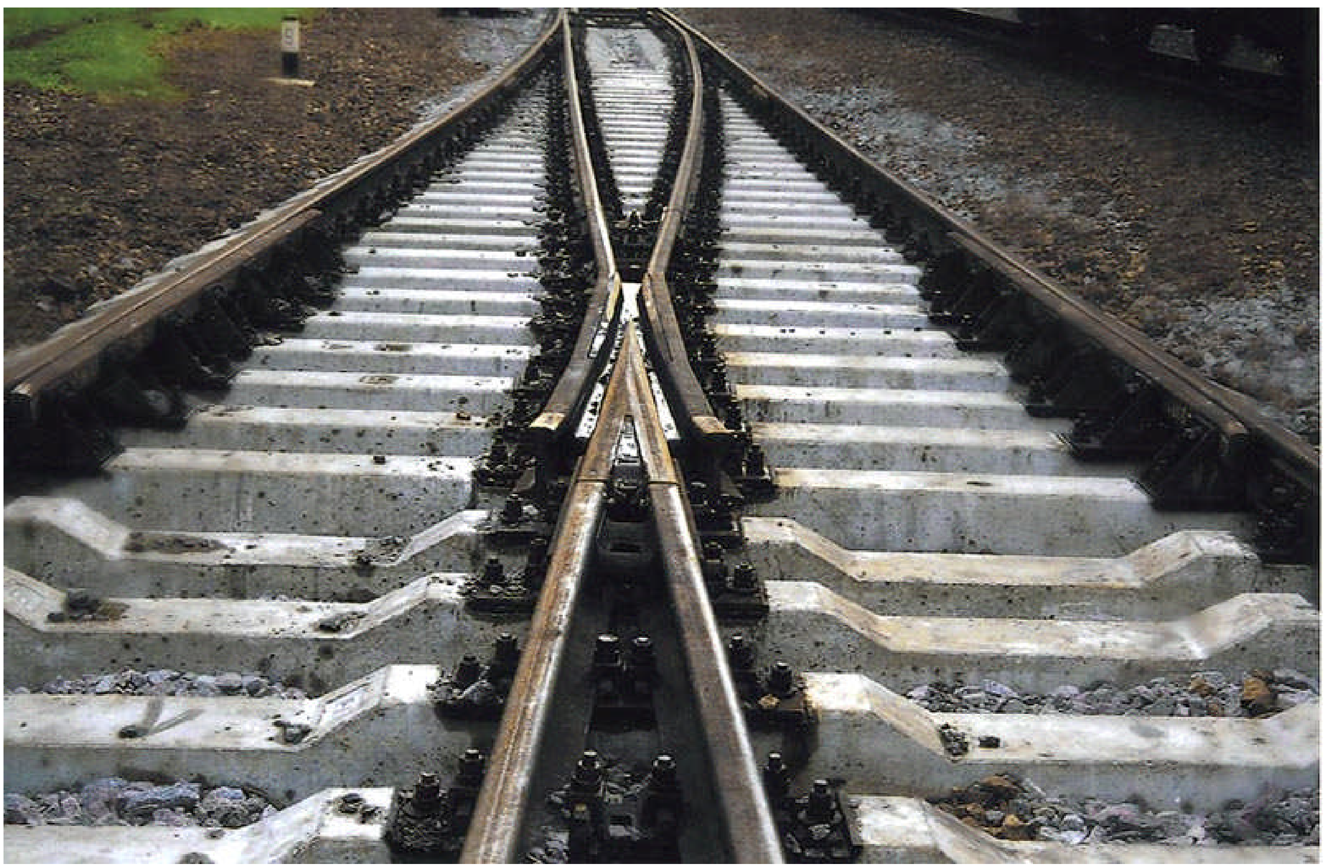
ACCC

Review of ARTC DORC Valuation

Assessment of the reasonableness of the proposed valuation for the 10 year access undertaking

March 2008



PRICEWATERHOUSECOOPERS

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This assessment paper has been prepared by PricewaterhouseCoopers (PwC) and Himark Consulting Group (HCG) for the sole use of the Australian Competition & Consumer Commission (ACCC). Its aim is to assist in the drafting of ACCC's determination regarding Australian Rail & Track Corporation (ARTC) DORC valuation for certain rail lines as described in this assessment. It is prepared for no other purpose. This paper represents indicative advice only, and is not an audit. This document is not intended to be utilised or relied upon by any persons other than ACCC, nor to be used for any purpose other than that articulated above. Accordingly, PricewaterhouseCoopers nor Himark Consulting Group accept no responsibility in any way whatsoever for the use of this report by any other persons or for any other purpose.

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Executive Summary

The Australian Competition and Consumer Commission (ACCC) regulates the Australian Rail Track Corporation (ARTC) under Part IIIA of the Trade Practices Act 1974. Part IIIA establishes the legal regime to facilitate access to the services of certain facilities of national significance including railways.

In 2002 the ACCC approved an access undertaking from ARTC, pursuant to Part IIIA of the Trade Practices Act. The 2002 access undertaking relates to those parts of the Interstate Rail Network linking Kalgoorlie (WA), Tarcoola (SA), Broken Hill (NSW), Melbourne (Vic) and Wodonga (Vic).

In 2004 ARTC entered into a lease arrangement with the State Government of NSW for parts of the NSW inter-State rail network, including the Hunter Valley lines.

In December 2007 ARTC submitted a new access undertaking for approval by the ACCC under Part IIIA of the Trade Practices Act 1974. The new undertaking extends to the leased tracks on the interstate network in NSW, as well as to tracks on the interstate network in VIC and SA. ARTC will submit a separate undertaking to the ACCC for the Hunter Valley rail network.[1]

Terms of Reference for this Review

PricewaterhouseCoopers (PwC) has been engaged by the ACCC to independently assess/review the ARTC Depreciated Optimised Replace Cost (DORC) valuation prepared by the Booz Allen Hamilton (BAH). This review was a 'desk-top review' of the reasonableness of the valuation.

ARTC's proposed DORC valuation

As discussed, BAH has prepared a DORC valuation on behalf of the ARTC for the purposes of ARTC's access undertaking. BAH's approach to this project included:

- Establishing the cost of each pricing segment consistent with ARTC's access undertaking;
- To include only those assets in place in late 2006, BAH made no adjustment for capital investment over the next five years; and
- A desktop review of the information provided by ARTC, no field inspection was undertaken.

[1] In September 2004, ARTC commenced a 60 year lease over the interstate tracks and the Hunter Valley coal network in NSW pursuant to an agreement between ARTC, the NSW and Federal governments. The 2007 December undertaking does not cover access to tracks in the Hunter Valley coal network; these will be the subject of a separate access undertaking that ARTC is expected to lodged by ARTC at a later date.

BAH final ORC and DORC costs are presented below.

BAH DORC results

Network results	
ORC ($million)	7037
DORC ($million)	3712
Per cent life consumed	47%
WA/VIC/SA	
ORC	3,394
DORC	1,852
NSW	
ORC	3,643
DORC	1,865

Source: BAH

Optimisation of the network

There has been limited optimisation of the network. However, this does not necessarily mean that the optimisation is not unreasonable given:

- Limited augmentation of the VIC/SA/WA segments of the network suggests little difference from the 2001 optimisation assumptions;
- Restrictions on the ability to use suburban infrastructure in Sydney, Melbourne, and Adelaide in peak times thereby limiting the ability to further optimise train timetables;
- The exclusion by BAH of non core assets, e.g. sidings, passing loop, and spurs not required for mainline operations;
- The use of functional performance specifications across relevant infrastructure types, e.g. concrete over timber, and
- The use of CTC across the majority of the network.

Further, PwC considers that the question of over capacity on the Cootamundra to Junee line segment has not been unreasonably included given the demand increases likely as freight is substituted between road and rail on the North South corridor.

Replacement costs

PwC has found that the replacement costs proposed by ARTC are not unreasonable. This is based on a number of factors, including:

- Results from random sampling of quantity information used in arriving at the final value of replacement costs that unit rates have been multiplied by appropriate quantities to arrive at a final value;

- Random sampling did not identify any material inconsistency in the information provided and the assumptions of the BAH DORC model quantities;

- That the below rail unit rates across specific items are broadly consistent with comparables from Western Australia, and Queensland Rail where differences exists these are generally explainable; and

- That the average ARTC proposed unit rates for Access prices, across the network are lower than recent actual costs incurred by ARTC in upgrading projects completed in its capital program.

Depreciation rates used in the DORC

The depreciated value for each item for each line has been calculated by three alternative methods each estimating the percentage of the asset consumed:

- An assessment of the percentage of the asset used versus the technical specification of the asset, e.g. for rail the maximum life is based on the quantity of gross million tonnes passing over the rail over its life;

- Where appropriate, the 2001 DORC valuation depreciation life's have effectively been rolled forward to reflect the impact of MPM on asset life's; and

- In all other insistences, a detailed status of all infrastructure was prepared for ARTC by WorleyParsons 2005[2] and by URS[3]. These reports where used as a baseline for the current asset condition, however, a further two years was added to the findings of these reports to establish the present percentage of life consumed. Again where appropriate reductions or at the very least no deterioration was assumed where the necessary MPM works were undertaken on the assets in question.

Assets which have been assumed to be in the condition reported by either URS or Worley Parsons have been considered as not unreasonable in this review[4]. Further, where assets have been assumed to be approximately 50 per cent through their asset life on the basis of MPM, PwC considers that this is not an unreasonable assumption as the MPM program effectively replaces these assets on an ongoing basis[5]. This is consistent with assets such as fences, level crossings and tunnels. This also includes the use of the values assumed in the 2001 DORC valuation. MPM should in theory ensure that the assets have a similar condition between the two valuations and as such the use of the 2001 assumptions is not considered unreasonable in the context of this DORC valuation.

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[2] Worley Parsons prepared a report on track, signals communications and associated infrastructure conditions.

[3] URS undertook a sub-consultancy to the Worley Parsons Report which focused on the condition of structures, namely bridges, across the network.

[4] This review has not involved a detailed critique of the methodologies or findings of the URS and Worley Parsons reports.

[5] However, MPM will extend life but it generally does not create an indefinite life (eg rail can be s.t grinding to maintain shape but this can only be done for a limited number of cycles before replacement is required.

For other assets, notably rail, it is more appropriate to consider the actual usage of the asset against the specified technical life of the asset. This approach has been employed for rail and concrete sleepers. As such the percentages of life used assigned by BAH for rail and concrete sleepers have not been considered to be unreasonable.

The weighted average of the ‘% life consumed’ for each segment of the ARTC Network has been calculated by BAH as follows:

- SA/WA/VIC 45.4 per cent
- NSW 48.8 per cent, and
- ARTC network 47.2 per cent.

Levels close to 50 per cent are consistent with railway lines which are subject to periodic maintenance program to retain a fit for purpose condition. Given that the condition of each asset on individual segments of the network has been assessed and that the weighted averages have been assessed on the basis of the proportion of the individual segment and the proportion of value of each asset class, the percentages outlined by BAH are not considered to be unreasonable in the context of this DORC valuation. Further each asset has been assessed against it present condition and no further adjustments are deemed to be necessary.

Overall conclusion on reasonableness of the proposed DORC

Overall the approach and final values proposed by ARTC do not appear unreasonable based on:

- Our sample testing;
- Comparisons to other jurisdiction; and
- Other assumptions regarding optimisation of the network, replacement costs, and depreciation.

As such PwC’s finding is that the ARTC’s DORC valuation is not unreasonable. Given the ARTC forecast increases in traffic over the next five years on mainlines, further optimisation of the network does not appear warranted at this time.

1 Introduction

1.1 Background to Review

The Australian Competition and Consumer Commission (ACCC) regulates the Australian Rail Track Corporation (ARTC) under Part IIIA of the Trade Practices Act 1974. Part IIIA establishes the legal regime to facilitate access to the services of certain facilities of national significance including railways.

In 2002 the ACCC approved an access undertaking from ARTC, pursuant to Part IIIA of the Trade Practices Act. The 2002 access undertaking relates to those parts of the Interstate Rail Network linking Kalgoorlie (WA), Tarcoola (SA), Broken Hill (NSW), Melbourne (Vic) and Wodonga (Vic).

In 2004 ARTC entered into a lease arrangement with the State Government of NSW for parts of the NSW inter-State rail network, including the Hunter Valley lines.

In December 2007 ARTC submitted a new access undertaking for approval by the ACCC under Part IIIA of the Trade Practices Act 1974. The new undertaking extends to the leased tracks on the interstate network in NSW, as well as to tracks on the interstate network in VIC and SA. ARTC will submit a separate undertaking to the ACCC for the Hunter Valley rail network.[6]

1.2 Terms of Reference for this Review

PricewaterhouseCoopers (PwC) has been engaged by the ACCC to independently assess/review the ARTC Depreciated Optimised Replace Cost (DORC) valuation prepared by the Booz Allen Hamilton (BAH). This review was a 'desk-top review' of the reasonableness of the valuation.

The terms of reference for this review is at Appendix A. This work was completed in conjunction with the rail engineering expertise of Himark Consulting Group Pty Ltd (Himark).

ARTC's December 2007 Undertaking covers the interstate mainline standard gauge track linking Kalgoorlie (WA); Adelaide, Wolseley and Crystal Brook (SA); Melbourne and Wodonga (Victoria); and Broken Hill, Cootamundra, Albury, Macarthur, Moss Vale, Unanderra, Newcastle (NSW) (to the Queensland border).

While the Undertaking is limited to these segments, the ARTC has provided the ACCC with a financial model which allocates its total operating and maintenance costs across all

[6] In September 2004, ARTC commenced a 60 year lease over the interstate tracks and the Hunter Valley coal network in NSW pursuant to an agreement between ARTC, the NSW and Federal governments. The 2007 December undertaking does not cover access to tracks in the Hunter Valley coal network; these will be the subject of a separate access undertaking that ARTC is expected to lodged by ARTC at a later date.

segments of its network, regardless of coverage under this Undertaking. PwC notes that while the ARTC has a lease over additional segments of track in NSW (including the Hunter Valley Coal Network) the December Undertaking excludes the Hunter Valley coal network [7] review is limited to the segments described above.

1.3 Description of ARTC Standard Gauge Rail Network

In 1997 ARTC was established by an Inter-Governmental Agreement between the Commonwealth, New South Wales, Victoria, Queensland, Western Australia and South Australia. Figure 1 sets out the network.

Figure 1.2 ARTC Network Map

Source ARTC

Part IIIA of the *Trade Practice Act 1974* establishes the legal regime to facilitate access to the services of certain facilities of national significance including railways. ARTC has voluntarily submitted an Access Undertaking to the ACCC for assessment under Part IIIA. ARTC's 2007 Interstate Access Undertaking outlines the terms and conditions on which

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[7] The Hunter Valley coal network being coal lines in Newcastle from the Newcastle Ports and extending through the Hunter Valley to werris Creek and the Ulan coal mine (see ARTC Access Undertaking Application 20 December 2007.- (www.accc.gov.au/rail).

ARTC upon which ARTC will negotiate and offer access to access seekers to its rail network. If accepted by the ACCC the Undertaking is legally enforceable.

2 Definition of ARTC Modern Equivalent Form (MEF) Standard

2.1 DORC in the context of rail

Australian regulatory authorities have used the DORC methodology as an estimate of the total economic value of a particular asset base. The DORC value is used in the setting of prices through the application of a return on capital invested in a particular asset. As the DORC value is used in the determination of prices it is important that assets included in the valuation are appropriately optimised and do not represent a 'gold plated' asset and takes appropriate consideration of those assets which have been made redundant due to technological changes (an example of these assets in rail is the updates in communication/signalling technologies). However, it is important that the replacement costs considered in the valuation do not incorporate any changes to the performance standards on the network.

The DORC should represent the unconsumed portion of an asset and therefore should reflect the economic life of the asset. The application of the DORC approach requires the following:

- Optimisation of the network to ensure that the asset is efficiently designed;
- Optimisation of the replacement costs of the asset to ensure that the asset is efficient procured; and
- Depreciation of the asset to ensure that the appropriate economic live of the asset is reflected in the value of the asset.

Within the context of rail it is also important to consider whether the valuation is assumed to be on a greenfield site or a brownfield site. The difference between the two assumptions is based on the cost differential between working on a site without any existing development thereby allowing easier construction (greenfields) versus working on an existing network further complicating the construction and, all other things being equal, increasing costs (brownfields).

2.2 ARTC's proposed DORC valuation

As discussed, BAH has prepared a DORC valuation on behalf of the ARTC for the purposes of ARTC's access undertaking. BAH's approach to this project included:

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BAH's final ORC and DORC costs are presented in Table 2.1.

Table 2.1 BAH DORC results

Network results	
ORC ($million)	7036.0
DORC ($million)	3712
Per cent life consumed	47%
WA/VIC/SA	
ORC	3,394
DORC	1,852
NSW	
ORC	3,643
DORC	1,865

Source: BAH

2.3 The 2001 DORC for SA/WA/VIC Rail Network

As part of the 2002 decision on the access undertaking for ARTC, the ACCC accepted the DORC valuation proposed by ARTC. This DORC was prepared by Booz Allen Hamilton (BAH) and was reviewed for the ACCC by its independent consultants, Currie and Brown.

BAH's DORC valuation was limited to the area covered by the access undertaking at that time, namely it excluded the NSW aspects currently subject to this access undertaking review. The original valuation prepared by BAH outlined a DORC valuation of $1.639 billion. Currie and Brown, while suggesting that the valuation was within a conservative range, accepted that the valuation was a reasonable estimate. The valuation of the SA/WA/VIC rail network is outlined in Table 2.2. The table also compares this valuation to the more recent valuation of the WA/VIC/SA valuation prepared by BAH.

2.2 Increase between 2001 and 2006 ARTC DORC valuations

WA/VIC/SA	2001	2006	Increases from 2001 to 2006
ORC	2,929	3,367	15%
DORC	1,639	1,852	13%
Precent life consumed	44%	45%	1%
ORC average pre kilometre ($)	763,004	877,815	15%
DORC average pre kilometre ($)	427,033	482,798	13%

Source: PwC Analysis
Note: any difference from the information presented in BAH report is based on rounding unless otherwise stated. Further in the BAH report the 2006 years incorrectly stated that the growth in the network valuation was higher (16 per cent ORC and 13 per cent DORC) than stated in this table.

Between the 2001 valuation and the 2006 valuation, the optimised replacement cost (ORC) and the final DORC costs have been escalated by 15 per cent and 13 per cent respectively. However, on a per kilometre basis across the network these increases have been 37.92 per cent and 30 per cent. The differences between the per kilometre valuations reflect a total network picture in the 2006 valuation rather than the more limited 2001 network. The increase in the average cost across the network reflects the additional costs of the NSW network.

However, the difference between the overall DORC and ORC suggests that the ARTC network valuation over the SA/WA/VIC network has actually decreased in real terms, that is it has not kept pace with inflation. Had the original DORC been subject to a roll forward mechanism whereby the valuation was adjusted purely on the basis of CPI movements the DORC would have increased by 17.5 per cent and 18.8 per cent (see below for further discussion) using commonly accepted roll forward mechanisms. However, this does not reflect any adjustments for capital expenditure or regulatory depreciation. However, assuming that the asset is kept at a consistent standard then we would expect that the depreciation would effectively be offset by replacement capital expenditure. As such the asset base would remain relatively stable, and only be adjusted for indexation of the valuation to ensure the real value was unchanged. As such at a minimum PwC would expect that, at a minimum, the DORC valuation established in 2001 would have at least increased by movements in the CPI, unless there had been a significant technological break through which made a number of existing assets redundant.

Further, as part of the 2002 review, there were a number of examples where Currie and Brown suggested that the BAH valuation potentially understated the DORC. This suggested that the DORC valuation was within the tolerance range of valuation estimates. Within the various valuation techniques it is common to apply sensitivities of approximately plus or minus 10 per cent to calibrate and test the valuation established. As such it is not uncommon for competing valuations to use the same source data but be within a tolerance range of plus or minus 10 per cent. Table 2.3 sets out the comparison of those adjustments against the average costs generated by the new valuation.

Table 2.3 Currie & Brown adjustments from 2001 valuation

	Rail per km	Primary turnouts	Second turnouts
2001 ($) figures			
Original DORC for WA/SA/Vic	$445,000	$140,000	$127,000
Currie & Brown original	$480,000	$200,000	$140,000
Current DORC	$484,618	$201,451	$184,710
2006 ($) figures			
Original DORC for WA/SA/Vic	$526,360	$165,596	$150,220
Currie & Brown original	$567,759	$236,566	$165,596
Current DORC	$573,221	$238,282	$218,481

Source: PwC Analysis, Currie and Brown, BAH
NB all estimates are on a per unit basis, escalation based on 3.1% per annum CPI increase over 5.5 years, consistent with the BAH approach.

As can be seen in Table 2.3, comparing the current DORC valuation to the previous 2002 DORC valuation on a consistent basis, that is, on a per unit (kilometre) basis, it can be seen from the table that the costs are within a similar valuation range.

On a per kilometre basis, the 2001 Currie and Brown benchmark of rail costs was $480,000 which compares favourably to the current DORC prepared by BAH which is $484,618 once it is de-escalated and presented in consistent terms. Likewise for the primary turnouts which are within 1 per cent of each other ($200,000 and $201,451 respectively). The only place that the two valuations difference considerably is the secondary turnouts which represent a price differential of 32 per cent over the Currie and Brown original estimate. However, these assets only account for a limited proportion of the total network asset valuation.

2.4 2004 ARTC Lease of NSW Mainline Rail Network

In 2004, the ARTC agreed to operate elements of the NSW rail Network on the basis of 60 year lease with the NSW Government. The lease covers[8]:

- The NSW interstate rail corridor;
- Hunter Valley rail corridor;
- The dedicated metropolitan freight lines to the Sydney ports; and
- An agreement to construct the Southern Sydney Freight Line.

The ownership of the network was retained by the NSW government and as such there was no transaction value ascribed to the network at this time. However, there was a commitment made by the ARTC to invest $872 million into the leased network over a five year period. While this provides a broad guide to the valuation of the equity which ARTC would be expected to pay for the asset it is difficult to quantify the actual value of the network due to a number of issues, including:

- The subsidy payment made by NSW as part of the lease agreement;

[8] http://www.artc.com.au/library/agreement_summary.pdf

- Equity injections by both NSW ($62 million) and ARTC ($143 million); and
- The degree to which the investment was self funding from some of the more profitable segments of the network (namely the Hunter Valley Coal network)

An additional complication in determining the actual valuation of the network was that the lease covered the total network and not only the areas covered by this access undertaking.

Escalation factors used in the 2007 Valuation

In general the BAH has assumed that costs from the 2001 DORC have increased by between 18 per cent (CPI) and 37.4 per cent (benchmark costs). BAH has adopted a mid point of 28 per cent in its calculation of updates to installation costs whereas 18 per cent has been used for other costs.

In its explanation of the 28 per cent escalation factor, BAH noted that it made the following assumptions for its base case regarding escalation factors:

- The movement in the CPI as measured by the Australian (all groups) index between 30 June 2003 and 30 June 2006[9]; and
- An upper benchmark of 37.4 per cent based on the ARTC's current materials prices, plus installation costs sourced from Booz Allen Hamilton's 2003 Tarcoola to Darwin DORC[10] and the Southern Alliance costs estimate.

PwC notes that the upper benchmark was based on the ARTC's current Southern Alliance estimate of per kilometre costs for a 7 kilometre passing lane and the 2003 Tarcoola to Darwin construction costs.

The lower benchmark escalation factor — 18 per cent

BAH's use of the ABS CPI as the measure for cost escalation is consistent with common industry practice. However, normally there is consistency in the escalation periods with the time elapsed between valuations. That is, if a valuation has not been reviewed for five years, the full five years of CPI movements are factored into the lower cost escalation factor.

In the case of this DORC valuation, BAH has applied the CPI movement from the latter three year period and applied this annualised rate over the full five and half years since the previous DORC valuation. That is, the 3.1 per cent per annum escalation of CPI has been determined by reviewing three years of CPI movements between 2003 and 2006 and applied from the beginning of 2001.

Alternative approaches would have been to consider:

- the actual CPI movement in each year and apply this actual profile to underlying costs; or

[9] As measured by the Australian Bureau of Statistics (ABS)
[10] Which, in turn, partly reflected the results of the 2001 ARTC DORC.

- the point on point estimate over the period, that is to apply the same formula but to movement in the CPI from 2001 to 2006.

These approaches provide three alternative approaches to the calculation of CPI movements. The first approach is the one used by BAH. BAH assumed that the past three years of data is appropriate to average across the entire period. The second approach would be index the costs to a reference point and ensure that the compounding impact were included in the assessment of cost increase. The final approach would be consider the CPI against a point on point movement of the CPI index. Each approach yields a slightly different answer, however, the materiality of these differences is unlikely to be significant over a relatively short time period. Table 2.4 sets out the differences between the various approaches in terms of their final outcome.

Table 2.4 CPI movements – using three different methods

Date	**2000 Dec**	**2001 June**	**2002 June**	**2003 June**	**2004 June**	**2005 June**	**2006 June**	**Calculation**	**Annualised result**
Raw ABS data	131.3	133.8	137.6	141.3	144.8	148.4	154.3		
BAH approach [6]				141.3			154.3	3.07%	18.1%
Point on point approach [7]	131.3						154.3	3.18%	18.8%
Indexed approach [8]	1	1.02	1.05	1.08	1.10	1.13	1.18	1.175	17.5%
Range of results									17.5% to 18.8%

Source: ABS

6. That is taking June 2003 and June 2006 movement as representative of movement over the period - 18.1% is calculated as 1.0307^5.5-1 = 18.094%.

7. That is taking December 2000 and June 2006 movement as representative of movement over the period – [(154.3)/(131.4) -1]/5.5 = 3.18% and therefore 1.0318^5.5-1 = 18.8%

8 Indexation taken as Previous years indexed*(1+change in that year) -1 will give compound CPI.

PwC has been unable to reconcile the BAH figure used in its original calcuaiton of CPI from with information from the ABS. However, the difference between the two figures is unlikely to be material as the ABS data suggests the starting point for the calculation should be 141.3 rather than the data used by BAH, which was 141.1. The rounded impact of this difference is zero as both answers round to 3.1 per cent per annum. As can be seen in Table 2.3 the range of results between the various alternative options is 17.5 per cent and 18.8 per cent.

PwC understands that BAH has used the 2003 to 2006 movement to ensure that the annualised measure used was consistent with escalating the more recent valuation of the 2003 Tarcoola to Darwin DORC estimate (which, in turn, partly reflected the results of the 2001 ARTC DORC). In other words the 2003 valuation already included some inflated costs from the DORC valuation used in 2003. This appears to be a logical conclusion given the various valuation points used by BAH.

As any point within this range is justifiable from a methodological standpoint we have considered that as the ARTC has used the bottom of the range this outcome is not unreasonable. In making this assessment, we note that the ARTC cost escalation factor is at the approximate mid point of our two alternative methodologies.

The upper benchmark escalation factor — 37.4 per cent

The upper benchmark used by BAH is based on the installation costs associated with Tarcoola to Darwin and the ARTC's current material prices. This results in a cost escalation of 37.4 per cent. However, BAH has recognised that this cost increase is likely to be too high and has instead chosen a mid point between 37.4 per cent and the movement in the CPI of 18 per cent, namely 28 per cent, and used this to escalate costs for installation purposes.

In assessing the reasonableness of this estimate we have considered a number of producer price indices to understand the movements in costs experienced across a range of goods typically used in the rail industry. Table 2.5 set out these indices.

Table 2.5 Producer Price Indexes, Australia

	Manufacturing materials	Industrial machinery and equipment manufacturing	Domestic materials	Iron and steel manufacturing
December 2000	133.9	136.7	134.6	102.1
June 2006	163.5	186	186.5	127.3
Percentage change	22%	36%	39%	25%
	General construction	Road and bridge construction	Building construction	Non-building construction
December 2000	106.3	107.8	106.2	107.8
June 2006	138.8	136.5	139.1	136.5
Percentage change	31%	27%	31%	27%
	Imported materials	Machinery and equipment manufacturing		
December 2000	133.6	120.3		
June 2006	131.2	116		
Percentage change	-2%	-4%		

Source: ABS data.

As can be seen in Table 2.5 the range of price movements has been considerable, with locally sourced goods and services increasing in a range between 22 per cent and 39 per cent. However, where there is an available international substitute, costs have actually been reduced which is highlighted by machinery and equipment manufacturing and imported materials which have decreased by 4 per cent and 2 per cent respectively over the same period. Putting to one side the impact of international substitutes, the cost increases for locally sourced goods and services have been considerable over the period mainly driven by a tight labour market and resources boom. These moments are within the range suggested by BAH. As such, in considering the upper benchmark used to escalate installation costs BAH has used 28 per cent which we consider is within the benchmark range arising from our review of applicable price indices.

In the context of cost movements over the past 5 years we note there has been a significant increase in the costs of construction over and above the CPI movements measured by the ABS. It is difficult to assess whether these movements will be sustained over the longer term, however, they have most probably been influenced by the current resources boom which has increased the demand for construction services.

3 ARTC Modern Equivalent Form (MEF) Standard

3.1 Definition of MEF for ARTC Rail Network

ARTC has developed an infrastructure asset specification termed "Modern Equivalent Form" (MEF). The MEF is a modern day set of standards that would be used today as the construction standard for 'greenfield' mainline rail construction through out Australia. This MEF standard is that standard to which generally all Australian below-rail managers aspire towards, although the standard for some lines may differ due to a number of factors, including branch or seasonally used lines and heavy duty coal lines. It is also acknowledged that while the MEF is the desired standard, many of the currently operated mainlines are not to this standard, but ultimately with Major Periodic Maintenance (MPM) the standard may be achieved.

BAH has used this MEF standard as the standard required to assess the replacement costs in this DORC valuation.

ARTC have indicated and confirmed its MEF standard and it is summarised in Table 3.1[11].

Table 3.1 ARTC MEF for All Mainlines

ARTC Proposed MEF	All Mainlines SA, WA, Vic, NSW
Axle Load Freight (tonne) – (tal)	21.0
Max. Speed - Freight (kph)	115 (at 21 tal)
Max. Speed - Passenger (kph)	160 (at 19 tal)
Average Formation height (m)	Varies
Rail (kg/m)	60 CWR
Ballast depth (mm)	250
Sleeper Type & spacing/km	Concrete/1,500
Rail/Sleeper Fasteners	Elastic steel clip fasteners
Passing Loop Length (for single track operations) (m)	1800
Train Operation	Central Train Control (CTC)

Source: ARTC

The *ARTC Track and Civil Code of Practice* provides a complete set of track and civil engineering specifications relied upon in determining the Mainline MEF. Similarly, for Signalling, Communications and Level Crossing equipment, engineering specifications and standards have been adopted by ARTC as policy on all rail lines within their jurisdiction[12].

ARTC have indicated that while the MEF method of valuing the network assets is all encompassing, the real cost to upgrade each mainline's assets to reach the MEF standard over time is generally higher. This additional cost is not fully recovered by the replacement

[11] ARTC Teleconference communication 1 Feb 08; T Ryan, G Edwards (ARTC) & K Norley (BAH)
[12] ARTC website http://extranet.artc.com.au/engineering

costs included in 2006 proposed DORC valuation[13]. That is to say that the DORC actually undervalues the true replacement costs of the assets as it does not include value improvements required by legislative changes, or changes in standards imposed since the asset was last valued. If such improvements result in higher replacement costs, the new Gross Replacement Value then becomes the base for the next valuation for example upgrading timber sleepers with concrete or 47kg rail with 60kg rail, or providing an additional passing loop, etc. consistent with good DORC/ORC practices, the impact of changes in legislation and standards has not be included in the DORC valuation proposed by BAH.

ARTC has advised that their 5 year MPM program is designed to enable mainlines to be upgraded on a 'needs basis' calculated on the basis of:

- Age and deterioration of infrastructure;
- Maintaining train speeds; and
- Usage in both train numbers and gross tonnage carried and safety of operation to reach the MEF standard, e.g. ultimately full concrete sleeper track on the North – South corridor.

3.2 Assumed Economic Life of MEF Infrastructure

The ARTC specifications require that all materials provided and all workmanship undertaken have a specific Economic Life on which a life expectancy can be achieved and hence a depreciation value over time can be developed. Economic life refers to the lesser of physical life (with MPM) or the economic life of the primary customer (e.g. Hunter Valley Coal Rail Network life is reduced to the remaining life of the coal mines). The economic life of an asset is defined as the period of actual usefulness of an asset. Economic life refers to the period beyond which it is cheaper to replace or scrap an asset than to continue maintaining it. This is not to be confused with depreciable life.

Some regulated entities operate with different accounting & regulatory asset lives the same way regulatory DORC and accounting International Financial Reporting Standards Cash Generating Unit Test values can also be legitimately different. While the ARTC annual report also refers to maximum economic, accounting life, the weighted average lives are likely to be closer to those nominated by ARTC in their regulatory submission. For example rail on straight line sections with modest tonnage could last 110 years but 50 years is a reasonable weighted average cross-network approximation. Hence the annual report maximum lives and regulatory submission average lives differ but the relationship is not by half. This will establish a further differentiation between those represented in the annual report and those used in the DORC valuation.

In relation to why most rail networks (of more than 2-3 decades in age) with MPM programs tend to have accumulated depreciation of 45 per cent to 55 per cent this is best explained

[13] ARTC Teleconference communication 1 Feb 08; T Ryan (ARTC)

by MPM and cyclical upgrades' resulting in a 'saw-tooth' effect on condition quality around a mean of approximately 50 per cent.

The following life expectancies for the ARTC Mainlines are reflected in the assumptions developed by BAH for this DORC valuation and are similar to the economic life expectancy of other below-rail providers in Australia[14].

Table 3.2 Comparison of Economic Life of Assets

Asset	ARTC* (years)[15]	ARTC (years)[16]	WestNet (years)[17]
Earthworks for track	Not stated	100	100
Bridges & Tunnels	40 & 50	100	100
Culverts	100	50	50
Level crossings	Not stated	20	20
Rail	110	50	50
Sleepers – concrete	70	50	50
Sleepers – timber	n/a	20	20
Ballast	60	25	25
Rail fasteners	Not stated	25	25
Turnouts	15	20	20
Track construction	Not stated	50	50
Signalling – track & flashing lights	30	25	20
Signalling – boom gates	Not stated	25	20
Communications	30	25	20

Sources: WA Rail Access Regulator and ARTC
Note: *ARTC – Maximum Economic Useful Life (ARTC Annual Report 2006 p54)

The ARTC Maximum Economic Useful Life (ARTC Annual Report 2006 p54) is the assessed Maximum Economic Life that individual materials over the entire ARTC Network could be expected to last but "depends on the age and location of particular assets, the economic life will potentially vary" (Column 2 in Table 3.2). For the purpose of this DORC valuation for interstate mainline operations, the Economic Life of the individual materials and installation thereof has been adopted by BAH (Column 3 of Table 3.2), which PwC considers as being a fair and reasonable assumption as it is consistent with 'saw tooth' effect outlined by BAH[18].

Table 3.2 indicates a similar Economic Life for all the civil and track assets with an extended life for the Signals and Communications assets from 20 years for WestNet in WA to 25 years for ARTC. This variation is simply explained with the greater usage of the ARTC network than that of WestNet Rail, replacement with more modern signalling and

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[14] Costing Principles to Apply to WestNet Rail, Determination of WA Rail Access Regulator, 27 September 2002, page 17.
[15] Various - *ARTC Track and Civil Code of Practice;* ARTC specifications; ARTC DORC Valuation spreadsheet FM 23 Jan 07; BAH ARTC Network DORC January 07
[16] Various - *ARTC Track and Civil Code of Practice;* ARTC specifications; ARTC DORC Valuation spreadsheet FM 23 Jan 07; BAH ARTC Network DORC January 07
[17] Costing Principles to Apply to WestNet Rail, Determination of WA Rail Access Regulator, 27 September 2002, pages 53,54
[18] http://www.artc.com.au/library/Booz%20Allen%20final%20report%20May%202001.pdf

communication equipment has occurred giving a higher and more efficient use life of the assets delivered.

3.3 Description of Rail Network for inclusion in this DORC Valuation

The ARTC Network included in this evaluation, as previously indicated, was originally constructed by the variously State and/or Federal Government Railway Departments over a period in excess of 150 years to different gauges, standards and originally for use by light steam locomotives carrying passengers and freight where the motor vehicle was relatively rare and road crossings of rail were mostly at grade. The construction methods used during the early days were, when compared to today's methods, primitive and mostly labour oriented and hence the many of the rail corridors that are still used today are winding with tight curves, shallow cuttings and a number of tunnels and bridges. Bridges were located only where the railway crossed bodies of water or low lying ground with road over rail and rail over road bridges originally uncommon, with at-grade level crossings being the regular form of crossing.

While the mainline rail gauges in SA and Vic have been converted to standard gauge, NSW has retained standard gauge and some small sections of track have been straightened, the legacy of the earlier era remains, whereby small radius curves (less than 350m radius) have a reduced economic life and require regular and additional maintenance. This affects the operation of heavier and faster trains by reducing their speed of travel.

Using the small radius curve affect on the valuation and depreciation rate of the rail and track laying as an example, this affect has been assessed in the BAH DORC in detail to ensure that a realistic valuation of the various assets is achieved, with the following discussion.

Most lines in this DORC valuation have some sections of small radius curves through slightly hilly terrain, but others have a considerable percentage of small radius curves through more mountainous terrain, as shown in Table 3.3. These small radius curves have an affect on Economic Life of the track through the line section. The impact is due to the additional wear on the rail and the centrifugal forces applied by trains travelling on the track through small radius curves causing their potential movement. To allow for this an equivalence factor is applied to the curve length to allow for this reduction in economic life which equates to an addition length of straight (tangent) track for that section under review. In the BAH valuation, this factor has been applied to provide a uniform economic life for the rail and track laying in determining the DORC cost value and depreciation of the assets.

The BAH process that has been adopted in ascertaining a valuation of all the assets has included an in-depth assessment of all aspects of ARTC's below rail asset costs as is indicated, as an example, in Table 3.3 below for the affect of curves on replacement cost and the Economic Life of the asset.

Table 3.3 DORC Evaluation of Curves on Economic Life

Segment name	Segment STK (kms)	Lengths for curves (kms)	% curves >600 m	% curves >= 350 m & <= 600 m	% curves <350 m	% straight (tangent)	Equiv. % tangent allowing curves
Dry Creek - Crystal Brook	198.2	34.5	16.7%	0.7%	0.0%	82.6%	81.9%
Crystal Brook - Pt Augusta	132.0	53.1	38.8%	1.0%	0.4%	59.8%	58.0%
Pt Augusta - Tarcoola	435.9	87.6	19.8%	0.3%	0.0%	79.9%	79.6%
Tarcoola - Parkeston	1344.2	49.7	3.6%	0.1%	0.0%	96.3%	96.2%
Crystal Brook - Broken Hill	395.4	84.2	20.9%	0.3%	0.1%	78.7%	78.2%
Broken Hill - Parkes	709.6	66.7	7.4%	1.7%	0.3%	90.6%	88.3%
Parkes - Cootamundra	207.2	41.4	17.1%	2.7%	0.3%	80.0%	76.8%
Dry Creek - SA/VIC Border	240.0	38.4	10.1%	2.4%	3.5%	84.0%	74.6%
SA/VIC Border - Melbourne	560.0	207.2	34.4%	2.4%	0.2%	63.0%	60.2%
Dry Creek - Outer Harbour	20.4	6.1	10.0%	10.0%	10.0%	70.0%	40.0%
Tottenham - Albury	332.6	160.0	47.9%	0.0%	0.1%	52.0%	51.8%
Albury - Macarthur	1057.5	510.8	30.0%	15.3%	3.0%	51.7%	30.4%
Spencer Jct - Whyalla	74.8	8.9	11.9%	0.0%	0.0%	88.1%	88.1%
Appleton Dock Jct - Appleton Dock	2.5	0.8	10.0%	10.0%	10.0%	70.0%	40.0%
Moss Vale - Unanderra	61.2	37.1	13.5%	9.3%	37.8%	39.4%	0.0%
Islington (Newcastle) - Maitland mains	60.4	22.0	35.0%	1.5%	0.0%	63.6%	62.1%
Maitland - Craven	116.9	76.2	17.3%	18.7%	29.2%	34.9%	0.0%
Craven - NSW/QLD Border	637.3	363.3	16.4%	16.4%	24.1%	43.0%	0.0%

Source: Compiled from BAH - ARTC DORC Valuation spreadsheet FM 23 Jan 07
Notes: Curves > 600m are curves with radius greater than 600m; curves >= 350m & <= 600m are curves with radius between 350m and 600m; curves <350m are curves with radius less than 350m; tangents are sections of straight track.

3.4 Existing Network where it meets MEF Standard

In general terms, it can be stated, from the BAH Working Spreadsheets that support the BAH 2006 DORC valuation, that there are no major mainlines sections which meet the full compliance of the ARTC Mainline Network MEF. Following an Information Request of ARTC, it appears that the Moss Vale to Unanderra line may be the exception which was upgraded between 1996 and 2002 with 60kg rail on concrete sleepers on a 250mm ballast bed[19].

This being said, the reason why the various sections do not meet the MEF standard can be summarised as follows:

[19] ARTC Email 21 February 2008

- Where a line section may have concrete sleepers, the rail is only 47kg or 53kg which may have been the maximum rail size at the time of construction; but the rail has not currently met its Economic Life and does not requires replacement;

- Many line sections have timber sleepers, which have not currently met their Economic Life and accordingly will be replaced with concrete under a future ARTC MPM program;

- Some line sections have a combination of timber and steel sleepers to maintain the track gauge and these will be replaced with concrete under a future ARTC MPM program;

- Most line sections have insufficient ballast below the base of the sleeper (150mm or 200mm) which will be corrected under a future ARTC MPM program;

- Train control, due to remoteness of some of the line sections, is carried out under a Safe Working “Train Order” or other regime and not by CTC workings; or

- A combination of the above.

It is ARTC’s philosophy, that performance and outcome are important in successfully managing the below rail component of a mainline rail operation[20] and accordingly, if below-rail meets Safe Working standards and the required train operator performance standards, the outcome is assured without consideration of the MEF materials used. This does not necessarily result in the values being greater than the MEF standard in terms of civil and rail construction types. Rather, there is the potential for the value of assets being higher than physical value where there has been considerable technological change, for example the replacement of existing communications from the 1920’s with modern day equivalent results in a higher valuation than the assets that are in situ. However, these examples are rare given the majority of the asset base is driven by the civil and rail construction costs.

As previously indicated, the MEF is the minimum it would cost to replace the existing asset with a technologically modern equivalent new asset with the same service potential, allowing for any differences in the quantity and quality of output and in operating costs. The MEF is progressively being achieved as MPM is performed as required to meet the performance requirements.

3.5 ARTC Program to upgrade Network Infrastructure to MEF Standard

ARTC is working on a 5 year rolling MPM program to upgrade assets when either:

- Capacity constraints require upgrading to meet performance criteria, eg provision of additional or lengthened passing loops; or

- Materials having expired their Economic Life and are affecting performance or on the financial maintenance costs as would be imposed if retained, eg timber sleepers.

[20] ARTC Teleconference communication 1 Feb 08; T Ryan, G Edwards(ARTC) & , K Norley (BAH)

Recent track upgrades are fully reflected in the DORC valuation by line sections as they are identified as being ‘new’ with little or no depreciation applied to the replacement item(s). This continuous upgrade program is reflected also in the improvements included in the increased train paths available and hence capacity improvements.

4 Optimised Rail Network

4.1 Optimised Capacity Considerations

There are a number of considerations in regards to the assessment of the reasonableness, or otherwise, of the optimisation undertaken by BAH in the DORC valuation. BAH has effectively separated the optimisation of the network into:

- The original ARTC segments - Victorian, South Australian and Western Australia; and
- The network segments from the leased NSW aspects of the network.

BAH has accepted that the optimisation of the 2001 DORC value was correct given the absence of any significant augmentation in the interceding period. As such BAH has not optimised any of the original ARTC segments, aside from the specific exclusion of certain elements of the ARTC asset base which are not integral to the operation of the mainline network. This includes on various lines, sidings and spur lines..

In terms of the network segments associated with the NSW network, BAH has only identified the Cootamundra and Junee segment of the network as requiring consideration of the optimisation of these assets. BAH has noted that current traffic volume do not appear to justify the retention of double track on this segment. However, BAH considered that it would be a more pragmatic approach to allow for the retention of double track on the Cootamundra-Junee route due to:

- Forecast growth over the regulatory period will result in an increased utilisation of this segment[21];
- The alternative to double track would be a series of passing lanes which would considerable increase the complexity of the network, further, it would not necessarily result in a more cost effective approach to the double track;
- The track accounts for less than 1 per cent of the ARTC total network length; and
- The double track reduces the need for passing loops along this section of the rail network which in turn reduces the cost of this line.

The BAH DORC valuation report assumes that there is generally little by way of augmentation leading to an Optimisation of capacity on the ARTC Network. However delving further into the assumptions relating to the valuation, it appears performance improvements have occurred in various sections of the network where MPM upgrades to track and signalling have occurred. This has been shown specifically in the NSW network where additional train paths have become available outside the metropolitan areas where conflicts do not occur with the suburban or outer suburban passenger scheduling. For

[21] However, the BAH analysis indicates that this is still not sufficient, in isolation, to justify the retention of double track.

example, with improvements on the Goulburn to Albury and Goulburn to Parkes corridors, including:

- Curve easing;
- Resleepering at various sections; and
- Resultant improvements to sectional train times.

This has lead to the ARTC being able to achieve additional train paths[22]. At the same time the ARTC continues to be captive to the demands of major metropolitan areas in achieving greater network optimations. Trains currently arriving at or departing the metropolitan areas are restricted in network peak times which has a 'flow on' affect on filling train paths further outside the suburban areas which in turn affects the network optimisation.

Sydney (including the suburban freight corridors between Macarthur to Chullora and through Strathfield and Hornsby to Islington, Newcastle) has total restrictions on freight operations (except on dedicated freight lines) during weekday peak periods and although this is outside this DORC valuation, these restrictions have an external impact on ARTC's optimising the functional capacity of the network close to suburban or in outer suburban areas.

An example of these restrictions (even with double track operation) outside the Sydney suburban rail area can be seen from the NSW *Standard Working Timetable Book 4 Macarthur to Albury & Branches*[23] version 3 of 6 January 2008 where in summary (eg on Mondays);

- The last early morning freight train departs Macarthur at 3.45am and the next departs Macarthur at 9.10am;
- six Passenger trains operate to the south taking all train paths between 5.20am and 8.38am (mostly all stop trains);
- The last afternoon freight train departs Macarthur at 2.39pm with the next at 7.57pm; and
- six Passenger trains operate to the south taking all train paths between 3.36pm and 7.40pm (mostly all stop trains).

Similar restrictions also apply and congestion occurs in the suburban areas of Melbourne[24] and Adelaide during network peak times where Standard and Broad Gauge crossings or Dual Gauge track conflict. There are no apparent restrictions in Perth and Brisbane due to freight and passenger line separation to the freight terminals. However, there are restrictions in Melbourne, Sydney, and Adelaide limit ARTC's opportunities to conduct significant network optimisation.

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22 http://www.artc.com.au/library/SWTT_V3_S53.pdf
23 http://www.artc.com.au/library/SWTT_V3_S1.pdf
24 Railway Digest vol. 46 no. 3, March 2008, pp 34-35.

PwC agrees with BAH, that subject to the impacts of external sources, *"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 purpose of this DORC valuation)".*[25] In agreeing with BAH we have considered the restrictions imposed in Sydney, Melbourne and Adelaide. Further, it is important to note that neither BAH or ARTC have suggested that the DORC valuation needs to be increased to include a provision to release these restrictions on the network. While passing no judgement on the appropriateness of this practice, PwC notes that this continues to support the relatively conservative nature of the valuation proposed by BAH.

As noted above, where assets are in situ, and are not fully utilised by current traffic levels (e.g. double track between Cootamundra and Junee), BAH has not optimised the assets from the 2006 asset base. PwC considers that the BAH approach is conservative as no additional infrastructure is included in the valuation, further, PwC considers that the treatment of the additional capacity is not unreasonable.

4.2 Optimised Rail Network Considerations

BAH state that the SA and VIC track configuration was optimised in the 2001 DORC valuation taking into consideration forecast capacity growth requirements in each line section and this configuration has also been used in this 2006 DORC valuation. Reviewing the various lines in the SA/WA/VIC network as indicated on Network Diagrams B1 and B2 in Appendix B of this Review, the following track sections are included in the DORC valuation and relevant descriptions thereof are made:

- Dry Creek – Crystal Brook
  From the junction with the Outer Harbour line, single track with the Dry Creek yard crossing loop and then single track with 9 passing loops to the 0.0 mileage mark at Coonamia near Crystal Brook where there is double track. The Dry Creek North yard, other sidings, passing loops, etc not required for mainline operations are excluded.

- Crystal Brook – Port Augusta
  The short section of double track at Coonamia then single track with 4 passing loops and 2 turnouts to sidings to Pt Augusta. The Port Pirie yard and other sidings not required for mainline operations are excluded.

- Port Augusta – Tarcoola
  Crossing loop through the Spencer Junction yard then single track with 12 passing loops with a turnout to the Whyalla line and 2 turnouts and siding connection to the Darwin line at Tarcoola. The Spencer Junction yard and other sidings not required for mainline operations are excluded.

- Tarcoola – Parkeston WA
  The single track across the Nullarbor Plain with 30 passing loops and a double

[25] Noting that within the DORC valuation methodology, additional capacity is potentially acceptable, including an allowance for five years of growth over the current demand.

siding connection at Rawlinna. Other sidings and ARTC assets not required for mainline operations are excluded.

- Crystal Brook – Broken Hill NSW
  From the junction with the Dry Creek line near Crystal Brook, single track with 12 passing loops to SA/NSW Border. Other sidings and ARTC assets not required for mainline operations are excluded.

- Dry Creek – SA/VIC Border
  From the junction with the Outer Harbour line, single track with 2 turnouts and siding for access to the Adelaide Freight Terminal and then near Mile End, a crossing loop around the Keswick Passenger Terminal and then single track with !7 passing loops to the VIC Border. Other sidings and ARTC assets including the Tailem Bend yard not required for mainline operations are excluded.

- SA/VIC Border – Melbourne
  From the SA Border, single track with 20 passing loops, 19 turnouts to access sidings, 2 broad gauge diamond cross-overs, double track gauge separation with the BG line from Ballarat to the gauge separation at Newport South Junction, then the double track to the Tottenham Junction gauge separation with 8 turnouts to sidings, then single track with 2 diamond cross-overs to the junction with the Albury line at Tottenham, then single track to Melbourne yard with 1 passing loop, quad tracks through the Bunbury St Tunnel, crossing loop at the Melbourne yard and 11 turnouts to access sidings. Other rail assets including 20 passing/siding loops and spur lines not required for mainline operations are excluded.

- Dry Creek – Outer Harbour
  The single mainline is included with turnouts only to allow access to 3rd party sidings; other ARTC assets are excluded.

- Tottenham VIC – Albury NSW
  From the Tottenham Junction, single track with 15 passing loops, 24 turnouts and 3 diamond cross-overs to access sidings over the distance to the VIC/NSW Border at Albury. Other sidings and assets not required for mainline operations are excluded.

- Spencer Junction – Whyalla
  From Spencer Junction, single track for approx 75kms with 1 passing loop at Roopena. Other sidings and ARTC assets including the Whyalla and associated yards not required for mainline operations are excluded.

- Appleton Dock Junction – Appleton Dock
  From the connection with the Tottenham – Melbourne line a single track to the Appleton Dock. Other sidings not required for mainline operations are excluded.

Following the review of each of the lines in SA/WA/VIC network, PwC is satisfied that these segments of the network have not been optimised inappropriately. Having reviewed the assets included in the DORC model, PwC has not found any evidence that assets not included on the mainline network have been included in the asset base. This assessment has been based on a number of factors including, a review of the each line and line section as to which mainline infrastructure is included and which segments and assets are excluded from the DORC valuation.

The consideration of the BAH assumption PwC notes that some sections of this network appear to be at their maximum for the gross tonnage being carried. Uniformity of passing loop lengths would improve train operations and optimise the workings of individual line sections. However, further detailed analyses would be required to provide an optimised network with regard to tonnage carried and train numbers which is outside the scope of this review.

The DIRN network in NSW has a mix of double and single track as summarised in the BAH DORC Valuation. Taking into consideration the current tonnage carried on some sections of the double track, especially the section between Cootamundra and Junee on the Albury to Macarthur line, there is potentially scope for assets to be optimised. However, as noted this segment is a relatively small part of the network. Further, PwC has been advised by ARTC that anticipated increases of freight between Melbourne and Sydney will warrant the inclusion of these assets over the next 5 years[26]. Considering ARTC's stated mandate to ensure that freight is shifted by from road to rail on the North South corridor this assumption does not appear to be unreasonable.

Reviewing the various lines in the NSW network as indicated on Network Diagrams B3 and B6 in Appendix B of this Review, the following track sections are included in the DORC valuation and relevant comments thereto are made:

- Broken Hill – Parkes
  From SA/NSW Border, single track to Broken Hill with double track through Broken Hill yard and then single track to Goobang Junction at Parkes with 12 passing loops and 1 turnout to access a siding to the junction with the Cootamundra line. Other sidings including the Broken Hill yard and ARTC assets not required for mainline operations are excluded.

- Parkes – Cootamundra
  From the turnout from the junction with the Broken Hill and Dubbo lines, single track with 5 passing loops and 2 turnouts forming a triangle for both south and north bound connections to the Melbourne – Sydney mainline at Cootamundra. Other sidings and assets not required for mainline operations are excluded.

- Albury – Macarthur
  From the VIC/NSW Border at Albury, 2 extended passing loops/run around at Albury Station/yard, then single track to Junee with 11 passing loops of differing lengths, then double track to Cootamundra with 11 cross-overs and the Bethungra Spiral (1 track only). At Cootamundra, there are 2 passing lanes in addition to the mainline double track to allow for consist splitting for one of the many destinations, including Sydney, Broken Hill, Parkes, Dubbo and Hunter Valley destinations. 2 crossovers to the Parkes line triangle are followed by double track to Goulburn with

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[26] ARTC Teleconference communication 1 Feb 08; T Ryan, G Edwards, K Norley (BAH)

addition consist splitting passing lanes at Harden and Goulburn and 20 cross-overs. From Goulburn to Macarthur is double track with a third extended CityRail stabling/passing lane at Moss Vale and to access to the triangle the Unanderra line, with 35 cross-overs, 3 turnouts to access sidings, 2 major industry sidings and a number of tunnels. Other sidings and ARTC assets including major yards at Albury, Junee, Cootamundra, Harden, Goulburn and Moss Vale not required for mainline operations are excluded.

- Moss Vale – Unanderra
  From the Moss Vale Triangle the single track traverses down the escarpment with 4 passing loops and a number of tunnels before becoming double track at its connection to the RailCorp track at Unanderra (near Wollongong). 1 siding not required for mainline operations is excluded. This line appears to meet MEF standard for below rail operations.

- Islington (Newcastle) – Maitland Mains (to Telarah)
  At the Islington Junction, 3 tracks from the Sydney Main connect with 2 tracks from Newcastle (all included in the valuation) and then there is quad track to Maitland (only double included in this valuation) with double track cross-over connection between the Hunter Valley mainline and the North Coast mainline at East Greta Junction with double track to Telarah with a third extended CityRail stabling/passing lane at Telarah station, 16 cross-overs, 3 turnouts to access sidings and major cross-overs at Islington Junction and East Greta Junction and the new Sandgate Viaduct (excluded). Other sidings, Hunter Valley coal operation lines, the Telarah yard and assets not required for mainline operations are excluded.

- Maitland – Craven
  From Telarah, the single track becomes the North Cost line with 8 passing loops of various lengths and 2 turnouts for access to sidings. Other sidings and assets not required for mainline operations are excluded.

- Craven – NSW/QLD Border
  From Craven, single track with a number of tunnels, major bridges over the coastal rivers, 37 passing loops and a double extended passing loop at South Grafton station for consist splitting, XPT stabling to the Spiral at the NSW/QLD Border. South Grafton yard, all other sidings and ARTC assets not required for mainline operations are excluded.

The single track network in NSW is typical of long haul rail networks when there is often an increase in density of passing loops at the centre third of the distances between cities or important node points. This enables the line to be optimised to match capacity requirements. It can be said that, typically, as an example, as there are no major intermediate junctions between the end junction nodes of Broken Hill and Parkes, that the majority of trains that leave Broken Hill arrive in Parkes, and vice versa. Therefore the number and length of passing loops has to match the density of the number of trains and their length using that line with a general uniformity of distance between the loops as necessary to match operational capacity. A similar situation is found on the Maitland to the NSW/QLD Border, Moss Vale to Unanderra and Parkes to Cootamundra lines.

For the double track sections between Albury and Macarthur, this is a completely different situation. Required train capacity and the relative locations of rail junction nodes on the line will be different again. Here there are a number of major intermediate junction nodes where trains of both freight and passenger can enter in to, exit from and terminate on the line and where adequate infrastructure has to be available to meet capacity requirements at and between each node junction. With the node ends and junctions on the line at Albury, Junee, Cootamundra, Goulburn, Moss Vale and Macarthur (none being >200kms apart, most <100kms apart), each sub-section of the line between nodes has a different capacity and operational criteria. At the time of BAH preparing this DORC valuation, it is stated that the double track sub-section between Junee and Cootamundra was underutilised and could be considered as only a single track with 3 passing loops over approximately 55kms. PwC agrees with BAH, that due to the small sub-section of underutilised track (about 50kms) which represents less than 5 per cent of the Albury – Macarthur equivalent single track line section and with consideration of the cost of track cross-overs, other required infrastructure, economies of scale regarding earthworks, drainage, ballast and communications of double track over single track, that this sub-section should be retained in the DORC valuation.

As has been described in detail previously for each line, optimisation of the entire network has been achieved by only including in this DORC valuation those tracks, passing loops, turnouts, cross-overs and sidings directly required for the mainline operations, with all other ARTC assets excluded.

4.3 Optimised Infrastructure Considerations

This DORC valuation, using the MEF standard concept as the base, depreciates each item of infrastructure as a percentage of its Economic Life and hence provides a uniform valuation at a point in time for each item. The MEF items of infrastructure are generally the same being used by all below-rail operators in Australia and accordingly are available as standard items without special one-off type manufacturing runs being required. For example, the use of readily available concrete sleepers as the MEF over the now rarer timber sleepers is one area of industry optimisation which has a considerable benefit in the cost/life ratio to the below-rail operator and end use beneficiary. Concrete sleepers cost about $90 each, have an Economic Life of 50 years with a unit installation cost of about $40 each with no substantial maintenance cost over its life where timber sleepers cost today about $105 each, have an Economic Life of 20 years, cost about $60 to install and have an exponential maintenance cost due to loads carried and deterioration of up to $500 over its life. Consequentially in recent years it has been more appropriate to assume concrete sleepers in a optimised approach as they have a lower whole of life costs.

Signalling and communications infrastructure is one area continually being upgraded and modernised. Most signalling and communications tenders are called on a performance specification and hence an MEF standard is not applicable in this instance and BAH assumption *"that prior generation installations continue over the next five years"* is considered as being not unreasonable assumption for these items.

4.4 Optimised Train Control Considerations

The MEF standard for Train Control is considered as Central Train Control (CTC) with its in-built safe working tiers and practices for modern mainline and urban operations.

ARTC operates CTC over 80 per cent of the network with the remainder by Train Order or Electric Staff systems. The lines included in this DORC valuation and the Train Control system used is indicated in Table 4.1.

Table 4.1 ARTC Train Control Systems (at 2006 Valuation)

Train Control Centres	Control Board	Lines included	Train Control System
Adelaide	NE Victoria	Tottenham – Albury	CTC
	ASW	Tottenham – Pyrenees (Vic)	CTC
	Melbourne	Tottenham – Melbourne, Docks	CTC
	South	Pyrenees – Mile End (Adelaide)	CTC
	Adelaide Met	Mile End – Dry Creek, Outer Harbour	CTC
	West	Dry Creek – Spencer Junction	CTC
	North	Crystal Brook – Broken Hill	ABS
	Tarcoola	Spencer Jct – Tarcoola, Whyalla	Train Order
	Kalgoorlie	Tarcoola – Kalgoorlie	Train Order
Junee	Main South A	Macarthur – Goulburn	Auto Sigs, S/B, CTC
	Main South A	Moss Vale – Unanderra	CTC
	Main South B	Goulburn – Cootamundra	Auto Sigs, Sig Boxes
	Main South B	Cootamundra - Junee	Auto Sigs, Sig Boxes
	Main South B	Junee - Albury	CTC
Orange	Branches	Cootamundra – Parkes	Electric Staff
	West	Parkes – Broken Hill	Train Order
Broadmeadow	Lower Hunter	Islington (Newcastle) – Maitland	Hybrid Interlocking
	North West	Maitland – Gloucester	CTC
	North Coast	Gloucester – Casino	CTC
	North Coast	Casino – NSW/QLD Border	Electric Staff

Source: ARTC

Table 4.1 shows that the various systems used in 2006 on mainline operations within the ARTC network covered under the 2006 DORC valuation where a range of Train Control system extending from modern automatic (CTC) and extremely 'out-dated' manual systems are in use[27].

The CTC system, while monitored from a central control centre, is programmed for operation against a predetermined train schedule with automatic signalling operated by sensors on the track under a Safe Working protocol. No train time is lost for drivers to report their location and this system is used in more heavily operated areas.

The NSW Macarthur-Albury line is operated under a old manual signal box control over each line section, whereby the signal box operator is advised from the central control centre or by train sensors on the track of train location against a train schedule; no train time is lost for drivers to report their location and this system is being replaced by CTC as train numbers increase.

[27] For example the Casino – NSW/QLD Border which has an Electric Staff system first installed for steam trains around the 1920s.

The Train Order system is a manual system used on single bidirectional lines and is controlled from the central control centre and relies on radio/telephone contact between the trains and the control centre, whereby a driver has to be given authority for their train to enter a specific section of line; train operating time is lost for drivers to report their location, waiting time for trains to cross at passing loops and have authority granted to proceed; this system is used on lines with relatively low train numbers and long distances between passing loops.

The Electric Staff and other similar systems are antiquated manual systems dating back to steam age train operation used on single bidirectional lines whereby the train driver seeking permission to enter a line section has to physically have in his/her possession or have sighted the train staff applicable to that line section and to manually set the signals to stop other trains entering the section before informing the central control centre by radio/telephone of their intention to proceed. Train operating time is lost for drivers to stop and collect the staff, report their location, waiting time for trains to cross and exchange staffs; this system is used on older remote location lines with relatively low train numbers.

The optimisation of the Train Control operations to ultimately CTC throughout the ARTC network allows for a common Safe Working protocol to be used and with the savings in train travel times, increases in line capacity can be achieved and improvements in network operation efficiency and practices can be also achieved through the centralised automated train operations centres.

In line with ARTC's lease agreement to improve the NSW network, ARTC has made a number of upgrades to the 2006 Train Control management system through 2006 and 2007 including having transferred the Train Control of the Parkes – Broken Hill and Parkes – Cootamundra lines from Orange to Junee Control Centre[28] and replaced the Hybrid system in the Lower Hunter and the outdated Casino – NSW/Qld Border Electric Staff system to Acacia Ridge (Brisbane) with CTC[29] and closed numerous mainline signal boxes on the Macarthur-Albury and other lines.

4.5 Conclusion on the optimisation of the network

There has been limited optimisation of the network. However, this does not necessarily mean that the optimisation is not unreasonable given:

- Limited augmentation of the VIC/SA/WA segments of the network suggests little difference from the 2001 optimisation assumptions;
- Restrictions on the ability to use suburban infrastructure in Sydney, Melbourne, and Adelaide in peak times thereby limiting the ability to further optimise train timetables;
- The exclusion by BAH of non core assets, e.g. sidings, passing loop, and spurs not required for mainline operations;

[28] http://www.artc.com.au – Investment Strategy Overview; Train Control Consolidation
[29] ibid – Sydney – Brisbane; CTC signalling between Casino and Acacia Ridge

- The use of functional performance specifications across relevant infrastructure types, e.g. concrete over timber, and
- The use of CTC across the majority of the network.

Further, PwC considers that the question of over capacity on the Cootamundra to Junee line segment has not been unreasonably included given the demand increases likely as freight is substituted between road and rail on the North South corridor.

5 Replacement Costs

5.1 Approach Taken

BAH has calculated the Replacement Costs using a number of basic sets of costing information sources for railway unit capital construction costs. Each source has been measured as a greenfields site and applied across the network based on the quantities contained in the ARTC databases relating the dimensions of the network.

These quantities are those readily available from the ARTC and are available from the ARTC website; http://www.artc.com.au. The quantities for the SA/VIC ARTC network are similar to those used for the 2001 DORC valuation, except where some lines have been upgraded or changed due to usage changes in the intervening period. For the NSW network, ARTC received a full set of engineering operational details as a part of their lease agreement. This information, together with details of upgrades undertaken and engineering audit reports prepared by independent consultants has formed the basis for the calculation of the 2006 DORC valuation[30].

PwC has conducted a random sampling of the quantities in each infrastructure type and on randomly selected lines throughout the network. This sampling has been conducted by confiming quantities obtained, eg length of track, passing loops, turnouts, ballast depths, bridges, level crossings, etc, between the ARTC website specifications and the BAH worksheets.[31] Through this sampling process we found that data was consistent in respect to the functionality of the underlying assets. While there was not a one for one matching of asset information. However, we found this data supported the physical assumptions made in the DORC valuation and as such were not unreasonable in the context of available information. Accordingly the worksheet quantities outlined in BAH valuation model were considered acceptable for undertaking the DORC valuation.

5.2 Assumptions used in Evaluating Replacement Costs

The general assumptions that BAH has used for the DORC, while they are not explicitly stated in the BAH valuation report, have been derived from the relevant sections of the BAH Working Spreadsheets. These assumptions indicate from where and how the unit rates and costs have been obtained. The following assumptions have been made:

- Infrastructure design criteria to meet ARTC standards;
- All rates are based on 2006 costs;
- All rates are exclusive of Goods and Services Tax (GST);

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[30] Replacement cost methodology assessment meeting; ARTC Sydney; 7 February 2008; G Edwards, K Norley (BAH), F Mau (BAH); ARTC DORC Valuation spreadsheet FM 23 Jan 07; BAH ARTC Network DORC January 07.

[31] ARTC DORC Valuation spreadsheet FM 23 Jan 07; BAH ARTC Network DORC January 07

- No contingency allocation has been made to any element of the network (where comparison with estimates of costs have been undertaken, contingencies have been disregarded);
- Existing track conditions are as stated in the ARTC Track Measurement Parameters – Raw Data spreadsheet stating ballast depths, sleeper type and general track condition, etc;
- All existing tracks are retained on their existing alignments and other rail infrastructure is located within the existing corridors;
- No changes to track grades, section lengths nor alignments have been included, except those in place in December 2006;
- Network signal and communication infrastructure are those existing in December 2006 and cost of the MEF standard is based on the CTC system recently installed Casino – Acacia Ridge system in NSW/QLD;
- Unit rates for supply and delivery of materials has been assessed as a uniform unit rate to cover all sections of the network;
- Unit rates for installation include allowance for all materials supply, delivery, labour, installation, plant and equipment and consumables;
- The 2001 DORC valuation for SA/WA/VIC included a Location Allowance; this has been excluded from the 2006 DORC valuation; and
- Project management, design fees, etc. are included in the applicable rates but contractor profit and overheads have been excluded.

Other documents that BAH has relied upon for both quantities and the unit rates of infrastructure to enable the calculation of the DORC valuation have been requested and are listed below. Some of these have not been provided and hence have not been sighted for confidentiality reasons, although ARTC has provided all the BAH working documents to support their methodology and the assumptions made on quantities, unit rates and the depreciated condition of each item, as applicable, on each track section. The total suite of documents is:

- ARTC DORC Valuation spreadsheet FM 23 Jan 07;
- BAH ARTC Network DORC January 07;
- Connell Wagner database prepared for ARTC on unit rates for each type of asset;
- Sinclair Knight Merz CEDRIC database;
- WorleyParsons 2005 Report on infrastructure condition in NSW;
- URS subconsultancy 2005 Report on structures condition in NSW;
- ARTC Southern Alliance construction estimate (additional passing loops);

- North-South Corridor Strategy construction estimates prepared by Hyder Consulting for Ernst & Young 2007 (unit rates not provided)32;
- Liverpool Range tunnel project estimates for the NSW Ministry of Transport in 2000;
- Ulan to Muswellbrook and the Casino to Acacia Ridge re-signalling project estimates; and
- ARTC TrackData on-line infrastructure database.

From the above a very good understanding of the methodology used by BAH in undertaking the DORC valuation has been provided and the PwC is satisfied that an overall rigorous assessment by BAH has been undertaken.

5.3 Below-Rail Civil Infrastructure

Comparative rates for the purpose of benchmarking in recent years have been difficult to obtain due to:

- A lack of greenfield rail projects of a suitable large scale; or
- Confidentiality reasons.

BAH have benchmarked their civil below-rail estimates against:

- the 2001 DORC for SA/VIC plus adding the applicable CPI;
- the APT DORC valuation;
- the ARTC Southern Alliance construction estimate;
- The ARTC 2007 Casino-Acacia Ridge upgrade signals/communications estimates; and
- Compared their rates against the Ernst & Young/Hyder more recent (2007) North-South Corridor Strategy construction estimates.

To enable an independent comparative assessment of estimated civil below-rail rates, PwC has compared recent published rates achieved by the WA Economic Regulatory Authority in their 2007 Rail Access Determination and QR's actual rates incurred for duplication of QR's coal network west of Rockhampton in Queensland. While some items are relevant to narrow gauge (NG), where necessary an applicable conversion factor has been applied to indicate a conversion to comparative standard gauge (SG) costs. It should be noted that SG and NG concrete sleepers are the same cost supplied on site. Table 5.1 indicates the relative comparison rates in 2006 in accordance with the assumptions indicated above.

[32] This document was provided on a Commercial in Confidence basis, however, the relevant information was not included.

Table 5.1 Comparative Sample Typical Civil Below-Rail Rates in $ 2006

Item	Unit	BAH rate ($)	WA rate ($)[33]	QR rate ($)[34]
Rail – 60kg	Tonne	1330	***1440	1350
Sleepers – Concrete	Each	86	90	91
Ballast (incl transport)	Tonne	40	25-30	30-33
Earthworks	Lin km	Av 155,295	218,750	192,000
Tracklaying (excl t/outs)	Lin km	119,130	144,300	*150,000
Turnouts primary – 80kpm	Ea installed	356,282	**365,000	320,000
Turnouts primary – 60kpm	Ea Installed	238,282	**255,000	225,000
Turnouts secondary	Ea Installed	218,481	**243,000	210,000
Bridges (complex)	Lin m	Av 26,755	24,000	-
Bridges (simple)	Lin m	Av 26,755	16,200	-
Fencing (where applicable)	Lin km	24,242	70,000	-

Source data BAH, ERA, QR
Note:*1660 sleepers/km, **incl transport from east coasts, ***incl transport

From Table 5.1, it can be seen that in most instances there is broad similarity in the comparison of the civil unit rates. Variations are expected which are dependent on the definition of the "Scope of Work" contained within each rate plus other factors such as transport costs.

The most significant variation is with bridges. However, given that the vast majority of bridges in the ARTC asset base are mainline bridges spanning larger rivers the use of a single average across these structures is considered not unreasonable. This is primarily due to the more complex nature of the bridges on mainline operations versus branch line operations. The cost differential between the Westnet and Queensland Rail comparisons is primarily driven by cost escalation over the CPI.

Overall, the rates used to determine a unit rate for the ORC for the civil, track and structures component averages over the ARTC network at $964,556 per single track km. Individually for SA/WA/Vic, the civil, track and structures component is $836,220 per single track km and for NSW, the civil, track and structures component is $1,137,333 per single track km. Comparative construction costs for the civil engineering components of recent "greenfield" equivalent rail projects are, for the ARTC Southern Alliance Passing Loop project $1,036,260[35] per single track km (excluding contractor's margin and safe working costs which would increase these costs) and for the North-South Corridor Strategy estimates of $1,116,000[36] per single track km (excluding contractor's margin, again increasing the costs). Therefore a range in excess of $1,036,260 to $1,116,000 can be assumed for greenfields construction costs per kilometre of track.

[33] http://www.era.wa.gov.au - Final Determination - Corrigenda Version - WestNet Rail's Floor and Ceiling Costs for Certain Rail Lines – 31/7/07; WestNet Rail Submission - 15/9/06; WorleyParsons Report - 15/9/06

[34] personal communication to Himark; QR - 15 February 2008

[35] Taken from BAH sense check of calculation in BAH DORC Valuation spreadsheet FM 23 Jan 2007

[36] Ibid.

Overall, the rates used to determine a unit rate for the civil, track and structures component for the ORC does not appear unreasonable as they are within the benchmark ranges of Wa and QR and the recent greenfield projects.

5.4 Signals and Communications

As previously indicated, unit rates for signalling and communications can vary considerably depending on age and specification required. The unit rates used in the DORC valuation are those obtained from recent estimates prepared by ARTC for new signalling and communications on the Gulgong to Muswellbrook (via Ulan) coal line in the NSW Hunter Valley. In addition, ARTC has recently prepared cost estimates for the NSW North Coast line between Casino and Acacia Ridge terminal in Brisbane. A signalling and communications benchmark is available for various mainlines with CTC in WA from the WA Economic Regulatory Authority's Rail Access Determination 2006[37]. The comparisons are indicated in Table 5.2.

Table 5.2 Comparative Typical Signal & Communications Rates in $2006

Line	ORC Equiv ($m)	Length (kms)	ORC ($/km)
Signals Upgrade - CTC			
BAH Network wide	458.9	6,686	68,628
Gulgong – Muswellbrook (NSW)	10.17	137.0	74,255
Casino – Acacia Ridge (Qld)	11.28	161.1	70,028
Signals			
BAH Network NSW	227.9	2850	79,967
BAH Network SA/WA/Vic	152.0	3836	39,612
Forrestfield – Kalgoorlie (WA)	88.81	665.0	133,550
Kwinana – Bunbury (WA)	35.14	176.1	199,546
Communications			
BAH Network NSW	45.6	2850	16,013
BAH Network SA/WA/Vic	33.4	3836	8,695
Forrestfield – Kalgoorlie (WA)	43.75	655.0	66,794
Kwinana – Bunbury (WA)	12.60	176.1	71,550

It is reiterated here that the difficulty in assessing the inclusion or exclusion of items required regarding signals and communications for the full replacement cost of the items. The ARTC signals upgrades in the Table 5.2 above are in fact exactly that and do not represent the full cost of the signalling, communications and associated train control function and the difference in cost is evident when comparing the signals plus communication rates per km in the benchmarked WA Determination. BAH used the basis of the upgrade costs for the Gulgong – Muswellbrook line (applicable in 2006 when the DORC valuation was prepared) but the later Casino – Acacia Ridge rate per km, or even higher, would have been more representative as it is a section of a line more typical of the ARTC network carrying a mix of freight and passenger traffic operating on varying schedules and traffic speeds.

[37] http://www.era.wa.gov.au - Final Determination - Corrigenda Version - WestNet Rail's Floor and Ceiling Costs for Certain Rail Lines – 31/7/07; WestNet Rail Submission - 15/9/06; WorleyParsons Report - 15/9/06

5.5 Level Crossings and Other Relevant Infrastructure

Level crossings, access roads for maintenance, signage and fencing of the track are all important aspects of track construction. The rates used in the DORC valuation for these and other similar items have to be generalised as each is specification, location and usage is specific to the individual sites. Each of these items mostly constitute large quantities of the individual item although the unit rate is relatively low. Their inclusion is important and assessment of a fair and reasonable replacement rate is difficult as a precise benchmark value on each is totally use and site specific, eg no two level crossings are identical. In preparing for the 2002 WA Rail Determination, a complex matrix of level crossing types was developed but it became obvious that such detail over the WA rail network could not be valued and this approach was abandoned.

In this DORC valuation, BAH has costed level crossings at $84,315 for major crossings and $16,049 for private access crossings. It is considered, when comparing these costs to those used for construction of level crossings in Queensland and WA that the average cost of major crossings on highways may be undervalued by between 10 per cent - 15 per cent and for access crossings the cost included in the DORC represents the correct level for replacement valuation.

5.6 Train Control Infrastructure Capital Costs

Train control infrastructure costs do not appear to have been included in the actual DORC valuation model. While the actual track side CTC equipment has been included as an item in the signals and communication costs, for example Casino-Acacia Ridge upgrade has $800,000 allowed; the Ulan line upgrade does not have a specific item. It would appear that the actual infrastructure and equipment for the train control at Adelaide, Broadmeadow and Junee is not included in the DORC valuation.

It is the PwC opinion, that the train control, being an integral part of the required infrastructure to enable the operation of the ARTC Network, like any other piece of infrastructure required for the operation of trains, eg rail, sleepers, signals, etc, should be included as a separate item in the DORC valuation.

The inclusion of these assets suggests that the valuation could potentially be higher. As such it is not unreasonable to consider that these costs are appropriate, albeit potentially lower than what would be allowed under the DORC methodology.

5.7 Conclusion on Replacement costs

PwC has found that the replacement costs proposed by ARTC are not unreasonable. This is based on a number of factors, including:

- Results from random sampling of quantity information used in arriving at the final value of replacement costs that unit rates have been multiplied by appropriate quantities to arrive at a final value;

- Random sampling did not identify any material inconsistency in the information provided and the assumptions of the BAH DORC model quantities;
- That the below rail unit rates across specific items are broadly consistent with benchmarks from Western Australia, and Queensland Rail where differences exists these are generally explainable; and
- That the average ARTC proposed unit rates for Access prices, across the network are lower than recent actual costs incurred by ARTC in upgrading projects completed in its capital program.

6 ARTC Network 2006 ORC and DORC Valuation

6.1 ARTC Network 2006 ORC

The Network 2006 ORC valuation for ARTC mainlines has been rigorously calculated each rail line separately by BAH using the following data sets provided by ARTC where:

For SA/WA/VIC

- the 2001 DORC valuation with CPI at 3.1 per cent increase applied;
- with a revision for the current total length of track in the optimised network (3,836 STK);
- any MPM upgrades that have been undertaken since the 2001 DORC valuation have been included;
- all ARTC non-mainline required assets are excluded;
- all ARTC mainline assets have been reviewed for quantity and to ensure optimisation within the network;
- all ARTC assets are assumed at MEF or equivalent;
- current (2006) replacement costs of all ARTC assets (using optimised quantities) have been applied to these assets;
- The ORC for each asset group for each line has been calculated.

For NSW

- the quantity of assets contained in the 2004 Lease Agreement has been taken as a base;
- any MPM upgrades that have been undertaken since July 2004 have been included;
- all ARTC non-mainline required assets are excluded;
- all ARTC mainline assets have been reviewed for quantity and to ensure optimisation within the network;
- all ARTC assets are assumed at MEF or equivalent;
- current (2006) replacement costs of all ARTC assets (using optimised quantities) have been applied to these assets;

- The ORC for each asset group for each line has been calculated.

A major anomaly was identified by BAH in that the 2001 DORC valuation for SA/WA/VIC indexed by CPI of 3.1 per cent per annum, as previously indicated, extended to 2006, a 5 year increase of 18.0 per cent whereas the 2006 replacement costs calculation for the same set of assets produced an increase of 37.4 per cent.

BAH have addressed this as follows:

"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.)".*[38]

To resolve this anomaly, BAH has applied the 2006 ARTC Network average ORC valuation per km to a Benchmarking Test against the recent comparative greenfield rail construction costs major for lines in Australia.

The problem then is what projects to ascertain recent credible construction costs or estimates of proposed major lines to be undertaken in Australia. BAH ascertained that Benchmarking should be carried out against:

- Construction rates achieved and DORC valuation for the Alice Springs to Darwin rail line – Asia Pacific Transport (APT), 2003;
- ARTC Southern Alliance construction estimate (additional passing loops), 2006; and
- North-South Corridor Strategy construction estimates prepared by Hyder Consulting for Ernst & Young 2007.

BAH, in their calculation spreadsheets used the 2006 Southern Alliance construction and the 2003 Tarcoola to Darwin cost as the basis for their calculation of material costs and construction, as described as follows:

"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%

[38] BAH 2006 DORC, page 10 footnote 2

loading is used only for construction costs, not materials costs (where the 18% loading is retained).”[39]

The base use of an 18 per cent loading on materials used and a 28 per cent loading on installation over the 2001 DORC valuation is a professional resolution to the identified costing problem and is not considered to be unreasonable. The average unit rate for track replacement for the 2006 valuation as calculated by BAH is $1.05 million per kilometre which compared with a recent QR duplication project in Central Queensland (adjusted for conversion from narrow to standard gauge) of $1.03 million per kilometre.[40]

As noted in section 2, the PwC has previously discussed the two escalation factors used and found that they were within the expected bands once cost moments are considered across the CPI and the various applicable cost indices.

The NSW 2006 ORC calculation has used the same loadings as for SA/WA/VIC network. BAH has developed an ORC valuation for each individual line within their working spreadsheets and Table 6.1 below gives the overall ORC valuation.

Table 6.1 2006 ORC values for the ARTC Network

ARTC Network	STK	ORC ($)	ORC/km ($)
SA/WA/VIC	3836	3,642,930,303	949,670
NSW	2850	3,394,049,284	1,190,895
TOTAL NETWORK	6686	7,035,979,587	1,052,327

Source: BAH - ARTC 2006 Standard Gauge DORC Valuation

6.2 Depreciation in the ARTC Network 2006 DORC

The depreciated value for each item for each line has been calculated by three alternative methods each estimating the percentage of the asset consumed:

- An assessment of the percentage of the asset used versus the technical specification of the asset, e.g. for rail the maximum life is based on the quantity of gross million tonnes passing over the rail over its life;
- where appropriate, the 2001 DORC valuation depreciation life’s have effectively been rolled forward to reflect the impact of MPM on asset life’s; and

[39] ibid, page 10 footnote 3
[40] personal communication Himark; QR - 15 February 2008

Table 6.2 % Consumed of Individual Line Assets for 2006 DORC

Line	Total STK	Rail life (tonnage)	Turnouts	Concrete sleepers	Timber sleeper	Ballast	Struct's UB	Struct's OB	Culverts	Tunnels	Level xings	Fences assumed	S&C
Dry Creek - Crystal Brook	198.2	37%	40%	56%	0%	24%	76%	0%	85%	0%	50%	50%	80%
Crystal Brook - Pt Augusta	132.0	34%	39%	54%	0%	24%	36%	0%	65%	0%	50%	50%	80%
Pt Augusta - Tarcoola	435.9	41%	45%	52%	0%	24%	70%	0%	76%	0%	0%	50%	80%
Tarcoola - Parkeston	1344.2	29%	41%	46%	0%	43%	78%	0%	76%	0%	50%	50%	80%
Crystal Brook - Broken Hill	395.4	23%	29%	46%	0%	12%	29%	0%	31%	0%	50%	50%	80%
Broken Hill - Parkes	709.6	11%	75%	0%	70%	75%	40%	0%	50%	0%	50%	50%	80%
Parkes - Cootamundra	207.2	26%	75%	10%	73%	75%	32%	0%	50%	0%	50%	50%	80%
Dry Creek - SA/VIC Border	340.0	64%	56%	60%	0%	24%	65%	0%	84%	0%	50%	50%	80%
SA/VIC Border - Melbourne	560.0	18%	24%	20%	79%	36%	65%	0%	84%	0%	50%	50%	80%
Dry Creek - Outer Harbour	20.4	72%	23%	0%	50%	50%	0%	0%	50%	0%	50%	50%	80%
Tottenham - Albury	332.6	45%	23%	0%	72%	39%	45%	0%	39%	0%	50%	50%	80%
Albury - Macarthur	1057.5	0%	68%	16%	82%	0%	49%	59%	50%	50%	50%	50%	80%
Spencer Jct - Whyalla	74.8	13%	37%	50%	50%	24%	19%	0%	15%	0%	50%	50%	80%
Appleton Dock Jct - Dock	2.5	50%	50%	0%	50%	50%	0%	0%	50%	0%	0%	50%	80%
Moss Vale - Unanderra	61.2	38%	25%	16%	0%	25%	46%	58%	50%	50%	50%	50%	80%
Islington/Newcastle Maitland	60.4	68%	50%	16%	75%	50%	50%	0%	50%	0%	50%	50%	80%
Maitland - Craven	116.9	32%	50%	16%	50%	50%	54%	0%	50%	50%	50%	50%	80%
Craven - NSW/QLD Border	637.3	44%	50%	16%	59%	50%	48%	56%	50%	50%	50%	50%	80%

Source BAH

- in all other insistences, a detailed status of all infrastructure was prepared for ARTC by WorleyParsons 2005[41] and by URS[42]. These reports where used as a baseline for the current asset condition, however, a further two years was added to the findings of these reports to establish the present percentage of life consumed. Again where appropriate reductions or at the very least no deterioration was assumed where the necessary MPM works were undertaken on the assets in question.

Table 6.2 indicates the summary of the '% of life consumed' (or accumulated depreciation) as calculated by BAH in their working spreadsheets calculated by the above methods.

The percentage of consumed line asset was assessed depending on a number of factors, including:

- Rail life – was established as a function of the usage on the particular line and the percentage used across the network and the proportion of the network for each particular segment;
- Turnouts – were established in accordance with the Worley Parsons condition report;
- Concrete sleepers – depended on the actual life of the assets over the average economic life of the asset;
- Timber sleepers – were assessed against the Worley Parsons condition report;
- Ballast – were assessed against the Worley Parson condition report and some additional roll forward of these assumptions;
- Structure underbridge and overbridge – based on the URS report;
- Culverts – based on the 2001 DORC with the assumption that the assets have been maintained with MPM over the period, where there was no 2001 DORC life assumption, the URS report has been used;
- Tunnels – 50 per cent life has been assumed on the basis of MPM;
- Level crossing – 50 per cent life has been assumed on the basis of MPM;
- Fences – 50 per cent life has been assumed on the basis of MPM; and
- Signals and Communications – 80 per cent life has been assumed on the basis of the URS report.

[41] Worley Parsons prepared a report on track, signals communications and associated infrastructure conditions.
[42] URS undertook a sub-consultancy to the Worley Parsons Report which focused on the condition of structures, namely bridges, across the network.

Assets which have been assumed to be in the condition reported by either URS or Worley Parsons have been considered as not unreasonable in this review[43]. Further, where assets have been assumed to be approximately 50 per cent through their asset life on the basis of MPM, PwC considers that this is not an unreasonable assumption as the MPM program effectively replaces these assets on an ongoing basis[44]. This is consistent with assets such as fences, level crossings and tunnels. This also includes the use of the values assumed in the 2001 DORC valuation. MPM should in theory ensure that the assets have a similar condition between the two valuations and as such the use of the 2001 assumptions is not considered unreasonable in the context of this DORC valuation.

For other assets, notably rail, it is more appropriate to consider the actual usage of the asset against the specified technical life of the asset. This approach has been employed for rail and concrete sleepers. As such the percentages of life used assigned in Table 6.2 for rail and concrete sleepers are not considered to be unreasonable.

The weighted average of the '% life consumed' for each segment of the ARTC Network has been calculated by BAH as follows:

- SA/WA/VIC 45.4 per cent
- NSW 48.8 per cent and
- ARTC network 47.2 per cent.

Levels close to 50 per cent are consistent with railway lines which are subject to periodic maintenance program to retain a fit for purpose condition. Given that the condition of each asset on individual segments of the network has been assessed and that the weighted averages have been assessed on the basis of the proportion of the individual segment and the proportion of value of each asset class, the percentages outlined by BAH are not considered to be unreasonable in the context of this DORC valuation. Further each asset has been assessed against it present condition and no further adjustments are deemed to be necessary.

The ARTC Network 2006 DORC calculation has used the '% consumed' for each asset item as the depreciation and extrapolated for each asset item over each line. This is then applied to the ORC valuation of the line. This in turn provides the DORC valuation. BAH has provided a DORC valuation for each individual line within their working spreadsheets and Table 6.3 below gives the overall DORC valuation.

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[43] This review has not involved a detailed critique of the methodologies or findings of the URS and Worley Parsons reports.

[44] However, MPM will extend life but it generally does not create an indefinite life (eg rail can be s.t grinding to maintain shape but this can only be done for a limited number of cycles before replacement is required.

Table 6.3 2006 DORC values for the ARTC Network

ARTC Network	STK	DORC ($)	DORC/km ($)
SA/WA/VIC	3836	1,852,013,562	482,798
NSW	2850	1,864,733,023	654,266
TOTAL NETWORK	6686	3,716,746,585	555,142

Source: BAH - ARTC 2006 Standard Gauge DORC Valuation

6.3 Conclusions

This review has assessed the BAH working spreadsheets and the other documents requested and that have been supplied by ARTC. Overall the 2006 standard gauge DORC valuation of the ARTC network by BAH is broadly consistent with DORC valuation approaches provided to economic regulators in access pricing decisions.

There are challenges for BAH in the benchmarking of the some unit rates included in this valuation. As indicated in the BAH report, it is responsible to adjust unit rates with an appropriate escalation factor to bring these to current prices.

ARTC has provided some examples demonstrating recent significant costs growth, e.g. Southern Alliance construction estimate (additional passing loops), 2006 proposed by ARTC as appropriate. However, as noted this is driven by a number of factors which we cannot predict will continue with any certainty.

Simple escalation of the 2001 and 2003 valuations would be less appropriate as rail network costs have significantly exceed CPI movements of this period. Comparison against the 2001 ARTC DORC or the DORC valuation of for the Alice Springs to Darwin rail line in 2003 plus CPI is not appropriate as increases in installation costs have significantly exceeded CPI. This has also been identified by BAH in benchmarking with the *North-South Corridor Strategy* construction estimates prepared by Hyder Consulting for Ernst & Young 2007, which appears to be in excess of 10 per cent above the BAH 2006 DORC valuation.

Overall the approach and final values proposed by ARTC do not appear unreasonable based on our sample testing, comparisons to other jurisdiction and other assumptions outlined in sections 4.5 regarding optimisation of the network, 5.7 regarding replacement cost, and 6.2 regarding depreciation rates. As such the ARTC's DORC valuation is not unreasonable. Given the ARTC forecast increases in traffic over the next five years on mainlines, further optimisation of the network does not appear warranted at this time.

Appendix A

ARTC 2007 CONSULTANCY – TERMS OF REFERENCE DORC REVIEW

Summary of Consultancy Tasks

The consultant is to prepare a draft and a final report for the ACCC detailing its approach and findings of its assessment and a detailed discussion. If the Final Report contains confidential information, a non-confidential version of the report will also need to be produced, which the ACCC may release publicly. The reports must include the following:

6.3.1.1 Task 1. Information Sources

a) explain the information sources ARTC (BA&H) used to determine its asset values. The consultant should explain how these information sources were used and evaluate whether the information sources were reasonable for determining ARTC's asset values;

b) test a significant amount of data sources to establish confidence in the process that ARTC has employed to quantify its assets. PwC will need to explicitly explain the approach and breadth of sampling they will do in their proposal;

c) review the adequacy of the information used by ARTC and its consultants to prepare its asset database and in doing so, carry out checks of ARTC ownership or control of assets if required; and

d) identify and explain the key differences in value between the 2001 DORC valuation compared to the 2007 DORC valuation where relevant.

Task 2. DORC Assessment

Explain the assumptions and methodology ARTC used to develop its DORC valuation. In particular, the report must include analysis on network optimisation, replacement cost and depreciation. Issues that the consultant must examine include the following:

<u>A. Optimisation</u>

The consultant is required to examine the reasonableness of the network optimisation process adopted across segments of the network and determine whether sufficient optimisation has been completed.

In examining the optimisation across all asset classes, the consultant should examine what considerations ARTC (BA&H) gave to excess capacity and how future capacity requirements and uncertainty have been taken into consideration. For example, should double track between Cootamundra and Junee be retained? Are there other areas where assets are not required for current and planned growth in the DORC values such as double track, passing lanes and excessively built overpasses?

In reviewing optimisation, the consultant should examine whether there are assets that should be totally optimised out of the regulatory asset base. For example, are there sections of track that should be totally optimised out due to there being other sections of track that could be used to go around these track sections? Total optimisation out of the regulatory asset base should also be considered for non track assets such as bridges (i.e would some of these assets not be built at all today given their high costs).

If the consultant determines greater optimisation should occur, is it likely that any optimised assets will need to be re-optimised into the regulatory asset base in the future and if so, when might this be expected?

B. Replacement Cost Estimates

The consultant is required to examine the reasonableness of the replacement cost estimates by ARTC.

The consultant should examine ARTC's uplift figures and any benchmarks used to obtain those figures for each of the different asset classes (including: track, turnouts, structures, earthworks, signalling, train control, safeworking, communications, fences and level crossings). For example, are uplift figures of 28 per cent on installation and 18 per cent on materials appropriate for track and turnout assets? Given ARTC's benchmark capital expenditure costs are based on relatively small amounts of capital work, for example, the 6.8 km passing lane costs obtained from ARTC's Southern Alliance, the consultant should specifically examine:

- whether the use of benchmarks is generally applicable for a given asset class and whether the assets in that given asset class are likely to vary too much to use benchmarks;
- what economies of scale or scope would be realised if the whole network was built as one project and if ARTC's (BA&H) uplift figures appropriately accounted for these economies for each different asset class;
- would there be significantly different costs to construct different segments depending on where the work was done (e.g. country versus city or mountains versus plains) and the difference this might make to segment DORC values; and,
- has ARTC (BA&H) utilised all available data to obtain cost estimates?

In examining segment costs where benchmarks are not used, are the estimates reasonably based (for example earthwork cost assumptions)? Earthworks estimates may be a particular issue on the NSW segments of track where they are very high due to the nature of the terrain.

In examining replacement cost estimates, what are the appropriate efficient replacement assets? For example, is 60kg rail optimal and why?

In considering the appropriate replacement assets, the consultants should consider ARTC's use of perpetual maintenance (MPM) and general operating costs based on existing actual asset costs. In particular, do ARTC's operating costs and MPM assumptions affect the optimal replacement asset choice to be used for valuation to ensure fair compensation? In considering this issue, the consultant should consider whether the allowance for depreciation, based on track condition and asset life will adequately adjust for any increased standard optimised asset (e.g. 60kg rail now assumed) and whether this adjustment has been adequately performed.

C. Depreciation

The consultant is required to examine the reasonableness of the depreciation assumptions for each asset class. In particular the consultant should examine:

- How remaining asset lives (of existing actual assets) were estimated and if these assumptions are reasonable;
- Whether the depreciation assumptions for the optimal replacement assets (modern equivalent assets) are consistent with the remaining life of the actual assets in place; and
- Whether a further reduction in the DORC values are required for the higher operating costs of any actual assets in place relative to the modern equivalent assets over the assumed remaining life of the assets. If a further adjustment is required on any assets, how significant an adjustment is this likely to be, is this adjustment normally made, and can this adjustment be reasonably accurately quantified? For example, if wood and concrete sleeper are both assumed to have five years life remaining, what is the approximate difference in the NPV of maintenance and opex of the different sleeper types over the last five years asset lives and should the DORC (based on concrete sleepers that are the MEA) be adjusted downwards for this difference (assuming they have a lower NPV of costs over their assumed remaining life)?

D. Other Relevant Issues

The consultant should address any other issues the consultant thinks relevant to the DORC valuation of ARTC's relevant assets.

3. Resources

A copy of ARTC's 2007 DORC valuation and financial model and access undertaking will be provided to the consultant as well as a copy of ARTC's 2001 DORC valuation. The consultant will be expected to liaise with ARTC on any matters it requires further information on.

A copy of ARTC's access undertaking and supporting documents are available from the ACCC website (www.accc.gov.au) go to Industry Regulation & Price Monitoring and choose Rail.

4. Deliverables

a) List of questions to be sent to ARTC identifying the information needed to conduct the consultancy.

b) Draft and Final report addressing Tasks 1 and 2.

The final report should address any questions and/or comments the ACCC has in relation to the draft report. If the final report includes confidential information, a second non-confidential report should also be produced, which the ACCC may release publicly.

5. Communication and Draft Report

The consultant should:

a) liaise with the ACCC on progress of work and major issues as they arise;

b) present the findings of the draft report to the ACCC project team; and

c) address ACCC comments/questions regarding the prepared reports

6. Estimated Budget

The ACCC estimates the DORC review consultancy at approximately [confidential]

7. Timelines

It is expected that this consultancy would take approximately 8 weeks to complete. See timelines below:

	Timeline
Initial meeting and information gathering	1-2 weeks
Draft Report	4 weeks
ACCC review	1 week
Final Report	1 week

Depending on the detail required, there may be a delay between providing the list of questions to ARTC and finalisation of ARTC's responses to those questions.

9. ACCC Contacts

Dominic L'Huillier - Director Transport Regulatory, ACCC on (03) 9290 1807.

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Appendix B

ARTC Rail Network Diagrams

B1	SA/WA Corridor Network Diagram
B2	Victoria Corridor Network Diagram
B3	NSW (South) Corridor Network Diagram
B4	NSW (West) Corridor Network Diagram
B5	NSW (North) Corridor Network Diagram
B6	NSW (Hunter Valley) Corridor Network Diagram

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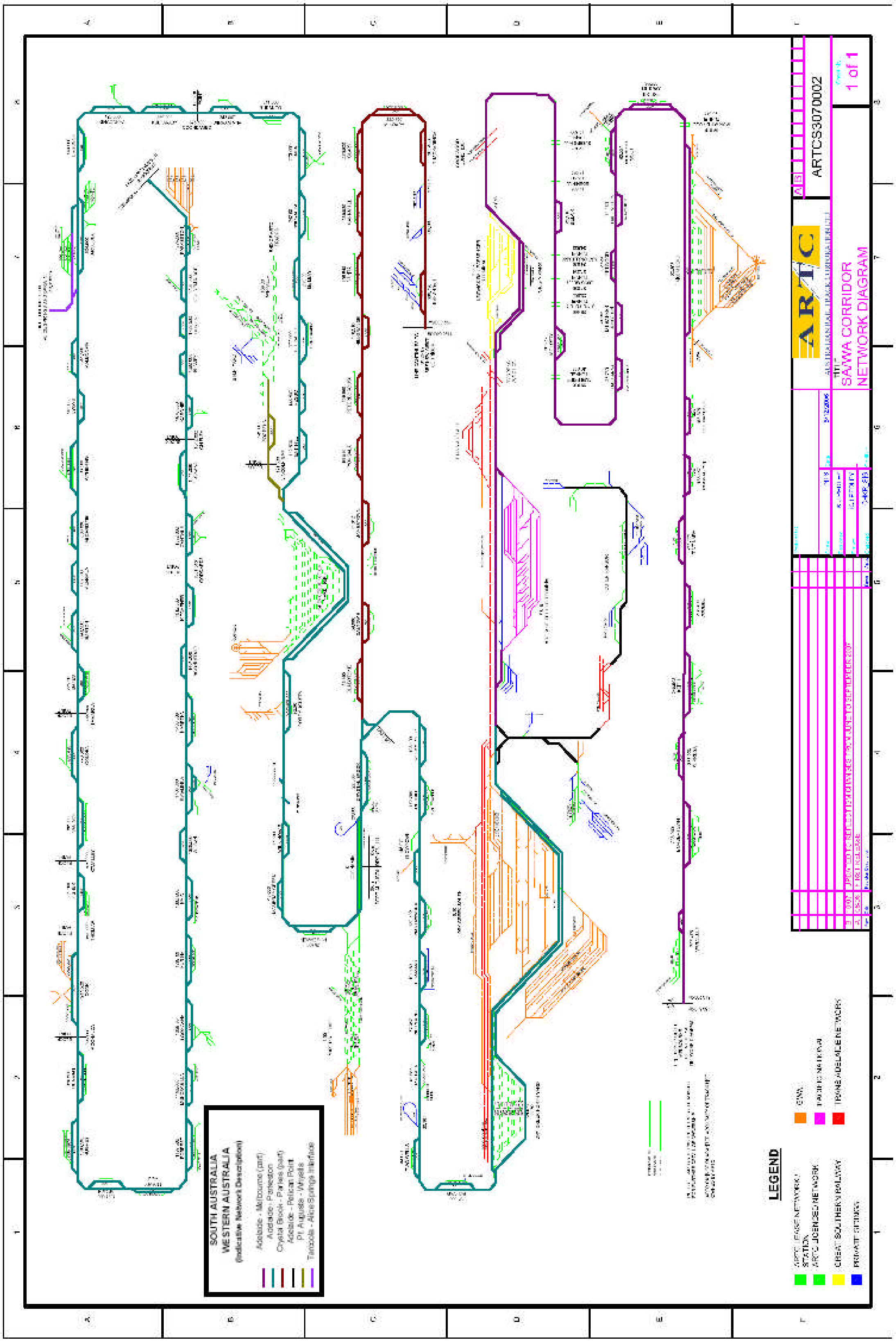

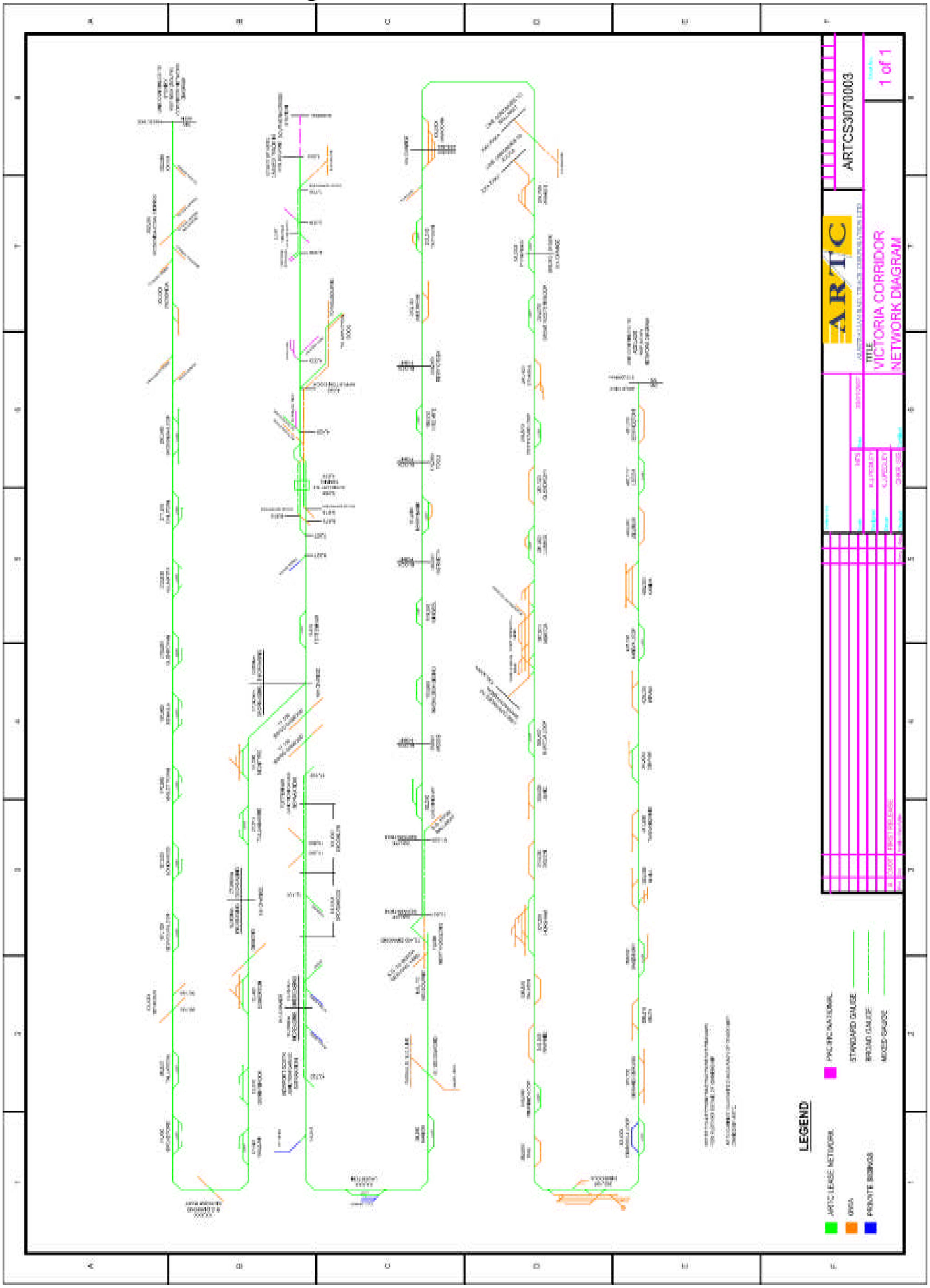
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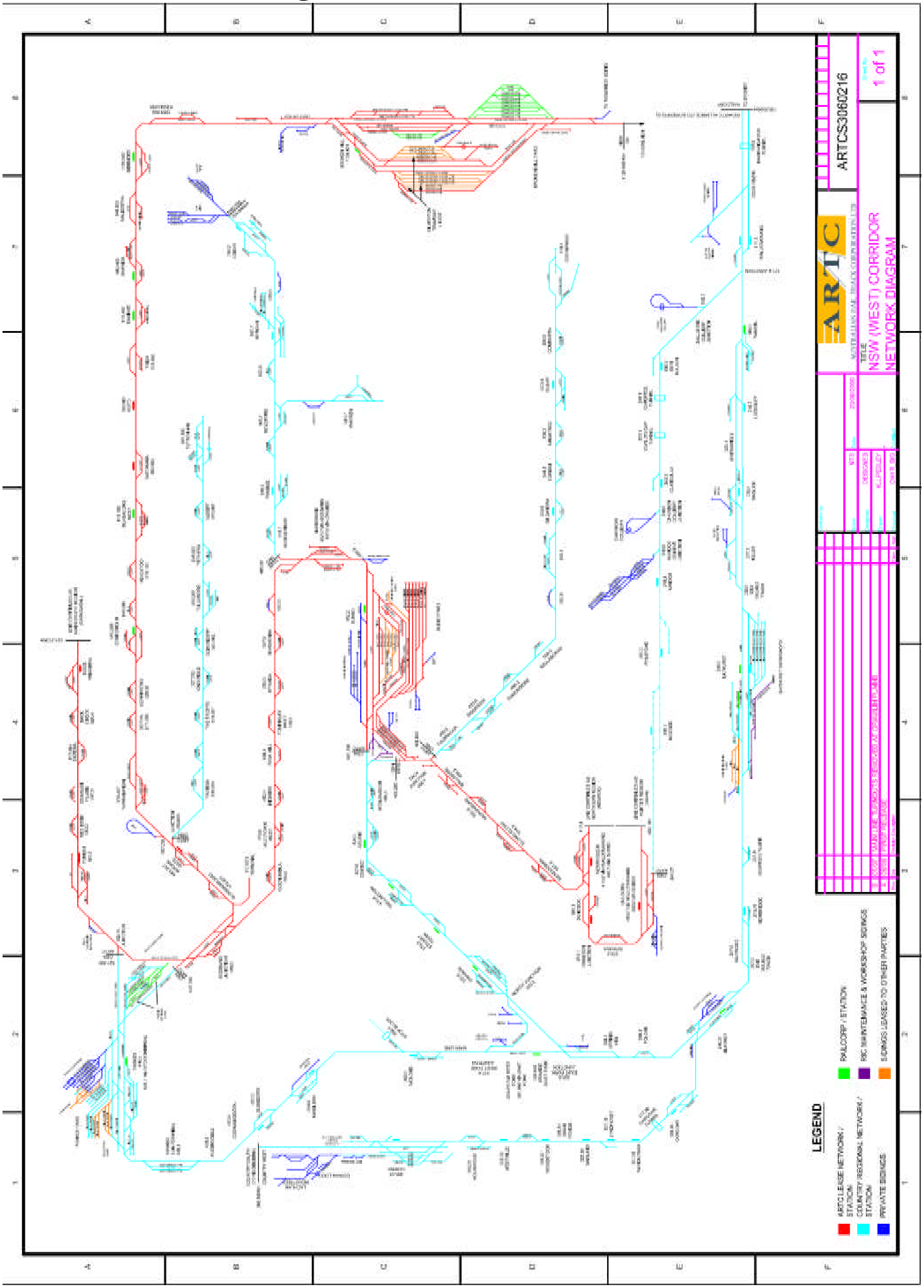
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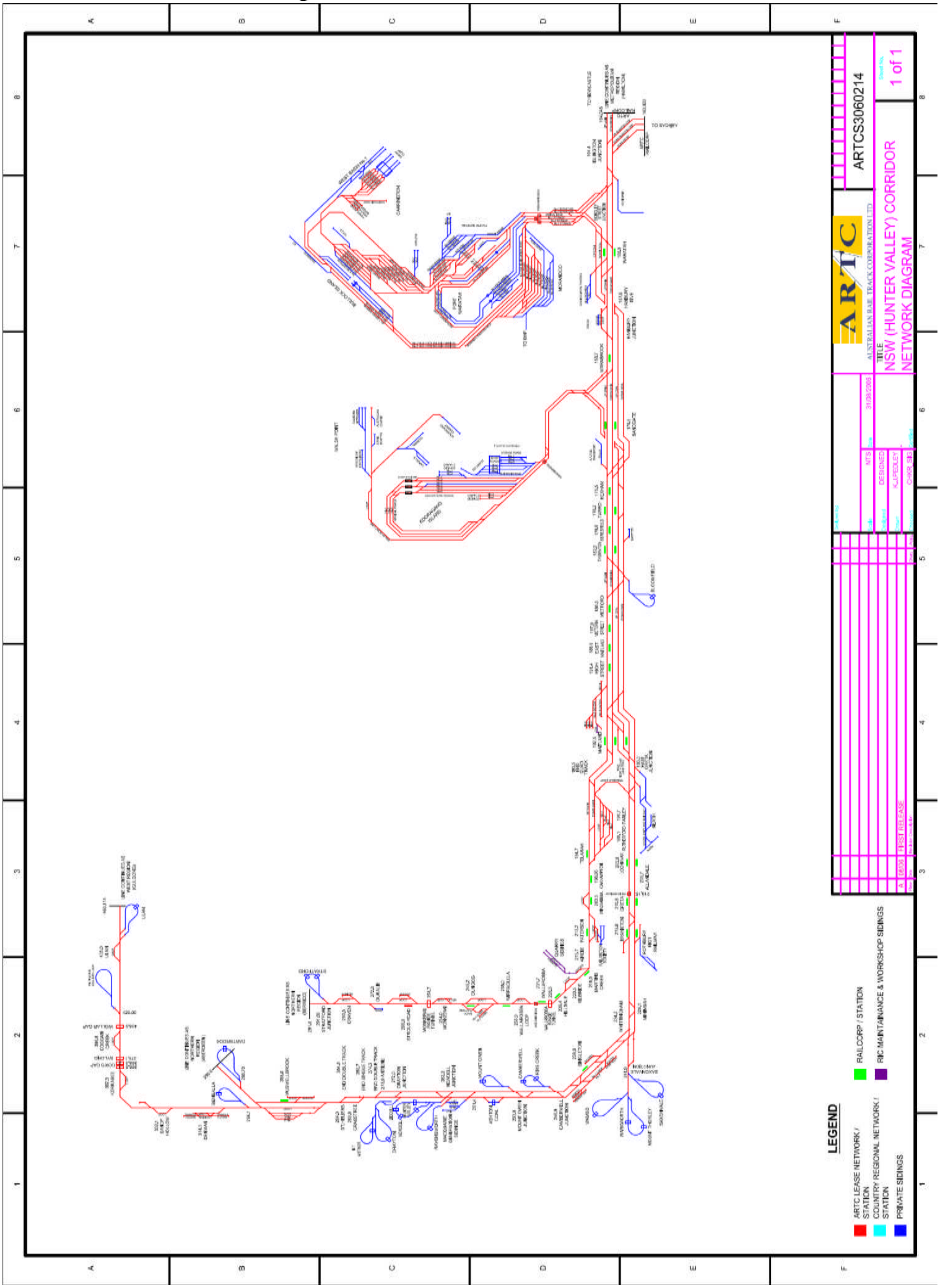
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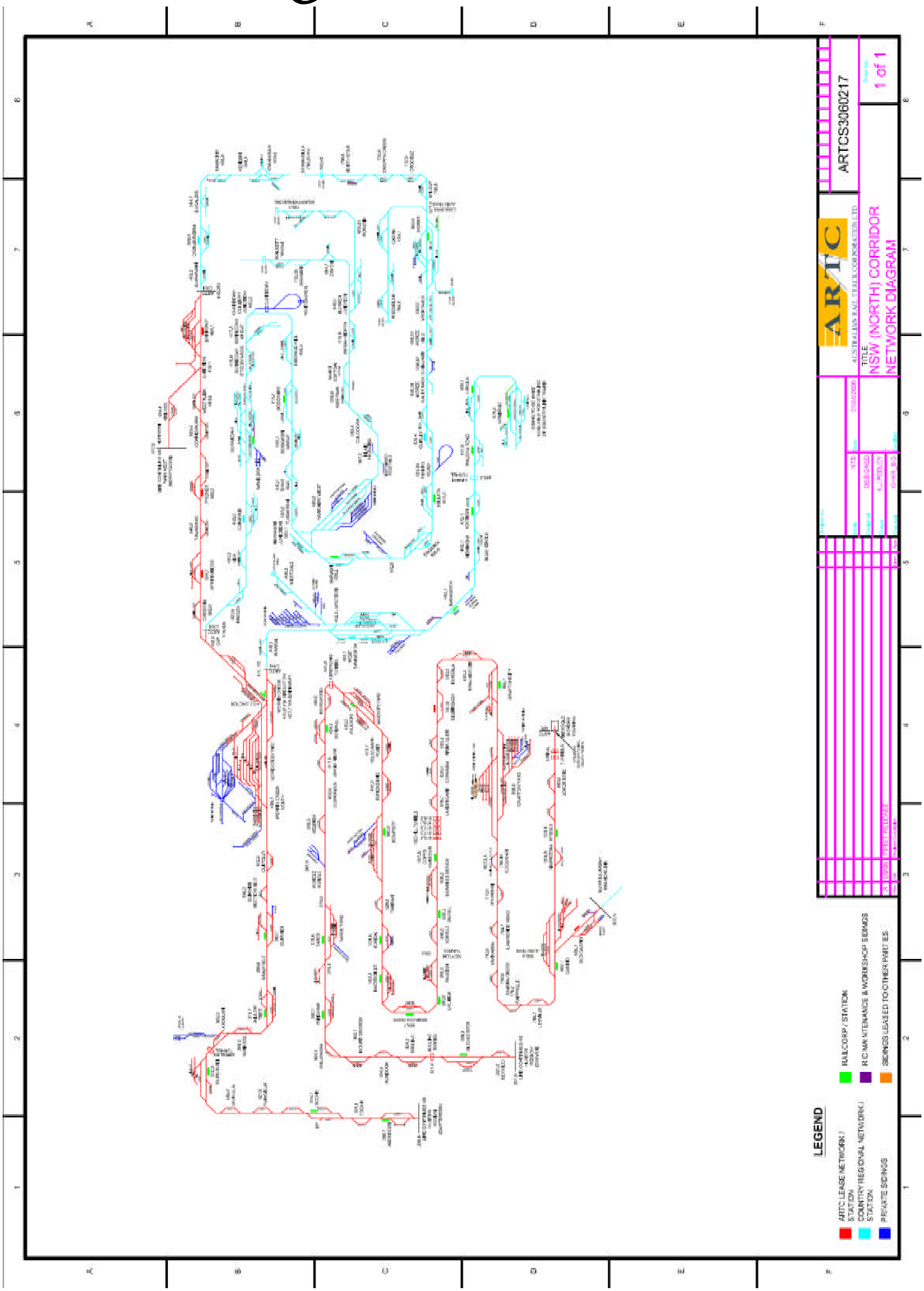
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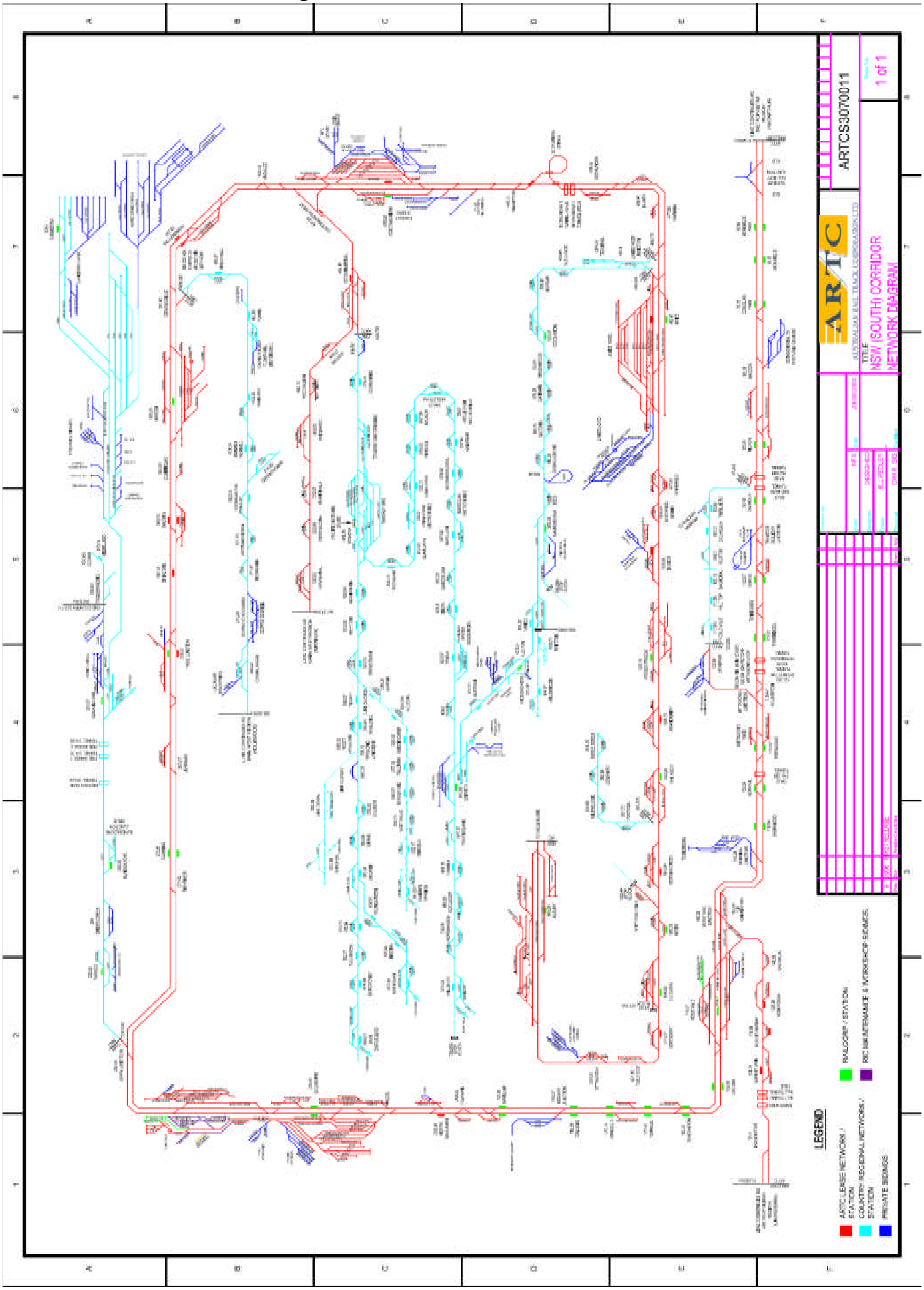

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APPENDIX C

Source Documents

Document Title	Prepared by	Date	Comment
ARTC Standard Gauge Rail Network DORC - 2006	Booz Allen Hamilton	January 2007	Base Document
ARTC DORC Summary Valuation spreadsheet	Booz Allen Hamilton (FM)	23 Jan 2007	Detailed Working for Base Document
ARTC ORC & DORC Valuation worksheet	Booz Allen Hamilton (FM)	23 Jan 2007	ORC & DORC valuation item calculation
ARTC Consolidated Rail Data worksheet	Booz Allen Hamilton (FM)	Nov 2006	Mainline rail data in place
ARTC Asset Summary & % Consumed worksheet	Booz Allen Hamilton (FM)	Nov 2006	Assessment of % consumed from other sources
ARTC South Alliance Passing Lane Estimate worksheet	Booz Allen Hamilton (FM)	Dec 2006	Detailed Estimated Rates for comparison
ARTC 2001 DORC Structures worksheet	Booz Allen Hamilton (FM)	Amended 25 Aug 2006	SA/WA/VIC Structures summary
URS Bridge Data worksheet	Booz Allen Hamilton (FM)	Aug 2006	NSW Structures summary
ARTC Unit Rate Data Base	Connell Wagner		Unit Rates for civil & track assets
ARTC CEDRIC database	Sinclair Knight Merz	Updated 2004	Asset database for SA/WA/ VIC assets for valuation
ARTC Infrastructure Condition database	WorleyParsons	2005	Infrastructure condition of NSW assets for valuation
ARTC Structures Condition database	URS as subconsultant to WorleyParsons	2005	Structures condition of NSW assets for valuation
ARTC TrackData on-line infrastructure database	ARTC	On-going	On-going status reporting of assets
ARTC Track & Civil Code of Practice	ARTC	Issue 1 Rev 3; Feb 2007	ARTC Standards
ARTC Engineering Standards	ARTC	Revised; 21 Nov 06	Engineering Standards
ARTC 2001 Rail Network DORC for SA/WA/VIC	Booz Allen Hamilton	Jan 2001	2001 Base Document
Report on ARTC 2001 Access Submission to ACCC	Currie & Brown	2001	Review of ARTC 2001 DORC
Australia Bureau of Statistics	ABS	Various	Review Consumer Price Indices
IPART 2001 Review of NSW Rail Network	Independent Pricing & Regulatory Trib. of NSW	2001	Review of NSW Network
Economic Regulatory Authority of WA	ERA of WA	Various	Rail Access Determinations for WestNet Rail
ARTC – Casino to Acacia Ridge; Resignalling & CTC	ARTC Project Tender	May 2005	Specification and Cost Estimates – Sigs & CTC
ARTC – Ulan to Muswellbrook CTC Design	ARTC – Rail Infrastructur Group Memo	28 March 2007	Specification and Cost Estimate – Sigs & CTC
North-South Rail Corridor Study for AusLink	Ernst & Young, ACIL, Hyder Consulting	30 June 2006	Comparison of Cost Estimates
ARTC North-South Rail Corridor Upgrade Project	ARTC South Improvement Alliance	March 2006	Comparison of Cost Estimates