

FINAL REPORT

ARTC Standard Gauge Rail Network DORC

Australian Rail Track Corporation Ltd

Sydney

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the use and information of the client to whom it is addressed*

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1 Introduction

1.1 Background

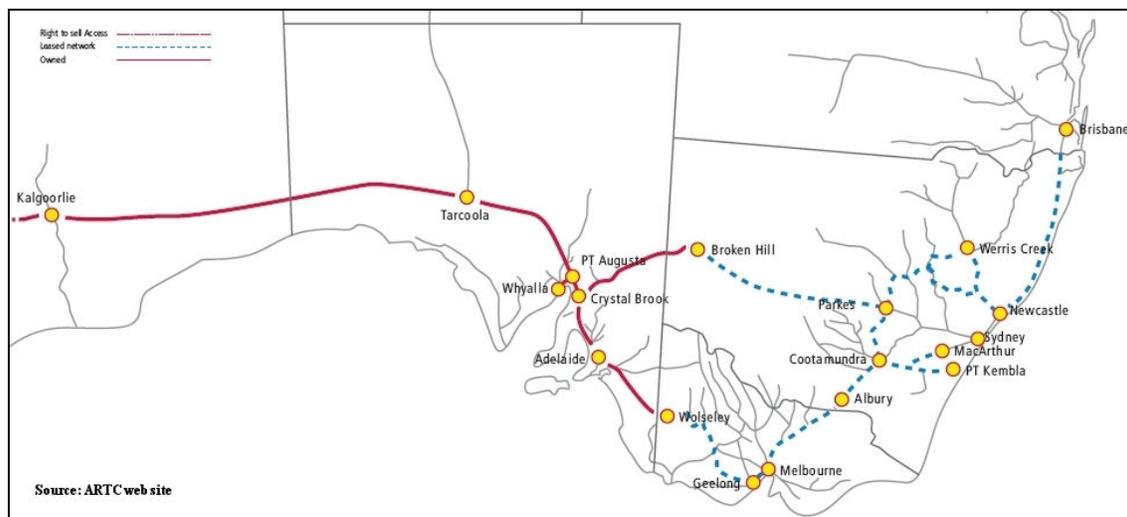
Booz Allen Hamilton (Booz Allen) has been retained by the Australian Rail Track Corporation Ltd (ARTC) to develop a Depreciated Optimised Replacement Cost (DORC) methodology to support ARTC's next Access Undertaking ("the 2006 DORC"). The valuation is to be acceptable to the Australian Competition and Consumer Commission (ACCC) in respect of ARTC's interstate network (as defined) in Victoria, South Australia, Western Australia and NSW.

ARTC previously engaged Booz Allen in 2000 to undertake a DORC valuation of the (then current) ARTC rail network in South Australia (SA), and the leased network in Victoria (VIC). Booz Allen's report dated February 2001 ("the 2001 DORC") provides the basis from which the current work has been developed.

This report describes the scope, approach and results of the 2006 DORC analysis, which includes the ARTC rail network infrastructure assessed by Booz Allen in 2001 and the leased Defined Interstate Railway Network (DIRN) in New South Wales (NSW)¹.

Figure 1 provides a generalised view of the extent of ARTC's network subject to this DORC evaluation. More detailed network maps are included in Appendix 2.

Figure 1 – ARTC's network



¹ For comparative purposes, a notional date of 30 June 2001 has been established for the 2001 DORC and 30 June 2006 in respect of the 2006 DORC

The sections of the ARTC network included in the study are:

ARTC Track Sections	
1.1	Dry Creek - Crystal Brook
1.2	Crystal Brook - Pt Augusta
1.3	Pt Augusta - Tarcoola
1.4	Tarcoola - Parkeston
2.1	Crystal Brook - Broken Hill
2.2	Broken Hill - Parkes
2.3	Parkes - Cootamundra
3.1	Dry Creek - SA/VIC Border
3.2	SA/VIC Border - Melbourne
4.0	Dry Creek - Outer Harbour
5.1	Tottenham - Albury
5.2	Albury - Macarthur
5.3	Southern Sydney Freight Line (SSFL)*
6.0	Spencer Junction - Whyalla
7.0	Appleton Dock Junction - Appleton Dock
8.1	Moss Vale - Unanderra
9.1	Islington (Newcastle) - Maitland mains
9.2	Maitland - Craven
9.3	Craven - NSW/QLD Border

Source: ARTC

*SSFL not included in 2006 DORC.

1.2 Establishing the DORC value

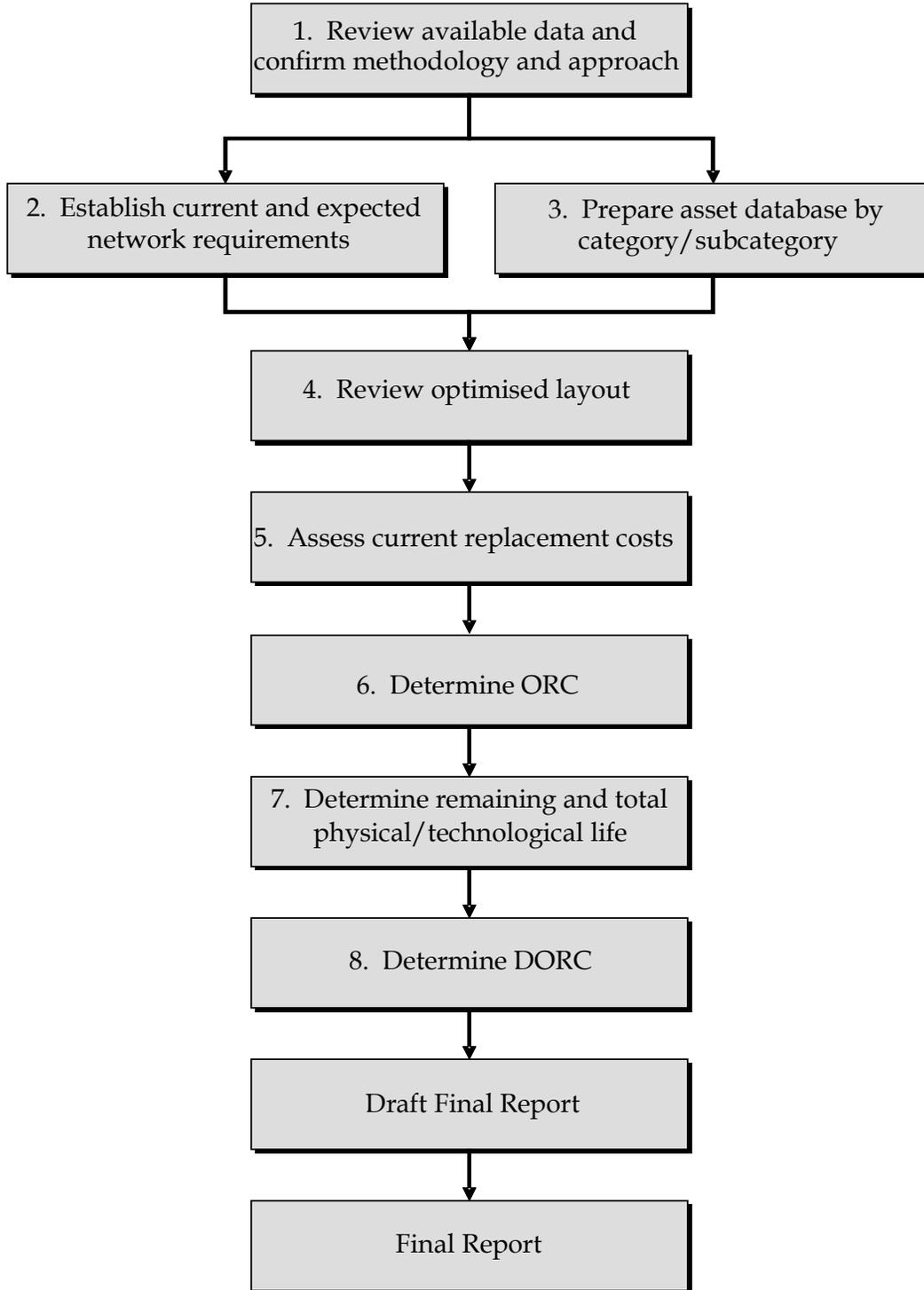
The approach used in establishing the DORC value is illustrated in Figure 2 below.

The ARTC network under study was divided into pricing segments matching those adopted by the ARTC, as listed in section 1.1 above.

The 2006 DORC considers infrastructure in place in late 2006 and does not forecast changes over the following five years, as was the case in the 2001 DORC.

The philosophy underlying calculation of the DORC is discussed in detail in Appendix 1.

Figure 2 - Approach



The brief was to determine the DORC by way of a desktop study using information provided by ARTC. No field inspection was done to verify the accuracy or otherwise of this information.

1.3 Structure of the Report

The Report is structured to reflect the key work steps in the assignment. There are six further sections:

- ▶ Section 1 Introduction (this section)
- ▶ Section 2 Existing and expected rail network requirements
- ▶ Section 3 Optimised rail network
- ▶ Section 4 Replacement costs
- ▶ Section 5 Condition Assessment
- ▶ Section 6 Final ORC and DORC values.
- ▶ Section 7 Roll forward calculations

2 Existing and expected rail network requirements

2.1 Rail Task

Table 1 provides details of ARTC's train task in generalised terms as, for historical reasons, specific details of train type and speed vary somewhat across ARTC's network. These are being rationalised under a current project in which NSW's Train Operations Control (TOC) manual is being merged with SA and VIC operating practices to form the Route Access Standards (RAS) manual. In consequence, the 2006 DORC evaluation applies to track with variable technical standards. While in theory this should impact upon the DORC evaluation, the pragmatic approach taken here is that the same or very similar trains travel across ARTC's network and so all infrastructure and train operations are taken as being essentially equal.

Table 1 - Train Characteristics

ARTC Business Segment	Max. train speed (km/h)	max. axle load (T)
Passenger Super Premium	130/160	20
Freight or Passenger Premium	115	20
Freight High	110	21
Freight Standard	80	23

2.2 Historical Rail Task

Many asset types have lives which can be measured in gross tonnes. For example, a certain rail size may be quoted as having a life of 600 million gross tonnes (MGT), meaning that the rail is considered to require replacement when it has carried 600 MGT of traffic.

Calculating remaining asset life in years for such assets requires knowledge of the asset life, the asset life already consumed, and the expected usage over future years. Unfortunately, there is no reliable data available on the gross tonnes already carried by the ARTC network from initial construction of the network to now. In SA and Victoria the tonnage consumed reported from the 2001 DORC has been updated to take account of tonnage since. In NSW, the assumption has been made that the historical level of traffic is the same as the forecast level of traffic for this year.

As a check on the validity of the approach to rail task and MGT life consumed, Table 2 compares forecasts of 2006 tonnage reported in the 2001 DORC with the actual tonnages reported for 2006. As can be seen, the 2001 forecasts somewhat underestimated the 2006 task due to stronger than expected growth and improved rail performance, but nevertheless there is a reasonable match.

Table 2 - Traffic Volume on ARTC Network in Million Gross Tonnes

Corridor, Sectors		2006 forecast in 2001 DORC, MGT	2006 actual (Source: ARTC) MGT
1.1	Dry Creek to Crystal Brook	8.4	11.0
1.2	Crystal Brook to Port Augusta	10.2	13.2
1.3	Port Augusta to Tarcoola	8.7	11.4
1.4	Tarcoola to Parkeston	8.1	9.8
2	Crystal Brook to Broken Hill	5.1	5.3
3	Dry Creek to SA Border	11.7	10.9
3	SA Border to Melbourne	13.7	11.4
4	Dry Creek to Outer Harbour	3.2	4.8
5	Tottenham to Wodonga	7.3	9.2
6	Spencer Junction to Whyalla	1.9	2.0
7	Appleton Dock Jct. to Appleton Dock	2.9	4.3

3 Optimised rail network

3.1 Approach to Optimisation

Producing a fully optimised network layout normally requires extensive analysis of traffic requirements and detailed computer simulation of the network operation. Such a rigorous approach has not been possible within the timeframe available to carry out this DORC, and is unlikely to be warranted under the circumstances. Given the relatively simple nature of ARTC's network, the optimisation process was essentially limited to reviewing the number and placement of crossing loops and associated train control systems, plus reviewing the track structure required for present and future traffic.

3.2 Maximum Capacity Considerations

It is understood that ARTC currently meets stipulated performance criteria for the percentage of "Healthy" trains which achieve their timetabled transit time, though Operators have occasional difficulty entering ARTC's network on time. However, in the event that extra paths are requested by operators, it is becoming increasingly difficult for ARTC to find additional paths with reasonable transit times around the peak hours. This implies that the current network configuration is reasonably well matched to the demand (for the purposes of this DORC valuation).

3.3 Optimised Network

Track configuration was optimised in the 2001 DORC (for South Australia and Victoria) taking into account the forecast train numbers likely to use each segment over the next five years. Some areas require more crossing loops, particularly across the Nullarbor. In other areas optimisation resulted in short loops being eliminated, or extended: the western line through Victoria is an example. The optimised loop arrangement resulted in a layout that has in fact developed since 2001, though with somewhat different detailed arrangements. In consequence, the SA and VIC optimised network forecast in 2001 has been utilised in the 2006 DORC.

The situation in NSW is somewhat different. The DIRN network has a mix of double and single track (double track being between Macarthur and Junee), leading to the reasonable question whether the double track is necessary. In particular, the section of track between Cootamundra and Junee has a low number of trains per day per track and, strictly speaking, should be considered as requiring single track only. However, a pragmatic approach has been adopted given the result would be a reduction of 56.2 km of track, or less than 1% of ARTC's network. Accordingly, this track section has been included. This issue is further discussed in Appendix 1.

Another reason for including this track length is that ARTC have underway a significant loop extension program across the whole network. The scope of the 2006 DORC precludes detailed assessment of full optimised network requirements and consequently precise location and length of loops has not been calculated. Instead, the existing network loops have been adopted for valuation purposes, though several are in the process of being lengthened to reflect operation of longer trains.

The simplistic approach of including this 56.2 km of double track section of infrastructure effectively allows some valuation offset to the exclusion of these loop extension works. This does produce a slight distortion to segment evaluation, but the practical effect is, as noted before, less than 1%, which is well within the accuracy of segment valuations.

In optimising infrastructure it is assumed that the only track infrastructure required for ARTC's operations is mainline and crossing loops. Where there are additional tracks and sidings coming off the mainline or crossing loops in the current network configuration, the assumption is that ARTC will own the turnout connecting the additional tracks to the mainline or crossing loop and that the connecting track (and subsequent turnouts) will be owned by another party.

A slight exception is that a total of 17 km of yard sidings have been included in NSW. This follows from an examination by ARTC Operations of the necessary minimum infrastructure required to provide for reliable train operations. As the result is less than 0.25% of the network, these yard sidings have been included.

3.4 Optimised Infrastructure

In developing replacement costs, "modern equivalent form" (MEF) configuration applies. Infrastructure considered in the 2001 DORC was relatively homogeneous, but today there is a wide range of existing infrastructure configuration across ARTC's network. Rail sizes vary, sleeper types and spacings vary, maximum allowable axle loads vary, bridge designs vary, topography is highly variable, train control and communication systems vary, and so forth. Further, there is a some uncertainty regarding actual configuration.

Hence determining *which* MEF applies *where* is not clear cut.

Furthermore, there has been a significant change in some key infrastructure supply items. Notably signals and communications are changing relatively radically, and timber sleepers now cost (slightly) more than concrete sleepers (while concrete sleepers provide a much longer and more reliable service life). As the outcome of signals and communications changes are not clearly definable, it is assumed that prior generation installations continue over the next five years. As concrete sleepers are readily available and proven, it is assumed that the MEF of sleepers should be concrete.

In general terms, infrastructure configuration is taken as reasonably constant across the network, resulting in a uniformity of approach to evaluating ARTC's network. This does lead to some differences from the 2001 DORC – for example 60kg rail is assumed to be MEF for present 47kg rail, unlike the 2001 DORC when 50kg rail was considered the MEF.

This approach reasonably recognises the current practice of changing out or renewing 47 kg rail with 60 kg rail. Further, this approach provides consistency of valuation between SA and VIC, and NSW, where each is 50% of the whole. In consequence, equal value is applied to 1 km of track in SA and 1 km in NSW.

4 Replacement Costs

Replacement costs were calculated in detail for the 2001 DORC using asset configuration information and unit rates developed for each type of asset. Some unit rates were developed from first principles by Booz Allen and some unit rates were developed by Connell Wagner and others in previous work for the ARTC.

While the rates used in the 2001 DORC were reasonable at the time (and subsequently matched reasonably other DORC work such as Tarcoola – Alice Springs, allowing for inflation, in 2003), there has been a very large increase in costs recently.

Detailed cost estimates were obtained from ARTC's Southern Alliance for a proposed passing lane. (The estimates were provided at a very aggregated level, leading to considerable interpretation being required.) The estimates covered a 6.8 km section of track, including all associated works, (including some works that would not apply to a greenfields site, the costs for which have been stripped out where identifiable). As Southern Alliance includes commercially selected contractors and designers, it can be reasonably assumed that their estimates would represent efficient costs. While not directly comparable to large scale greenfield site assumptions applicable to a DORC, the ARTC estimate covers a not inconsiderable scope of work.

However, in unit rate terms, the comparison between the 2001 DORC (plus CPI inflation) and ARTC's Southern Alliance estimates is stark. This supports considerable anecdotal (and some objectively reported) evidence that infrastructure construction costs have recently increased beyond CPI. This issue is further discussed in Appendix 1.

While construction costs have increased, better management by ARTC of materials purchasing has contained costs well. It may be deduced that it is the actual installation that has increased greatly in cost.

Booz Allen has attempted to reconcile these matters by analysing:

- ▶ rates used in the 2001 DORC;
- ▶ construction rates achieved on the Alice Springs to Darwin line works;
- ▶ ARTC's Southern Alliance estimate; and
- ▶ construction and installation estimates prepared by Hyder Consulting in the recent *North-South Corridor Study* undertaken for the Australian Government and made available by ARTC for this assessment on a confidential basis

The, *a priori*, generalised result is that the base installation element of the cost of works should have:

- ▶ a 37.4% loading, applied in lieu of an 18% mark-up previously used in the 2001 DORC²; and
- ▶ an 18% loading applied to the ARTC purchase price for materials (where readily identifiable)

These adjustments would collectively produce approximately the same estimated cost as the known current cost of an ARTC Southern Alliance passing lane of seven kilometres in length.

As this mark-up would presumably decrease considerably where a project of the scale of replacement of ARTC network were involved, some reduction from the 37.4% loading should apply.

There is no ready point of reference to apply in this situation. Therefore, the following approach has been adopted:

- ▶ the 18% loading used in the 2001 DORC has been increased to 28%³ for *installation costs*, while an 18% loading has been retained for *materials supply costs*;
- ▶ where materials are not readily separable (e.g. structures), the 28% figure has substituted for the previous 18% loading

This results in a loaded “optimised” track replacement cost of **\$573,221 per km**.

Each of the following sections clarifies which loading has been applied.

It should also be noted that the 2006 DORC track construction rate benefits from ARTC’s bulk materials purchasing policies, offsetting the higher installation costs to some extent.

The 2001 DORC allowed for a “location factor” that varied from 0% to 8% to account for the distance from major population centres. Given the previous discussion about rates and the uncertainty associated with construction costs, it seems unreasonable to load uncertainty with additional factors. It should also be noted that track costs on a relatively wet, topographically challenging east coast would also need some sort of weighting by comparison with the simple (though remote) access to desert construction sites.

² The 37.4% loading was calculated as follows: ARTC’s current materials prices were allowed for, plus installation costs sourced from Booz Allen Hamilton’s 2003 Tarcoola to Darwin DORC estimate (which, in turn, partly reflected the results of the 2001 ARTC DORC). An inflation rate of 3.1% p.a. was then applied to the 2001 DORC installation costs so as to equate them to 2006 dollars. The 18% loading allowed for in the 2001 ARTC DORC was then deducted. A loading of 37.4% was then added back so as to produce a match for ARTC’s current Southern Alliance estimate of per kilometre costs for a 7 kilometre passing lane.

Note that the CPI estimate of 3.1% p.a. was based on the annual average of the change in Australian (All Groups) CPI between 30 June 2003 and 30 June 2006. That is, $((154.3/141.1)-1)/3 * 100 = 3.1$ an average inflation rate of 3.1% per annum (p.a.).

³ A 28% loading has been selected as this is the rounded average of the earlier 18% loading (too low) and the 37.4% loading estimated above (probably too high). As indicated, above there is a need for a more conservative loading than 37.4% given that the comparator is a 7 kilometre stretch of track with no “economies of scale” effects. Also note that the 28% loading is used only for construction costs, not materials costs (where the 18% loading is retained).

Consequently this approach has not been repeated and it is assumed that the rates discussed here would average out across the network for differing reasons (such as remoteness, topography and climactic and geological conditions)

As indicated, a consistency check was also conducted, comparing unit rates for construction and installation, reported by Hyder Consulting in the recent *North-South Rail Corridor Study* (2006) with those estimated by Booz Allen.

Booz Allen's estimated (unweighted) unit costs for construction and installation, including ballast, concrete sleepers and rail equated to \$496,000 per kilometre, while Hyder Consulting's equated to \$490,000 per kilometre – a difference of only 1.2%. While signalling and earthworks unit costs estimates could not be compared, Booz Allen and Hyder unit costs per kilometres for bridges, turnouts, tunnels, level crossings and crossing loops were similar in magnitude.

4.1 Track

A standard track cross-section with the following attributes has been considered:

- ▶ Rail size: 60 kg/m
- ▶ Sleeper type: Concrete, with resilient fasteners
- ▶ Sleeper spacing: 650 mm average
- ▶ Ballast depth: 250 mm under the sleeper
- ▶ Ballast shoulder: 250 mm

The unit rate for track replacement is \$573,221 per kilometre as discussed above, including an 18% loading on materials used and a 28% loading on installation.

Track quantities in single track kilometres (STKs) are listed in Table 3, where STKs in any segment are equal to route kilometres times the number of tracks and allowing for any loops and yards.

Table 3 – Track STKs

Segment Number	Segment	STK
1.1	Dry Creek – Crystal Brook	198
1.2	Crystal Brook – Port Augusta	132
1.3	Port Augusta – Tarcoola	436
1.4	Tarcoola – Parkeston	1,344
2.1	Crystal Brook – Broken Hill	395
2.2	Broken Hill – Parkes	710
2.3	Parkes – Cootamundra	207
3.1	Dry Creek – SAVIC Border	340
3.2	SAVIC Border – Melbourne	560
4.0	Dry Creek – Outer Harbour	20
5.1	Tottenham – Albury	333
5.2	Albury – Macarthur	1058
6.0	Spencer Junction – Whyalla	75
7.0	Appleton Dock Junction – Appleton Dock	3
8.1	Moss Vale – Unanderra	61
9.1	Islington (Newcastle) – Maitland mains	60
9.2	Maitland – Craven	117
9.3	Craven – NSW/QLD Border	637
	Total	6686

4.2 Turnouts

Turnouts may be classified into primary and secondary turnouts. Primary turnouts are those that connect directly to the ARTC mainline, for example turnouts at each end of a crossing loop or turnouts connecting private sidings to the mainline.

Secondary turnouts are those that connect to non mainline track, for example turnouts to sidings and yards from crossing loops.

Table 4 lists Booz Allen’s interpretation of turnout numbers obtained from information provided by ARTC, listed as Primary and Secondary turnouts located in each DORC segment.

Table 4 - Primary and Secondary Turnouts

Segment Number	Segment	Primary	Secondary
1.1	Dry Creek – Crystal Brook	23	11
1.2	Crystal Brook – Port Augusta	14	7
1.3	Port Augusta – Tarcoola	29	15
1.4	Tarcoola – Parkeston	84	41
2.1	Crystal Brook – Broken Hill	35	17
2.2	Broken Hill – Parkes	43	21
2.3	Parkes – Cootamundra	11	5
3.1	Dry Creek – SA/VIC Border	44	21
3.2	SA/VIC Border – Melbourne	82	40
4.0	Dry Creek – Outer Harbour	11	5
5.1	Tottenham – Albury	59	29
5.2	Albury – Macarthur	76	38
6.0	Spencer Junction – Whyalla	7	3
7.0	Appleton Dock Junction – Appleton Dock	1	6
8.1	Moss Vale – Unanderra	9	4
9.1	Islington (Newcastle) – Maitland mains	27	14
9.2	Maitland – Craven	23	12
9.3	Craven – NSW/QLD Border	83	41

Two standard turnout configurations have been adopted for the ARTC network, based upon existing configuration, with the Primary turnout specified for 60 km/h operation⁴.

- ▶ Primary turnouts with rail bound manganese crossings and concrete bearers, cost \$238,282 per unit for supply and installation
- ▶ Secondary turnouts with timber bearers, cost \$218,481 per unit for supply and installation.

These costs exclude switch motors, which are included in the signalling costs. Costs include the loading discussed above. That is, an 18% loading has been applied to materials costs and a 28% loading has been applied to installation costs.

⁴ An optimised loop is considered to include two primary turnouts and one secondary turnout.

4.3 Structures

Structures include underbridges, overbridges, footbridges and culverts.

In previous asset valuation work for ARTC, Connell Wagner developed unit rates for replacement of structures within South Australia and Western Australia. These have been used in the 2001 DORC and checked in the Tarcoola to Alice Springs DORC. These rates were increased by the loading of 28%, applied to the combined materials and installation rate in this case (in lieu of the 2001 DORC 18% loading, as discussed above). The resulting underbridge rate is \$18,509/m.

However, data from the ARTC's Structures Manager, indicated that current underbridge projects were found to average about \$35,000/m. While this figure represents relatively isolated projects, ARTC's Structures Manager demonstrated that widely spread underbridges of a variety of sizes and configurations were currently costing between \$30,000 and \$80,000 per m length to construct, though the higher end of the range tended to be special situations. Nevertheless, it must be recognised that the entire 2001 ARTC DORC and 2003 Tarcoola to Darwin DORC included only one significant river crossing (over the Murray), while the North Coast Line in NSW has dozens of significant river crossings.

The average of the \$18,509/m and \$35,000/m rates, or \$26,755/m, has been adopted.

The 2001 DORC had no allowance for overbridges or foot bridges. A rate of 75% of the underbridge rate has been assumed for overbridges and 25% for foot bridges. It is noted that this approach has no material effect, with overbridges and footbridges accounting for only 3% of the value of structures.

The 2001 DORC Connell Wagner structures database was used to identify and quantify structures in South Australia and Western Australia. Similarly a Sinclair Knight Merz CEDRIC database referenced in the 2001 DORC was used for structures in Victoria.

An infrastructure condition survey undertaken for ARTC in NSW by WorleyParsons in 2005 (discussed in further detail in a subsequent section) included bridge assessment by URS Corporation (Asia Pacific). Bridge type and length data was obtained from the URS spreadsheets to populate the 2006 DORC model.

Culvert details were obtained from the same sources.

4.4 Earthworks

The 2006 DORC valuation used for SA and VIC earthworks used the estimated 2001 DORC values plus inflation of 3.1% p.a. It was assumed that maintenance would compensate for any depreciation over the period.

ARTC undertook a review of earthworks values for the NSW DIRN network in 2005. ARTC's replacement and depreciated values have been used in the 2006 DORC.

A sense check was undertaken comparing the unit rates from SA and VIC with NSW and a few segment earthworks values were amended to provide reasonable coherence between segments. That said, the range of earthworks scope varies significantly across ARTC's current network, leading to considerable uncertainty in

valuation. In general, all the rates may be low given the situation found with track and bridges, however, given the cross checks comparing relatively old pricing that derived from Connell Wagner and quite new estimates undertaken by ARTC compare reasonably, it seems unreasonable to increase the earthworks estimates.

The result is a range of rates varying from about \$19,000/km between Broken Hill and Parkes to over \$1.1M/km between Moss Vale and Unanderra.

Tunnels were estimated at \$15,986/m using 2001 DORC data, plus a 28% loading, as discussed earlier. Again a cross-check was undertaken by comparing this rate with a m run rate obtained from Booz Allen's Liverpool Range tunnel project undertaken for the NSW Ministry of Transport in 2000, plus inflation. As commented previously, this rate may not reflect recent increased costs.

4.5 Signalling, Train Control, Safeworking and Communications

Signalling and train control equipment includes signals, interlockings and signage required to provide for safe passage of trains over the ARTC network. As the whole technology and operation of signalling and train control is under review and as details of current installations were not readily available in a form allowing replacement cost and condition assessment, the 2001 DORC SA and VIC replacement costs were loaded by 28%, in lieu of the 18% loading used in the 2001 DORC.

The result was \$43,259/track km for signalling and \$9,711/track km for communications. This result was then used as an averaged cost per kilometre figure for the SA and VIC parts of the network. As indicated, this is an overall average, with the result that some segments will be over valued and some undervalued and the average is weighted by the relatively sparse signalling applicable in the SA and VIC base data. To correct for this on the Tottenham to Albury section the rate was weighted by a factor of 1.5.

In recognition of the lack of data, additional cost information was obtained for recent projects being undertaken in NSW. Two major resignalling projects were investigated; the Ulan to Muswellbrook resignalling and the Casino to Acacia Ridge resignalling. This allowed additional cost per km figures to be calculated specifically for the NSW parts of the network. The costs for the Casino to Acacia Ridge project (\$75,137/track km for signalling and \$16,493/track km for communications) were used for the North-South Corridor in NSW and the costs for the Ulan to Muswellbrook project (\$52,472/track km for signalling and \$11,518/track km for communications) have been used for the rest of the NSW segments of the network with the exception of Broken Hill to Parkes which was costed using the original SA and VIC rates.

In addition to the wayside safeworking infrastructure costs a sum of \$10 million was included as the ORC of the control centres.

4.6 Fences and Level Crossings

It is normal practice to provide fencing along a railway to prevent animals and unauthorised persons gaining access to the infrastructure. For the purposes of this evaluation, it is assumed that fences are provided on one side of single lines in remote areas and on both sides in reasonably populated areas.

A 28% loading was applied to level crossing fencing cost estimates, consistent with the discussion at the beginning of this chapter. The resulting rate per single fence kilometre is \$18,279.

The 2001 DORC level crossing numbers were used in SA and VIC. Estimates from ARTC were used for NSW. (There is a project under way in NSW at present to better identify crossing numbers. It is highly likely that the result will be an increase.)

The 28% cost loading was also applied to level crossings. Level crossings may be across main roads with boom gates and signalling (estimated at \$237,757 per track) or public level crossings with no lights or booms (estimated at \$33,167 per track) or farm access type crossings (estimated at \$16,049) per track. As no reliable information was found regarding which crossings were signalled, it was assumed that 25% of public crossings were signalled, resulting in a composite rate per public level crossing of \$84,315.

5 Condition Assessment

5.1 General sources of information

The 2001 DORC for SA and VIC was undertaken with quite elaborate analysis of track condition and with considerable input from ARTC's Asset Management personnel regarding non track assets. There were also reasonably current asset condition reports available from other consultants, SKM in VIC, for example. By comparison, the most recent SKM report on infrastructure condition was undertaken in 2003. Consequently, this DORC was undertaken largely using data available from the 2001 DORC, with an allowance for increased age of components plus an allowance for renewals.

In mid 2005 ARTC had an asset condition investigation undertaken that sought to document infrastructure condition at ARTC take-over in September 2004. A series of reports by WorleyParsons and sub consultants, (URS has been previously referenced regarding bridges, for example), provide a fairly complete description of infrastructure condition. WorleyParsons provided a number of spreadsheets listing details such as rail type and age. ARTC's project manager for the NSW asset condition investigation produced a comprehensive Executive Summary for the project as a whole.

All these documents have been referenced during this DORC project. However, it should be noted that a common source of data for these reports appears to be the TrackData on-line infrastructure database. The TrackData database was largely inherited from Rail Infrastructure Corporation, however it has been updated in the past (to a varying degree) to both improve information quality and to reflect on-going renewals. In practice there are quite severe limitations to applicability of all this data for the DORC project.

Booz Allen has consequently used a range of data sources, including direct access to TrackData, the WorleyParsons reports and spreadsheets and ARTC's Executive Summaries, direct communications with Corridor Management personnel, ARTC data and Booz Allen's own knowledge. Inevitably there is inconsistency between these sources, and detailed knowledge of asset condition is limited. Furthermore, each source has a different data structure, none matching precisely ARTC's DORC segments, with the result that there will inevitably be errors in Booz Allen's asset register and asset condition data.

Booz Allen's spreadsheets are extensively commented to identify data sources, and assumptions applied. The following comments upon specific asset types should be regarded as a brief overview to aid understanding of the ORC and DORC evaluations.

5.2 Track

Rail

The assessment of life consumed is based upon two factors: tonnage carried and, where available, specific observations or data regarding condition.

Tonnage carried

The 2001 DORC has formed the base line for SA and VIC rail lives. A simple calculation of additional tonnage has been undertaken using MGT figures, and the resulting increase in life consumption by comparison with a nominal 600 MGT total life has been calculated (reflecting the assumed life for 47kg rail, which represents by far the largest proportion of rail installed in track).

Rail renewal has averaged 0.5% per annum, which has been assumed to reflect limited rail replacement on high wear curves, at locations suffering contact fatigue and replacement of rails having internal flaws, and so has been ignored.

Data is less certain in NSW. For the most part, the rail type and age reported by WorleyParsons has been used together with MGT reported by ARTC to find total tonnes passed. As by far the majority rail type on the DIRN network in NSW is 53kg, a nominal 750 MGT total life has been used for consumed life calculations. Where track segments are recorded to have a lesser rail size, (for example, Stockinbingal to Parkes), 600 MGT is assumed to be the total rail life.

The selected rail life tonnages figures follows directly from the 2001 DORC and from the 2003 Tarcoola – Darwin DORC. In turn these relate back the 2001 IPART Hunter Valley DORC (Booz Allen, “Valuation of Certain Assets of the Rail Access Corporation”, May 2001) in which considerable investigation determined 53 kg rail could be anticipated to have a life of 460 MGT in 30 t axle load heavy haul operations.

It should be noted that rail life varies with usage (e.g. tonnage), support condition (assumed to be constant for this evaluation, though the 2001 DORC included assessment of support condition), management (e.g. grinding), and curvature. Of these, tonnage and curvature clearly vary. Tonnage has been assessed in the evaluation by corridor (and sub-corridor as appropriate), and the estimated total tonnage that has passed over the rail is compared with the assumed available rail life to find the proportion of life consumed.

Curvature has been calculated for each segment in the following bands: straight track plus curves greater than 600 m radius, curves between 600 m radius and 350 m radius, and curves less than 350 m radius. Curves between 600 m and 350 m radius are assumed to consume rail life at twice the rate of rail on straight track, and curves less than 350 m are assumed to consume rail life at three times the rate of rail on straight track. The evaluation then attributes a proportion of life consumed for each segment corresponding to the proportion of curves, while achieving the overall average of 600 MGT for 47kg rail and 750 MGT for 53kg rail.

(It should be recognised that ARTC's rail management strategy, including works for straightening and grinding rail, for sleeper and fastener improvement, and for ballast and formation strengthening, will achieve improved rail life over time. Consequently future DORC evaluations may include longer rail lives.)

Using their particular segmentation, WorleyParsons have reported the quantity of rail in need of early renewal in each section so affected. As the proportion of rail affected is low in each case, this data has been ignored as the rail asset would normally have a range of consumed life in any section of track, including rail with little remaining life. However, the result may be an underestimate of consumed life in some DORC segments, with the Main South Line being a potential candidate, for example.

Sleepers

Assessment of sleeper life consumed is based upon age, using concrete sleepers as a MEF. Where concrete sleepers are presently in place, the age is simply compared with a presumed total life of 50 years.

Where timber are installed, an equivalent life consumed figure is calculated for the MEF concrete sleeper. For example a timber sleeper may be assessed as having 5 years' life remaining. Comparing this with an assumed 20 year total life, then the timber sleeper is considered to be 75% life consumed. However, to have 5 years' remaining life, the MEF sleeper would need to be 90% life consumed. This approach has been used in the current DORC.

In many cases WorleyParsons reported timber sleeper condition as being, for example, "40% of sleepers having less than 5 years' life". The procedure used to calculate life consumed in this instance is as follows. Take 40% < 5yrs as being a sleeper count, needing reasonably prompt renewal, hence 100% life expired, then determine remaining sleeper contribution to life consumed assuming they are 50% life consumed on average. E.g. $40\% + (100-40) \times 50\% = 70\%$ overall life consumed.

Timber sleeper condition takes into account sleeper renewals where known. As the number and distribution of steel sleepers that are more-or-less randomly interspersed in timber sleepers in NSW is not known, they have been ignored.

Ballast

A detailed analysis of ballast condition was undertaken for SA and VIC track in the 2001 DORC. As with rail, a very small amount of ballast renewal occurs each year. Advice from ARTC asset managers indicates a ballast renewal rate of around 1.4% p.a.. This is allowed for in the valuation. The effect is 19% extra wear on ballast by comparison with the 2001 DORC.

In NSW WorleyParsons provide a ballast assessment in terms of Good, Fair and Poor. Life consumption figures of 25%, 50% and 75% are assigned respectively.

Turnouts

In SA and VIC, turnout life was assumed to be 43% consumed based on data used for the 2001 DORC. In NSW WorleyParsons provide very general descriptions as for ballast and matching 25%, 50% and 75% life consumed assessments were applied.

5.3 Structures

In SA and VIC the same life consumption was used in the current DORC as was used in the 2001 DORC. This assumption is based upon ARTC having an ongoing program of refurbishment and renewal, involving progressive programmed renewal in SA, for example.

In NSW a reasonably detailed condition assessment was undertaken by URS, sub consultant to WorleyParsons, in 2005. This data has been utilised in NSW.

5.4 Earthworks

Earthworks are assumed to be a perpetual asset in that given appropriate maintenance they do not "wear out" due to the passage of trains or time. For the purposes of this analysis, earthworks are assigned a depreciated value according to their age relative to a nominal life of 100 years. Where earthworks are over 50 years old, they are capped at a depreciated value of 50% of their replacement value. The same approach has been taken for tunnels.

5.5 Signalling, Train Control and Communications

In 2001, signalling and communications (S&C) were found to be 62% life consumed on average in SA and VIC. If S&C systems are considered to last 25 years, then it is $6/25 = 24\%$ more life consumed since 2001. Some renewals work has been undertaken, therefore it has been assumed that these assets are 80% life consumed. The same approach has been assumed for NSW.

5.6 Fences and Level Crossings

Fences and level crossings are assumed to be 50% life consumed.

6 Final ORC & DORC values

6.1 Network ORC and DORC

The final replacement cost (ORC) and depreciated, optimised replacement cost (DORC) values for the ARTC network (including NSW corridor formation assets) are presented in Table 5.

The following points are worth noting with respect to this estimate.

- ▶ The 2006 network DORC is \$3.7 billion, derived from an ORC of \$7.0 billion.
- ▶ The 2006 network DORC is \$555,142 per km and ORC is \$1,052,327 per km.
- ▶ The average life consumed of the network infrastructure is some 47.0%.
- ▶ By comparison, the 2001 DORC (which excluded all NSW assets) equates to \$1.6 billion in 2006 dollars (after adjustment for inflation at an estimated rate of 3.1% p.a., based on a comparison between the Australian All Groups CPI at 30 June 2001 and 30 June 2006).
- ▶ Average life consumed of 44% estimated for the 2001 DORC compares with 45.4% estimated for the 2006 DORC (for SA and VIC).

Table 5 – 2006 DORC and ORC

Item	Item
Network Results: 2006	
ORC (\$ millions)	7,036.0
DORC (\$ millions)	3,711.7
Per cent life consumed (%)	47
STK including yards	6,686
STK excluding yards	6,671
ORC average per kilometre (\$)	1,052,327
DORC average per kilometre (\$)	555,142
Network Results: 2001*	
ORC (\$ millions)	2,929.1
DORC (\$ millions)	1,639.4
Per cent life consumed (%)	44
STK including yards	3,839
ORC average per kilometre (\$)	763,004
DORC average per kilometre (\$)	427,033

Appendix 1 – 2006 ARTC DORC: Underlying Philosophy

Introduction and Scope

Booz Allen Hamilton (Booz Allen) has been retained by the ARTC to develop a Depreciated Optimised Replacement Cost (DORC) methodology to support ARTC's 2006 Access Undertaking(s) ("the 2006 DORC"). The methodology is to be acceptable to the Australian Competition and Consumer Commission (ACCC).

The next Access Undertaking will describe, amongst other things, the terms and conditions on which the ARTC will provide access to third parties. The ACCC is required to assess the Undertaking against criteria 44ZZA of the Trade Practices Act (TPA). Once accepted, the Undertaking becomes binding on the ARTC and other participants in the access regime.

Booz Allen previously developed a DORC for ARTC ("the 2001 DORC") in support of its 2001 Access Undertaking. The 2001 DORC provided a valuation for the ARTC's Victorian, South Australian and Western Australian interstate rail network segments. The ACCC accepted Booz Allen's DORC as a part of its *Decision: Australian Rail Track Corporation Access Undertaking*, May 2002 ("the 2002 Decision").

ARTC's consultancy brief to Booz Allen Hamilton ("the brief") requested that the following major asset classes be included in the 2006 DORC for all ARTC interstate rail segments:

- ▶ Track
- ▶ Earthworks
- ▶ Structures
- ▶ Signals
- ▶ Train Control
- ▶ Communications

The scope of the 2006 DORC does differ significantly from that of the 2001 DORC, in that:

- ▶ It includes a valuation of NSW interstate rail network segments leased to ARTC. Note that this excludes Hunter Valley rail segments, as defined in the NSW RAU;
- ▶ It includes rail yards (where used for operational purposes) located in NSW

Use of DORC

The relevance of a DORC valuation to the Undertaking is in its relationship to pricing. The TPA is not prescriptive as to how prices for access are to be determined, indeed it favours commercial negotiation. In accepting the Undertaking, however, the ACCC will want to be satisfied that prices are reasonable and do not include

monopoly rent⁵. The monopoly rent test (which is a price or revenue 'ceiling test') generally applied is that the infrastructure provider should not earn more than a reasonable risk-adjusted return on the value of assets employed.

DORC is a generally accepted method of valuing assets in such a context, applied in many rail valuations to date.

It is noted that the ACCC's *Statement of Principles for the regulation of electricity transmission revenues – background paper* (2004) recommended a Depreciated Historic Cost (DHC), taking account of inflation, for use in valuing transmission assets.

The ACCC adopted this approach in preference to DORC, as periodic revaluation of sunk assets (under DORC) could result major changes in asset value. This in turn could lead to unpredictable revenues and prices. Further, the prospect of windfall gains or losses may deter efficient investment.

In the case of the ARTC's network assets, the use of DHC would appear to be less defensible, for the following reasons:

- ▶ In practice, ARTC's access prices on the interstate network as a whole have not (to date) approached the price ceiling. The ACCC also noted this fact in the course of the 2002 Decision, using it to reject ARTC's arguments regarding insufficient network investment incentives:

*It is difficult to see how ARTC's incentives are adversely affected when current prices are currently set below those that would recover the full economic cost of the service provided.*⁶

In a context where ARTC's access prices remain well below the calculated ceiling level, it is difficult to argue that use of DORC, together with periodic revaluations, will result in significant price fluctuations and inappropriate investment signals.

- ▶ The ARTC has indicated that many network assets are old and nearing the end of their useful lives. This opens up the potential for a significant disconnect between historic cost and modern replacement costs. It is not clear that simply indexing historic cost by inflation provides a good indicator of the value of the existing network over the *long term*, though the use of CPI is likely to be practical in the short term. This is particularly so, given changes in real costs of raw materials over time (e.g. timber for sleepers)⁷.

For these reasons a DORC approach has been retained for this review. Consistent with the requirements of the brief, a 2006 DORC has been calculated, These issues are discussed in brief below.

⁵ The 44ZZA criteria do not specifically refer to excluding monopoly rents although regulators have interpreted this requirement given they are required to take account of the public interest, including the public interest in having competition in markets, and the interests of the persons wanting access to the service.

⁶ ACCC, *op. cit.*, p.150

⁷ Recent increases in raw materials and construction costs (in excess of CPI growth) have been cited as a reason for cost blowouts in at least one major Australian rail project (the Chatswood-Epping link). See, for example, *Sydney Morning Herald* August 11, 2006. This reference cites building industry costs of 6% as opposed to forecast CPI increases of 3% as a major reason for cost blowouts on this project. However, as discussed below, difficulties with the use of CPI in connection with DHC over the longer term should be distinguished from its use as an index over the short to medium term (e.g. five year regulatory periods). In the latter case, CPI is typically a preferred method of indexation.

Definition of DORC

The DORC is the replacement cost of an 'optimised system', less accumulated depreciation.

Booz-Allen's interpretation of the DORC is to base the replacement cost valuation on the replacement cost of existing assets with the optimisation reflecting only the elimination of redundant assets and potential cost savings from new technologies (e.g. updates in communications/signalling technologies). It does not incorporate any increase in performance standards. If any such increase is unavoidable (due to factors such as asset obsolescence), then in theory an adjustment should be made to allow for this. This point is further discussed below.

Regulatory practice

DORC is applied to establish the regulated cost base against which reasonable prices can be determined. Regulators will try and ensure that as far as possible regulated outcomes reflect competitive market outcomes.

IPART in its 1999 review of the NSW rail access regime, argued in the context of DORC that "an optimised system is a reconfigured system using modern technology designed to serve the current load with current technology, with some allowances for growth"⁸. Further "this method excludes any unused or under utilised assets and allows for potential cost savings that may have resulted from technological improvement"⁹. The latter point relates to the use of *modern equivalent form* (MEF) methodology. While it is conceivable modern equivalent forms could be more expensive, this is generally not the norm.

NSW Treasury Policy Guidelines state "It is stressed that optimisation for valuation purposes is not concerned with improving the system from its current state. The system must never be valued as better than it is, whether in terms of capacity or other standards. Optimisation leads only to reductions in the replacement costs of network system assets"¹⁰.

The DORC is a method of valuing *existing* assets. It is therefore based on the functionality and service performance of existing assets, not on functionality and service performance of assets not yet in place, even though the existing assets would not be replaced on a like-for-like basis. If the replacement assets being valued generate higher functionality and performance than those in place, *in theory*, some form of adjustment to replacement costs is required. This issue is further discussed below.

Application of regulatory practice to replacement cost methodology

The current ARTC network comprises of significant quantities of infrastructure which are obsolete by modern construction standards and/or are approaching the end of their useful lives. For example, large sections of track currently utilise timber

⁸ IPART, "Aspects of the NSW Rail Access Regime", Final Report April 1999, p.34. As indicated below, the current taken to the 2006 DORC reflects more recent regulatory thinking, which does not cater for 'growth allowances'.

⁹ IPART (1999); *op-cit*, p.34

¹⁰ NSW Treasury, "Policy Guidelines for Valuation of Network Assets of Electricity Network Businesses", Technical paper, December 1995 p26

sleepers, rather than concrete ones (which would be used if the network were constructed today) or use obsolete, lighter rail, which would not be employed today.

This raises two immediate questions:

- ▶ Should increased service potential, inherent in the use of MEF, be adjusted for ?
- ▶ How should the remaining life of assets be treated, particularly when replacement assets may be more “long lived” than *in situ* assets (eg concrete vs. timber sleepers) ?

In terms of the first question, as it is reasonable to base the DORC on the cost of MEF which would be used to replicate the performance of assets currently *in situ*. In practice, MEF might be of a higher standard than assets currently *in situ* (say 60kg rail rather than 53kg rail or concrete vs. wooden sleepers). Where this is the case, some adjustment to the replacement value of assets might, in theory, be justified.

To see this, imagine that, in a competitive market, a rival user was to build a new railway line, in competition to an existing one. The new line would no doubt be based on the most modern assets and technologies and reflect the service and performance standards required to best compete in its market both currently and into the future.

If the existing line, for historical reasons, reflected a lower standard, it is not reasonable to expect that in a competitive market, the owner of the existing line could charge the user the same as it would cost the user to build the bypass line. They would have to offer a substantially lower price which reflected the lower functionality and performance of the existing asset. In regulating access to the existing line, regulators would therefore seek to ensure that the asset value was appropriately adjusted to reflect the reduced standard.

In practice, it may be difficult to adjust replacement values to reflect such reduced functionality. Doing so may introduce an further element of substantial uncertainty into the process. The 2006 DORC has therefore adopted a pragmatic approach to this issue and no adjustment has been made to asset values in order to allow for reduced functionality relative to MEF.

In terms of the second question, a key issue for ARTC is that while some *in situ* infrastructure may have only a few years of useful life left, the MEF may have a considerably longer life span, given modern materials. For example, timber sleepers which have used up 23 years of their 25 year lifespan will need to be replaced in two years, whereas concrete sleepers of the same age (and with a 50 year life span) will not.

It should be recalled that DORC methodology aims to replicate the second hand value of assets in a competitive market. It is not aimed at simply writing down the replacement costs to reflect a "pure" interpretation of asset age. Rather, *any second hand assets should be written down to reflect the reduced service potential of second hand assets* relative to new ones.

DORC is intended to reflect the cost of replacing relevant capacity (or service potential) with MEF. As indicated above, use of MEF is not intended to produce a "superior" service potential (including remaining service potential) to existing assets.

Thus, assuming that concrete sleepers form the modern equivalent for timber ones an adjustment to the remaining life of concrete sleepers is necessary to reflect the fact that existing track has only a very limited future service potential.

Table A-1 below indicates the approach taken, using the example of timber and concrete sleepers. The remaining life of concrete sleepers is adjusted to equate to that of timber ones (i.e. 2.5 years).

Table A-1: Application of approach to remaining life for timber and concrete sleepers – hypothetical only

Item	Timber sleepers (in actual use)	Concrete sleepers (MEF)
Useful life (years)	25	50
Percent depreciated (%)	90	95
Life expired (years)	22.5	47.5
Remaining Life (years)	2.5	2.5
Replacement Cost (\$)	100	100
Depreciated Value (\$)	10	5

NB: All figures are hypothetical

Booz Allen has adopted this approach for the current DORC estimates. Thus, where, for example, concrete sleepers have been adopted as a modern replacement asset for timber sleepers, an adjustment has been made to the remaining service potential (i.e. life) of the concrete sleepers to bring them into equivalence with timber ones.

As indicated in Table A-1 above, the use of this approach can have the effect of reducing the value of the initial asset base, relative to what would have been the case if simple “like for like” replacement was assumed (and was possible). For example, in the case of sleepers:

- ▶ Concrete and timber sleepers are currently comparable in price;
- ▶ However, applying a higher rate of depreciation to the initial (equivalent) concrete sleeper asset cost, lowers asset value.

Future demand

It is generally accepted that a DORC valuation should include some form of allowance for future demand. The justification for allowing for growth in a regulated asset base is that even in competitive markets, future demand is not known with certainty and a certain amount of excess capacity is 'normal', particularly when investment decisions involve a significant time lag.

A related factor is that major pieces of capital infrastructure, such as rail networks, are essentially indivisible in many respects – eg one cannot run a conventional train on a single rail.

To only allow the infrastructure provider to recover the costs of capacity which is fully utilised at any point in time would be particularly harsh, impractical, and could potentially discourage investment

Booz Allen's approach to future demand (for the 2006 DORC) is conservative in that it does not allow for the inclusion into the 2006 asset base of any *additional infrastructure* deemed necessary to meet future network demand over the regulatory period. This approach is consistent with recent regulatory decisions¹¹.

However, to the extent that assets *in situ* may not be fully utilised by current traffic levels (eg double track between Macarthur and Junee), these have not been optimised out of the 2006 asset base. These issues are further discussed below.

Optimisation of ARTC network

In practical terms, the issue of optimisation can be divided into two parts for the purposes of the current report:

- ▶ Optimisation of the ARTC network segments considered in the 2001 DORC (i.e. ARTC interstate network segments in Victoria, South Australia and Western Australia)
- ▶ Optimisation of the ARTC network segments leased from NSW

The ACCC previously accepted the optimised ARTC asset base, provided in the 2001 DORC.

In terms of the optimisation of the network considered in 2001, no significant segment asset augmentation has taken place, while traffic volumes have grown over the past five years. This suggests that there is an *a priori* case for adopting the asset base provided by the ARTC in respect of these segments as an optimised asset base. Booz Allen's analysis, detailed in the main report, supports this finding.

NSW interstate rail segments have not been subject to a detailed optimisation process in the past. However, Booz Allen's analysis has determined that the only significant optimisation issue appears to be in respect of the provision of double track between Cootamundra and Junee.

Current traffic volumes would not appear to justify the retention of double track on this route.

However, the following points should be noted:

- ▶ Forecast growth in traffic volumes during the regulatory period will result in higher utilisation of this track (though Booz Allen analysis indicates that this is still not sufficient, in isolation, to justify the retention of double track)
- ▶ The most logical alternative to double track would be a series of passing lanes, given ARTC's assessment of the remainder of this line. However, the design of such a system of passing lanes in order to ensure that current ARTC network service potential is met (eg capacity, transit times and reliability) could be extremely complex. For the same reason, it is also unclear if this would actually represent a more cost-effective approach to the provision of current service potential on this route than the current provision of double track.

¹¹ See Queensland Competition Authority (QCA) (2005), *Final Decision: Dalrymple Bay Coal Terminal: Draft Access Undertaking* pp.121-138

- ▶ The track in question is only 56.2 kilometres in length and thus accounts for less than 1% of ARTC's total network length.
- ▶ The inclusion of such track acts as a valuation offset to ongoing loop extensions across the network, which have not been incorporated in the 2006 DORC.

Booz Allen believes that a pragmatic approach is to allow for the retention of double track on the Cootamundra-Junee route. This approach was adopted for the 2006 DORC.

Treatment of federal funding and financing costs

ARTC's forward capital program is, in part, reliant on injections of Federal funding in the form of grant monies.

The 2002 Decision noted arguments by parties such as Toll, FreightCorp and NECG that the ARTC's current asset base and forward capital expenditure has been partly funded through Commonwealth grants. As such, it was argued that an adjustment should be made to reflect the fact that such monies were "gift funded".¹²

In the 2002 Decision, the ACCC noted that adjusting the DORC to allow for the sources of *past funding* of sunk assets would be a complex exercise and potentially less relevant going forward, given that access revenues are well below the ceiling.

The ACCC did note, however, that *ongoing* Commonwealth grants may need to be taken into account in determining floor and ceiling revenue limits. This approach was seen as being consistent with that of the NCC in its Final Recommendation regarding the Darwin to Tarcoola rail line which allowed the regulator discretion to adjust the DORC valuation to account for government and non-government assets.¹³

As indicated, the purpose of the DORC is to value existing assets, which provide a given level of functionality and service. Accordingly, Booz Allen believes that the issue of the *source* of funds used to construct the network is entirely separate to that of the estimation of the network DORC *per se*.

It is also noted that no estimate of financing costs has been applied to the DORC. Arguably, such costs should be applied to the (non-Commonwealth funded) portion of the existing asset base and to ongoing expenditures by ARTC. However, consistent with separating the estimation of DORC from that of funding sources, Booz Allen believes that it is preferable to omit financing costs from the DORC estimate.

The extent to which the issue of source of funds is seen as relevant to the ultimate setting of floor and ceiling *prices*, is therefore a separate issue and a matter for regulatory discretion, as indicated in the 2002 Decision.

Accordingly, no adjustment has been made by Booz Allen to the DORC in respect of the source of funds used to construct either the existing network (i.e. sunk assets).

Indexation of DORC estimates for future years

¹² ACCC (2002) *op. cit.*, pp.147-149

¹³ *Ibid*

Booz Allen notes that CPI indexation was applied to the 2001 DORC, going forward by ARTC. This approach was accepted in the 2002 Decision as a means of providing an approximation of DORC between valuations. The 2002 Decision noted the change in DORC over time could be expected to reflect inflation and the rate of technological change¹⁴.

The issue of applying indexation to derive future estimates is distinct from that of the estimation of the 2006 DORC itself.

Booz Allen notes, that CPI remains a common approach to indexation for inflation, where it is applied in similar circumstances. For example, the Queensland Competition Authority (QCA) recently criticised QR's use of a non-CPI inflator (the Rawlinson's Construction Index) to inflate its asset base in its Draft and Final Decisions on *QR's 2005 Draft Access Undertaking*. The QCA indicated that it would apply a non-CPI inflator to the asset base only under circumstances where it had not performed the original valuation or there was considerable uncertainty about the original valuation¹⁵.

In its earlier Draft and Final Decisions on *QR's 1999 Draft Access Undertaking*, the QCA also explored the issue of the use of a rail specific inflator in the context of adjusting *reference tariffs*. The QCA noted that a rail specific cost inflator known as the Rail Cost Adjustment Factor (RCAF) is used for regulatory purposes by the Surface Transportation Board in the United States. However, there is no equivalent index in Australia and construction of such an index would involve data difficulties and reliability issues (eg the fact that, in a small market such as Australia, the activities of the rail entity itself would drive the index). Similar issues are relevant to the question of inflating the asset base.

The QCA indicated that CPI's strengths lay in its usefulness and broad acceptance and the fact that it provides a consistent basis for the forecasting of inflation. In particular, the QCA pointed to its use in:

- ▶ macroeconomic policy,
- ▶ the indexation of public and private contracts and charges and
- ▶ its past use by regulators to inflate the a regulated entity's cost base¹⁶

It is also noted that estimation of the NSW Rail Access Undertaking calls for use of the (Sydney) CPI to be applied to the opening asset base as a part of its roll-forward calculations.

Brownfields Vs greenfields

As defined by IPART, a "brownfields" valuation "relates to a value which assumes construction takes place around all existing above ground development and community infrastructure"¹⁷. Conversely a "greenfields" valuation "relates to a

¹⁴ ACCC (2002) *op. cit.*, pp.149-150

¹⁵ QCA(2005), *Draft Decision: QR's 2005 Draft Access Undertaking*, pp.5-7 and QCA (2005), *Decision: QR's 2005 Draft Access Undertaking*, pp.4-5

¹⁶ QCA(2000), *Draft Decision: QR's 1999 Draft Access Undertaking* pp.238-241 and QCA(2001), *Final Decision: QR's 1999 Draft Access Undertaking* pp.238-241

¹⁷ IPART, "Aspects of the NSW Rail Access Regime", *Final Report April 1999*, p.35

value which assumes construction across an area free of any development"¹⁸. Typically, brownfields valuations include the costs of surface restoration and other surface diversions.

For most of ARTC's network, the impact of community development on replacement cost is largely irrelevant. The urban areas will be the exception.

Perhaps a more significant issue, however, is the assumption of whether replacement occurs under traffic. Replacement under traffic can add significantly to the cost because of the possible need to build diversions and because of the impact on labour and equipment productivity. An assumption of no traffic (i.e. exclusive access for construction) was applied in the RAC DORC because of the structure of the charges (periodic renewals are expensed) and to Booz Allen's 2001 DORC for ARTC.

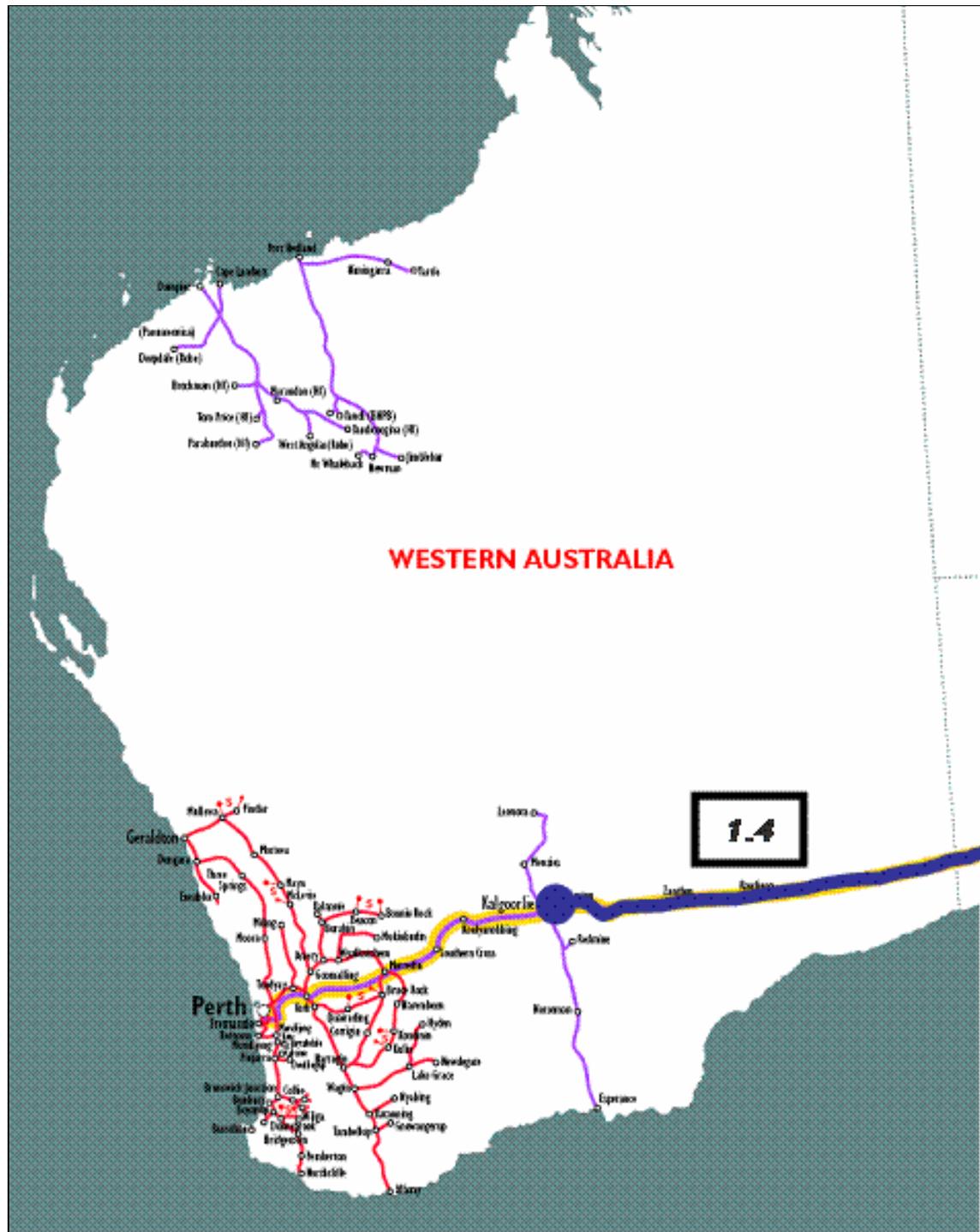
It could be argued that the no traffic situation is also more consistent with a bypass interpretation of the ceiling test (although a bypass test might take into account surface restoration type costs associated with a brownfields valuation).

Given these considerations, the 2006 DORC was assessed on a greenfields basis (consistent with the 2001 DORC).

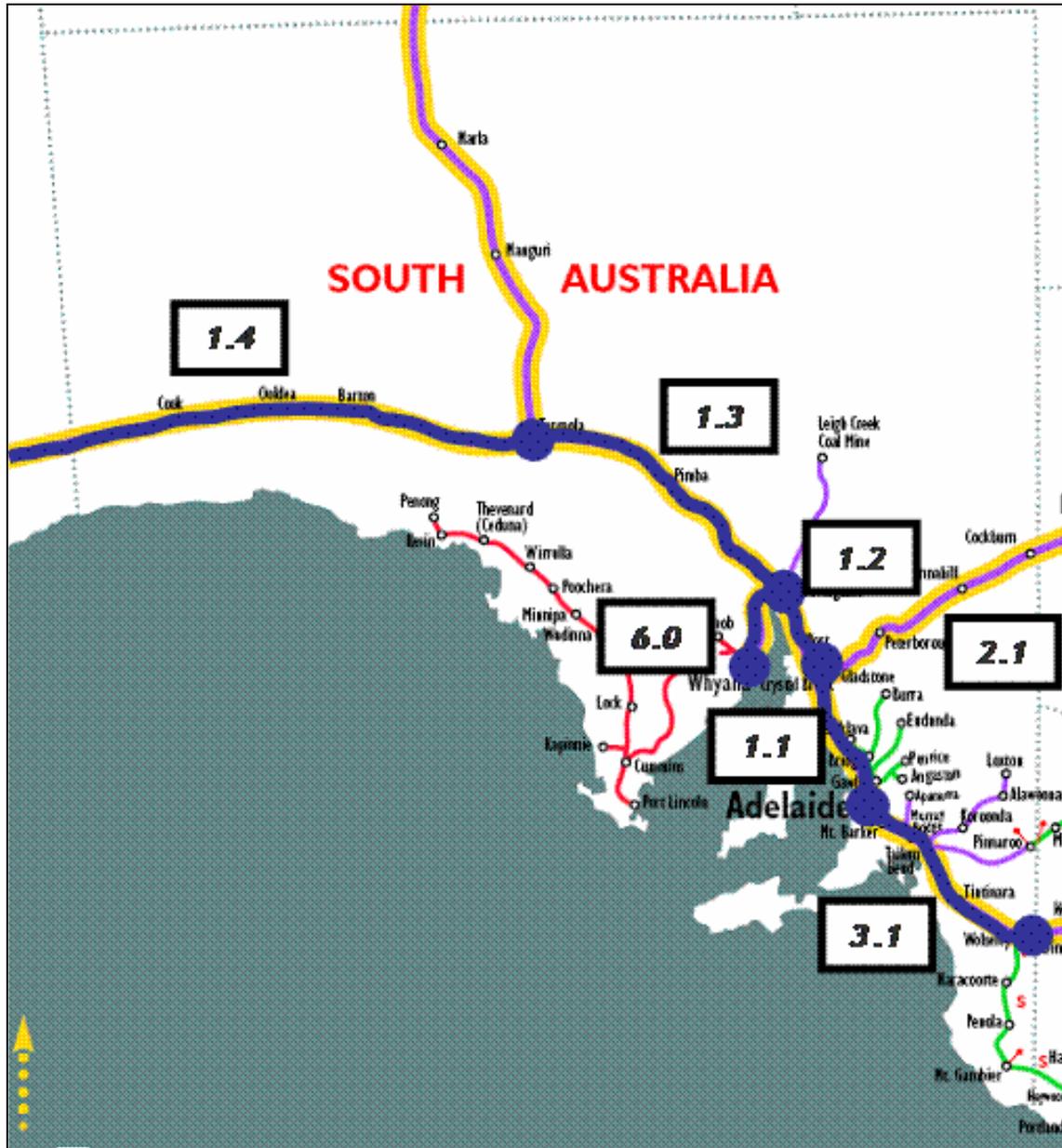
¹⁸ *Ibid*, p.35

Appendix 2 – Network Maps

Western Australia



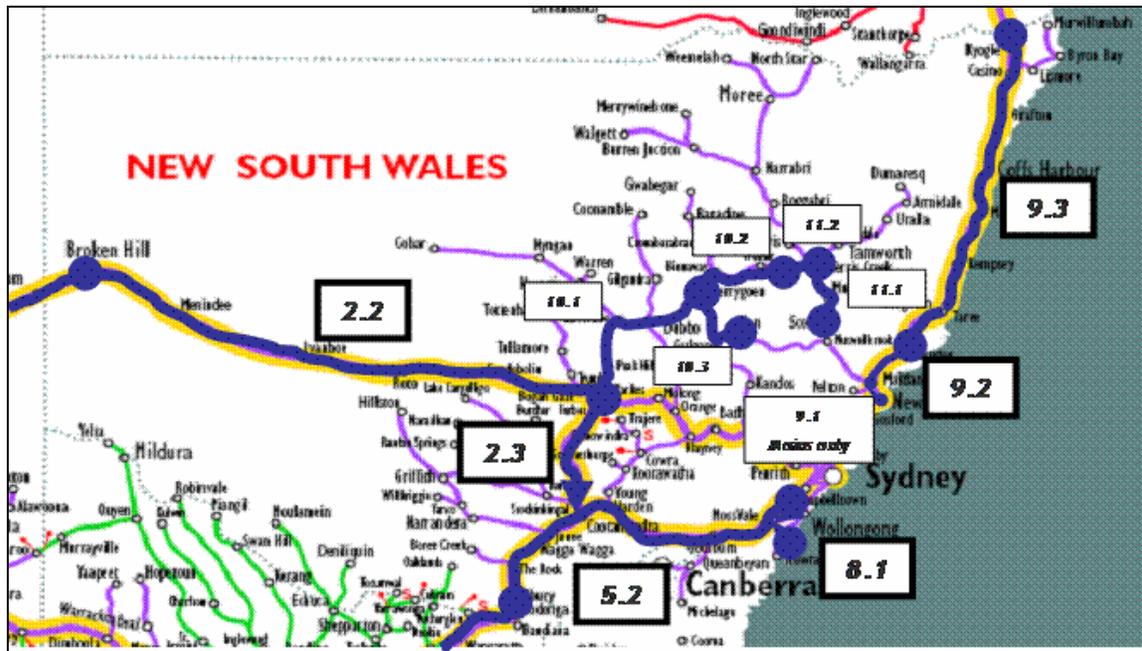
South Australia



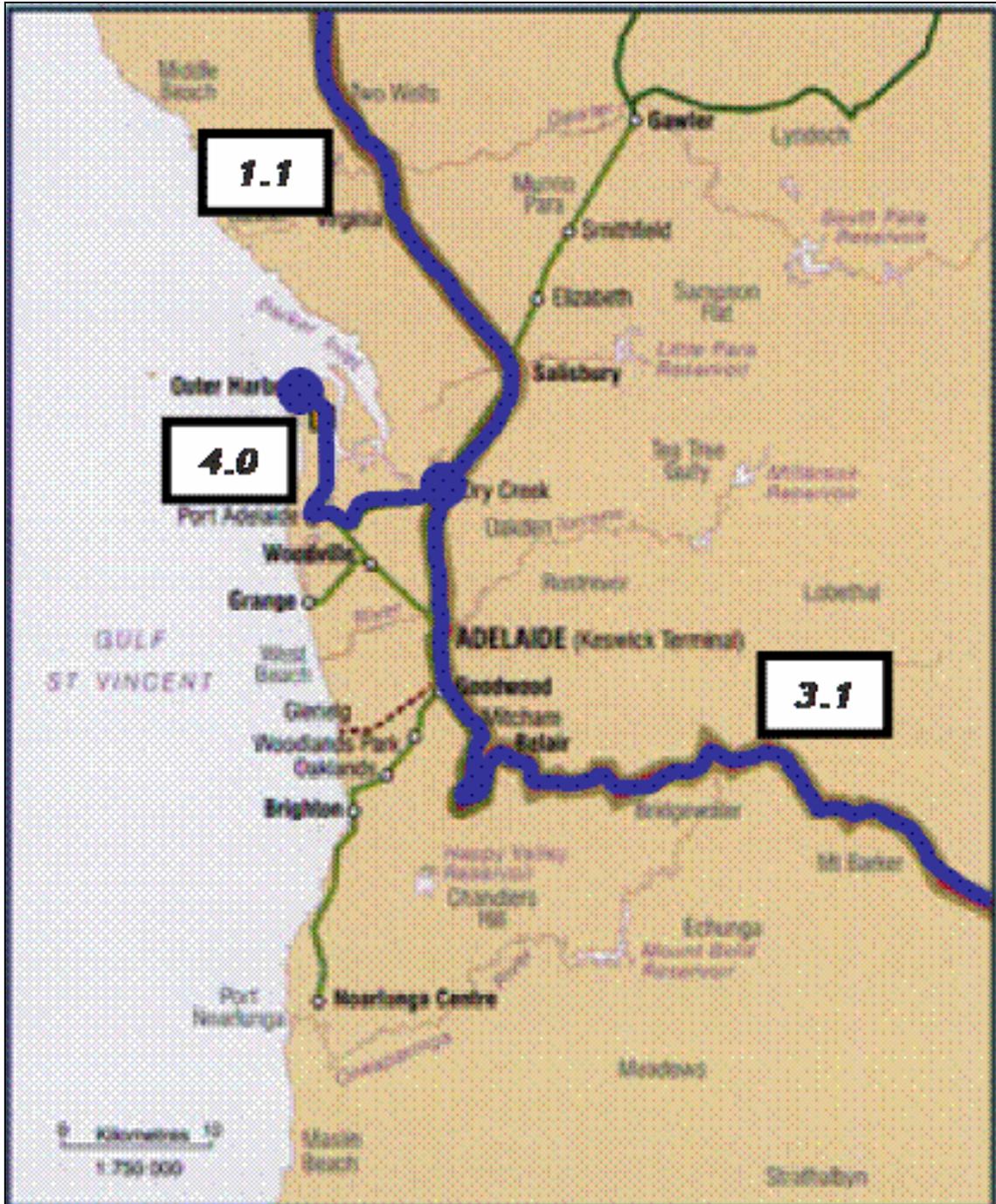
Victoria



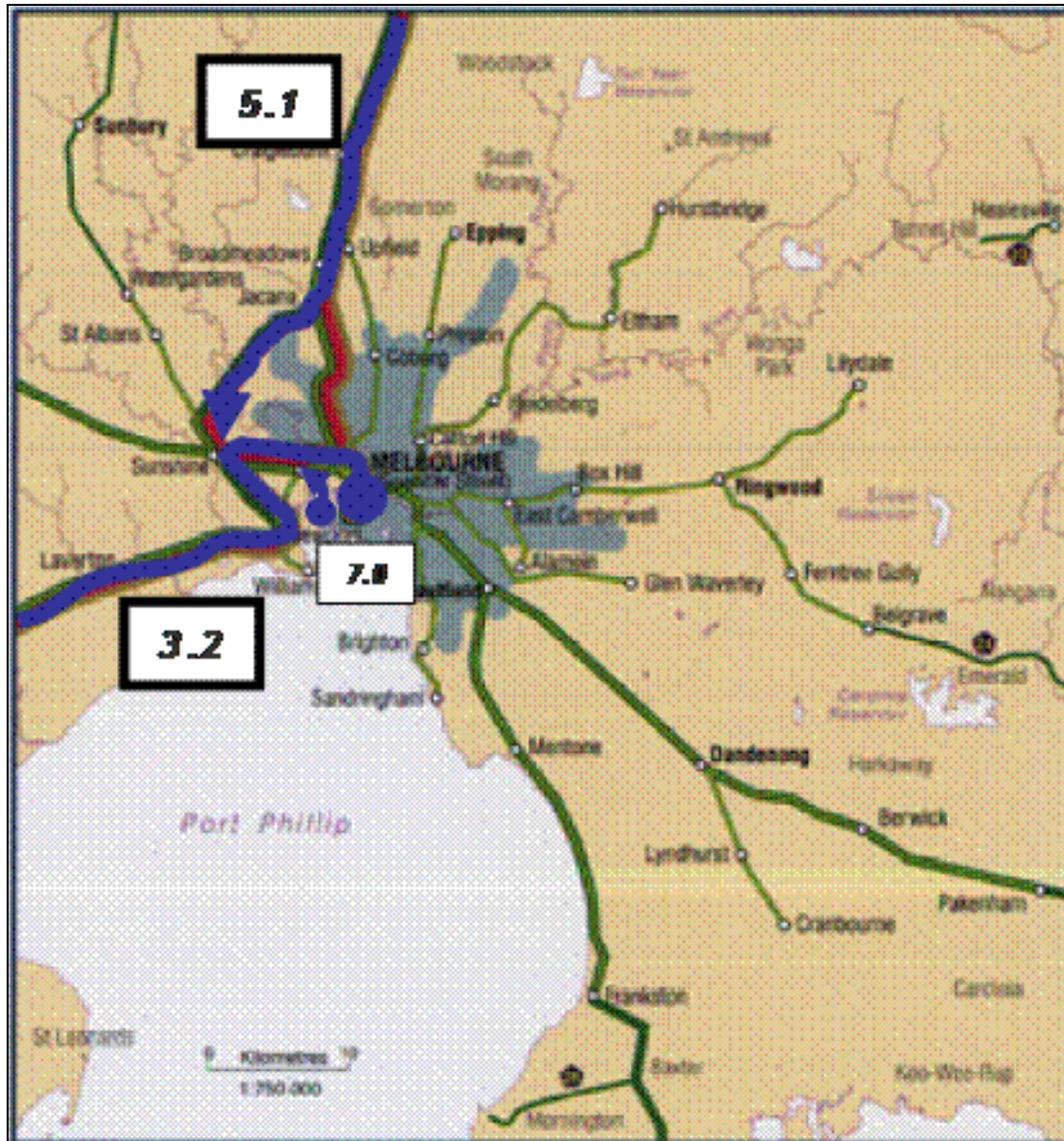
New South Wales



Adelaide



Melbourne



Appendix 3 – Segment ORC and DORC results

Segment ORC and DORC Results: 2006 DORC

DORC	Segment ID	Segment name	Main lines & loops STK	Yards STK	Total STK	Track, turnouts xings & fencing ORC	Track, turnouts xings & fencing DORC	Earthworks & tunnels ORC	Earthworks & tunnels DORC	Structures & culverts ORC	Structures & culverts DORC	Signalling ORC	Signalling DORC	Communications ORC	Communications DORC	Total ORC	Total DORC
1	1.1	Dry Creek - Crystal Brook	198.2	0	198.2	\$190,980,576	\$78,407,797	\$12,366,712	\$6,183,356	\$30,562,881	\$6,679,326	\$8,608,851	\$1,721,770	\$1,889,748	\$37,950	\$184,408,768	\$93,370,198
	1.2	Crystal Brook - Pt Augusta	132.0	0	132.0	\$86,331,672	\$52,943,777	\$7,364,577	\$3,682,289	\$15,517,246	\$9,922,825	\$5,733,443	\$1,146,689	\$1,258,561	\$251,712	\$116,205,499	\$65,946,981
	1.3	Pt Augusta - Tarcoola	435.9	0	435.9	\$288,294,052	\$161,678,190	\$61,488,744	\$30,744,372	\$31,025,875	\$9,818,726	\$18,933,392	\$3,786,678	\$4,196,110	\$831,222	\$383,888,173	\$205,859,189
	1.4	Tarcoola - Parkeston	1344.2	0	1344.2	\$825,190,532	\$497,165,051	\$189,368,966	\$84,684,483	\$18,181,097	\$4,211,496	\$58,385,559	\$11,677,112	\$12,816,342	\$2,563,268	\$1,083,942,496	\$600,301,411
2	2.1	Crystal Brook - Broken Hill	395.4	0	395.4	\$246,893,109	\$176,701,484	\$58,765,955	\$17,629,787	\$39,113,455	\$27,525,519	\$17,174,267	\$3,434,853	\$3,769,961	\$753,992	\$365,806,748	\$226,045,635
	2.2	Broken Hill - Parkes	708.6	1	709.6	\$436,249,119	\$180,365,482	\$26,854,000	\$13,427,000	\$41,392,562	\$24,359,000	\$30,778,163	\$6,156,633	\$6,756,182	\$1,351,236	\$542,030,026	\$225,656,351
	2.3	Parkes - Cootamundra	207.2	0	207.2	\$131,542,160	\$48,736,323	\$8,266,000	\$4,133,000	\$18,545,460	\$12,138,159	\$10,871,750	\$2,174,350	\$2,386,482	\$477,296	\$171,611,852	\$67,659,128
3	3.1	Dry Creek - SAVIC Border	340.0	0	340.0	\$225,724,910	\$112,561,863	\$25,756,546	\$12,879,273	\$23,355,700	\$6,958,696	\$14,767,959	\$2,953,592	\$3,241,747	\$648,349	\$292,848,861	\$135,631,783
	3.2	SAVIC Border - Melbourne	560.0	0	560.0	\$378,521,146	\$232,742,610	\$41,554,761	\$20,777,380	\$38,611,728	\$10,890,183	\$24,323,697	\$4,864,739	\$5,339,348	\$1,067,870	\$488,350,660	\$270,342,782
	4	Div Creek - Outer Harbour	15.4	5	20.4	\$16,019,961	\$6,952,216	\$1,216,169	\$608,084	\$145,507	\$72,754	\$663,902	\$133,780	\$146,832	\$29,366	\$18,197,371	\$7,796,201
5	5.1	Tottenham - Albury	332.6	0	332.6	\$228,438,400	\$103,239,239	\$12,367,500	\$7,420,500	\$152,893,399	\$84,842,057	\$21,669,808	\$4,333,962	\$4,766,787	\$951,357	\$420,125,893	\$200,787,115
	5.2	Albury - Manarthur	1048.5	8	1057.5	\$684,072,044	\$476,382,332	\$222,092,085	\$111,046,043	\$204,682,140	\$104,293,094	\$78,856,874	\$15,771,375	\$17,310,045	\$3,482,009	\$1,187,013,239	\$710,954,852
6	6	Spencer Lct - Whialla	74.8	0	74.8	\$47,019,171	\$32,489,381	\$6,935,665	\$3,038,082	\$19,688,215	\$16,044,711	\$649,790	\$713,184	\$23,836	\$4,767	\$3,605,086	\$52,364,611
7	7	Appleton Dock Lct - Appleton Dock	2.5	0	2.5	\$1,086,981	\$1,393,025	\$111,832	\$55,916	\$145,507	\$72,754	\$108,588	\$21,718	\$23,836	\$4,767	\$3,476,755	\$1,548,179
8	8.1	Mess Vale - Urquandora	61.2	0	61.2	\$40,811,704	\$29,436,752	\$65,758,555	\$32,879,868	\$9,317,670	\$4,045,110	\$4,698,375	\$919,875	\$1,009,309	\$304,880	\$321,495,684	\$83,332,685
	8.1	Mess Vale - Urquandora	61.2	0	61.2	\$40,811,704	\$29,436,752	\$65,758,555	\$32,879,868	\$9,317,670	\$4,045,110	\$4,698,375	\$919,875	\$1,009,309	\$304,880	\$321,495,684	\$83,332,685
9	9.1	Singleton (Newcastle) - Maitland mains	60.4	0	60.4	\$45,693,538	\$20,484,941	\$9,712,000	\$4,659,000	\$6,806,016	\$3,403,008	\$4,540,294	\$908,059	\$960,650	\$199,330	\$67,748,498	\$29,831,338
	9.2	Maitland - Craven	116.9	0	116.9	\$80,693,799	\$50,135,465	\$34,218,090	\$17,109,045	\$48,659,010	\$22,573,799	\$5,784,099	\$1,282,217	\$1,282,217	\$385,043	\$73,849,125	\$91,980,772
	9.3	Craven - NSWQldt Border	636.3	1	637.3	\$421,350,818	\$206,247,315	\$400,091,540	\$200,045,770	\$435,619,948	\$226,301,783	\$47,808,074	\$9,561,615	\$10,494,455	\$2,098,891	\$1,315,364,834	\$646,253,373