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Review of Australian Rail Track Corporation's valuation for the Gap to Turrawan Segment of the Hunter Valley rail network

Report prepared for the Australian Competition and Consumer Commission

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Executive summary

Marsden Jacob Associates (Marsden Jacob), working with CMT Solutions, was engaged by the Australian Competition and Consumer Commission (ACCC) to review the Australian Rail Track Corporation's (ARTC) proposed depreciated optimised replacement cost (DORC) valuation of the Gap to Turrawan Segment of the Hunter Valley rail network. The ARTC's proposed valuation was prepared by Evans & Peck.

Proposed DORC Valuation for the Gap to Turrawan Segments

The proposed DORC valuation for the Gap to Turrawan Segments is $325,412,165 (Table ES1).

Table ES1: Summary of DORC by component

Asset Description	DORC	% of total DORC
Track Grade / Earthworks	$113,886,394	35.0%
Signalling Equipment	$108,959,006	33.5%
Sleepers	$33,751,500	10.4%
Bridges	$23,509,414	7.2%
Ballast	$15,104,501	4.6%
Rail	$14,417,067	4.4%
Culverts	$6,283,947	1.9%
Level Crossing	$3,640,929	1.1%
Fencing	$1,912,134	0.6%
Glued Insulated Joints	$1,133,328	0.3%
Turnouts	$989,223	0.3%
Miscellaneous Structures	$949,626	0.3%
Network control centre	$516,750	0.2%
Lubrication	$293,709	0.1%
Telecommunications	$64,638	0.0%
TOTAL	**$325,412,165**	**100.0%**

Source: MJA analysis of Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Note: Totals may not add due to rounding.

Key Findings

The DORC valuation would be reasonable if a range of issues are resolved

We find that the DORC valuation would be reasonable if a range of issues are resolved (Table ES2). We have estimated that addressing these issues decreases the DORC value by between $14.0 and $25.8 million. This represents between 4.3% and 7.9% of the total DORC value of $325.4 million.

However, we note that this estimated impact does not include two issues related to what is included in the DORC valuation. These two issues (under the "Assets included in the DORC valuation" part of Table ES2) are likely to have a material impact if implemented as part of the DORC valuation. We have not valued these two issues because they are outside the scope of our project brief. These two issues are:

- There is a case for including in the DORC the maintenance and operating cost savings associated with modern technology assets. If this is included in the DORC valuation, the DORC value is expected to decrease.
- There is a question as to whether it is appropriate for the costs of financing construction to be included in the DORC valuation. We note that including the costs of financing construction in the DORC valuation would act to increase the DORC value. It is our view that the inclusion of financing costs must be based on careful consideration of a range of matters, including whether construction costs already include an allowance for capitalised interest.

Additionally, our estimate of the value of the impact of resolving the issues we have raised should be considered in the context in which we have undertaken our review. This is because while some of the issues identified are beyond dispute (e.g. model inconsistencies), there are other issues that are not readily illustrated in this report with supporting evidence. Moreover, in cases where a range of values exists or there is limited information from published sources, the figures used in this report have been drawn from the professional experience of CMT Solutions who have previously worked on similar projects – many of which involved the use of confidential data. This confidential data has been used in good faith.

We further note that although the track grade/earthwork costs are likely to be reasonable based on available benchmarks, it is difficult to obtain comparable cost data because there is limited recent history of this type of construction along the east coast of Australia for heavy haul railways.

Table ES2 summarises the results of our analysis for four key elements of the review, namely:

- consistency with standard DORC methodologies;
- assets included in valuation;
- optimisation; and
- DORC calculations.

We have provided more details on the "DORC calculation" aspect of our review in Table ES3[1]. The reader should note that our review of the DORC calculation focused on the six major asset components of the DORC valuation, as presented by Evans & Peck in their report. The six major asset components are: ballast; bridges; rail; signalling equipment; sleepers; and track grade. These six components make up more than 95% of the DORC valuation.

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1 The total DORC value impact in Table ES3 matches the value for the "DORC calculation" in Table E2.

Table ES2: Summary of key findings

Area of examination	Our findings	Estimated impact of our findings on DORC value
Consistency with standard DORC methodologies	The high level structure of Evans & Peck's DORC methodology is reasonable because it is broadly consistent with standard DORC methodologies and with the NSW Government guidelines for this type of valuation.	Not applicable
Assets included in the DORC valuation *Are the appropriate assets included in the valuation?*	The assets included in the valuation are reasonable subject to the following: ▪ between 4 and 12 of the passing loops/sidings should potentially be excluded because of their use by non-coal traffic, which would reduce the DORC by between \$3.4 and \$8.3 million[2]; ▪ there is a case for including the future maintenance and operating costs savings that result from a modern equivalent asset (incorporating optimal design and modern technologies); and ▪ There is a question as to whether it is appropriate for the costs of financing construction to be included in the DORC valuation.	-\$3.4 to -8.3 million *(note we have not valued the impact on maintenance and operating costs or including the financing costs of construction)*
Optimisation *Are the configuration, size and scope of the rail segment optimal for the current or expected demand?*	The assumptions made by Evans & Peck relating to the size and configuration of the rail segment are reasonable subject to some additional examination of passing loops. We believe it is reasonable because from a coal only perspective because: ▪ there is some evidence that demand for the rail segment (by coal trains) is not exceeding network capacity; and ▪ the evaluation of the net benefits of moving to a higher axle load on each wagon is still in progress. However, a more detailed examination is required to assess whether the number of passing loops for coal operations is reasonable. ARTC has provided some early justification for this infrastructure, but we believe it merits more detailed consideration.	Not applicable
DORC calculations *Are the DORC detailed assumptions and calculations reasonable for the six major asset components?*	Our examination of the six major asset components revealed that the assumptions and calculations were reasonable subject to some specific issues being addressed. The combined effect of adjusting for these issues is to decrease the DORC value by between \$10.6 and \$17.5 million. More details on these issues and their impact on the DORC valuation are contained in Table ES3.	-\$10.6 to -\$17.5 million
TOTAL IMPACT ON DORC VALUE *(note this does not include the impact on maintenance and operating costs or including the financing costs of construction)*		**-\$14.0 to -\$25.8 million**

2 We note that during our review the ARTC indicated that the type of sleepers and rail assumed by Evans & Peck for some passing loops and sidings was not consistent with the actual asset in place. Therefore, appropriate adjustments should be made in the DORC valuation for those passing loops and sidings that are not excluded from the valuation.

Table ES3: DORC calculation issues – additional supporting information

Issue identified	Impact on DORC valuation	Estimated impact of our findings on DORC value
The total cost for some components are higher than comparable costs	We estimate that the DORC value would be reduced by between $9.5 and $16.4 million taking into account our cost comparisons of similar engineering projects. This reduced value derives from ballast, sleepers, rail and signalling costs.	-$9.5 to -$16.4 million
The remaining life of a small number of assets is not reasonable	We estimate that the DORC value would be adjusted downwards by $6.1 million by altering some of the remaining asset lives: ▪ the remaining lives of bridges built in 1909 are likely to have a remaining life of at least 5 years. If we make this adjustment, we estimate this increases the DORC value by $1.15 million; ▪ the remaining life of all signalling assets should be no more than 30 years. If we make this adjustment, we estimate this decreases the DORC value by $7.15 million; and ▪ the remaining life of sections of track that are timber (3 in every 4 sleepers) and steel (1 in every 4) should be adjusted to allow for the remaining life of the timber sleepers. If we make this adjustment, we estimate this decreases the DORC value by $0.07 million.	-$6.1 million
There are some inconsistencies in the DORC calculations	We estimate that the DORC value would be adjusted upwards by $5.0 million by resolving some model inconsistencies: ▪ the full cost of the 47kg rail has not been included in the model. If we make this adjustment, we estimate this increases the DORC value by $0.54 million; ▪ there is a misspecification of one section of track as being timber instead of a concrete sleeper for the purposes of adjusting for useful life. If we make this adjustment, we estimate this increases the DORC value by $8.09 million; and ▪ ballast costs have been double counted for one section of the rail segment. If we make this adjustment, we estimate this decreases the DORC value by $3.66 million.	+$5.0 million
TOTAL IMPACT ON DORC VALUE (noting that this is only a subset of the total value estimated in Table ES2)		**-$10.6 to -$17.5 million**

There are some limitations to our review

We note that in undertaking this review we have focused on issues that materially impact on the DORC valuation. In particular, we have focused on the six asset components that contribute more than 95% of the DORC value and through examining the key components of Evans & Peck's spread-sheets that were provided to us.

We further note that our assessment is purely desktop based and there was no visual or other type of inspections of the assets. Rather we have relied upon data that we understand has come from ARTCs transactional systems as well as inspection reports undertaken by the ARTC or their consultants.

Project Scope

Marsden Jacob and CMT Solutions were asked by the ACCC to examine the DORC valuation proposed by the ARTC (and as prepared by Evans & Peck) and review the reasonableness of the:

- information sources used to estimate the DORC value of the Gap to Turrawan segments; and
- assumptions and methodology used to estimate the DORC value of the Gap to Turrawan segments.

Additionally, the ACCC asked us ensure that our review:

- examine the assumption that the DORC is valued under a 'brownfields' assumption and whether this is different to a 'greenfields' assumption;
- investigate whether the network control costs are appropriate and not double counted in other parts of rail track pricing;
- assess whether the mark-ups that have been assumed in the DORC calculations are reasonable;
- examine whether the optimisation assumptions appropriately include consideration of current and future demand for rail track services; and
- investigate whether the operating and maintenance costs savings resulting from modern technology should be included in the DORC.

1. Introduction

1.1 About this report

Marsden Jacob Associates (Marsden Jacob), working with CMT Solutions, was engaged by the Australian Competition and Consumer Commission (ACCC) to review the Australian Rail Track Corporation's (ARTC) proposed depreciated optimised replacement cost (DORC) valuation of the Gap to Turrawan Segment of the Hunter Valley rail network.

This report details the findings of our review.

1.2 Background

On 29 June 2011, the ACCC approved ARTC's Hunter Valley Coal Network Access Undertaking (HVCNAU) and a variation was accepted on 17 October 2012[3]. The HVCNAU implements a revenue cap based on the economic cost of providing services. This constrains the revenues ARTC may receive from access charges. Economic cost of providing services includes a return earned on assets and therefore requires a regulatory asset value be ascribed to all relevant assets for inclusion in the regulatory asset base.

The HVCNAU provides for the negotiation of access to the Hunter Valley Rail Network operated by ARTC in New South Wales. ARTC leases the Hunter Valley Rail Network from the New South Wales government under a 60 year lease granted on 5 September 2004.

On 1 July 2011, the Gap to Turrawan Segments came under ARTC's management when the ARTC incorporated the Northern line from Gap to Boggabilla into its Hunter Valley lease.

On 28 June 2013, ARTC submitted to the ACCC a proposed variation application to extend the coverage of its HVCNAU to include the Gap to Turrawan Segments of the Hunter Valley rail network (the Proposed Variation). The Proposed Variation includes a depreciated optimised replacement cost (DORC) valuation proposal for the Gap to Turrawan Segments. The DORC valuation was prepared by Evans & Peck.

In July 2013, the ACCC released a consultation paper titled "Australian Rail Track Corporation's proposed variation to the HVCNAU to include the Gap to Turrawan Segments". In this report the ACCC stated that the ARTC has put forward a DORC valuation for this section of track based on a report prepared by Evans & Peck.

The proposed DORC valuation for the Gap to Turrawan Segments is $325,412,165 (see Table 1). The Evans & Peck DORC valuation methodology is based on the Australian Accounting Standards Board 'Property, Plant and Equipment' (AASB 116) and NSW Treasury Policy and Guidelines paper 'Valuation of Physical Non-Current Assets at Fair Value' (TPP 07) standards.

[3] http://www.accc.gov.au/regulated-infrastructure/rail/artc-hunter-valley-access-undertaking, accessed 28th November 2013.

Table 1: Summary of DORC by component

Asset Description	DORC	% of total DORC
Track Grade / Earthworks	$113,886,394	35.0%
Signalling Equipment	$108,959,006	33.5%
Sleepers	$33,751,500	10.4%
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Turnouts	$989,223	0.3%
Miscellaneous Structures	$949,626	0.3%
Network control centre	$516,750	0.2%
Lubrication	$293,709	0.1%
Telecommunications	$64,638	0.0%
TOTAL	**$325,412,165**	**100.0%**

Source: MJA analysis of Evans & Peck (2013) and spread sheet provided by Evans & Peck.

1.3 What we were asked to do

In undertaking this project, we were asked by the ACCC to examine the DORC valuation proposed by the ARTC (and as prepared by Evans & Peck) and review the reasonableness of the:

- information sources used to estimate the DORC value of the Gap to Turrawan segments; and
- assumptions and methodology used to estimate the DORC value of the Gap to Turrawan segments.

Additionally, the ACCC asked us to ensure that our review:

- examines the assumption that the DORC is valued under a ‘brownfields’ assumption and whether this is different to a ‘greenfields’ assumption;
- investigates whether the network control costs are appropriate and not double counted in other parts of rail track pricing;
- assesses whether the mark-ups that have been assumed in the DORC calculations are reasonable;
- examines whether the optimisation assumptions appropriately include consideration of current and future demand for rail track services; and
- investigates whether the operating and maintenance costs savings resulting from modern technology should be included in the DORC.

1.4 Project approach and methodology

1.4.1 Key review components

Our approach to reviewing the DORC valuation prepared by Evans & Peck is multi-faceted. The key components of our review are outlined in Table 2. In general terms, we have:

- reviewed the Evans & Peck valuation report[4];
- examined the spread-sheets that were used to estimate the DORC by Evans & Peck;
- examined issues further, where appropriate, by asking a series of questions to the ARTC relating to the assessment by Evans & Peck;
- reviewed previous valuation reports of rail track assets in New South Wales, which were provided by the ACCC;
- drawn upon the professional engineering knowledge and prior experience of CMT Solutions; and
- sourced appropriate published and confidential benchmarks from other valuations where appropriate.

Table 2: Approach to review

Key review components	Explanation
Consistency with standard DORC methodologies	▪ Assess the consistency of Evans & Peck's approach with standard DORC methodologies.
Assets included in valuation	▪ Assess whether the Evans & Peck report has reasonably included all of the appropriate assets in their valuation.
Optimisation	▪ Investigate the process that has been undertaken to develop the optimised system.
DORC calculation	▪ Examine Evans & Peck's detailed calculations used to develop the DORC valuation. We have focused this examination on the six major components of the DORC calculation.

1.4.2 Key assumptions

In undertaking this review, we have assumed the:

- DORC valuation is for 1 January 2013. This is the basis under which Evans & Peck has developed its DORC valuation[5]; and
- DORC valuation is to be undertaken on a "stand-alone basis". The valuation assumes that the assets are being built only for the transportation of coal.

1.4.3 Scope of the review

To ensure the review focused on issues that materially impact on the DORC valuation we have focused our examination of:

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4 Evans & Peck (2013).

5 Evans & Peck (2013), page 9.

- the DORC calculations (chapter 4) on six asset components that contribute more than 95% of the DORC value. These components are track grade, signalling equipment, sleepers, bridges, ballast and rail (see Table 1). This approach has been taken since we have assumed that assets within the 5% are unlikely to be material to the overall DORC valuation; and
- Evans & Peck's spread-sheet (chapter 4) on the key parts of the calculations. We have not audited every cell within the spread-sheets.

1.5 Structure of this report

The remainder of the report consists of the following chapters:

- Chapter 2: Consistency with standard DORC methodologies;
- Chapter 3: Assets included in the DORC valuation;
- Chapter 4: Optimisation;
- Chapter 5: DORC calculation; and
- Annex A: References

2. Consistency with standard DORC methodologies

This Chapter examines the consistency of Evans & Peck's approach with standard DORC methodologies.

2.1 What is a DORC valuation?

In simple terms, the DORC valuation is the replacement cost of an optimised system less accumulated depreciation.

In the absence of a competitive market, the DORC methodology is typically applied to value assets because it is:

- consistent with the price charged by an efficient new entrant into an industry; or
- consistent with the price that a firm with a certain service requirement would pay for existing assets in preference to replicating the assets.

DORC is the maximum value consistent with avoiding economically inefficient system wide bypass. Essentially, the DORC value should be just low enough that a potential investor would rather buy and use the old assets at the DORC value rather than build a new railway.

There are several generic steps that are typically applied in estimating the DORC value for a segment of rail track (Table 3). These generic steps are aligned with the approach recommended by the NSW Government (2013)[6].

At this point it is important to define some key terminology:

- Modern engineering equivalent replacement asset (MEERA): A replacement asset using modern technology is often referred to as the 'modern engineering equivalent replacement asset' (or MEERA). If the MEERA is fully optimised it can be referred to as the "optimised replacement cost" (or ORC); and
- The DORC is referred to in the HVCNAU as the regulatory asset base (RAB).

The ACCC has not engaged Marsden Jacob to review the depreciation methodology that is subsequently applied to the DORC valuation. However, we note that in developing the DORC value Evans & Peck have implicitly used a straight-line depreciation approach. This method aligns with the HVCNAU[7].

6 NSW Government (2012).

7 ARTC (2012), clause 4.7.

Table 3: Process steps for estimating DORC

DORC calculation steps	Explanation
1. Determine what is being valued	▪ Identify the scope of assets that are being valued.
2. Determine optimal system	▪ Determine the optimal configuration, size and scope of the assets to meet the current or expected demand. ▪ Determine: – the optimal design of the system components; and – optimal modern technologies used to construct the system components.
3. Estimate replacement cost of optimised system (“Optimised replacement cost” – “ORC”)	▪ Estimate the replacement cost of the optimised system as defined above. ▪ The replacement cost of the optimised system[8]: – uses modern technology; – should only deliver the same economic benefits as the current assets; – adjusts for over-design, overcapacity and redundant components; – adjusts for differences in the quality and quantity of outputs (of the optimised system compared to the current system); and – adjusts for differences in operating costs (of the optimised system compared to the current system).
4. Estimate cumulative depreciation	▪ This involves estimating the life consumed of the existing asset.
5. Estimate the depreciated optimised replacement cost (“DORC”)	▪ This equals the replacement cost of the optimised system less cumulative depreciation.

2.2 How has the DORC been calculated in this valuation?

The Evans & Peck DORC methodology is outlined on page 14 of their report[9]. This methodology is broadly consistent with the generic DORC methodology we described in Table 3. Therefore, we believe that the general high level structure of the DORC methodology undertaken by Evans & Peck is reasonable.

8 This draws on NSW Government (2012), page 3. In particular, the TPP 07-01 states that “Replacement cost is measured by reference to the lowest cost of replacing the economic benefits with a technologically modern equivalent optimised asset, having regard to differences in the quality and quantity of outputs and operating costs, and adjusting for over-design, overcapacity and redundant components”.

9 Evans & Peck (2013), page 14.

We note that the approach used by Evans & Peck to calculate depreciation differs somewhat to previous valuations that have been undertaken. This is because differences in the useful life of the current asset compared to the MEERA are undertaken as part of the ORC valuation under the Evans & Peck approach, while other valuations typically account for it in the depreciation calculation. The impact on the DORC is the same regardless of where the adjustment takes place. However, care needs to be taken when comparing the consumed life (%) in the Evans & Peck report to other valuations.

Recognising this methodological difference, in this report we will refer to the optimised replacement cost prior to the adjustment for useful asset life as the "optimised cost (pre adjustment for useful lives)". This includes all forms of optimisation with the exception of the adjustment for useful life.

Additionally, Evans & Peck have estimated an optimised replacement cost after the adjustment for useful life. We will refer to this as the ORC**,** which is consistent with the approach taken by Evans & Peck.

See Chapter 5 for a detailed review of the DORC valuation calculation.

3. Assets included in the DORC valuation

This Chapter examines whether the Evans & Peck report has included all of the appropriate assets in the DORC valuation.

3.1 What assets were included in valuation?

A range of assets have been included in the valuation of the segment from Gap to Turrawan. The Evans & Peck DORC valuation is based on cost estimates for the following assets[10]:

- Ballast;
- Bridges;
- Culverts;
- Fencing;
- Glued insulated joints;
- Track grade (i.e. earthworks);
- Lubrication;
- Level crossings;
- Miscellaneous structures;
- Network control centre;
- Rail;
- Signalling equipment;
- Sleepers;
- Telecommunications; and
- Turnouts.

To inform our assessment of whether all of the appropriate assets have been included in the DORC valuation the following issues have been examined:

- brownfields versus greenfields assumption;
- exclusion of land from the valuation;
- inclusion of all relevant assets owned by ARTC;
- cost of financing construction;
- impact of MEERA on operating and maintenance costs; and
- inclusion of the network control centre costs.

These issues are discussed in more detail below.

10 Evans & Peck (2013), page 6.

3.2 Brownfields assumption

Greenfields versus brownfields assumption

There are two land-use assumptions that can be made when estimating a DORC value: brownfields versus greenfields valuation.

Greenfields valuation: Under a greenfields valuation, a new rail segment is developed assuming that no development has occurred in the area including roads, water, electricity or communities. Therefore, a theoretical track could be laid across an area of land that is free of any development.

Brownfields valuation: Under a brownfields valuation, a new rail segment is developed assuming that construction occurs around existing infrastructure, including those relating to above rail development, roads and communities. Therefore, a brownfields valuation optimises the route of the segment taking into account existing developments. Moreover, a brownfields valuation is limited in its ability to optimise the route path in the way that a greenfields valuation is able to do so.

Taking into account the differences between greenfields and brownfields, we have identified a number of differences in the costs that may result from the different approaches (Table 4). The overall impact of these cost differences on a DORC valuation will depend on a range of issues such as: route optimisation under both approaches; out of hours construction requirements under the brownfields approach; and planning and development requirements under both approaches.

Table 4: Comparison of greenfields and brownfields

Characteristic	Comparison
Land costs	▪ The land costs included in the DORC valuation may be different for greenfields and brownfields because they may assume different routes. For example, a brownfields route might be longer than a greenfields route because it has to work around existing developments.
Earthworks and other formation costs	▪ The earthworks and other formation costs may be different for greenfields and brownfields because they may assume different routes (as per above). A brownfields approach requires the route to integrate with existing developments.
Traffic costs	▪ The brownfields construction costs may be higher than greenfields because track works may have to be undertaken outside normal hours since there is existing traffic on the segment. This might result in additional overtime costs and delays to above rail operations. In contrast, under a greenfields valuation there is no traffic along the segment.
Planning and development costs	▪ A greenfields valuation is likely to require planning and development costs not required under a brownfields valuation, such as: environmental impact assessments, planning for basic utilities, planning and developing access roads, organising electricity supply and allowing for contingency costs (since there may be more uncertainty on the costs of construction along the

Characteristic	Comparison
	segment). In contrast, a brownfields valuation is likely to have costs that are not required under a greenfields valuation, such as planning and development costs associated with integrating with existing infrastructure. ▪ Additionally, a greenfields valuation assumes that basic supporting infrastructure (roads, utilities etc.) are constructed at the same time in a way that complements the new rail line. If this is not the case, there would be additional costs under this approach compared to a brownfields approach.

Evans & Peck assumes brownfields

The Evans & Peck report states that it has applied a brownfields valuation approach[11]. However, in applying this approach they have made the following assumptions:

- land values have been excluded from the DORC. This is discussed in more detail in section 3.3;
- the additional costs due to traffic in Table 4 have been set to zero. Evans & Peck state that this results in a conservative brownfields valuation; and
- it appears that Evans & Peck have assumed that the route used for valuation purposes is the same as the current route.

The exclusion of land and additional costs due to traffic result in the Evans & Peck approach being similar to a greenfields approach. This is because there are no land costs under the brownfields or greenfields approach and the additional traffic costs are zero under both approaches.

However, the Evans & Peck "brownfields" approach may still have differences to a greenfields approach due to differences in earthworks and/or planning and development costs. For instance, they may traverse different routes and a brownfields site will need to take into account of existing developments, whereas a greenfields site will have a range of start-up costs (e.g. environmental approval costs, possible new access roads) not relevant to a brownfields site.

Assessment of Evans & Peck "brownfields" approach

We find that the "brownfields" approach employed by Evans & Peck is reasonable.

In assessing the reasonableness of the approach taken by Evans & Peck, we have examined whether the "brownfields" approach (and with all of its accompanying adjustments) aligns with the first principles of DORC valuation of this nature. We define a first principles approach as one that examines whether Evans & Peck's method aligns with what it would cost for a new entrant to establish a new rail line (the "bypass cost").

Based on first principles, we believe that the approach taken by Evans & Peck is reasonable. In particular, it appears reasonable to exclude additional costs due to traffic since it could be

11 Evans & Peck (2013), page 20.

argued that this is consistent with the cost that a new entrant would face if they constructed a new rail line. This was discussed in Booz Allen Hamilton (2007)[12].

Additionally, it is reasonable to exclude the additional earthworks, planning and development costs resulting from integrating with existing developments because these are likely to be small as the rail segment is located in country areas. This is consistent with the 2007 valuation of ARTC's interstate rail network which states that the impact of community development on replacement costs is largely irrelevant with the exception of urban areas[13].

Finally, we note that the Evans & Peck methodology has similarities to the 2007 DORC valuation of the ARTC's interstate network[14]. Although the 2007 valuation of the interstate network was stated to be a greenfields valuation[15], the approaches are actually quite similar. In particular, the no traffic impact assumption made by Evans & Peck is the same as in the 2007 valuation.

3.3 Exclusion of land from the valuation

Land values have not been included in the Evans & Peck DORC valuation[16]. We note that the Evans & Peck report does not provide a reason for excluding the cost. During our review of the DORC, ARTC advised that they lease the land upon which the track infrastructure sits from the New South Wales Government under an arrangement with a nominal lease fee.

Taking this into consideration, we believe that it is reasonable to exclude land costs from the valuation since if ARTC was to sell the track assets the new owner would theoretically inherit the same arrangements.

3.4 Are all relevant assets included in the DORC valuation?

Overall, we find that all relevant assets are included in the DORC valuation. However, we question whether all of the passing loops and siding should be included in the valuation.

The Evans & Peck report[17] states that their DORC valuation has included 14.7 kilometres of passing loops and sidings specifically associated with the coal infrastructure. This relates to 18 passing loops and sidings. The parts of the rail segment that are specifically included are outlined by Evans & Peck in a map in Appendix 6 of their report. Further information provided by ARTC to us during our review indicates that six of the passing loops are required for coal operations (Burilda, Breeza, Curlewis, Gunnedah Stockyards, Emerald Hill and Boggabri). This equates to approximately 9 kilometres of the 14.7 kilometres.

Of the remaining 5.7 kilometres (which relates to 12 sidings and passing loops), the ARTC has indicated to us that three sidings are used solely by non-coal trains (equating to 0.941 kilometres) and one asset is largely privately maintained and owned (1.495 kilometres). We believe that these four assets should potentially be excluded from the DORC valuation on the

12 Booz Allen Hamilton (2007), Appendix 1.

13 Booz Allen Hamilton (2007), Appendix 1.

14 Booz Allen Hamilton (2007).

15 Booz Allen Hamilton (2007), Appendix 1.

16 Evans & Peck (2013), page 48.

17 Evans & Peck (2013), page 9.

basis that we are undertaking a coal only valuation. Moreover, it is likely that if there was no non-coal traffic on the rail segment these assets would not be required.

For similar reasons, if there was no non-coal traffic on the rail segment it is possible that some or all of other 8 passing loops and sidings (which also form part of the remaining 5.7 kilometres) would not be required. We have been unable to obtain sufficient information from the ARTC during the project on this issue, although the ARTC has indicated that some of these 8 assets are used for coal operations (e.g. for storage of and access to maintenance equipment and assets and to store coal trains off the mainline in order to effect crew change). However, we do note that the length of 6 of the 8 passing loops and sidings is less than 500 metres long which restricts its uses for coal operations.

Therefore, we believe that the DORC value should potentially be adjusted to exclude between 4 and 12 of the assets. This would reduce the DORC by between $3.4 and $8.3 million. This includes adjusting the DORC value of ballast, earthworks, sleepers, rail and signalling.

Finally, we note that the ARTC has not included stations, overbridges or tunnels. This seems reasonable given that the stations are for passenger travel and, based on additional information provided by the ARTC during this review, the overbridges are not included in the DORC valuation since they are not owned by the ARTC. The ARTC have confirmed that no tunnels exist on the segment.

3.5 Cost of financing construction

There is a question as to whether it is appropriate for the costs of financing construction to be included in the DORC valuation. We note that including the costs of financing construction in the DORC valuation would act to increase the DORC value. It is unclear whether the DORC valuation prepared by Evans & Peck includes the cost of financing construction.

The inclusion of the costs of financing construction in the DORC valuation is a complex issue for a range of reasons:

- there does not appear to be a consistent approach taken across other valuations to this issue with some including it and others not including it;
- previous valuations of ARTC's interstate network[18] and the Dartbrook to Gap valuation[19] do not appear to include financing costs; and
- it is critically linked to the construction timeframe, which is not taken into consideration as part of the Evans & Peck DORC valuation process.

It is our view that that the inclusion of financing costs must be based on careful consideration of a range of matters, including whether construction costs already include an allowance for capitalised interest.

18 Booz Allen Hamilton (2007).

19 Booz and Co. (2008).

3.6 Operating and maintenance costs

One of the issues with assuming the replacement of an old asset with a modern equivalent is the impact of modern design and technologies of the asset (i.e. the MEERA) on ongoing operating and maintenance costs.

The HVCNAU[20] provides for track access revenue to be set no higher than the "Economic Cost", which for a particular rail segment includes:

- segment specific costs, which means operating costs the ARTC can directly identify with a segment;
- depreciation of segment specific assets, where the asset value is the DORC value (which is depreciated over time);
- a return on segment specific assets, where the asset value is the DORC value (which is depreciated over time);
- an allocation of non-segment specific costs;
- an allocation of return on non-segment specific assets; and
- costs for additional capacity.

Under this approach, the DORC valuation necessarily reflects the capital costs associated with the MEERA or optimised asset. However, the operating costs (or "segment specific costs") may not necessarily reflect those appropriate to a MEERA. This is because operating costs are based on the existing asset and the existing asset may not be the modern equivalent asset, i.e. uses a design or technology that is not of a modern standard or that is fully optimised.

There are two options within the current pricing framework to ensure consistency between the operating costs set in the Economic Cost formula and the DORC. These are outlined in Table 5.

Table 5: Alternative approaches to allow for different operating costs

Options	Explanation
Option 1: Adjust the initial DORC	The initial DORC is adjusted by the difference in the present value of expected future year operating costs associated with a MEERA asset being installed compared to the present value of expected future operating costs of the existing asset. Under this option, it would logical for differences in operating costs to persist for a time length that reflects the remaining life of the asset as set under the DORC valuation. We note that this approach assumes that the asset is replaced at a future time that reflects the remaining life as set in the DORC valuation.
Option 2: Adjust ongoing operating costs (or "segment specific costs")	The operating costs each year are adjusted as part of the annual ACCC compliance assessment[21]. This adjustment would reflect differences between actual operating costs

[20] ARTC (2012), clause 4.5.

[21] ARTC (2012), clause 4.10.

Options	Explanation
	and the operating costs that would exist under the MEERA asset. Under this option, the differences in operating cost for each year would be based on the MEERA operating cost and existing asset cost (as set in the DORC) and would persist for a time length that reflects the remaining life of the asset as set under the DORC valuation.

The Evans & Peck report does not examine this issue in their report, although we note that ARTC has a preference for Option 2[22]. In our opinion, one of these options should be allowed for in the pricing framework. Otherwise, there will be an internal inconsistency in the pricing framework.

In considering these two options, we have applied a standard assessment framework that we have applied in other sectors (including roads)[23], see Table 6. Based on this analysis, we believe there is a strong case for incorporating the adjustment into the DORC (Option 1) as this is likely to result in a relatively smaller administrative cost and regulatory burden.

We further note that this approach is consistent with the ACCC's 2011 annual compliance assessment which states that "for future valuations, in particular where network segments of a higher economic value are sought to be included in the HVCNAU, the ACCC considers that ARTC ought to undertake a comprehensive DORC assessment, including taking into account cost savings and productivity gains arising from optimisation of the assets" [24].

We have not valued the impact of including in the DORC the impact on ongoing maintenance and operating costs, because valuing this component is outside the scope of the project since it requires detailed examination of maintenance and operating costs.

Table 6: Operating costs - assessment of alternative options

Criteria	Assessment against criteria
Criteria 1: The option promotes appropriate incentives for efficient rail usage ("demand-side efficiency")	▪ There is not likely to be much difference between the two options in terms of demand side efficiency. This is because the impact on charges is largely a timing issue since one option reflects the difference in operating costs up front whereas the other option reflects the difference over time.
Criteria 2: The option promotes efficient funding and investment of rail infrastructure services ("supply-side efficiency")	▪ There is not likely to be much difference between the two options in terms of supply side efficiency. This is because investment going forward is not likely to be influenced by the timing of cash flows associated with either option.
Criteria 3: Under the option, charges are robust, easy to	▪ A key issue is how the administrative cost of estimating the differences in operating costs up front compares to the

22 ARTC (2013c), page 27.

23 MJA (2013).

24 ACCC (2013), page 8.

understand and predictable while not promoting excessive administrative costs and complexity	administrative cost of examining the operating cost differences each year[25]. From an administrative perspective, it may be less costly to estimate the difference up front since there may be some adjustments that need to be made to the calculation (e.g. inflation) each year under option 2.
Criteria 4: Under the option, rail users with similar characteristics are treated equally and individuals bear the costs they impose	▪ We do not perceive a difference between the two options under this criteria because all rail users will receive the same charges.

3.7 Network control centre costs

According to the Evans & Peck report[26], in 2006-07 ARTC undertook a substantial train control consolidation (TCC) project in NSW at total cost of $80 million. These will be referred to as "network control costs". The ARTC has indicated that it allocated $13.175 million of this amount to the Hunter Valley coal network in its annual Hunter Valley compliance submission in 2006-07. Additionally, $12.2 million of this amount was added to the regulatory asset base in 2006-07, with the remaining amount due to be recovered at some time in the future via parts of the Hunter Valley coal network not classified as Pricing Zones 1 and 2.

Subsequently, an amount of $340,000 was included in the 2008 DORC valuation of the Dartbrook to Gap rail segment to allow for an allocation of network control costs. Further, as part of the current Gap to Turrawan valuation, an amount of $690,000 has been included to allow for its allocation of network control costs. We note that this amount relates to the ORC value in the Evans & Peck valuation. The DORC value is $516,750 on the basis that the asset is 25% life consumed.

The placing of these costs in the DORC seems reasonable and it does not appear from the ARTC that these costs are also being recovered in another place as well, such as operating costs. The allocation of costs to the Gap to Turrawan segment is high relative to the Dartbrook to Gap segment. In particular, the allocated cost is more than double ($690,000 compared to $340,000) for a similar length of track. We understand from the ARTC that they are not able to retrieve the calculations for the Dartbrook to Gap segment.

However, we do not believe that any changes to the allocation would materially impact the DORC valuation given that the difference (around $350,000) between the two most recent allocations is only around 0.1% of the total DORC estimated by Evans & Peck and that the ARTC has indicated that volumes in the zone incorporating the Gap to Turrawan segment has increased relative to other zones (which may have led to a higher allocation for this zone when the original allocations were made).

25 For example, as part of the annual ACCC compliance assessment.

26 Evans & Peck (2013), page 46.

3.8 Conclusion

In conclusion, we find that the majority of assets included in the Evans & Peck DORC valuation are reasonable. However, there are three issues that we believe ARTC should consider addressing or further investigating in the DORC valuation:

- there is a case for not all of the passing loops, lanes and sidings being included in the valuation. In particular, we believe that the DORC value should potentially be adjusted to exclude between 4 and 12 of the passing loops/sidings. This would reduce the DORC by between $3.4 and $8.3 million[27];
- there is a case for including in the DORC the future maintenance and operating costs savings that result from the modern equivalent asset (incorporating optimal design and technologies) being applied in the DORC valuation. The case is enhanced if there is a higher administrative burden (and level of complexity) in assessing the cost savings each year relative to a one-off assessment as part of the initial DORC valuation; and
- there is a question as to whether it is appropriate for the costs of financing construction to be included in the DORC valuation.

[27] We note that during our review the ARTC indicated that the type of sleepers and rail assumed by Evans & Peck for some passing loops and sidings was not consistent with the actual asset in place. Therefore, appropriate adjustments should be made in the DORC valuation for those passing loops and sidings that are not excluded from the valuation.

4. Optimisation

This Chapter examines the process that has been undertaken to develop the optimised system.

4.1 Optimisation method and outcomes

Optimisation is a key part of developing the DORC and as previously discussed it involves determining the optimal configuration, size and scope of the asset to meet the current or expected demand.

The Evans & Peck report[28] has examined optimisation by taking into consideration the purpose and capacity of the railway and then developing an appropriate MEERA standard for the specific asset. This is a reasonable approach to examine optimisation and we explore the purpose and capacity estimation processes in more detail below.

4.1.1 Purpose and capacity of the railway

There are two key factors that need to be assessed when considering the optimal size and configuration of the rail segment:

- the utilisation of the network capacity; and
- the optimal track load capacity.

Noticeably, these two factors are not independent since improving the track loading capacity will also improve the ability of the network to handle more trains in a given period. In reviewing these two factors, we note that optimisation has been undertaken using the existing route of the rail segment.

These two factors are examined in more detail below.

Track utilisation

Track utilisation refers to how much of the rail segment's network capacity is being used by coal freight traffic. The Gap to Turrawan rail segment is a single track line supported by a number of passing loops and lanes.

The Evans & Peck report[29] states that design and capacity of the rail segment is appropriate to meet existing peak coal haulage service demand requirements. This is based on analysis undertaken by Evans & Peck which shows that there are large amounts of time when coal does not take up 100% share of traffic on the segment:

- coal consumes 95% -100% of network usage for 8% of the time;
- coal consumes at least 80% of network usage for over 25% of the time (around 2 days per week); and
- coal only consumes 55% of network usage for 50% of the time.

From this analysis, Evans & Peck suggest that "capacity of the network inherent in the existing infrastructure alignment and configuration (other than those parts not utilised by coal) is

28 Evans & Peck (2013), page 23.

29 Evans & Peck (2013), page 25.

appropriate to meet existing peak coal haulage service demand requirements"[30]. However, we note that the analysis undertaken by Evans & Peck reflects the relative share of usage by coal trains compared to non-coal trains. Therefore, it is not a true reflection of how much of network capacity (in terms of maximum possible trains per day) is used by coal trains – although it could be an indicator of potential network capacity issues.

One of the key reasons for assessing network capacity is to determine whether there is an optimal number of passing loops for coal traffic. The ARTC has provided us with additional information about the appropriateness of the six passing loops that they have indicated are for coal operations. This additional information indicates that while one less passing loop for coal operations would appear sufficient, there would be practical considerations which would make this unworkable such as crewing and above rail fleet availability.

ARTCs explanation on this issue appears reasonable to us. However, we note that a more detailed examination would be required to validate this explanation. This has not been possible as ARTC was not able to provide us with additional information on this issue. In any case, the impact on the DORC value of one less passing loop is not likely to be large in the context of the overall DORC valuation since we estimate that one less passing loop for coal operations would reduce the DORC by at around $1.5 million.

However, taking into account the utilisation analysis undertaken by Evans & Peck and the additional passing loop information provided by the ARTC, it is reasonable to conclude that there is some evidence that demand for the rail segment (by coal trains) is not exceeding network capacity.

Another issue that should be considered in assessing the optimality of the rail segment is to what extent future demand for rail track is taken into account in setting the DORC. The data analysed by Evans & Peck is based on current network demand. In assessing the demand requirements for use of the track, the Evans & Peck report states that "future forecasts for increased tonnages and axle loads are not relevant for this valuation which is based on existing asset performance and capacity"[31]. Therefore, the Evans & Peck approach does not take into account future increases in demand.

In terms of the overarching pricing framework that underpins the HVCNAU, it is obviously important that future prices reflect future changes in capital expenditure associated with improvements to network capacity. The current pricing framework, as outlined in the HVCNAU, indicates that RAB values in future years are equal to the previous year RAB value plus any increases in capital expenditure less depreciation and asset write-downs. Therefore, future capital expenditure which increases the capacity of the network will appropriately flow through to the RAB in future years. Consequently, the initial DORC (which is the subject of the Evans & Peck valuation) does not need to allow for future increases in demand.

The way that the DORC adjusts going forward is important since demand is likely to increase in the short to medium term and this will lead to additional capital expenditure. For example, ARTC (2013a) states that for the Gunnedah Basin line, which extends from the junction for the Narrabri mine to Muswellbrook (and which contains within it the Gap to Turrawan segment), "coal demand on the line has already increased significantly and is forecast to continue to increase very rapidly"[32]. Of particular note is the new Maules Creek coal mine which is planned

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30 Evans & Peck (2013), page 25.

31 Evans & Peck (2013), page 23

32 ARTC (2013a), page 15.

to have its first coal sales in the second half of 2014[33]. According to ARTC (2013a), there are a number of ways in which it plans to allow for the additional required capacity (e.g. new passing loops, passing loop extensions, new passing lanes).

However, although the initial DORC does not theoretically have to account for future increases in demand, the initial DORC should at least ensure that current assets are able to handle an increase in demand in the next two to three years, taking into consideration the time taken to construct new assets. This appears to be the case based on Evans & Peck's utilisation analysis. However, we note that the DORC valuation relates only to coal assets. While this is appropriate for this valuation, it does complicate analysis of rail capacity issues since current network capacity issues are also a reflection of demand for rail track by passenger trains and non-coal freight trains (e.g. grain, cotton and flour products).

Load capacity

Load capacity refers to how much can be loaded onto a coal train set travelling along the rail segment. A key aspect of this is how much can be loaded onto each axle on a wagon.

The Evans & Peck report[34] has assumed for the purposes of the DORC valuation that the track on the rail segment is able to handle a maximum of 25 tonne axle load on a wagon. We believe it is reasonable at this point in time to use 25 tonne axle loads for the DORC valuation given that:

- this is the current track standard – ARTC (2013b)[35]; and
- it is difficult for us to evaluate whether the optimal axle load is 25 or 30 tonnes without undertaking a detailed supply chain study of the benefits and costs of increasing axle loads. We further note that ARTC has indicated to us they are currently working with coal miners that use the Gap to Turrawan rail segment to assess whether it is viable to increase the axle load from 25 tonnes to 30 tonnes.

4.1.2 MEERA standard and design and technologies of system components

The MEERA standard and design and technologies of the system components is examined in Chapter 5 for six of the major components of the DORC valuation.

4.2 Conclusion

Based on our review of the Evans & Peck DORC valuation report and subsequent information provided by the ARTC, we find that the assumptions made by Evans & Peck relating to the size and configuration of the rail segment are reasonable subject to some additional examination of passing loops.

We believe it is reasonable because from a coal only perspective there is some evidence that demand for the rail segment (by coal trains) is not exceeding network capacity and the evaluation of the net benefits of moving to a higher axle load on each wagon is still in progress.

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33 http://www.whitehavencoal.com.au/operations/maules_creek.cfm, accessed 25th October 2013.

34 Evans & Peck (2013), page 25.

35 ARTC (2013b), Route Access Standard HHN Section Pages, H3 - Werris Creek to Narrabri, page 4.

However, a more detailed examination is required to assess whether the number of passing loops for coal operations is reasonable. ARTC has provided some early justification for this infrastructure, but we believe it merits more detailed consideration.

5. Review of the DORC calculation

This Chapter examines the Evans & Pecks detailed calculations used to develop the DORC valuation. This includes consideration of benchmark costs.

5.1 Major components of DORC

This review focuses on the calculations underpinning the six major asset components of the DORC valuations, as presented by Evans & Peck in their report:

- ballast;
- bridges;
- rail;
- signalling equipment;
- sleepers; and
- track grade.

These assets were selected as they make up 95% of the total DORC value of $325,412,165 (Table 7).

Table 7: Summary of DORC by asset component

Asset Description	DORC	% of total	Cumulative total (%)
Track Grade	$113,886,394	35.0%	35.0%
Signalling Equipment	$108,959,006	33.5%	68.5%
Sleepers	$33,751,500	10.4%	78.9%
Bridges	$23,509,414	7.2%	86.1%
Ballast	$15,104,501	4.6%	90.7%
Rail	$14,417,067	4.4%	95.1%
Culverts	$6,283,947	1.9%	97.1%
Level Crossing	$3,640,929	1.1%	98.2%
Fencing	$1,912,134	0.6%	98.8%
Glued Insulated Joints	$1,133,328	0.3%	99.1%
Turnouts	$989,223	0.3%	99.4%
Miscellaneous Structures	$949,626	0.3%	99.7%
Network control centre	$516,750	0.2%	99.9%
Lubrication	$293,709	0.1%	100.0%
Telecommunications	$64,638	0.0%	100.0%
TOTAL	$325,412,165	100%	100.0%

Source: MJA analysis of Evans & Peck (2013) and spread-sheet provided by Evans & Peck.

Note: Totals may not add due to rounding.

5.2 Conclusions from the review of six major assets

Marsden Jacob's review of the six major asset components finds that the DORC calculations are reasonable subject to a range of issues being addressed (Table 8). The estimated impact of addressing these issues is between $10.6 and $17.5 million. Further detail on the estimation of the issues contained in Table 8 is presented in the following sections (sections 5.4 to 5.9). Additionally, further detail on the reasonableness of the optimised costs (pre adjustment for useful lives) is provided in section 5.10. We also examine whether mine lives are relevant to the depreciation assumptions in section 5.11.

Table 8: DORC calculation issues identified

Issue identified	Impact on DORC valuation	Estimated impact on DORC valuation
The total cost for some components are higher than comparable costs	We estimate that the DORC value would be reduced by between $9.5 and $16.4 million taking into account our cost comparisons of similar engineering projects. This reduced value derives from ballast, sleepers, rail and signalling costs.	-$9.5 to -$16.4 million
The remaining life of a small number of assets is not reasonable	We estimate that the DORC value would be adjusted downwards by $6.1 million by altering some of the remaining asset lives: ▪ the remaining lives of bridges built in 1909 are likely to have a remaining life of at least 5 years. If we make this adjustment, we estimate this increases the DORC value by $1.15 million; ▪ the remaining life of all signalling assets should be no more than 30 years. If we make this adjustment, we estimate this decreases the DORC value by $7.15 million; and ▪ the remaining life of sections of track that are timber (3 in every 4 sleepers) and steel (1 in every 4) should be adjusted to allow for the remaining life of the timber sleepers. If we make this adjustment, we estimate this decreases the DORC value by $0.07 million.	-$6.1 million
There are some inconsistencies in the DORC calculations	We estimate that the DORC value would be adjusted upwards by $5.0 million by resolving some model inconsistencies: ▪ the full cost of the 47kg rail has not been included in the model. If we make this adjustment, we estimate this increases the DORC value by $0.54 million; ▪ there is a misspecification of one section of track as being timber instead of a concrete sleeper for the purposes of adjusting for useful life. If we make this adjustment, we estimate this increases the DORC value by $8.09 million; and ▪ ballast costs have been double counted for one section of the rail segment. If we make this	+$5.0 million

Issue identified	Impact on DORC valuation	Estimated impact on DORC valuation
	adjustment, we estimate this decreases the DORC value by \$3.66 million.	
TOTAL IMPACT ON DORC VALUE (noting that this is only a subset of the total value we have estimated – refer to Table ES2 for total value)		**-\$10.6 to -\$17.5 million**

5.3 Structure of the review of the DORC calculations

Our review of the DORC calculations undertaken by Evans & Peck for each of the six major asset components is structured as follows:

- understanding of the asset for valuation purposes;
- reasonableness of optimal design and technologies;
- reasonableness of the optimised cost (pre adjustment for useful lives);
- reasonableness of the ORC;
- reasonableness of the depreciation assumptions; and
- inconsistencies in the calculations.

5.4 Ballast

5.4.1 MJA assessment of the reasonableness of the ballast DORC component

Ballast assets are valued at \$15,104,501 in the Evans & Peck DORC valuation.

We find that the DORC calculations relating to ballast are reasonable subject to a range of issues being addressed (Table 9). More detail is provided after Table 9 to support our assessment. The supporting information after the table only contains information on areas of examination that requires more detailed explanation.

Table 9: Ballast assessment

Area of examination	Our assessment
Understanding of the asset for valuation purposes	▪ We consider that Evans & Peck's assumptions on ballast depth and width is reasonable based on information provided by ARTC relating to ballast tests undertaken by ARTC. More detail is outlined in section 5.4.2.
Reasonableness of optimal design and technologies	▪ We consider Evans & Peck's definition of MEERA for ballast (i.e. ballast depth of 300 mm and shoulder width of 300 mm on each side) is reasonable. In particular, we note that ballast depth of 300 mm is consistent with the Hunter (2011) guidelines which apply to heavy haul track[36] and ballast shoulder width of 300 mm is consistent with the ARTCs stated code of practice[37] for heavy haul track. Additionally, the

36 ARTC (2011), page 6.

37 http://extranet.artc.com.au/eng_track-civil_procedure.html, accessed 15th October 2013.

Area of examination		Our assessment
		ballast depth is consistent with comparable valuations of heavy haul rail track[38].
Reasonableness of the optimised cost (pre adjustment for useful lives)	▪	We consider that the optimised cost (pre adjustment for useful lives) for the combined cost of ballast, sleepers and rail is slightly higher than the cost of comparable engineering projects. This is discussed in more detail in section 5.10.
Reasonableness of the ORC	▪	Evans & Peck applied an optimisation factor of 1 for ballast in its DORC valuation. We consider this reasonable as new ballast is typically of a similar useful life to existing track ballast.
Reasonableness of the depreciation assumptions.	▪	We consider that Evans & Peck's assumption on the proportion of life consumed appears reasonable based on the historical utilisation of the rail segment and timing of the planned next major maintenance. More detail is outlined in section 5.4.3.
Inconsistencies in the calculations	▪	No inconsistencies were identified in the DORC calculations.

5.4.2 Understanding of the ballast

We consider Evans & Peck's ballast depth and width assumptions are reasonable considering that information provided by ARTC indicates that testing has revealed that the ballast depths are consistent with the 300 mm assumed depth. These tests consisted of ground penetrating radar (GPR) data and digging test pits along the rail segment. Additionally, ARTC have indicated that ballast shoulder width has been validated by testing.

5.4.3 Reasonableness of depreciation assumptions

There are two key assumptions used by Evans & Peck to estimate the proportion of the asset that is life consumed: useful life and asset age.

The useful life of ballast is assumed to be 40 years in the Evans & Peck model (Table 11). The useful life of ballast is influenced by a number of factors, including: type of materials; climatic conditions; quality of construction; type of traffic; and a range of other factors. In particular, "ballast fouling" can significantly reduce ballast life by small coal particles falling from incorrectly loaded coal wagons.

Since the useful life of ballast will depend on a number of factors, we are not surprised by different values being represented in previous reports. For example, Price Waterhouse Coopers (PWC)[39] provided figures ranging from 25 years to 60 years. The 25 year life estimate is likely to be relevant in an area with high coal traffic which has a lot of ballast fouling reducing its useful life.

In terms of age of the ballast assets, Evans & Peck have determined the age of the existing asset based on consultation with ARTC. During the project we put additional questions to ARTC about the age of the asset. This revealed that there were no historical records available to support the age of the assets, apart from anecdotal evidence from ARTC staff provided to Evans & Peck. We would have preferred to have cited better information to support the asset age.

38 Booz and Co (2008), page 10.

39 PWC (2008), page 21

However, we understand that 60% of these assets were installed over thirty years ago and that it is reasonable to estimate the age of the assets using the knowledge of ARTC staff and consideration of previous valuations.

The combination of useful life and age of asset results in a remaining life of almost all of the ballast of 8 years (Table 11). As we have illustrated, this remaining life is reliant on estimates of useful life and asset age for which there is a range of possible values given the understanding of the useful life and age of the asset.

However, we do believe that the remaining life for ballast of 8 years is reasonable on the basis that:

- the track asset has not been historically fully utilised (as indicated by Evans & Peck[40]). This suggests that a 40 year useful life is reasonable; and
- the proportion consumed is approximately 80% for almost all of the ballast. This seems reasonable given that large maintenance expenditures are planned for the ballast in 5 to 9 years time (based on information provided to us by ARTC) for an asset that has a useful life of 40 years.
- additional information provided by the ARTC during the project indicated that, while some ballast along the rail segment does not appear to be in good condition on average, 8 years appears reasonable.

5.4.4 Summary of Evans & Peck DORC calculation for ballast

This section provides a summary of the ballast information in the Evans & Peck report that we examined as part of our review.

A summary of the Evans & Peck DORC calculation for ballast is shown in Table 10.

Table 10: Summary of DORC calculation for ballast

Component	Value
MEERA Cost	$73.11 million
ORC	$73.11 million
DORC	$15.10 million

Key estimation components for ballast

Evans & Peck's DORC calculation for each of the calculation steps can be summarised as:

- ***Asset validation:*** Evans & Peck[41] state that "information on the existing asset for track ballast has been provided anecdotally by ARTC asset managers".
- ***Optimised cost (pre adjustment for useful lives):*** The MEERA is based on 300mm bottom ballast and a 600mm ballast shoulder width. Evans & Peck[42] state that the 25 tonne axle load wagon dictates the ballast depth. The optimised cost (pre adjustment for useful lives) per kilometre for ballast is $250,347 (direct cost) or $499,841 including a 99.66% mark-up to allow for indirect costs.

40 Evans & Peck (2013), page 32.

41 Evans & Peck (2013), page 32.

42 Evans & Peck (2013), page 32.

- ***ORC:*** No optimisation factor is used because the current ballast is considered generally consistent with the MEERA standard.
- ***DORC:*** Depreciation is based on the age of the current asset compared to its useful life. Evans & Peck[43] assume that almost all of the ballast was installed in 1981 (Table 11). This is based on: 20% being installed prior to 1973; the balance being installed between 1973 and 1993 (on a straight line basis); and a small amount of the Gunnedah to Turrawan section being installed in 2009. The remaining life of the ballast is 8.3 years on average and the average amount consumed is 79%.

The following table summarise some of the information that we have examined on ballast in the Evans & Peck report and their spread-sheets.

Table 11: Ballast depreciation

Year installed	The Gap to Turrawan rail length		Remaining life	Useful life	% consumed
	Kilometres	%			
1981	144.9	99%	8.0	40.0	80%
2009	1.4	1%	36.0	40.0	10%
Total	146.3	100%	8.3	40.0	79%

Source: Evans & Peck (2013) and spread-sheet provided by Evans & Peck.

5.5 Bridges

5.5.1 MJA assessment of the reasonableness of the bridges DORC component

Bridge Assets are valued at $23,509,414 in the Evans & Peck DORC valuation.

We find that the DORC calculations relating to bridges are reasonable subject to a range of issues being addressed (Table 12). More detail is provided after Table 12 to support our assessment. The supporting information after the table only contains information on areas of examination that require more detailed explanation.

Table 12: Bridges assessment

Area of examination	Our assessment
Understanding of the asset for valuation purposes	▪ We consider that the bridge assets appear to be well understood for asset valuation purposes. In particular, ARTC has confirmed that the information on bridges is consistent with its bridge management system as well as its Ellipse database and we note that it appears that the bridge inspection reports are generally well maintained. It is noted that there are only 74 bridges along the rail segment (not 75 as listed in the Evans & Peck report[44]). We note that only 74 have been used in the DORC calculations.
Reasonableness of optimal design and	▪ The MEERA form of concrete or steel construction is considered reasonable.

43 Evans & Peck (2013), page 32.

44 Evans & Peck (2013), page 33.

Area of examination	Our assessment
technologies	
Reasonableness of the optimised cost (pre adjustment for useful lives)	▪ We consider that the optimised cost (pre adjustment for useful lives) appears to be reasonable. This is discussed in more detail in section 5.10.
Reasonableness of the ORC	▪ We consider that the optimisation factors for bridges (Table 14) are reasonable. In particular, while it may appear that the optimisation factor for masonry of 80% could be considered low, it can be justified by the superior performance reinforced concrete offers in bending and tension.
Reasonableness of the depreciation assumptions	▪ The Evans & Peck assumed remaining lives are considered mostly reasonable. However, we consider that the assumed remaining lives for bridges that were constructed prior to 1960 (Table 16) be re-examined since they may have a remaining life of at least 5 years. If the remaining life for each of these bridges was set at 5 years the DORC would increase by $1.15 million[45]. More detail is outlined in section 5.5.2.
Inconsistencies in the calculations	▪ No inconsistencies were identified in the DORC calculations.

5.5.2 Reasonableness of the depreciation assumptions

The Evans & Peck assumed remaining lives are mostly reasonable. However, we consider that the assumed remaining lives for bridges that were constructed prior to 1960 be re-examined since they may have a remaining life of at least 5 years. The reasoning for this is that the six concrete and steel bridges constructed in 1909 (Table 16) are likely to have received strengthening over the last 100 years that now means that their remaining life is likely to be at least 5 years.

Additionally, the forward plan of capital expenditure on the rail segment does not indicate that it is likely that these bridges will be replaced in the next 5 to 10 years – if anything there may be additional strengthening. Moreover, the ARTC has indicated that all underbridges have engineering assessments which verify they are all suitable for a 30 tonne axle load wagons. Finally, the capital cost of bridges is not likely to have been recovered through charges in previous years since ARTC has indicated that charges are only likely to have recently begun to recover some of the capital costs of assets.

We estimate that the DORC value for these bridges is currently $0. If the remaining life for each of these bridges was set at 5 years we estimate that the DORC would increase by $1.15 million. However, we note that the remaining life of these bridges at least 5 years. The appropriate remaining life for these assets could be established with additional information from ARTC.

In reviewing the useful lives we noted that the Evans & Peck report[46] states that the expected life of a concrete bridge is 100 years and the expected life of a steel bridge is 60 years.

45 Note that there is one timber bridge that was constructed in 1970 which Evans & Peck has estimated to be 100% consumed. A similar approach could be taken for this bridge as for the bridges constructed in 1909. However, we have not included this in the $2.3 million because of the negligible impact on the DORC and uncertainty around the current asset condition of this asset given it's a timber bridge.

46 Evans & Peck (2013), page 33.

However, the actual DORC assumptions applied by Evans & Peck in their DORC calculations are: 100 years for steel and concrete bridges built after 1960; and 60 years for steel and concrete bridges built before 1960. We consider the assumptions used in the DORC calculations reasonable. However, for reasons explained above, these assumptions should be treated with caution because many bridges would have been strengthened over time which would have increased their useful life.

5.5.3 Summary of Evans & Peck DORC calculation for bridges

This section provides a summary of the bridge information in the Evans & Peck report that we examined as part of our review.

A summary of the DORC calculation for bridges is shown in Table 13.

Table 13: Summary of DORC calculation for bridges

Component	Value
MEERA Cost	$49.37 million
ORC	$45.69 million
DORC	$23.51 million

Key estimation components for bridges

Evans & Peck's DORC calculation for each of the calculation steps can be summarised as:

- ***Asset validation:*** Evans & Peck[47] state that "the existing bridge assets have been identified from the Bridge Management System database and individual data sheets". Evans & Peck also state that[48] "ARTC has only provided information on underbridges and on this basis overbridges have not been included in the valuation".
- ***Optimised cost (pre adjustment for useful lives):*** The Evans & Peck MEERA bridge is mainly based on a concrete bridge unless the existing bridge is steel in which case the assumption is a MEERA steel bridge. Each assumed MEERA bridge consists of the same number/volume of components as the original structure. The optimised cost (pre adjustment for useful lives) for a bridge is based on the unit costs of its components: bridge deck; piers; and abutments (Table 15).
- ***ORC:*** As outlined in Table 14 below, the optimisation factors are dependent on the current asset type and bridge component.
- ***DORC:*** Life consumed is expressed as the per cent of the asset consumed and is based on the age of the asset compared to its assumed useful life (Table 16). If the age of asset is greater than its useful life the DORC for that asset is zero. The average amount consumed for bridges is 49%.

The following tables summarise the information that we have examined on bridges in the Evans & Peck report and their spread-sheets.

47 Evans & Peck (2013), page 33.

48 Evans & Peck (2013), page 33.

Table 14: Bridge information

Type of bridge cost	Current asset type	MEERA	Number of bridges	Optimisation
Bridge Deck	Timber	Steel	1	40%
	Concrete	Concrete	67	100%
	Steel	Steel	6	100%
	Sub-total		**74**	
Type of bridge cost	**Current asset type**	**MEERA**	**Number of bridges with piers**	**Optimisation**
Piers	Masonry	Concrete & low bridge height	3	80%
		Concrete & high bridge height	1	80%
	Concrete	Concrete & high bridge height	1	100%
	Unallocated	Concrete & low bridge height	23	80%
		Concrete & high bridge height	4	80%
	Sub-total		**32**	
Type of bridge cost	**Current asset type**	**MEERA**	**Number of bridges with abutments**	**Optimisation**
Abutments	Masonry	Concrete & low bridge height	3	80%
		Concrete & high bridge height	2	80%
	Concrete	Concrete & low bridge height	6	100%
		Concrete & high bridge height	3	100%
	Unallocated	Concrete & low bridge height	59	80%
		Concrete & high bridge height	1	80%
	Sub-total		**74**	

Source: Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Table 15: Bridge unit costs - summary

Bridge type			Number of bridges	MEERA average total cost per bridge	MEERA average total cost per metre	MEERA average total cost per square metre
Bridge deck	Piers	Abutments				
Concrete	Concrete low bridge height	Concrete low bridge height	24	$468,340	$44,403	$8,781
Concrete	Concrete high bridge height	Concrete high bridge height	1	$632,221	$30,991	$6,355
Concrete		Concrete low bridge height	42	$256,189	$60,971	$12,255
Steel	Concrete low bridge height	Concrete low bridge height	2	$3,705,185	$53,524	$10,975
Steel	Concrete high bridge height	Concrete high bridge height	5	$3,864,477	$54,276	$11,130
Total number of bridges/average cost per bridge/average cost per metre			**74**	**$667,096**	**$52,268**	**$10,573**

Source: MJA analysis of Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Notes:

1 The total costs in this table includes a mark-up of 99.66 per cent incremental (and based on) the direct costs.

Table 16: Bridge depreciation

Year installed	Current asset type	Number of bridges		Remaining life	Useful life	% consumed
		Number	% of total			
1909	Concrete	2	3%	0.0	60.0	100%
1909	Steel	4	5%	0.0	60.0	100%
1970	Timber	1	1%	0.0	40.0	100%
1972	Concrete	2	3%	59.0	100.0	41%
1980	Concrete	15	20%	67.0	100.0	33%
1985	Concrete	17	23%	72.0	100.0	28%
1985	Steel	2	3%	72.0	100.0	28%
1990	Concrete	17	23%	77.0	100.0	23%
1995	Concrete	6	8%	82.0	100.0	18%
2000	Concrete	5	7%	87.0	100.0	13%
2007	Concrete	1	1%	94.0	100.0	6%
2010	Concrete	1	1%	97.0	100.0	3%
2011	Concrete	1	1%	98.0	100.0	2%
Total		74	100%			49%

Source: Evans & Peck (2013) and spread sheet provided by Evans & Peck.

5.6 Rail

5.6.1 MJA assessment of the reasonableness of the rail DORC component

Rail assets are valued at $14,417,067 in the Evans & Peck DORC valuation.

We find that the DORC calculations relating to rail are reasonable subject to a range of issues being addressed (Table 17). More detail is provided after Table 17 to support our assessment. The supporting information after the table only contains information on areas of examination that requires more detailed explanation.

Table 17: Rail – our review assessment

Area of examination	Our assessment
Understanding of the asset for valuation purposes	▪ We consider the Evans & Peck[49] assumptions on the proportion of rail in each category (47 kg, 53 kg and 60kg) as being reasonable considering that we understand that Evans & Peck has taken into consideration the amount of track that has been recently installed with 60 kg rail track.

49 Evans & Peck (2013), page 32

Area of examination	Our assessment
Reasonableness of optimal design and technologies	▪ We consider the Evans & Peck assumed MEERA standard of 60 kg rail as reasonable. More detail on this is outlined in section 5.6.2.
Reasonableness of the optimised cost (pre adjustment for useful lives)	▪ We consider that the optimised cost (pre adjustment for useful lives) for the combined cost of ballast, sleepers and rail is slightly higher than the costs of comparable engineering projects. This is discussed in more detail in section 5.10.
Reasonableness of the ORC	▪ We consider the optimisation factors to be reasonable based on the useful lives that have been estimated by Evans & Peck. More detail on this is outlined in section 5.6.3.
Reasonableness of the depreciation assumptions	▪ The remaining asset lives are considered reasonable. In particular, the 10 year remaining life applied to 53 kg rail appears reasonable. More detail on this is outlined in section 5.6.3.
Inconsistencies in the calculations	▪ Only half of the 47 kg rail cost has been included in the cost. Once the full cost is included, we estimate that the DORC value increases by $0.54 million.

5.6.2 Reasonableness of optimal design and technologies

The Evans & Peck report[50] has developed the optimal design of rail based on a 25 tonne axle load. On this basis, Evans & Peck have set the MEERA standard at:

- 60kg head hardened rail for curved rail with radius <450m; and
- 60kg standard carbon for straight rail.

While the Hunter 200+ Guidelines[51] indicates that 53 kg rail is appropriate for 25 tonne axle loads (and results in 80 km/hr track speeds), we believe that the assumptions on the MEERA standard used by Evans & Peck are reasonable because ARTC has indicated that 47kg and 53 kg rail is no longer manufactured in Australia as a standard. This is also our understanding. Additionally, we note that the approach taken by Evans & Peck provides consistency with the DORC valuation of the interstate network in 2007[52] and that it has been standard practice to replace existing rail with 60kg when replacements are deemed appropriate.

5.6.3 Reasonableness of the ORC and depreciation assumptions

Rail asset life is generally measured in terms of the total million gross tonnes (MGTs) of traffic which can pass over the rail before degradation of the head renders the rail unserviceable.

The useful lives for the different rail assets (47kg, 53 kg and 60kg) has been estimated by Evans & Peck based on a rail simulation model which takes into account grinding and wear which are both a function of MGT. The useful lives as measured in MGTs estimated by Evans & Peck (and represented in MGT in Table 18) compare reasonably well against other comparable valuations. Therefore, we believe that the Evans & Peck assumptions are reasonable.

50 Evans & Peck (2013), page 39.

51 ARTC (2011), page 4.

52 Booz Allen Hamilton (2007).

Table 18: Rail – comparison of useful lives

Rail Section Size	Booz Allen Hamilton (2001)	Booz and Co. (2008)	Evans & Peck (2013) for Gap – Turrawan DORC
47kg/m (94lb/yd)	600		
100lb/yd		450	
103lb/yd		450	
53kg/m (107lb/yd)	750	600	
60kg/m (standard carbon)	900		600 to 1500
60kg/m (head hardened)	1,200		

Source: Booz Allen Hamilton (2001) page 17, Booz and Co. (2008) page 17, Evans & Peck (2013) and additional information from ARTC.

Notes: The Evans & Peck figure of 600 to 1500 MGT is based on additional information provided by ARTC.

Based on Evans & Peck's[53] estimated useful lives and asset ages, all of the 47 kg and 53kg rail appear to be life consumed. However, Evans & Peck assumes that there is still 10 years left in the asset based on information from a consultant that is undertaking a condition assessment of the existing Gap to Turrawan assets in support of the 30 tonne axle load study.

We consider this assumption to be reasonable based on an examination of historical usage and useful life as measured in MGT. For example, if we assume that the Gap to Gunnedah part of the rail segment has had historical consumption of 260 MGT (coal and non-coal)[54] and the useful life is around 500 MGT (taking into account the range of estimates for 47 kg, 53 kg, 100lb and 103 lb in Table 18), this would suggest that there may be around 240 MGT left in the asset. If we assume future consumption at 11.3 MGT (just coal) this would suggest that there may be more than 20 years life left in the asset for the section between Gap to Gunnedah. If we take into account that "much of the 100lb and 107lb rail (rolling dates in the 1930s) was cascaded as second-hand rail from the Sydney Metropolitan area in the 1960s"[55], from our desktop analysis the 10 year assumption appears reasonable.

5.6.4 Summary of Evans & Peck DORC calculation for rail

This section provides a summary of the rail information in the Evans & Peck report that we examined as part of our review.

A summary of the DORC calculation for rail is show in Table 19.

Table 19: Summary of DORC calculation for rail

Component	Value
MEERA Cost	$90.82 million
ORC	$78.14 million
DORC	$14.42 million

53 Evans & Peck (2013), page 38.

54 Evans & Peck (2013), page 23.

55 Evans & Peck (2013), page 38.

Key estimation components for rail

Evans & Peck's DORC calculation for each of the calculation steps can be summarised as:

- ***Asset validation:*** Evans & Peck[56] state that "ARTC was unable to reference an accurate mapping of the 100lb, 107lb and 53 kg rail but estimated that 95% of the rail would be either 100lb or 107lb". We note that the Evans & Peck spread-sheet (Table 20) indicates that 98% of rail is either 47 kg or 53 kg.
- ***Optimised cost (pre adjustment for useful lives):*** The MEERA is based on two types of rail: a 60kg standard carbon for straight rail; and a 60kg head hardened rail for curved rail with radius < 450m. The Evans & Peck report states[57] that a 25 tonne axle load wagon will result in the weight of the rail being 60 kg/m. The optimised cost (pre adjustment for useful lives) per kilometre for standard carbon is $324,144 (direct cost) or $647,185 (including mark-up to allow for indirect costs). The cost per kilometre for head hardened is $351,425 (direct cost) or $701,655 (including mark-up to allow for indirect costs – this assumes 99.66% mark-up of direct costs).
- ***ORC:*** The optimisation factors are based on comparing the useful life of standard carbon rail with the useful life of the current asset types. The optimisation factors applied against existing assets are shows in Table 20. Noticeably, around 88% of rail is in the 53 kg category.
- ***DORC:*** Life consumed is based on the age of the asset compared to its useful life. The remaining life is set at 10 years for rail that is passed its assumed asset life. The amount consumed varies by rail type (Table 21). The average amount consumed across all types of rail is 82%.

The following tables summarise the information that we have examined on rail in the Evans & Peck report and their spread-sheets.

Table 20: Rail information

Type of rail	The Gap to Turrawan rail length		Useful life	Optimisation factor	Optimisation factor calculation
	Kilometres	%			
47 kg rail	14.7	10%	40	100%	(=40/40)
53 kg rail (107lb)	129.2	88%	34	85%	(=34/40)
60 kg rail	2.4	2%	40	100%	(=40/40)
Total	146.3	100%			

Source: Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Notes:

1 *The Evans & Peck (2013) document refers to 100lb rail. We are assuming this is the same as the 47kg rail referred to in their spread sheet.*

56 Evans & Peck (2013), page 38.

57 Evans & Peck (2013), page 38.

Table 21: Rail depreciation

Type of rail		Remaining life (years)	Assumed useful life (years)	Revised useful life (years)	% consumed (applying revised asset life)	Distance (km)
47 kg rail	Straight track	10.0	40	88	89%	14.7
	Sub-segment total	10.0	40	88	89%	14.7
53 kg rail	Straight track	10.0	34	57	82%	112.3
	Arc track	10.0	34	57	82%	16.9
	Sub-segment total	10.0	34	57	82%	129.2
60 kg rail	Straight track	32.2	40	40	19%	2.2
	Arc track	36.0	40	40	10%	0.2
	Sub-segment total	10.0	40	40	18%	2.4
Average			**34**	**58.5**	**82%**	**146.26**

Source: Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Notes:

1 *53 kg rail is 107lb.*

2 *Straight track includes transition track.*

3 *% consumed equals (Revised useful life minus remaining life)/(revised useful life). Revised useful life is based on the assumed current age of asset plus ten years. Assumed asset life is based on expected asset life.*

5.7 Signalling equipment

5.7.1 MJA assessment of the reasonableness of the Signalling equipment DORC component

Signalling equipment assets are valued at $108,959,006 in the Evans & Peck DORC valuation.

We find that the DORC calculations relating to signalling are reasonable subject to a range of issues being addressed (Table 22). More detail is provided after Table 22 to support our assessment. The supporting information after the table only contains information on areas of examination that require more detailed explanation.

Table 22: Signalling - our review assessment

Area of examination	Our assessment
Understanding of the asset for valuation purposes	▪ We consider that the signalling assets appear to be well understood for asset valuation purposes. In particular, ARTC has confirmed that the information on signalling presented in data sheets provided to Evans & Peck is consistent with its Ellipse system.
Reasonableness of optimal design and technologies	▪ We consider that not all components are of a modern technology standard. However, this may well be reasonable given the rural location of the rail segment. More detail on this is outlined in section 5.7.2.
Reasonableness of	▪ We consider that the optimised cost (pre adjustment for useful lives) for

Area of examination		Our assessment
the optimised cost (pre adjustment for useful lives)		signalling is slightly higher than the costs of comparable engineering projects. This is discussed in more detail in section 5.10.
Reasonableness of the ORC	▪	We consider the optimisation factors reasonable given that the signalling assets were only recently installed.
Reasonableness of the depreciation assumptions	▪	We consider the depreciation assumptions to be reasonable with the exception of the useful life applied to some of the signalling assets. In particular, we consider the useful life of all of the signalling assets should be more no more than 30 years instead of 40 years. If we reduce the useful life to a maximum life of 30 years, we estimate that this decreases the DORC value by $7.15 million. More detail on this is outlined in section 5.7.3.
Inconsistencies in the calculations	▪	No inconsistencies were identified in the DORC calculations.

5.7.2 Reasonableness of the optimal design and technologies

Evans & Peck[4] valued the existing signalling asset on the assumption that it complies with the requirements of the Hunter 200+ Guidelines. We consider that it is appropriate that the Hunter 200+ Guidelines complement ARTC standards in the definition of a reasonable MEERA standard. However, we note that it is difficult to verify whether the physical asset meets the assumed MEERA signalling asset in a desk top study. Signalling equipment is a sophisticated asset with many small critical parts that can vary widely in their standard and cost.

In terms of technology, we consider a reasonable MEERA signalling standard is a processor based interlocking system. This is what has been installed on the rail segment and is commonly used in other rail systems.

We note that there are some components that appear not to be of MEERA standard. For example, there are unsignalled level crossings and ground frame operated points. However, we note that unsignalled level crossings may well be the optimal configuration given that much of the segment is situated in a rural location with relatively low road vehicle counts.

5.7.3 Reasonableness of the depreciation assumptions

Table 23 shows a comparison of DORC valuation data for signalling used by PWC (2008) and Evans & Peck in their report.

Table 23: Signalling – comparison of useful lives

Source Document		PWC		Evans & Peck DORC Data Sheet
Year		**2008**		**2013**
System	ARTC	ARTC	Westnet	ARTC
Expected Life – Track and Flashing Lights (Years)	30	25	20	40, 20 or 25 years for some components.
Expected Life – Communications (Years)	30	25	20	20 (telemetry)

Source: PWC (2008) page 21, and Table 26.

Using our past experience and understanding of rail signalling equipment we consider PWC's estimates of 30 years for the maximum useful life of all signalling assets to be reasonable. Evans & Peck's DORC valuation assumed the useful life of some of the signalling components is 40 years. Our examination of the data does not support Evans & Peck's signalling long life assumption and is therefore considered unreasonable. If we reduce the maximum asset life for all of the components of signalling from 40 years to 30 years this reduces the DORC value by $7.15 million.

5.7.4 Summary of Evans & Peck DORC calculation for signalling

This section provides a summary of the signalling information in the Evans & Peck report that we examined as part of our review.

A summary of the DORC calculation for signalling equipment is shown in Table 24.

Table 24: Summary of DORC calculation for signalling equipment

Component	Value
MEERA Cost	$134.40 million
ORC	$134.40 million
DORC	$108.96 million

Key estimation components for signalling

Evans & Peck's DORC calculation for each of the calculation steps can be summarised as:

- ***Asset validation:*** The Evans & Peck[58] report states that "signalling equipment has been valued based on the asset register and assuming the assets are installed in accordance with Hunter 200+ Guidelines".
- ***MEERA cost:*** The Evans & Peck[59] report states that the installed signalling equipment assets are generally the MEERA standard having been installed relatively recently. The MEERA unit costs (including mark-up) are shown in Table 25.

58 Evans & Peck (2013), page 42.

59 Evans & Peck (2013), page 42.

- ***ORC:*** The optimisation factors are 100% for each signalling equipment asset type with the exception of 50% optimisation of two signalling equipment asset types (mechanical facing points and mechanical points). Note that the optimisation factor for these two asset types is applied prior to setting the MEERA cost. Therefore, the MEERA cost and ORC values are the same for these two asset types.
- ***DORC:*** Depreciation (or % consumed) is based on the age of the asset compared to its useful life. The signalling equipment assets were all installed in 2006. The amount consumed varies by signalling equipment asset type (Table 26). The average amount consumed across all signalling equipment asset types is 19%.

The following tables summarise the information that we have examined on signalling in the Evans & Peck report and their spread-sheets.

Table 25: Signalling equipment information

Category	Number of units	MEERA cost per km	Kilometres	MEERA cost per unit	MEERA cost
CABLE ROUTE	131.6	$663,867	131.60		$87,364,957
CONTROL PANEL	1			$17,237	$17,237
DC/DC CONVERTER	3			$4,309	$12,928
ELECTRIC POINTS	20			$114,151	$2,283,014
FORTRESS RELEASING SWITCH	19			$54,578	$1,036,990
GENERATOR SUPPLY	9			$64,638	$581,742
JEUMONT TRACK CIRCUIT	14			$58,597	$820,351
LED TYPE SIGNAL	80			$77,277	$6,182,194
MECHANICAL FACING POINTS LOCK	37			$57,075	$2,111,788
MECHANICAL INTERLOCKING GROUND FRAME	22			$64,638	$1,422,036
MECHANICAL POINTS	81			$57,075	$4,623,104
MICROLOK INTERLOCKING	39			$323,190	$12,604,410
MISCELLANEOUS SIGNS	68			$1,488	$101,184
POWER SUPPLY 120V DC	13			$5,343	$69,464
POWER SUPPLY 12V DC (RECTIFIED)	38			$5,343	$203,050
POWER SUPPLY 50V DC (RECTIFIED)	33			$4,309	$142,204
POWER SUPPLY ROOM	1			$198,736	$198,736
RECTIFIED SUPPLY 415V	4			$75,411	$301,644
RECTIFIED TRACK CIRCUIT	103			$5,536	$570,247
SOLAR PANEL SUPPLY	1			$0	$0
STAFF HUT / RELAY ROOM	10			$198,736	$1,987,365
TRANSFORMER SUPPLY 415V	7			$150,822	$1,055,754
TELEMETRY SYSTEM	14			$9,068	$126,955
TRANSFORMER SUPPLY 120V	29			$150,822	$4,373,838
TRANSFORMER SUPPLY 240V	1			$150,822	$150,822
UPS SUPPLY 415V	1			$150,822	$150,822
WALK IN LOCATION / CUPBOARD	53			$111,442	$5,906,451
Total					**$134,399,285**

Source: Evans & Peck (2013) and spread-sheet provided by Evans & Peck.

Table 26: Signalling equipment optimisation and depreciation

Category	ORC	Remain-ing life	Useful life	% consumed	DORC
CABLE ROUTE	$87,364,957	33	40	18%	$72,076,089
CONTROL PANEL	$17,237	13	20	35%	$11,204
DC/DC CONVERTER	$12,928	33	40	18%	$10,665
ELECTRIC POINTS	$2,283,014	18	25	28%	$1,643,770
FORTRESS RELEASING SWITCH	$1,036,990	33	40	18%	$855,516
GENERATOR SUPPLY	$581,742	13	20	35%	$378,132
JEUMONT TRACK CIRCUIT	$820,351	33	40	18%	$676,790
LED TYPE SIGNAL	$6,182,194	33	40	17%	$5,100,310
MECHANICAL FACING POINTS LOCK	$2,111,788	13	20	35%	$1,372,662
MECHANICAL INTERLOCKING GROUND FRAME	$1,422,036	13	20	35%	$924,323
MECHANICAL POINTS	$4,623,104	13	20	35%	$3,005,017
MICROLOK INTERLOCKING	$12,604,410	33	40	18%	$10,398,638
MISCELLANEOUS SIGNS	$101,184	33	40	18%	$83,477
POWER SUPPLY 120V DC	$69,464	33	40	18%	$57,308
POWER SUPPLY 12V DC (RECTIFIED)	$203,050	33	40	18%	$167,516
POWER SUPPLY 50V DC (RECTIFIED)	$142,204	33	40	18%	$117,318
POWER SUPPLY ROOM	$198,736	33	40	18%	$163,958
RECTIFIED SUPPLY 415V	$301,644	33	40	18%	$248,856
RECTIFIED TRACK CIRCUIT	$570,247	13	20	35%	$370,660
SOLAR PANEL SUPPLY	$0				$0
STAFF HUT / RELAY ROOM	$1,987,365	33	40	18%	$1,639,576
TANSFORMER SUPPLY 415V	$1,055,754	33	40	18%	$870,997
TELEMETRY SYSTEM	$126,955	13	20	35%	$82,521
TRANSFORMER SUPPLY 120V	$4,373,838	33	40	18%	$3,608,416
TRANSFORMER SUPPLY 240V	$150,822	33	40	18%	$124,428
UPS SUPPLY 415V	$150,822	13	20	35%	$98,034
WALK IN LOCATION / CUPBOARD	$5,906,451	33	40	18%	$4,872,822
Total	**$134,399,285**			**19%**	**$108,959,006**

Source: Evans & Peck (2013) and spread-sheet provided by Evans & Peck.

5.8 Sleepers

5.8.1 MJA assessment of the reasonableness of the sleeper DORC component

Sleepers are valued at $33,751,500 in the Evans & Peck DORC valuation.

We find that the DORC calculations relating to sleepers are reasonable subject to a range of issues being addressed (Table 27). More detail is provided after Table 27 to support our assessment. The supporting information after the table only contains information on areas of examination that requires more detailed explanation.

Table 27: Sleepers – summary of our review assessment

Area of examination	Our assessment
Understanding of the asset for valuation purposes	▪ We consider Evans & Peck's assumption on the proportion of track (excluding passing loops and sidings) from the Gap to Turrawan in each sleeper category (timber, concrete etc.) as being reasonable since it is consistent with ARTC's transaction systems. The proportion in each category is illustrated in Table 29. ▪ However, additional information provided by the ARTC indicates that the passing loops and sidings are not all concrete sleepers, as assumed in the Evans & Peck spread-sheet model. The ARTC has indicated that there are also some timber and concrete sleepers that exist for passing loops and sidings. The ARTC has estimated that, under their initial estimate, the DORC valuation decreases by $1.3 million if the DORC valuation is revised to allow for these asset types[60]. We have not validated this figure or the restatement of asset types. Additionally, we have not used this figure in our overall assessment of the DORC valuation to avoid double counting since we separately estimate the value of excluding a number of passing loops and sidings.
Reasonableness of optimal design and technologies	▪ We consider that the definition of the MEERA as concrete sleepers is reasonable. Evans & Peck[61] state that "while concrete sleepers are not required technically, the practicality of sourcing good quality sleepers of the dimensions required is today infeasible as the timber supply has not been able to provide the Australian market in recent years". This is also our understanding of the state of the sleeper market.
Reasonableness of the optimised cost (pre adjustment for useful lives)	▪ We consider that the optimised cost (pre adjustment for useful lives) for the combined cost of ballast, sleepers and rail is slightly higher than costs of comparable engineering projects. This is discussed in more detail in section 5.10.
Reasonableness of the ORC	▪ We consider that the useful lives used to adjust the MEERA cost to the ORC are reasonable. In particular, the 20 year useful life assumption for timber sleepers and the 50 year useful life assumption for concrete sleepers. We provide more detail in section 5.8.2.
Reasonableness of the depreciation assumptions.	▪ We consider that the asset ages used in to estimate the life consumed of the asset are reasonable. This is because they are consistent with ARTC's database. We provide more detail in section 5.8.2. ▪ Much of the stock of timber sleepers that are installed are technically life consumed (i.e. their age is greater than assumed useful life) and are assumed to be 100% life consumed in the Evans & Peck model. This assumption seems reasonable given that timber sleepers were all replaced with concrete sleepers during 2013.
Inconsistencies in the calculations	▪ We identified two issues with the DORC calculations in the spread-sheet prepared by Evans & Peck. When these two issues are corrected in the

60 Note that this also revision of the DORC value includes a restatement of the rail asset types. In particular, the Evans & Peck model assumes that all rail for passing loops and sidings is 47kg rail when some of the rail is in fact 53kg and 60kg rail.

61 Evans & Peck (2013), page 26.

Area of examination	Our assessment
	spread-sheet we estimate that the DORC value increases by $8.02 m. More detail on these issues is outlined in section 5.8.3.

5.8.2 ORC and depreciation assumptions

Unlike rail, which has a useful life measured in million gross tonnes (MGTs) carried, the useful life of sleepers is typically measured in years. The DORC valuation prepared by Evans & Peck cites concrete sleepers at the MEERA standard, having a useful life of 50 years. This aligns with similar assessments for other systems undertaken over the last 10 years or so[62].

The useful life of 20 years for a timber sleeper also seems reasonable. For example, the Dartbrook to Gap valuation[63] also assumes 20 years for timber sleepers. However, there is less supporting evidence to support the estimated lives of steel sleepers, quoted as 50 years by Evans & Peck, and timber (1 in 4 steel) sleepers, quoted as 30 years. However, we note that these two categories are in aggregate only 2.3 kilometres (or less than 2%) of total segment length (Table 29). Additionally, we note that there is an issue with the calculation for timber (1 in 4 steel sleepers) which is discussed further in section 5.8.3.

Therefore, overall, the assumptions on useful life appear appropriate taking into consideration the reasonableness of the timber and concrete sleeper assumptions.

Where the sleeper asset age is concerned, we note that timber sleepers are currently laid along 64.6 kilometres of the segment (Table 29). Of these, 39.8 kilometres (or 62%) was installed in 1990 (Table 31). Therefore, much of the stock of timber sleepers that are installed are technically life consumed (i.e. their age is greater than assumed useful life) and are assumed to be 100% life consumed in the Evans & Peck model. If these assets are not being replaced in the very short term this assumption could be considered unreasonable. However, additional information provided by ARTC has revealed that the entire mainline will consist of concrete sleepers by the end of 2013, which is consistent with much of the timber sleepers being considered at the end of their useful life.

5.8.3 Inconsistencies in the sleeper DORC calculations

We have identified two inconsistencies with the sleeper DORC calculations in the spread-sheet prepared by Evans & Peck:

- the sections of track that are classified as timber (3 in 4) and steel (1 in 4) have a remaining life that reflects when the steel sleepers were installed. This does not reflect the remaining life of the timber sleepers as installation of steel sleepers (1 in 4) does not extend the life of the timber sleepers as reflected in the Evans & Peck model. The ARTC has indicated that adjusting the model to correctly allow for this issue results in a reduced DORC value of $0.07 million. We agree with the value of this correction.
- there is an optimisation factor of 40% applied to a section of track that has concrete sleepers instead of 100%. We estimate that adjusting the model to correctly allow for this issue results in an increase of $8.09 million in the DORC value.

62 Refer to Booz Allen Hamilton (2007), section 5.2 and Booz and Co. (2008), page 17.

63 Booz and Co (2008), page 17.

5.8.4 Summary of Evans & Peck DORC calculation for sleepers

This section provides a summary of the sleepers' information in the Evans & Peck report that we examined as part of our review.

A summary of the DORC calculation for sleepers is shown in Table 28.

Table 28: Summary of DORC calculation for sleepers

Component	Value
Optimised cost (pre adjustment for useful lives)	$85.15 million
ORC	$56.72 million
DORC	$33.75 million

Key estimation components for sleepers

Evans & Peck's DORC calculation for each of the calculation steps can be summarised as:

- ***Optimised cost (pre adjustment for useful lives):*** The MEERA is based on a heavy duty concrete sleeper. The optimised sleeper cost (pre adjustment for useful lives) per kilometre is $291,583 (direct cost) or $582,173 (including mark-up to allow for indirect costs). This assumes 99.66% mark-up of direct costs. The length of track used to estimate the total cost for the segment includes selected sidings and passing loops.
- ***ORC:*** The optimisation factors are based on comparing the useful life of heavy duty concrete sleepers with the useful life of the current asset types. Heavy duty concrete sleepers are considered to be the modern engineering equivalent. The optimisation factors applied against existing assets are shown in Table 29. There is a reasonably even mix of timber sleepers and concrete/steel sleepers (Table 29) along the Gap to Turrawan segment.
- ***DORC:*** Life consumed is based on the age of the asset compared to its useful life. The life consumed % is set at zero if the age of the asset is greater than its useful life. The amount consumed varies by sleeper type (Table 30). The average amount consumed across all sleepers is 40.5%.

The following tables summarise the information that we have examined on sleepers in the Evans & Peck report and their spread-sheets.

Table 29: Sleepers information

Type of sleepers	Gap to Turrawan track composition		Useful life (years)	Optimisation factor	Optimisation factor (calculation)
	Distance (kilometres)	% of total			
Timber	64.6	44.2%	20	40%	(=20/50)
Timber (with 1 in 4 concrete/steel)	0.9	0.6%	30	60%	(=30/50)
Concrete	79.4	54.3%	50	100%	(=50/50)
Steel	1.4	1.0%	50	100%	(=50/50)
Total	**146.3**	**100.0%**			

Source: MJA analysis of Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Notes:

1 The timber sleeper category includes timber transom and girder sleepers.

Table 30: Sleepers depreciation

Type of sleepers	Remaining life	Useful life	% consumed
Timber	2.2	20	89%
Timber (with 1 in 4 concrete/steel)	17.0	30	43.3%
Concrete	41.6	50	17%
Steel	37.0	50	26%
Average			**40.5%**

Source: MJA analysis of Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Notes:

1 The timber sleeper category includes timber transom and girder sleepers.

Table 31: Sleepers age profile

Type of sleeper and year installed	Distance of track (km)
Timber	**64.6**
1990	39.8
2000	24.8
Timber (with 1 in 4 concrete/steel)	**0.9**
2000	0.9
Concrete	**79.4**
1993	14.7
2008	63.8
2009	1.0
Steel	**1.4**
2000	1.4
Grand Total	**146.3**

Source: MJA analysis of Evans & Peck (2013) and spread sheet provided by Evans & Peck.

5.9 Track grade

5.9.1 Our assessment of the reasonableness of the track grade DORC component

Track grade assets are valued at $113,886,394 in the Evans & Peck DORC valuation.

We find that the DORC calculations relating to track grade/earthworks are reasonable subject to a range of issues being addressed (Table 32). More detail is provided after Table 32 to support our assessment. The supporting information after the table only contains information on areas of examination that requires more detailed explanation.

Table 32: Track grade – summary of our review assessment

Area of examination	Our assessment
Understanding of the asset for valuation purposes	▪ We consider that the assumptions on track grade are mostly reasonable. In particular, we note that if we were to undertake our own visual inspection of sections of the track it would not likely come up with substantially different assumptions on the categorisation of sections of the rail segment into tolerance categories. We have reached this conclusion after viewing the AK Car video provided by ARTC and the fact that two different sources (ARTC and Evans & Peck) were used to estimate the tolerance levels of different sections of track. ▪ Evans & Peck[64] state that they have assumed the earthworks to have been installed in accordance with the requirements of the Hunter 200+ Infrastructure Guidelines which have also been adopted as the MEERA standard. We note that Evans & Peck appear not to have verified that this is the case. Without detailed records that validate this assumption it is difficult to assess the reasonableness of whether all track grade works adhere to the guidelines. However, we are less concerned about any potential deviations from the guidelines compared to incorrect categorisation of tolerance levels. This is because of the potential impact on costs of any deviations. ▪ We note that we have confirmed with ARTC that the track grade costs include all costs for cuttings, embankments and other formation works.
Reasonableness of optimal design and technologies	▪ The MEERA standard as defined in the Hunter 200+ Guidelines[65] is considered to represent best practice and is therefore reasonable. Additionally, the broader optimisation undertaken by Evans & Peck assumes the current route is the optimised route, which is reasonable in the context of undertaking optimisation in the "normal course of business"[66] – as assumed by Evans & Peck. Additionally, we consider that Evans & Pecks assumptions on the optimality of ruling grade are reasonable in the absence of a more detailed examination of the benefits and costs of improving the ruling grade.
Reasonableness of the optimised cost (pre adjustment for useful lives)	▪ We consider that the optimised cost (pre adjustment for useful lives) appears to be reasonable. This is discussed in more detail in section 5.10. ▪ However, please note that although the track grade/earthwork costs appear reasonable based on available benchmarks, there may be a benefit in sourcing independent contractor quotations for these costs and/or a cost estimate from a quantity survey. This is because the benchmarks for track grade are not as robust as those used for other costs. Additionally, track grade costs are the largest component of the DORC value (35% of the DORC value).

64 Evans & Peck (2013), page 35.

65 ARTC (2011).

66 NSW Government (2012), page 30

Area of examination	Our assessment
Reasonableness of the ORC	▪ The ORC is the same value as the optimised cost (pre adjustment for useful lives). This is reasonable given that the existing asset is considered to be MEERA standard.
Reasonableness of the depreciation assumptions	▪ We consider the depreciation assumptions to be reasonable. In particular, we consider that the assumption that 50% of the asset is depreciated is reasonable. While we could undertake more detailed examination of the asset condition, we believe that it is likely to make similar conclusions based on our review of the AK Car Video of the track provided by ARTC. We provide more detail in section 5.9.2.
Inconsistencies in the calculations	▪ A ballast cost has been included in the track grade costs. This cost is already included separately in the ballast cost component. Removing the duplication would result in a decrease of \$3.66 million in the DORC. We provide more detail in section 5.9.3.

5.9.2 Reasonableness of the depreciation assumptions

Evans & Peck have assumed that the initial construction date is a derived date based on a 100 year useful life and that 50% of the asset has been consumed (Table 36). The 100 year life assumption appears reasonable taking into consideration that previous valuations have assumed that earthworks have a perpetual life: the Dartbrook to Gap DORC valuation[67] in 2008; and the interstate network DORC valuation in 2006[68] – although to estimate the DORC, the interstate network DORC valuation does assign a nominal life of 100 years to earthworks.

More importantly, the 50% consumed life assumption appears reasonable. The Evans & Peck report states:

> *"Discussions with local experts have suggested that the base formation has been in place for the history of the railway and, with regular maintenance, has performed to standard and would be expected to last as long again before requiring replacement"*[69].

This statement seems reasonable to us given that the earthworks appear to have been in place for at least 50 years. While we could undertake more detailed examination of the asset condition, we believe that it is likely to make similar conclusions based on our review of the AK Car Video of the track provided by ARTC.

5.9.3 Inconsistencies in the DORC calculations

The review has identified that the DORC calculation for track grade includes ballast costs which were also included separately in the ballast calculation, so the cost has been double counted. This additional ballast cost is shown in Table 36. We estimate that removing this ballast cost could reduce the value of the DORC by \$3.66 million.

67 Booz and Co. (2008), page 18.

68 Booz Allen Hamilton (2007), section 5.4.

69 Evans & Peck (2013), page 36.

5.9.4 Summary of Evans & Peck DORC calculation for track grade

This section provides a summary of the track grade information in the Evans & Peck report that we examined as part of our review.

A summary of the DORC calculation for track grade is show in Table 33.

Table 33: Summary of DORC calculation for track grade

Component	Value
Optimised cost (pre adjustment for useful lives)	$227.77 million
ORC	$227.77 million
DORC	$113.89 million

Key estimation components

Evans & Peck's DORC calculation for each of the calculation steps can be summarised as:

- ***Asset validation:*** The Evans & Peck report[70] define three types of ground profiling categories (the first column in Table 34). However, the report states that "detailed information on the existing track grade has not been available to enable precise measurements to be established of earthworks tolerances within the current asset register". The Evans & Peck report then goes on to say that they have established how much of the segment fits into the three categories by: observing the AK Car video that runs on the network (noting those areas of high tolerances) and separate and independent ARTC local experts. The report notes that in the circumstance in which they observed earthwork tolerances greater than 4 metres (as per the AK Car Video) they have adopted a +/- 4 metre assumption.
- ***Optimised cost (pre adjustment for useful lives):*** The Evans & Peck[71] report states that "earthworks have been assumed to be installed in accordance with the Hunter 200+ Infrastructure Guidelines, which has also been adopted as the MEERA standard". The optimised unit costs (pre adjustment for useful lives), i.e. cost per km), are outlined in Table 34. The length of track used to estimate the total cost for the segment includes other sidings and passing loops.
- ***ORC:*** The optimisation factor is 99.66% for all earthwork categories (Table 35).
- ***DORC:*** The earthworks are assumed to be 50% life consumed. The Evans & Peck[72] report state that this is based on discussions with local experts.

The following tables summarise the information that we have examined on track grade in the Evans & Peck report and their spread-sheets.

70 Evans & Peck (2013), page 35.

71 Evans & Peck (2013), page 35.

72 Evans & Peck (2013), page 36.

Table 34: Track grade information

Type of earthworks	Segment	The Gap to Turrawan track composition Kms	%	Direct cost per km	Total cost per km	MEERA cost
Earthworks tolerance +/-1m	Gap to Turrawan	79.0	54%	$493,800	$985,919	$77,848,173
	Additional areas (e.g. sidings)	14.7	10%	$493,800	$985,919	$14,456,532
Earthworks tolerance +/-2m	Gap to Turrawan	39.5	27%	$776,600	$1,550,556	$61,215,969
Earthworks tolerance +/-4m	Gap to Turrawan	13.2	9%	$2,547,000	$5,085,330	$66,922,943
Total		**146.3**	**100%**			**$220,443,616**

Source: Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Notes:

1 *The table does not include the additional ballast cost which is explained in more detail in Table 36.*

2 *Earthwork tolerances refer to estimated depth of cut or fill required to construct the route*[73]*.*

3 *The direct costs per km do not include a mark-up.*

4 *The total costs per km include a mark-up of 99.66%.*

Table 35: Track grade optimisation

Type of earthworks	Segment	MEERA cost	Optimisation	ORC
Earthworks tolerance +/-1m	Gap to Turrawan	$77,848,173	100%	$77,848,173
	Additional areas (e.g. sidings)	$14,456,532	100%	$14,456,532
Earthworks tolerance +/-2m	Gap to Turrawan	$61,215,969	100%	$61,215,969
Earthworks tolerance +/-4m	Gap to Turrawan	$66,922,943	100%	$66,922,943
Sub-total		**$220,443,616**		**$220,443,616**

Source: Evans & Peck (2013) and spread sheet provided by Evans & Peck.

Notes:

1 *The table does not include additional ballast costs which are explained in more detail in Table 36.*

73 Definition provided by ARTC (October 2013).

Table 36: Track grade depreciation

Type of earthworks	Segment	ORC	Remain-ing life	Useful life	% consumed	DORC
Earthworks tolerance +/-1m	Gap to Turrawan	$77,848,173	50	100	50%	$38,924,086
	Additional areas (e.g. sidings)	$14,456,532	50	100	50%	$7,228,266
Earthworks tolerance +/-2m	Gap to Turrawan	$61,215,969	50	100	50%	$30,607,984
Earthworks tolerance +/-4m	Gap to Turrawan	$66,922,943	50	100	50%	$33,461,471
Sub-total		**$220,443,616**			**50%**	**$110,221,808**
Ballast allowance for additional areas (e.g. sidings) = 14.7 kilometres multiplied by $499,841/kilometre and 50% consumed.						$3,664,586
Grand-total						**$113,886,394**

Source: Evans & Peck (2013) and spread sheet provided by Evans & Peck.

5.10 Benchmarking cost comparison of six asset components

5.10.1 Summary of our cost comparisons

Our review of the costs[74] of the six major asset components revealed that the optimised cost (pre adjustment for useful lives) the combined cost of ballast, sleepers and rail is slightly higher than costs of comparable engineering projects. We reached a similar conclusion for signalling assets.

However, we believe that the costs of bridges and track/grade earthworks are likely to be reasonable noting that appropriate benchmarks cover a wide range of cost. We further note that for track grade/earthwork costs it is difficult to obtain comparable cost data because there is limited recent history of this type of construction along the east coast of Australia for heavy haul railways.

5.10.2 Cost estimation approach taken by Evans & Peck

The Evans & Peck report has estimated the costs for each of the six asset components by adding together direct and indirect costs (Table 37). Direct costs have been defined as "all labour, plant, equipment, materials and subcontractor works necessary to replace an asset using modern equivalent materials and techniques"[75]. Indirect costs are a mark-up relative to the direct cost for each asset. The mark-up estimated by Evans & Peck includes:

- ***un-measurable items*** (e.g. environmental control costs, pre-condition survey costs, temporary work costs etc.);
- ***preliminaries*** (contractor costs including "mobilisation, demobilisation, site establishment, maintenance of site facilities, temporary services, supervision of the works and relevant contractors insurances"[76]);
- ***design***;
- ***contractor overhead and margins*** (including: "financial, legal, human resources, commercial, executive management, corporate infrastructure and support, corporate head offices running costs, payroll and project specific profit"[77]); and
- ***client costs*** (including delivery agency costs – such as the ARTC's "corporate overhead, project management costs, planning and environmental costs, technical management, community liaison and safety"[78] – and insurance costs not provided by contractor).

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74 These costs relate to the optimised cost (pre adjustment for useful lives) which we defined earlier in this paper.

75 Evans & Peck (2013), page 17.

76 Evans & Peck (2013), page 17.

77 Evans & Peck (2013), page 18.

78 Evans & Peck (2013), page 18.

Table 37: Cost per unit of major asset components (Evans & Peck report)

Asset component	Metric	Direct cost	Indirect cost	Total cost
Ballast	$ per kilometre	$250,347	$249,495	$499,841
Bridges	$ per square metre	$5,296	$5,278	$10,573
Rail	$ per kilometre	$327,236	$326,122	$653,359
Signalling equipment	$ per kilometre	$460,227	$458,661	$918,888
Sleepers	$ per kilometre	$291,583	$290,590	$582,173
Track grade/earthworks	$ per kilometre	$754,871	$752,302	$1,507,173
Ballast, rail and sleepers	$ per kilometre	$869,166	$866,207	$1,735,373

Source: MJA analysis of Evans & Peck spread-sheets.

Notes:

1 *The rail component includes the full cost of the 47kg rail.*

2 *The track grade component has excluded the double counted ballast cost in the Evans & Peck model.*

5.10.3 Our approach to review costs

Because of the material impact that indirect costs have on the DORC valuation (nearly 50%), we have assessed the reasonableness of these costs using a top-down approach. The top down approach compares the total cost (indirect and direct costs) of comparable asset costs. Therefore, in preparing comparable cost data, we have attempted to ensure that the total costs for relevant asset components includes the same mark-up components listed above, as we consider this a reasonable approach.

We have reviewed the total cost of each asset component in a range of ways including:

- comparison with published cost data from previous DORC valuations;
- confidential benchmark data from previous engineering assignments undertaken by CMT Solutions;
- detailed information obtained from the ACCC relating to the Dartbrook to Gap DORC valuation; and
- information obtained from the ARTC and Evans & Peck during the project.

We note that we asked the ARTC for the costs of similar projects to assist in our review. Unfortunately, the ARTC was not able to provide additional information since they indicated that they have not undertaken a construction project of the magnitude and type relevant to the Gap to Turrawan valuation. They further indicated that their activities primarily entail much smaller network augmentations (loops, duplication etc.) and specific asset upgrading to increase capacity and performance. Subsequently, they sought the experience of Evans & Peck to undertake this part of the valuation.

5.10.4 Ballast, rail and sleepers

In undertaking our review we have grouped together ballast, rail and sleepers to produce a single overall combined cost. This is because track laying costs often includes the combined cost of installing these assets. Our review shows that the Evans & Peck's combined cost of ballast, rail and sleepers is around 15% above a comparable benchmark prepared by CMT Solutions[79]. The CMT Solutions benchmark includes a mark-up with similar components but critically the client cost mark-up component is set at 15%.

We estimate that a 15% lower replacement of cost of ballast, sleepers and rail (pre adjustment for useful lives) reduces the DORC value by $10.0 million. However, we note that the ARTC has provided us with information that suggests that the mark-up for client costs is closer to 20%. We have not been able to verify the validity of this figure with closer examination of supporting data. If the client cost mark-up component is set at 20%, we estimate that the impact on the DORC is only $7.4 million. Therefore, it is reasonable to assume that the DORC impact lies between $7.4 and $10.0 million.

We further note that the comparable cost for ballast, rail and sleepers used in the Dartbrook to Gap (adjusted for inflation[80]) is lower than the CMT Solutions benchmark cost. However, unlike the confidential benchmark, the Dartbrook to Gap valuation appears to be based on cost information from the mid-2000s adjusted for inflation. Additionally, the mark-ups used in our confidential benchmark are closer to the Evans & Peck mark-ups than those used in the Dartbrook to Gap valuation.

5.10.5 Bridges

Comparing the cost of bridges is difficult as the structures along any given corridor are bespoke items which can be designed and constructed in a variety of ways to provide optimum whole of life cost efficiencies for expected axle loads and volume traffic passing along the route. Therefore, our review has considered whether Evans & Peck's bridge costs fall within a reasonable range. Our review shows that Evans & Peck's bridge costs are likely to be reasonable based on comparisons with the cost per metre and/or cost per square metre of comparable valuations.

For example, Evans & Peck's cost per square metre of around $10,500 (Table 15) is comparable to the $15,000 per square metre quoted in the recent PWC (2011) report which examined the gross replacement costs of The Pilbara Infrastructure (TPI) railway between Christmas Creek mine and Port Hedland[81]. It is our understanding that the costs of construction in the Pilbara region are typically 1.5 to 2 times those of east coast construction. Additionally, although bridge costs in term of cost per metre are higher than the Dartbrook to Gap valuation (adjusted for inflation and including client costs[82]), they are only slightly higher than that referred to as the average cost of bridge construction (in terms of $ per metre) from the ARTC's Structures Manager[83] in the Dartbrook to Gap valuation report (again, adjusted for inflation and including client costs).

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79 Note that the comparable benchmark is for a heavy haul track with similar topography.

80 It does not appear that client costs were included in the mark-up for this valuation.

81 PWC (2011), page 27.

82 It does not appear that the figure quoted in the Booz and Co (2008) report for bridge costs includes a mark-up for client costs.

83 Booz and Co (2008), page 12.

5.10.6 Signalling

The signalling costs of just over $900,000 per kilometre for the Gap to Turrawan appear high compared to some other valuations (e.g. Dartbrook to Gap valuation). However, signalling systems are a function of the rail segment in terms of factors such as overall rail traffic volumes, peak load traffic and number of connections of the main line to passing loops, lanes and sidings. Our review has examined that the unit cost rates for the key signalling components appear reasonable, although we believe that the mark-ups are slightly high overall. If we adjust for a lower mark-up of 102% (instead of 115%) for signalling, we estimate that this results in a lower signalling replacement cost (pre-adjustment for useful lives) of $7.8 million and a reduction in the DORC value by $6.3 million.

5.10.7 Track grade

Comparing the cost of track grade or earthworks to other valuations is also difficult because the earthwork costs can vary considerably based on the terrain and part of Australia within which construction is undertaken. Additionally, there are very few examples of earthwork constructions of this nature in recent years along the east coast, although some major railway construction works have taken place in the Pilbara region of Western Australia. Therefore, our review has considered whether Evans & Pecks track grade costs fall within a reasonable range. Our review shows that Evans & Peck's track grade costs are likely to be reasonable based on comparisons with the cost per kilometre of previous valuations.

For example, Evans & Pecks cost per kilometre of (Table 35) of around $1.5 million is comparable to the $2.2 million per kilometre quoted in the recent PWC (2011) report which examined the gross replacement costs of The Pilbara Infrastructure (TPI) railway between Christmas Creek mine and Port Hedland[84]. This is because it is our understanding that the costs of construction in the Pilbara region are typically 1.5 to 2 times those of east coast construction. Additionally, to make an appropriate comparison to the Pilbara cost, it appears to us that the Evans & Peck cost would need to be adjusted to exclude client costs (which reduces the $1.5 million by around 15%).

We further note that although track grade costs in term of cost per kilometre are higher than the Dartbrook to Gap valuation (adjusted for inflation and including client costs[85]), the Dartbrook to Gap valuation report states that the "cost of current railway formation works in the Upper Hunter Valley reveal pricing for earthworks is in excess of $2 million per kilometre for a 7 km section of track"[86].

In making the assessment that the track grade costs are likely to be within a reasonable range of track grade costs, we have taken into consideration our view that the mark-ups applied to track grade costs are only slightly below the benchmark mark-up that we would apply based on those used in our confidential benchmark costs for ballast, rail and sleepers.

5.11 Mine lives and remaining lives

As illustrated in sections 5.4 to 5.9, the remaining lives of the six asset components varies depending on the asset type and the age of the assets. Most assets have remaining lives that are

84 PWC (2011), page 28.

85 It does not appear that the figure quoted in the PWC (2011) report for bridge costs includes a mark-up for client costs.

86 Booz and Co (2008), page 10.

no more than 30 to 40 years, with the exception of some assets such as earthworks and bridges which have longer remaining lives.

From a theoretical perspective, it is desirable that the expected lives of existing mines and proposed new mines are at least as long as 30 to 40 years. This is important because if the mine lives were very short in timeframe the remaining lives of the assets assumed in the DORC valuation could be regarded as being too long when compared to the underlying economic value of the assets.

However, under the HVCNAU the value of these assets will be recovered (via the depreciation component of the Economic Cost[87]) within the useful life of the rail segment. This is because depreciation under the HVCNAU[88] takes into account the remaining life of coal mines utilising the rail segment. Therefore, given the nature of the HVCNAU, we do not believe that there is an issue with the remaining lives of the assets being potentially greater than the mine lives of the coal mines along the rail segment.

87 ARTC (2012), clause 4.7.

88 ARTC (2012), clause 4.7.

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