

5. OPERATIONAL REQUIREMENTS

5.1 OVERVIEW

The operational aspects of the proposed new service were considered in a study by GHD Transmark in consultation with Transport and Westrail. Significant aspects of the rail service which were addressed in formulating the operating strategy included:

- recognition of the nature of the proposed inter-regional integrated service and need for speed fast enough for minimum journey time with maximum appeal as an alternative to private car use;
- whether the new railway could be operated as a separate entity and its relationship to the existing network;
- capacity required for the forecast patronage (this is slightly greater than the initial forecast for the Northern Suburbs Transit System and other service requirements);
- type of rollingstock and its maintenance requirements.

5.2 THE TASK

A maximum 45 minute journey was stipulated between Rockingham and Perth for an estimated 8,500 people travelling from Rockingham and Thomsons Lake to Perth in the morning two-hour peak period.

The Transport patronage forecast showed the peak period for demand was from 7.00a.m. to 9.00a.m. It is the nature of railway operations that if the requirements are designed to carry the peak flow, then demand over the rest of the day will also be satisfied. The study was carried out on this basis.

104 new railcars will need to be purchased to meet the forecast demand.

5.3 FLEET AND SERVICE INTEGRATION

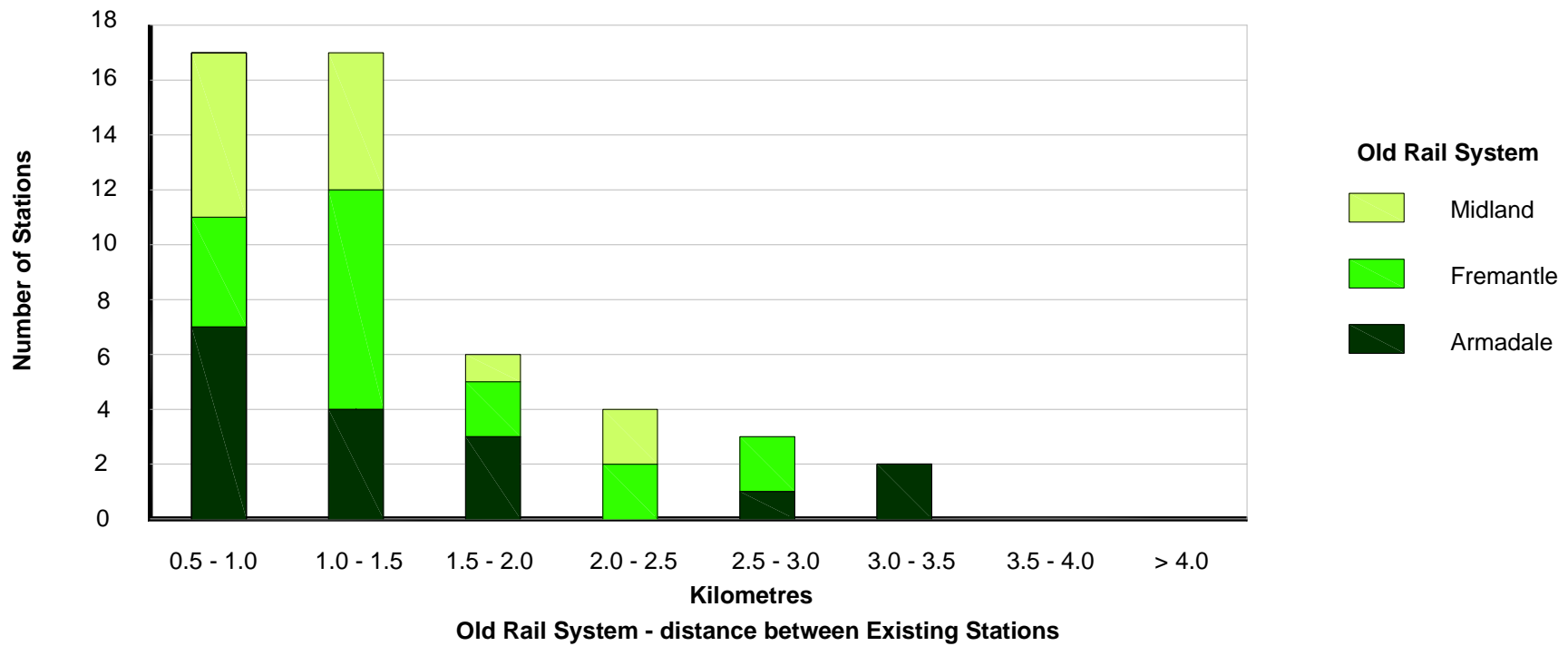
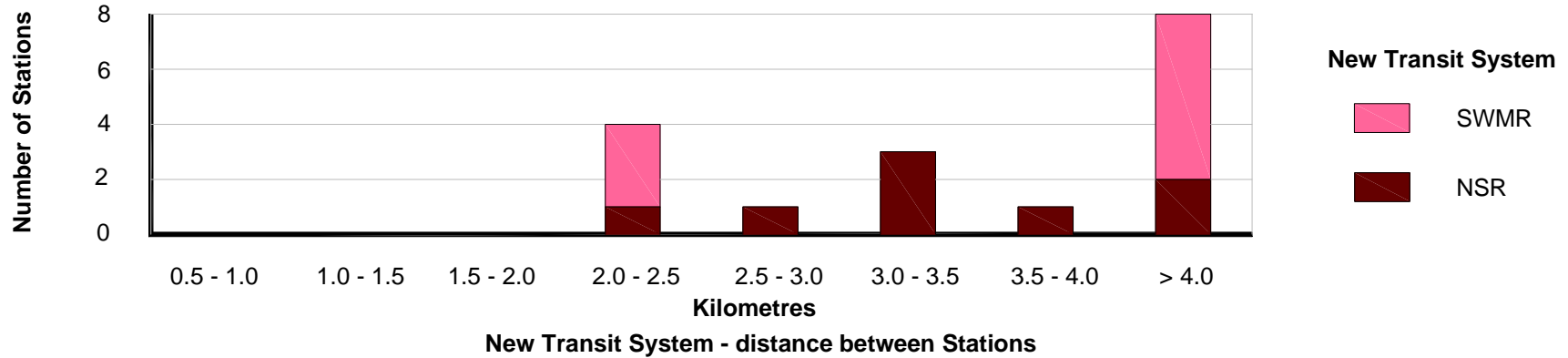
It was considered that the new railway could not be operated in isolation from the rest of the urban rail network because of the following interdependencies:

the need to operate a reliable and robust timetable;

- the need to operate an additional 12 trains per hour between Kenwick and Perth, taking into account the current eight services between Armadale and Perth;
- the effects of different service requirements and stopping patterns from Kenwick to Perth between the existing Armadale services and the proposed new services;
- the effect of increased train frequencies at level crossings;
- the need to integrate the new and existing services at Perth Station; and
- integration of the new services with other services beyond Perth.

It was found that the new South West Metropolitan services should be integrated with those for the Northern Suburbs. Reasons for this include:

- it will reduce the number of railcars required to operate the South West Metropolitan Railway (a minimum saving of eight cars);
- it will avoid turning back large numbers of trains at Perth Station with associated infrastructure requirements and time delays this would incur;
- it will improve timetable robustness, particularly in the event of train failure or out of course running;
- it will simplify train control;
- the Northern Suburbs Railway currently uses four-car consists which are filled to capacity during the peak. Over the next ten years a six-car consist will be required;



COMPARISON OF STATION SPACING BY LINES

Figure 25

- forecast demand on the South West Metropolitan Railway closely matches that of the Northern Suburbs Railway and will also require a six-car consist; and
- transit station spacing and track alignment of both railways suit rapid transit and permit line speeds above 110 km/h. With regard to how the new railway will fit in with the existing system, the study showed that the new service cannot be operated in isolation.

5.4 TRAIN SERVICE REQUIREMENTS AND OPERATIONAL ISSUES

5.4.1 Perth Station and Armadale Line

With regard to the capacity of the existing system to handle the increased traffic from the new railway, it was found that:

- there was insufficient capacity at Perth Station; and
- there would be no benefit in providing additional tracks from Perth to Kenwick.

The work showed an additional platform at Perth Station, parallel to the existing platforms was required, together with a new track to service the platform. See **Section 8.3**.

5.4.2 Integration with Existing Services from Perth to Kenwick

Integration of the South West Metropolitan and Armadale services are constrained by the number of station stops, not by the number of tracks. The existing tracks are used to only 40% of their capacity.

There are eleven closely spaced station stops in the 15 kilometre distance between Perth and Kenwick. This compares with eight transit stations on the 29.5 kilometres on the recently built Northern

Suburbs Railway. However the number of trains using the line each day between Kenwick and Perth is less than half that on the Northern Suburbs.

Between Perth and Kenwick there is a historical legacy of heavy rail service serving stations which are so close together that they are within walking distance of each other:

- Perth to McIver 530 metres
- McIver to Claisebrook 550 metres
- Burswood to Victoria Park 1130 metres
- Victoria Park to Lathlain 775 metres
- Lathlain to Carlisle 580 metres
- Carlisle to Oats Street 650 metres
- Welshpool to Oats Street 1100 metres
- Queens Park to Cannington 830 metres

The station spacing was established in an era when non-rail journey times were uncompetitive and car ownership was very low. Therefore having a railway station within walking distance, without an alternative transport choice, was essential.

In today's situation, stations too close together prevent a heavy rail system from performing to the potential the Northern Suburbs Railway has shown can be achieved. On **Figure 25** (opposite) the lower chart shows the distribution of station stops on the original suburban rail system. In contrast to that the upper chart shows the situation required for rapid transit as typified by the Northern Suburbs and now the South West Metropolitan Railway.

The study considered a hypothetical station on the Armadale service used by 400 people per day. Each stop at this station would add a trip time penalty of around one minute for the 10,000 people using the Armadale service but not using that station.

Between Kenwick and Perth, there are currently eight Perth bound services per hour in the peak. With this number of stations and signalling

requirements, the absolute maximum of number of trains which can be run over the section in one direction is 20 per hour. This restricts the number of possible train services from the South West Metropolitan Railway to 12 per hour.

Because of the close headway working, any perturbation to the service will cause delays and therefore at peak times existing Armadale services will be significantly affected by the new service. The current journey times from Armadale to Perth at peak periods are 34 minutes by Armadale “C” and 36 minutes by Armadale “D” pattern trains.

If Armadale Line stopping patterns at peak periods remain unchanged every train will take 19 minutes from Cannington to Perth. This will increase the journey time from Armadale to Perth from 34 minutes to 39 minutes by Armadale C pattern train. The journey time for Armadale D pattern trains will remain unchanged at 36 minutes.

The 19 minute Cannington - Perth journey time will also affect the ability of the new rail service from Rockingham to achieve the specified 45 minute journey time to Perth. As the proposed rail route to Perth is 10 km longer than the direct road route by the Kwinana Freeway, the rail services will have to operate at significantly higher speeds to provide a competitive journey time.

The prospect of travelling the last 12 km of a longer rail route into Perth at a top speed of 40km/h is inconsistent with providing a rail service journey time which is attractive to private car commuters and superior to any bus alternative.

It is clear that the new service cannot be successfully integrated without some major changes to existing operations. It was found that integration of trains from the South West Metropolitan Area with Armadale trains whilst maintaining a viable service for each is possible by:

- fewer stations between Cannington and Perth;
- changing the stopping pattern of the existing Armadale services; and
- a combination of the above.

It was noted that there are current plans to reconstruct the Victoria Park and Carlisle Stations. This work was programmed to be carried out by Westrail in 1998/99 but has been deferred pending completion of this study.

It was also noted the patronage at Lathlain and Welshpool Station was extremely low for a heavy rail service.

It was found a positive measure to achieve a viable integration of the existing and proposed services is by:

- introducing a skip-stop pattern for the Claisebrook and McIver Stations with each station served by alternate stopping trains;
- taking the opportunity presented by the need to reconstruct Victoria Park Station to relocate this facility further south as described in **Section 8.3** and in the process close Lathlain Station;
- closing Welshpool station; and
- re-organising the Perth to Armadale services.

A complete reappraisal of the existing service pattern for the Armadale service is required. This should be done with the objective of maintaining high levels of service and minimising inconvenience to existing users.

One solution is to vary the stopping pattern so that the station stops are shared between all train services. All trains would stop at Oats Street Transit Station which is the interchange with the Circle Bus Route. If this strategy is properly developed and combined with the station closures recommended above, Armadale to Perth journey times can be reduced by up to four minutes from the existing timetable. **Table 5.4.2** on page 51 summarises the scenarios considered.

In implementing these proposals, the use of feeder bus services for those who may be disadvantaged should be introduced.

TABLE 5.4.2

Summary of Station closure and Revised Peak Hour Stopping Patterns

Option	Cannington to Perth Fastest Journey Time	Journey time from Rockingham to Cannington to achieve a 45 minute specification	Armadale to Perth Journey Time
1. Current Situation	14	n/a	34 & 36 minutes
2. Introduce the new railway and no change to existing services.	19 minutes	26 minutes	36 & 39 minutes
3. Skip stop at Claisebrook / McIver & closure of Lathlain and Welshpool	17 minutes	28 minutes	35 minutes
4. Change stopping pattern of existing services plus Option 3 above.	14 minutes	31 minutes	30 & 32 minutes

Increased train frequencies on this section will result in the level crossings being closed to road traffic for much longer periods than they are at present. Measures to ameliorate the impact of these increased train services are included in Section 8.1.

5.4.3 Thomsons Lake - Perth Service

The new transit stations to be served by the stage to Thomsons Lake are at Thornlie, Nicholson Road, South Lake and Thomsons Lake. It was assumed there would also be a mandatory requirement to stop at Oats Street and perhaps Cannington.

Frequency is most important in attracting and maintaining patronage on public transport. To carry the forecast patronage of 3500 passengers in the two hour morning peak period will require a train every 5 minutes. The number of railcars which will be required for this task is 28.

This service may be introduced progressively as railcars become available. This will enable fine tuning and smoother integration with Armadale services.

5.4.4 Rockingham - Perth Service

Extending the service to Rockingham by year 2006 will require a further 60 railcars. This will provide a 5 minute service at peak periods.

New transit stations in the Rockingham Area will be dependant on the route option adopted. If the railway is to access the City Centre, the transit stations would be Rockingham Transit Mall (city centre) and Ennis Avenue.

If the "Direct Route" to Mandurah is adopted, the transit stations would be Waikiki and Rockingham Transit Station (Dixon Road).

5.4.5 Extension Of Services To Mandurah

Extension of services to Mandurah will be on the basis of a single track operation from Waikiki to Mandurah Terminus. It is estimated that this will require an additional 16 railcars.

5.4.6 Railcar Requirements

This Master Plan has examined the rolling stock requirements for the South West Metropolitan railway services as was possible within the allocated timescale and information available.

The need is recognised for a detailed examination of the rollingstock requirements of the entire urban rail system as it will be when services are commenced to Rockingham and Mandurah. This examination had commenced at the time the Master Plan was reprinted.

5.5 ROLLING STOCK SPEED

In **Section 5.4** the number of stations between Perth and Kenwick is discussed. This is typical of the older system lines from Perth to Armadale, Fremantle and Midland. The nature of the services on these lines precludes effective use of rollingstock capable of speeds greater than 90/100 km/h.

On the other hand the 110 km/h maximum speed of the existing trains used on the Northern Suburbs line is fully exploited. In fact, the Northern Suburbs service could benefit from higher speed trains.

The alignment of the South West Metropolitan Railway has been designed for speeds up to 140/150 km/h to allow for future developments.

The potential journey time savings offered by higher rollingstock speeds are shown in **Table 5.5** below.

TABLE 5.5

Journey Time Savings Over Total Distance
Compared with Existing 110km/h Rolling Stock

	120km/h	125km/h	130km/h	140km/h
NSTS (29km)	0.7 mins	1.0 mins	1.2 mins	1.5 mins
SWMR (80km)	2.0 mins	2.5 mins	3.0 mins	6.0 mins

While there are benefits from higher speeds, there are other considerations. These include increased power consumption, increased costs for overhead wiring systems and increased maintenance costs. Higher speeds will also require more tracks when operated on the same routes as slower trains. Noise and vibration from the railway increase with higher speed.

It was concluded that the optimum speed for a train to operate on the new South West Metropolitan Railway and the Northern Suburbs would fall in

the range of 120 - 130 km/h. The purchase cost of a railcar with this performance will be similar to that of one limited to 110 km/h. The cost of a 140km/h railcar will be higher as additional power will be needed to reach this speed and it is unlikely that the full capability of the vehicle could be utilized over all the route from Mandurah to Perth and on to the Northern Suburbs line.

In summary a new type of railcar should be purchased able to achieve service speeds up to 125 km/h. The new trains should be configured in three or four-car units. Adoption of a four-car unit will require some two-car units to make up a six-car train. The total number of individual cars required is 104.

5.6 DEPOT AND STOWAGE FACILITIES

5.6.1 Depot

A number of options for the optimum location for maintenance and cleaning the existing and new railcars were considered against the forecast demand for depot facilities slots, given the various scenarios for railcar consist and predicted growth on the Perth Urban Railway System. These options have been costed and the results are given in **Table 5.6.1** (opposite).

The selection of a new depot site for the new fleet whilst retaining Claisebrook Depot for the maintenance and servicing of the existing fleet (Option 4) is financially superior to any of the other options. The option to use the existing Claisebrook Depot for the additional railcars would require the new railcars to be of similar two-car configuration. That would add a minimum of \$36M to the cost of rollingstock procurement and on its own discounts this option against the preferred option. There are also town planning pressures to scale down the operations at Claisebrook.

TABLE 5.6.1

Estimated Cost of Maintenance Facility Options

Option		Outlay \$M
1 (Base Option)	Claisebrook Depot as present	Nil
2	Reconstruction and extension of Claisebrook Depot	40
3	New depot on the South West Metropolitan Railway and Claisebrook closed	53
4	New depot on the South West Metropolitan Railway and Claisebrook Depot retained	35

5.6.2 Stowage Facilities

Stowage on the current network is concentrated at Claisebrook Depot. This accommodates most of the 86 railcars now in service. There is also a small facility for eight, 2-Car units at Currambine. There are no existing facilities which are able to accommodate additional railcars envisaged under the SWMR proposals or any other growth/development scenario.

The new services will introduce an additional 104 railcars to the system. In isolation this will require the following overnight stowage facilities:

- 20 railcars in the Perth/Currambine area (16 can be accommodated by existing facilities at Currambine);
- 84 railcars in the Rockingham area

Future forecast growth over the whole system suggests the need for up to a further 32 railcars. A minimum overnight stowage requirement will be:

- 46 railcars north of Perth;
- 90 railcars in the Rockingham area

The need for a significant depot in the Rockingham area is compelling.

5.6.3 Train Crew Facilities

The new services will require additional train crew facilities. The 16 services that will start from Rockingham and terminate there in the evening will ultimately need accommodation for approximately 60 drivers.

5.7 BUS OPERATIONS STRATEGY

The South West Metropolitan Railway is a major spine of a totally integrated public transport network. The Kwinana Freeway Bus lane between Perth and the Murdoch Park & Ride Bus Station, and the Rockingham to Fremantle Transitway, are also important spines. Supporting these services will be the following secondary bus network which will connect with transit stations and major centres:

- *Cross suburban services* - will provide frequent services connecting suburban centres and transit stations.
- *Feeder services* - relatively short distance trips which provide frequent, direct connections to transit stations from nearby suburbs. Wherever possible feeder services will also connect with local suburban centres.
- *Minilinks* - community-based services which will run along a fixed route on the outward trip but determine the route for the return journey according to demand. In many cases the relatively low demand may allow small or mid-size vehicles to be used, with easier access to residential areas.
- *Major line haul services* - frequent long haul services connecting major centres via alternative routes.
- *System 21* - frequent high-quality services serving other corridors but connecting with trains.

