mel-Bne

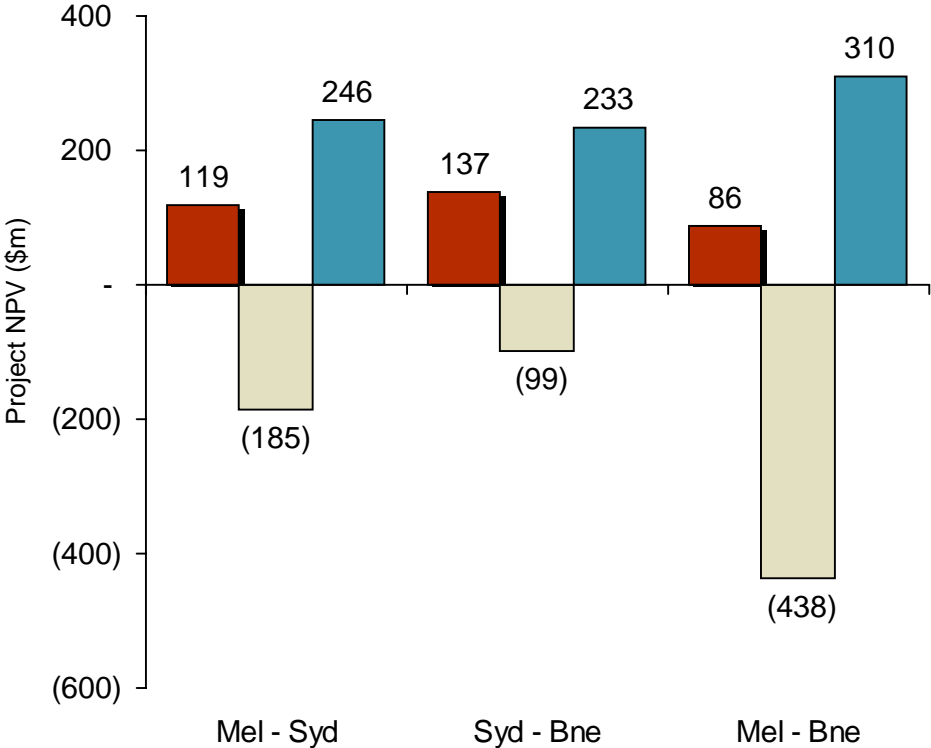
Attachment A: Evaluation Results

# The North - South market corridors maintain a positive NPV under sensitivity testing for Scenario 1 investments

### Scenario 1 Sensitivity Testing (Combined Benefits)



### Scenario 2 Sensitivity Testing (Combined Benefits)



## Attachment A : Performance Scenario Evaluation Results

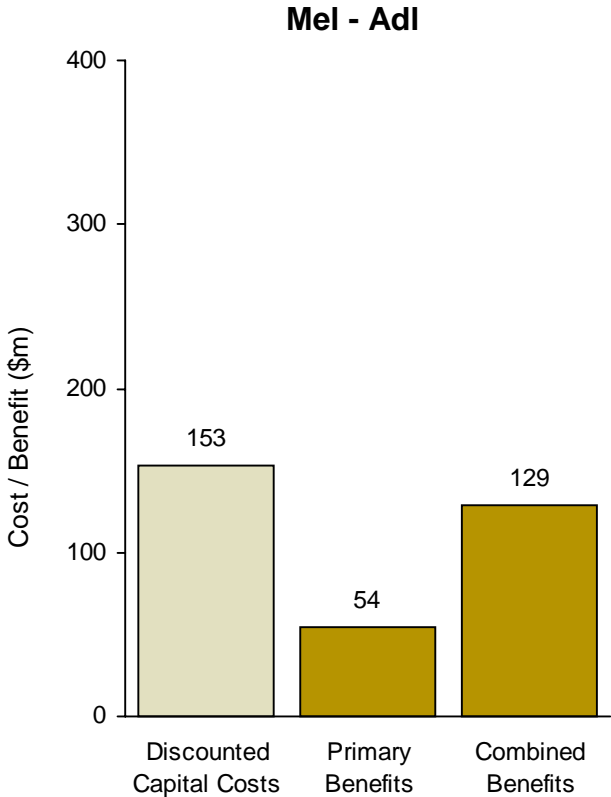
---

▶ North-South

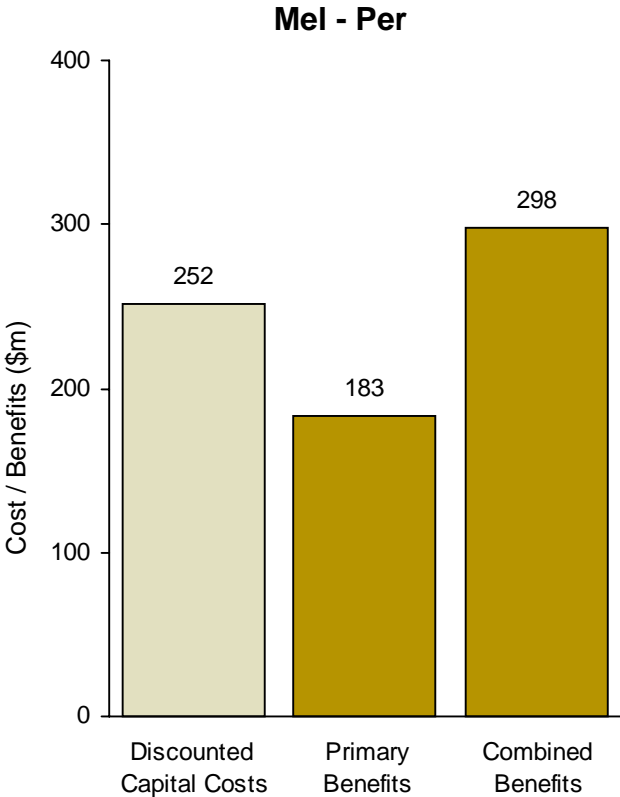
▶ East-West

# ATC target investments do not generate strong returns in the East - West markets

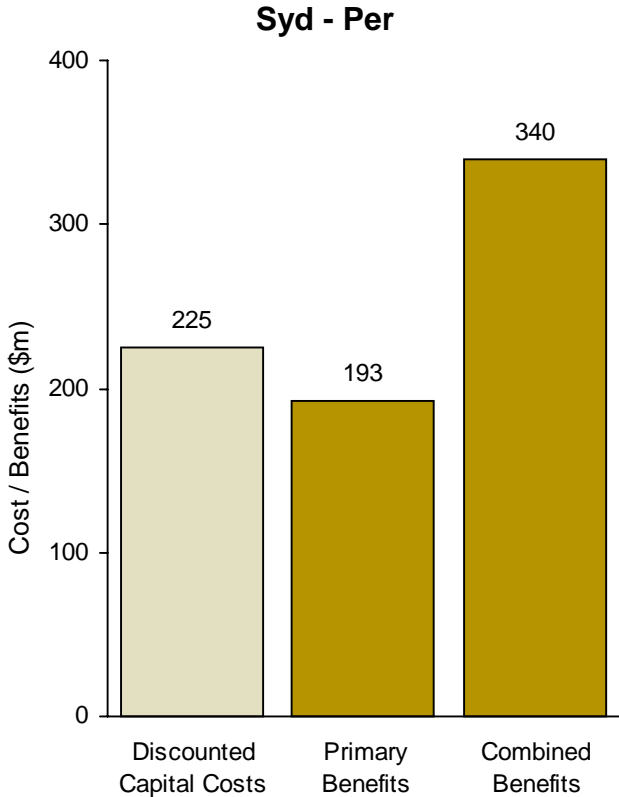
## East - West ATC Evaluation Results



<b>NPV (\$M)</b>	(99)	(24)
<b>BCR</b>	0.35	0.8
<b>IRR</b>	na	5%



<b>NPV (\$M)</b>	(68)	46
<b>BCR</b>	0.73	1.2
<b>IRR</b>	4%	9%

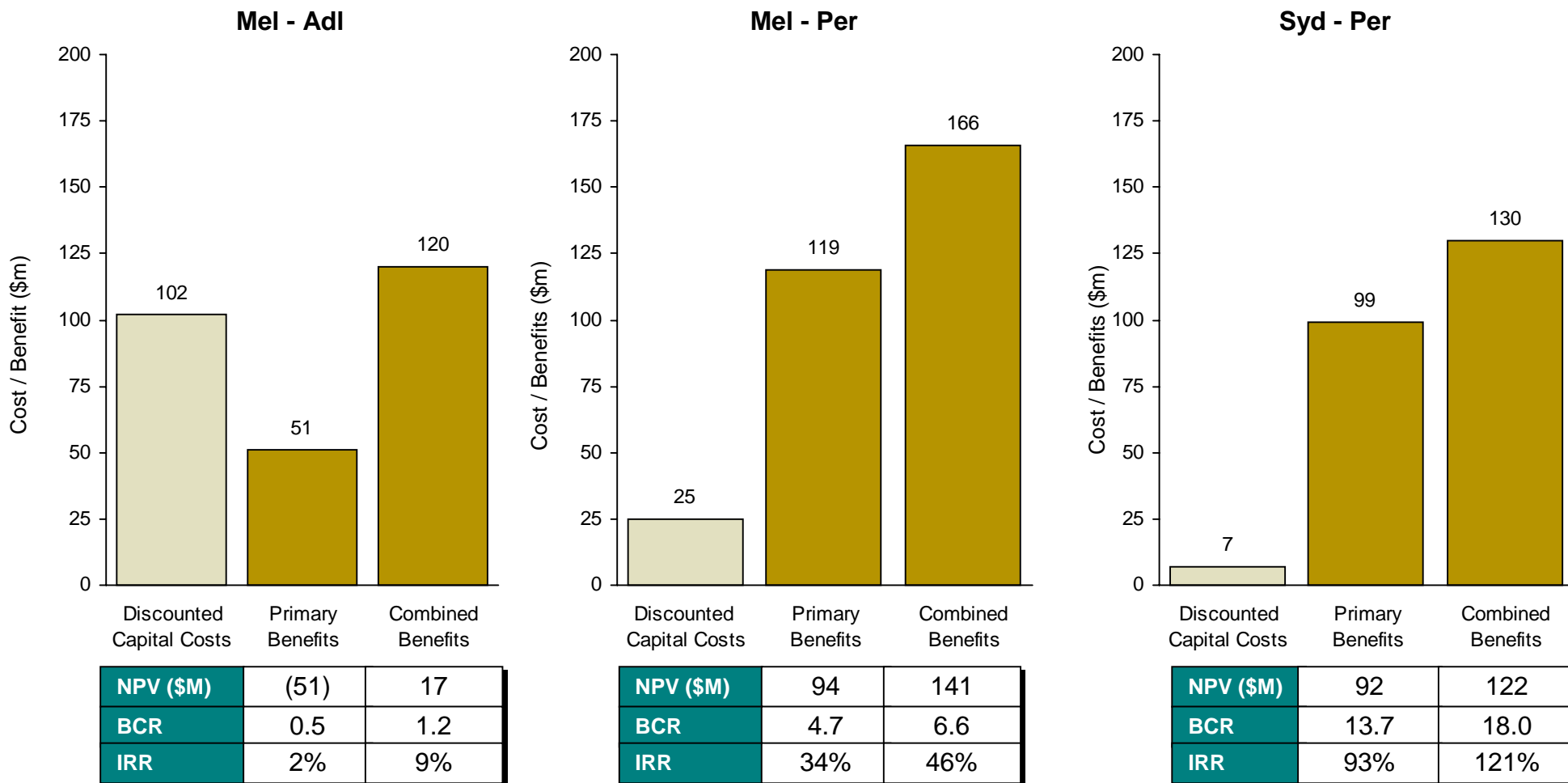


<b>NPV (\$M)</b>	(31)	115
<b>BCR</b>	0.86	1.5
<b>IRR</b>	6%	19%

## Attachment A: Evaluation Results

## Positive NPVs for Scenario 1 are achieved with low capital expenditure required in the corridors to Perth

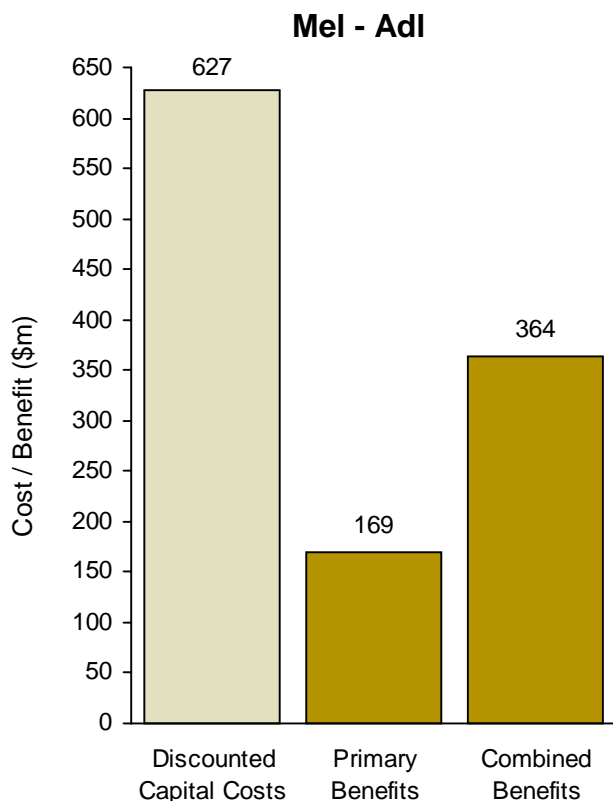
### East - West Scenario 1 Evaluation Results



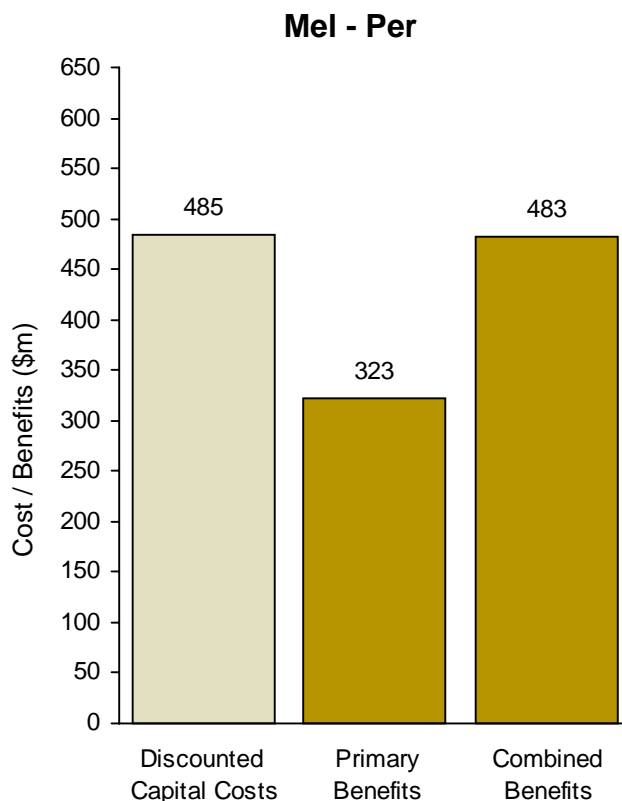


# Scenario 2 also shows a strong positive return for Sydney - Perth with relatively low capital cost requirements

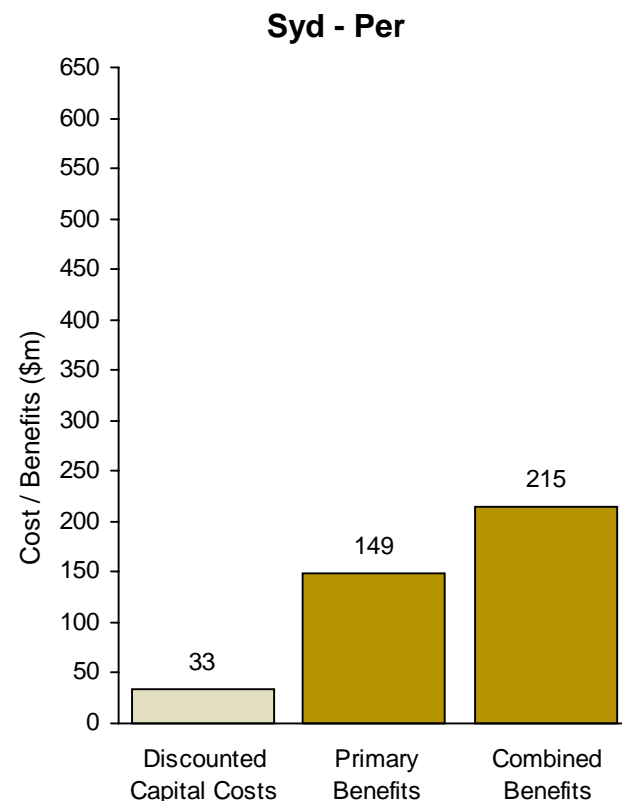
## East - West Scenario 2 Evaluation Results



<b>NPV</b>	(458)	(263)
<b>BCR</b>	0.27	0.6
<b>IRR</b>	na	3%



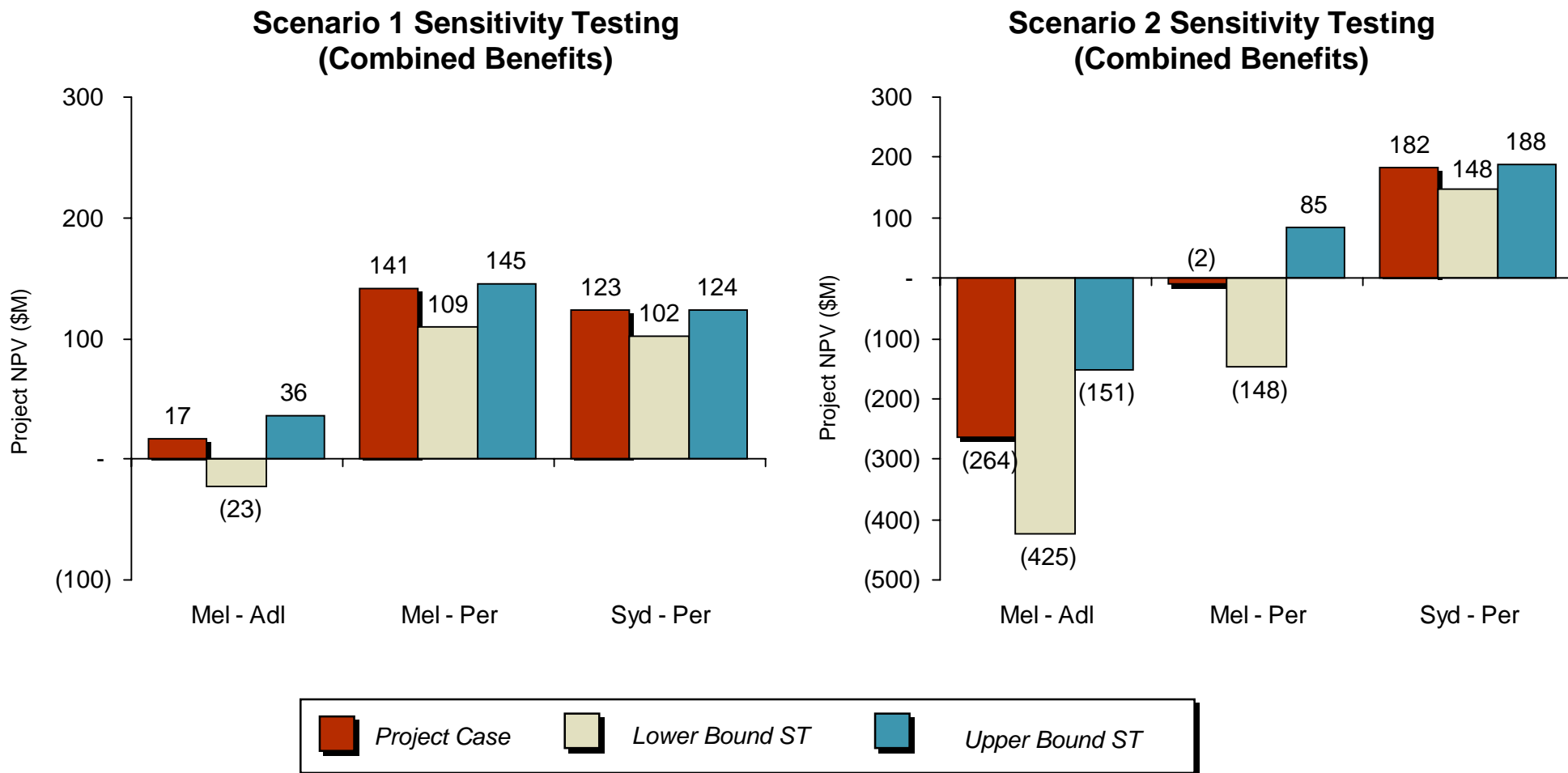
<b>NPV</b>	(162)	(2)
<b>BCR</b>	0.67	1.0
<b>IRR</b>	4%	7%



<b>NPV</b>	116	182
<b>BCR</b>	4.45	6.4
<b>IRR</b>	32%	45%

## Attachment A: Evaluation Results

# Melbourne - Perth and Sydney - Perth are able to maintain positive NPVs under Scenario 1 sensitivity testing - Melbourne - Adelaide does not



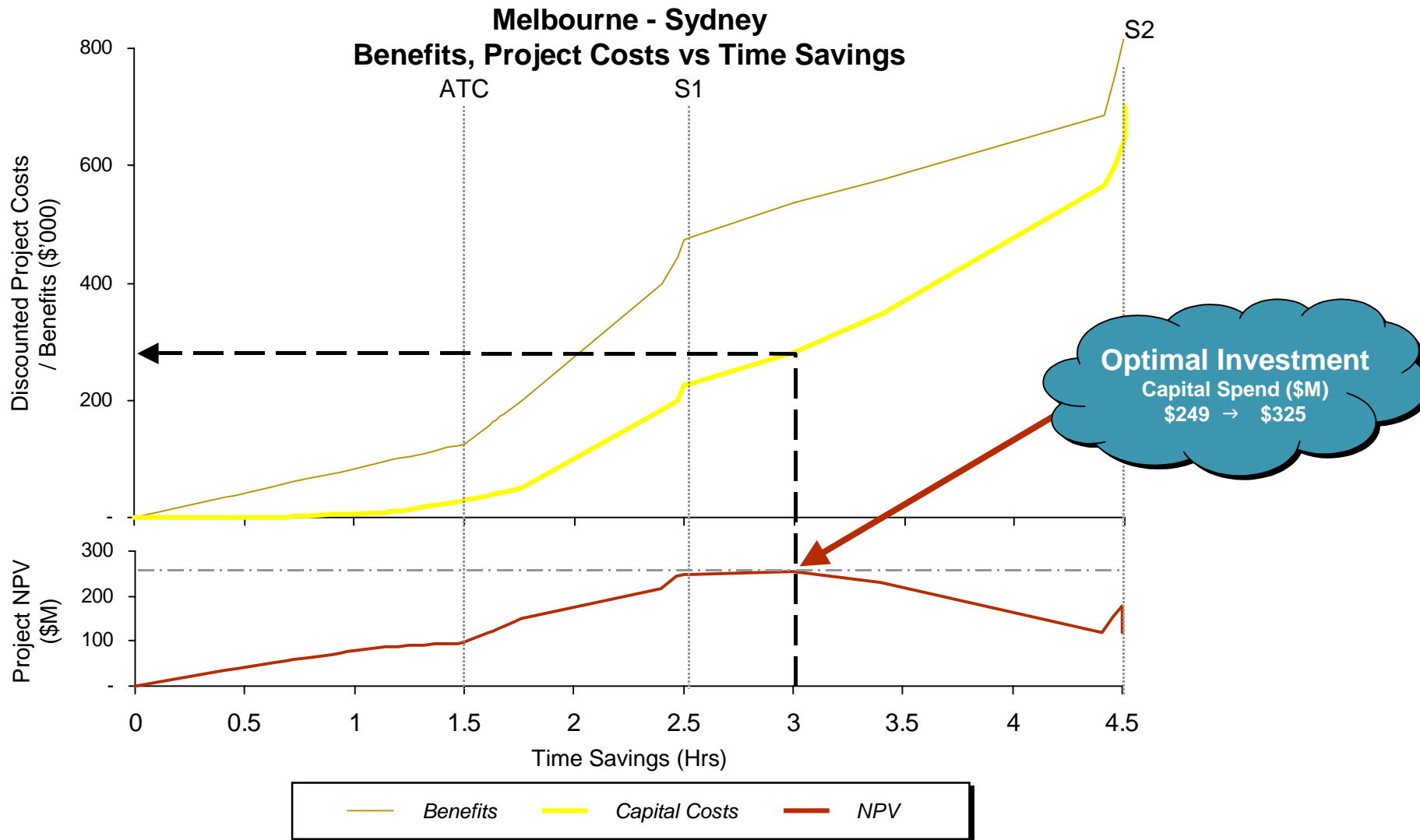
## Attachment B : Optimisation

---

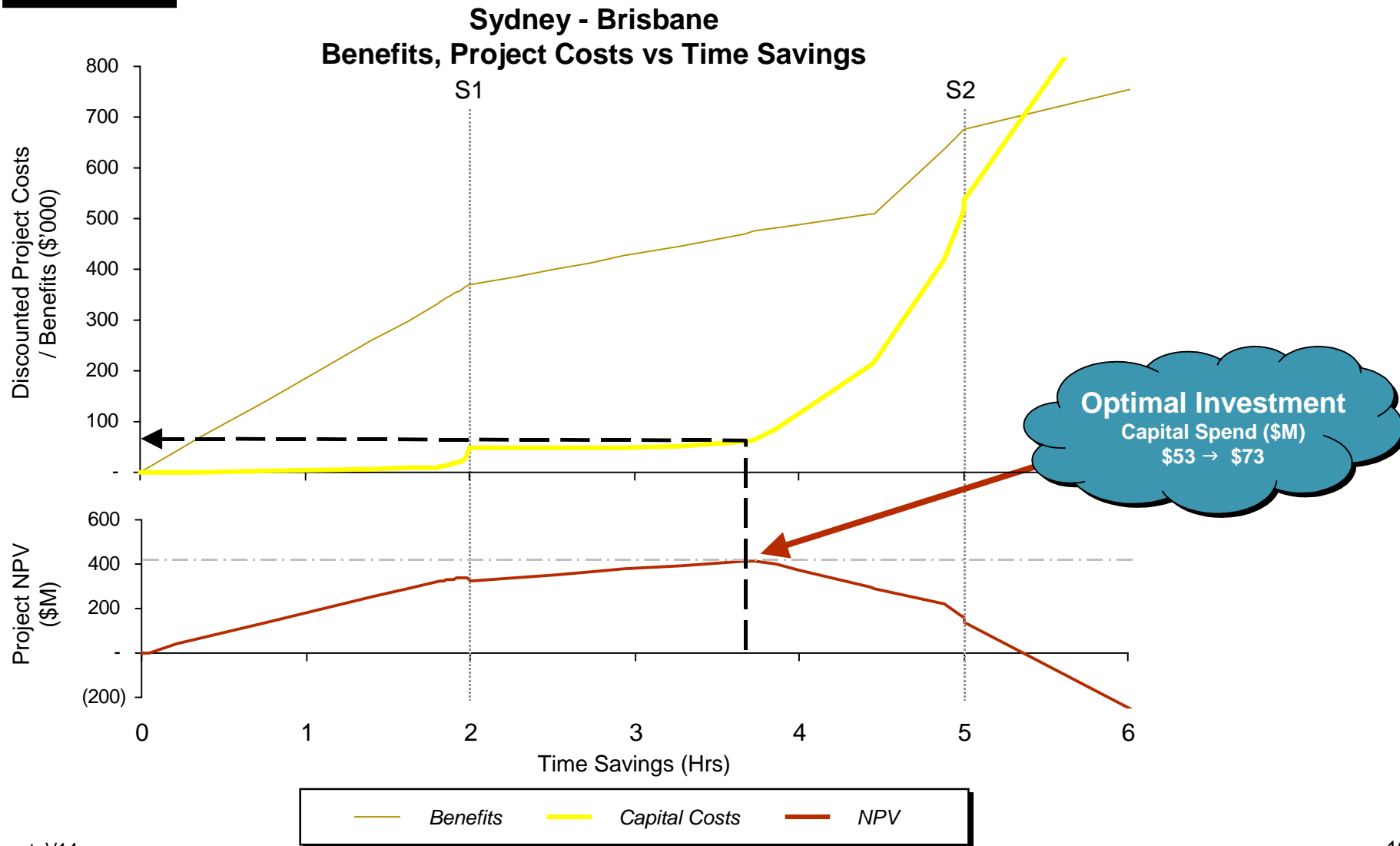
▶ North-South

▶ East-West

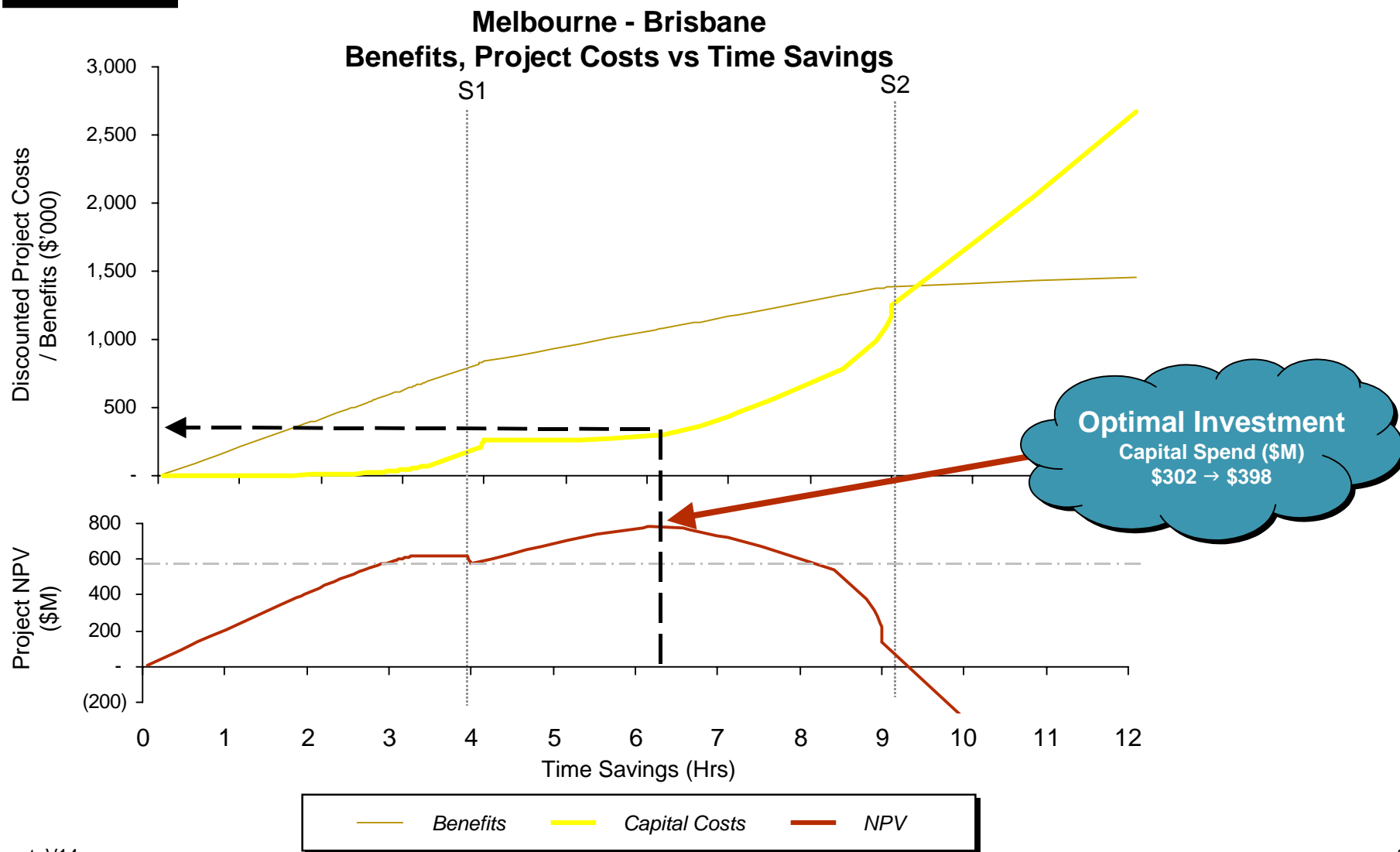
# Optimal investment on the Melbourne-Sydney market corridor is just beyond S1



# The Sydney - Brisbane optimal investment is at midpoint between S1 and S2



# Taken together, the Sydney - Brisbane and Melbourne - Sydney optimal investments substantially improve returns



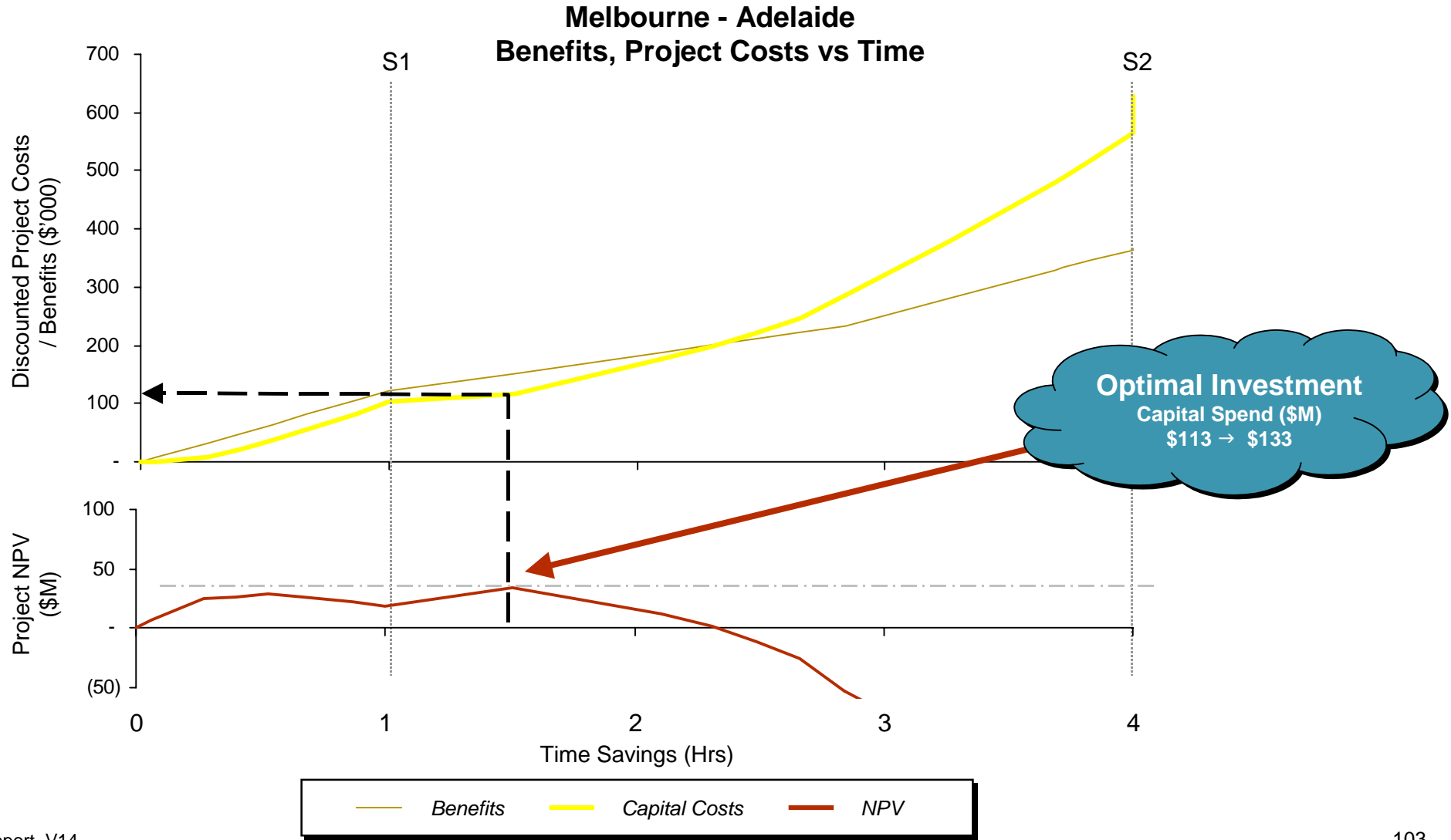
## Attachment B : Optimisation

---

▶ North-South

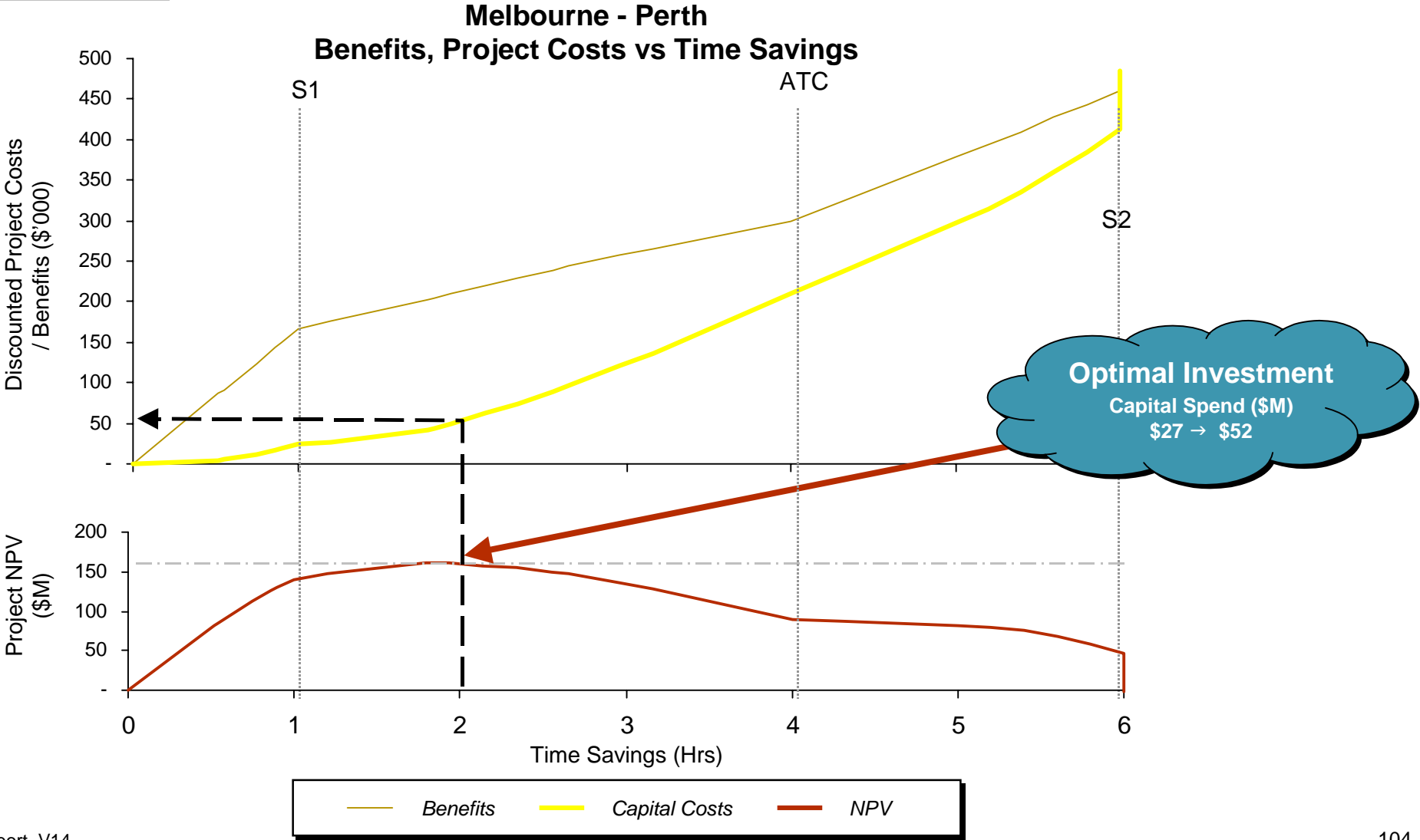
▶ East-West

# The optimal Melbourne - Adelaide investment remains marginal





# The optimal investment on the Melbourne - Perth market corridor is just beyond S1



# While for Sydney - Perth, the optimal investment is beyond the defined performance targets of S1 and S2

