Australian Rail Track Corporation

Depreciated Optimised Replacement Cost Calculation for additional segments of the ARTC network

Gap to Turrawan Valuation Report

28 June 2013

Version Control

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0.1	15/03/13	Chloe Xuereb Richard Bluett	Andrew Allen Jonathan Teubner	Draft for review
1.0	10/04/13	Chloe Xuereb Richard Bluett	Andrew Allen Jonathan Teubner	Draft for ARTC comment
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2.1	28/06/13	Chloe Xuereb	Andrew Allen	Addition of Tables 29 and 30

Table of Contents

List of Tables

List of Appendices

1 Executive Summary

Evans & Peck has been engaged by the Australian Rail Track Corporation (ARTC) to undertake Depreciated Optimised Replacement Cost (DORC) valuation for specific segments of ARTC's network.

This report provides the valuation of the Gap to Turrawan segment.

Evans & Peck has valued the assets on the Gap to Turrawan segment to be **$324,895,415.**

Table 1 below lists the value each asset in equipment classes.

Table 1 Revaluation summary

Asset Class	Asset Description	2013 ORC	2013 DORC	% Consumed
BA	Ballast	$ 73,108,274	$ 15,104,501	79%
BR	Bridges	$ 45,690,912	$ 23,509,414	49%
CU	Culverts	$ 10,849,935	$ 6,283,947	42%
FE	Fencing	$ 5,736,402	$ 1,912,134	67%
GJ	Glued Insulated Joints	$ 1,286,934	$ 1,133,328	12%
GR	Track Grade	$ 227,772,788	$ 113,886,394	50%
LB	Lubrication	$ 326,344	$ 293,709	10%
LC	Level Crossing	$ 7,353,880	$ 3,640,929	50%
MS	Miscellaneous Structures	$ 1,691,866	$ 949,626	44%
RL	Rail	$ 78,141,054	$ 14,417,067	82%
SE	Signalling Equipment	$ 134,399,285	$ 108,959,006	19%
SL	Sleepers	$ 56,723,983	$ 33,751,500	40%
TC	Telecommunications	$ 128,199	$ 64,638	50%
TG	Track Geometry	Included within Rail rate		
TO	Turnouts	$ 14,367,353	$ 989,223	93%
	TOTALS	**$ 657,577,206**	**$ 324,895,415**	**51%**

The values above were derived from rates calculated from first principles. This approach has ensured a complete and up-to-date representation of the works required for each of the asset types.

Each asset has a valuation class associated with it being composite, continuous or discrete. Composite assets are built up from a number of components associated with them. The 15 equipment classes have been further broken down into 61 asset groups. This more detailed breakdown will assist ARTC in evaluating accurate amounts to write down in the case of partial asset replacements.

The level of rigour which has been applied by Evans & Peck in building up its rates has, in the opinion of Evans & Peck, resulted in a comprehensive library of robust, market tested rates that have been used to determine the current value of ARTC's Infrastructure Assets.

There are 4 separate sections on the line, being:

- Gap to Watermark Coal
- Watermark Coal to Gunnedah Coal
- Gunnedah Coal top Boggabri Coal
- Boggabri Coal to Turrawan

The asset values have been established for each section, with the DORC result split by section being:

Table 2 DORC Results by Line Section

	Asset Description	Gap to Watermark Coal DORC	Watermark Coal to Gunnedah Coal DORC	Gunnedah Coal to Boggabri Coal DORC	Boggabri Coal to Turrawan DORC	Unit	Total DORC
BA	Ballast	$ 3,475,471	$ 3,662,911	$ 4,985,991	$ 2,980,128	m	$ 15,104,501
BR	Bridges	$ 3,660,503	$ 4,472,862	$ 14,273,809	$ 1,102,240	m2	$ 23,509,414
CU	Culverts	$ 1,137,350	$ 3,654,006	$ 1,031,224	$ 461,367	no	$ 6,283,947
FE	Fencing	$ 451,880	$ 479,123	$ 601,247	$ 379,884	m	$ 1,912,134
GJ	Glued Insulated Joints	$ 170,398	$ 678,290	$ 199,853	$ 84,786	no	$ 1,133,328
GR	Track Grade	$ 28,471,598	$ 28,471,598	$ 28,471,598	$ 28,471,598	m	$ 113,886,394
LB	Lubrication	$ 20,979	$ 125,875	$ 104,896	$ 41,958	no	$ 293,709
LC	Level Crossing	$ 716,643	$ 1,549,557	$ 612,608	$ 762,120	no	$ 3,640,929
MS	Miscellaneous Structures	$ 54,896	$ 595,280	$ 299,449	$ -	no	$ 949,626
TG	Rail	$ 3,151,406	$ 3,833,920	$ 4,864,162	$ 2,567,579	m	$ 14,417,067
SE	Signalling Equipment	$ 23,668,492	$ 31,837,973	$ 31,743,241	$ 21,709,300	m	$ 108,959,006
SL	Sleepers	$ 12,791,583	$ 15,103,972	$ 4,575,486	$ 1,280,459	no	$ 33,751,500
TC	Telecommunications	$ 16,160	$ 16,160	$ 16,160	$ 16,160	no	$ 64,638
TG	Track Geometry	Included within Track rate					
TO	Turnouts	$ 682,853	$ -	$ 306,369	$ -	no	$ 989,223
	TOTALS	**$ 78,470,212**	**$ 94,481,528**	**$ 92,086,095**	**$ 59,857,581**	**m**	**$ 324,895,415**

ARTC has provided a calculation for the apportionment of a DORC value for the network control centre attributable to the Gap to Turrawan segment based upon principles approved by the ACCC in the Port Waratah Coal Service application for inclusion in the Hunter Valley Access Undertaking. This apportionment is $516,750. This amount will be allocated to segments in Gap to Turrawan on the basis of train kilometres.

The total DORC value for the Gap to Turrawan segment is therefore **$325,412,165**.

2 Introduction

Australian Rail Track Corporation (ARTC) manages a substantial part of the rail network around Australia and is regulated by the Australian Competition and Consumer Commission (ACCC) under the Competition and Consumer Act 2010. ARTC is in the process of reviewing the coverage of its rail network under ACCC approved access undertakings; the Interstate Access Undertaking (IAU) approved in 2008 and the Hunter Valley Access Undertaking (HVAU) approved in 2011.

Since the approval of these undertakings, ARTC has assumed management through a long term lease of additional line segments/sections of the Interstate and Hunter Valley rail networks and is now seeking to incorporate some of these segments into the relevant undertaking by way of an application to the ACCC to vary the undertaking.

In support of these applications, ARTC requires the Depreciated Optimized Replacement Cost (DORC) of these segments to be determined.

This valuation provides the DORC for the 131km line segment from Gap to Turrawan, representing the difference between chainage 416.00km to 547.40km, which has been added to the Hunter Valley network. Furthermore, the valuation takes into consideration the 14km of passing loops and sidings specifically associated with the coal infrastructure, providing a total length for the segment of 145 km.

2.1 Background – Hunter Valley Access Undertaking

The HVAU was accepted by the ACCC in June 2011, with the valuation of the asset base largely established using a 1999 Booz Allan Hamilton review, and rolled forward in accordance with the provisions of the NSW Rail Access Undertaking until June 2011. Replacement costs for some parts of the network (Dartbrook to Gap) were benchmarked to 2003 market conditions in ARTC's proposal to the ACCC at the time, but no update on the underlying costs associated with the Optimized Replacement cost has been undertaken since that time.

2.2 Evans & Peck's Scope

ARTC has engaged Evans & Peck to provide DORC valuations for the Gap to Turrawan segment based on the current costs associated with construction of rail infrastructure subject to MEERA and ARTC standards. This will ensure that the DORC represents an up to date valuation of the assets.

Evans & Peck has provided ARTC with the following:

- The Modern Engineering Equivalent Replacement Asset (MEERA) cost for each equipment group identified in the ARTC asset registers as at 1 January 2013.
- The optimisation adjustment applied to establish the Optimised Replacement Cost (ORC), as at 1 January 2013, for each equipment group in the ARTC asset registers.
- The Depreciated Optimised Replacement Cost (DORC) for its infrastructure assets, achieved by depreciating the ORC for the assets relative to the assets' condition and remaining life.

2.3 Consultation with ARTC

Evans & Peck has engaged with ARTC to ensure that the revaluation work being undertaken is as accurate as possible. Consultation has involved senior ARTC management with respect to high level and strategic matters, and has involved local ARTC maintenance and asset management with respect to specific asset description, age and condition.

2.4 ARTC Inputs

To facilitate the DORC revaluation of the infrastructure assets in the Gap to Turrawan segment, ARTC has provided the following information:

- Installation dates for level crossings;
- Structure reports for each bridge by equipment number;
- Communication assets register;
- Track Configuration data (eg Rail weights, sleeper types, etc)
- Track condition charts - Werris Creek to Narrabri;
- Level crossing items from the Ellipse register;
- Signalling items from the Ellipse register;
- Line Diagrams for the Gap to Turrawan segment;
- Inspection reports for each culvert by equipment number;
- Inspection reports for miscellaneous structures (buffer stops, cattle stops and loading structures);
- Structures list for bridges, large culverts and small culverts;
- Map of Gap to Turrawan rail segment to be re-valued;
- Spreadsheet of all other assets existing within the segment;
- AK Car video of relevant track segments and TQI reports; and
- Condition assessment – results of 30 tonne axle load study currently in progress.

2.5 Evans & Peck's Outputs

As part of the DORC revaluation for the Gap to Turrawan segment, Evans & Peck has provided the following outputs:

- A consolidated asset database in Excel format, containing DORC data for each line item (1770 in total);
- Excel worksheets detailing the rates build-up from direct costs and assumptions for each Evans & Peck identified asset group; and
- Summary valuer's report and disclosures: word document detailing the infrastructure portfolio valuation (this report).

3 Asset Classification

ARTC has provided asset information in the form of asset registers such as Ellipse. Assets are normally identified within these registers with a unique equipment number and broader asset class. For those items without an equipment class, Evans & Peck assigned one. Asset classes identified align with those contained in ARTC's Hunter 200+ Infrastructure Guidelines[1]

Each asset class has a valuation type associated with it – composite, continuous or discrete – related to the form that information is provided in for each asset class.

The 15 equipment classes identified as existing in the Gap to Turrawan segment and their valuation types are as follows:

Table 3 Equipment Classes and Valuation Types

Equipment Class	Class Description	Valuation Type
BA	Ballast	Continuous
BR	Bridges	Composite
CU	Culverts	Composite
FE	Fencing	Continuous
GJ	Glued Insulated Joints	Discrete
GR	Track Grade	Continuous
LB	Lubrication	Discrete
LC	Level Crossings	Discrete
MS	Miscellaneous Structures	Discrete
RL	Rail	Continuous
SE	Signalling Equipment	Discrete
SL	Sleepers	Continuous
TC	Telecommunications	Discrete
TG	Track Geometry	Continuous (within RL)
TO	Turnouts	Discrete

3.1 Composite assets

Composite assets are built up by valuing a number of components against the size/quantity for that component to derive the price for each composite asset. These components consist of features of a particular item for which data exists to support a specific valuation and allow a

[1] A suite of internally endorsed ARTC documents intended to support broader ARTC infrastructure standards, taking into account the heavy haul requirements of the Hunter Valley coal network including:

- track, civil and structures design direction;
- consistent signalling, communications and electrical design and equipment;
- asset management and resourcing, availability, and reliability.

value to be derived. Bridges are composite assets, as they have been valued by combining a unit rate for each of the components (decks, piers and abutments). The resultant unit rates are multiplied by the relevant quantity to arrive at the overall Asset value.

3.2 Continuous assets

Continuous assets are related to a length along the railway. Continuous assets are valued by applying rates over a length of the asset to determine the value of the specific asset. Examples include track geometry and rail.

3.3 Discrete assets

Discrete assets are assets which are valued as individual items. A typical example of a discrete asset is signalling equipment such as track circuits that can be identified individually.

3.4 Grouping of assets

For the purposes of the revaluation, the 15 equipment classes were further broken down into asset groups assigned by Evans & Peck. These groups allow similar assets to be priced together. 61 groups have been identified – a listing can be found in Appendix 1.

4 Valuation Methodology

The revaluation methodology is based on Australian Accounting Standards Board *Property, Plant and Equipment* (AASB 116) and NSW Treasury Policy & Guidelines paper *Valuation of Physical Non-Current Assets at Fair Value* (TPP 07). These standards define the process for determining the DORC.

4.1 Asset valuation process

In accordance with the requirements of AASB 116 and TPP 07, a structured process has been developed to determine a valuation that allows for an appropriate modern engineering equivalent replacement asset (MEERA), and an appropriate measure of depreciation to be applied. The process is broken into the following:

- Asset valuation, involving the process of classifying the asset and undertaking a rate build-up from first principles to value the asset;
- Review of the asset standards to determine the appropriate MEERA value;
- Review of each asset group's practical capacity or useful life to allow the determination of an optimisation factor; and
- Asset condition assessment in comparison with the useful life of the asset to determine the remaining life and the depreciation factor.

This process is summarised on the following flow diagram:

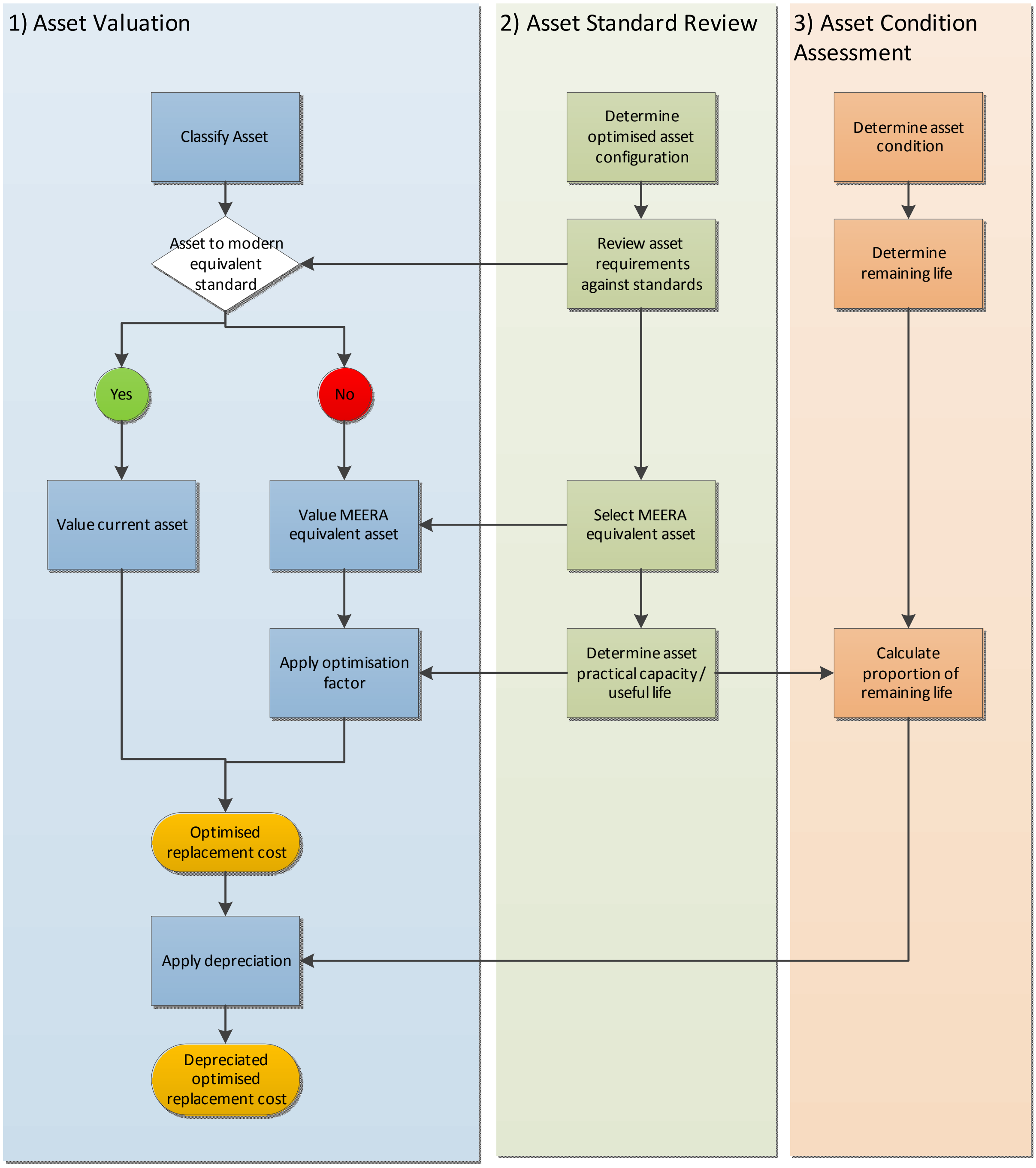

Figure 1 Calculation of the Depreciated Optimised Replacement Cost (DORC)

The valuation process described above is based on the following key assumptions:

- Assets are based on the configuration and location of the existing asset as of the date of the valuation (January 2013);
- Asset valuation is based on replacement with modern engineering equivalent replacement asset (MEERA) that provides an equivalent level of capacity and performance to the existing "as-built" asset but are not necessarily identical to the existing asset (consistent with the relevant requirements of section 4.4 of the HVAU;

- Determination of the MEERA asset was undertaken based on ARTC's standards unless specified otherwise below;
- MEERA assets were determined based on the line utilisation and vehicle axle loading for the following asset types:
  - Track including rail, fixings and sleepers.
  - Track formation, including ballast and sub-base.
  - Bridges and other load bearing structures.
- MEERA assets for the mechanical, electrical power and instrumentation and control elements will only be required to match the performance of the existing asset in terms of quantity and quality of output and may not replicate the existing asset identically.

4.2 Asset pricing

Pricing techniques for each asset will range from detailed first-principle estimates to comparisons with reference-class benchmarks. For the purposes of pricing each Asset Group, Evans & Peck determined the most appropriate pricing technique based on the profile of each Asset Group against a set of criteria based on the following factors:

- Complexity of work.
- "Typical" or "custom" nature of the works.
- Incorporating ARTC's most recent procurement data where available.
- Availability of similar reference class benchmarks.
- Price sensitivity of works compared to similar activities elements.
- Overall value of the works relative to the value of the asset portfolio.

Application of the valuation criteria is represented diagrammatically as shown in Figure 2 below.

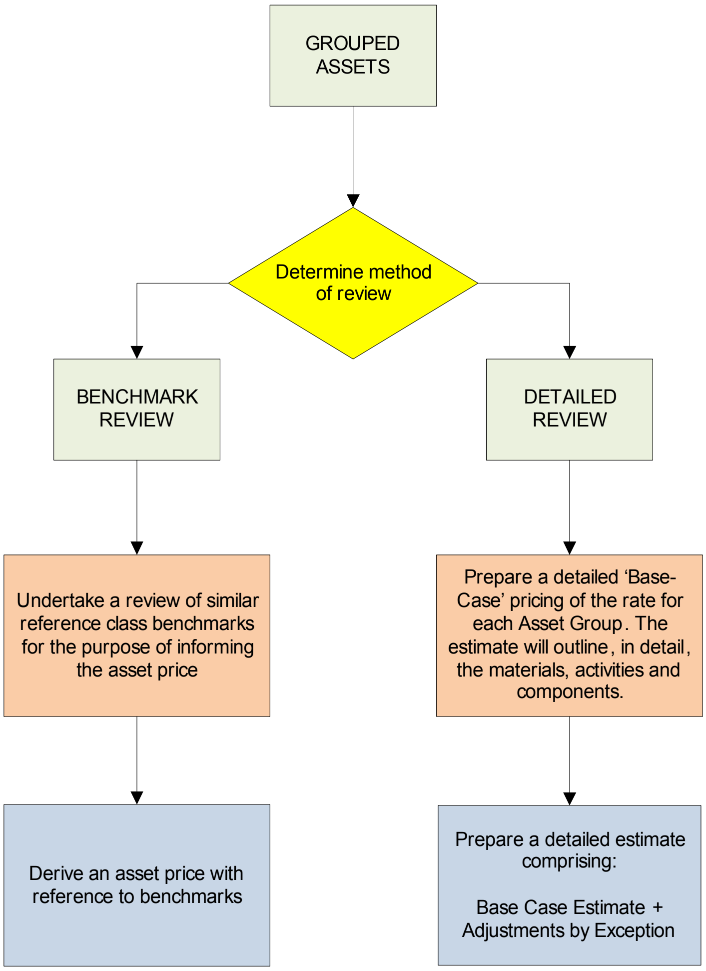

Figure 2 Asset pricing process

4.3 MEERA Pricing Model

Consistent with the relevant requirements of section 4.4 of the HVAU, asset replacement values are determined on the basis of a MEERA. This assumes the current infrastructure assets are replaced with a modern equivalent in accordance with the current codes, standard and technologies.

The MEERA value is determined by calculating the overall cost to construct a particular asset. Evans & Peck has based this calculation on the principles contained in the Department of Infrastructure, Transport, Regional Development and Local Government's *Best Practice Cost Estimation Standard for Publicly Funded Road and Rail Construction*, consisting of the following components:

- Contractor's Direct Costs
- Contractor's Indirect Costs
- Client Costs

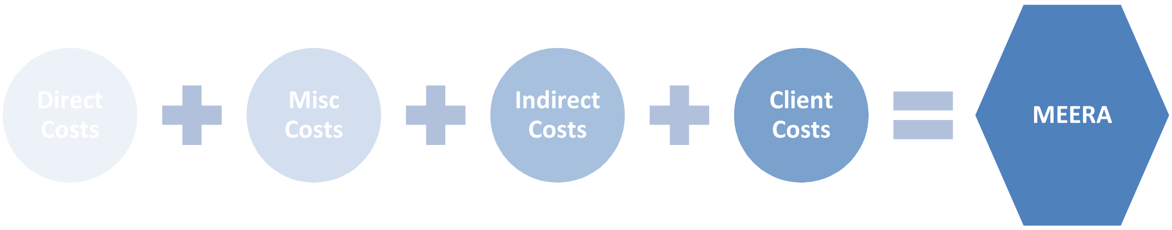

Figure 3 MEERA Valuation Structure

4.3.1 Direct Costs

The estimate of direct costs includes all labour, plant, equipment, materials and subcontract works necessary to replace an asset using modern equivalent materials and techniques. The estimate of direct costs assumes construction would take place in a single phase in a Brownfields railway environment.

For the purposes of this revaluation, the estimate of direct costs assumes replacement of the existing asset in the same location, generally within the rail corridor.

Determination of direct costs excludes:

- Removal of the existing asset being replaced, i.e. demolition and disposal.
- Management, engineering and other on-costs associated with the works that are included in indirect costs and client costs.

The starting point for these direct costs have been established based upon recently accepted (2010) benchmarks for other rail construction costs in NSW by IPART.

4.3.2 Miscellaneous Costs

Un-measurable items

Un-measurable items provide an allowance for miscellaneous costs not covered within the Direct Costs items included within the ARTC asset register. Items of cost would typically include environmental controls, existing services survey, pre-condition survey, temporary works, etc.

4.3.3 Indirect Costs

Indirect costs have been calculated as a percentage mark-up relative to the direct cost for each asset. The magnitude of the indirect cost mark-up varies for each Asset Group depending upon the nature, size and complexity of the works involved. Indirect costs have been calculated based on the following categories:

Preliminaries

Typically comprise contractor's costs including mobilisation, demobilisation, site establishment, maintenance of site facilities, temporary services, supervision of the works and relevant contractors insurances.

Design

Makes allowances for professional services associated with the design, procurement and management of the works. These percentages can vary significantly, especially in the case of specialist design such as signalling and electrical, due to the relative cost of design to the works and the level of safety assurance required within the design process.

Contractor's Overhead & Margin

Costs and expenses related to off-site business functions of the Contractor (in respect of the works), including: financial, legal, human resources, commercial, executive management, corporate infrastructure and support, corporate head offices running costs, payroll and project specific profit. Contractor's Overhead & Margin is applied as a mark-up on the Contractor's total costs comprising Direct Costs, Preliminaries and Professional Fees.

Direct Costs and Indirect Costs together make up the Contractor's Costs component of the MEERA valuation.

4.3.4 Client Costs

Client costs have been calculated as a percentage mark-up relative to the Contractor's Costs for each component. The percentage used was based on feedback from ARTC on typical past projects. Client Costs include the following categories:

Delivery Agency Costs

This represents the cost of the work being delivered by a separate agency. This includes the agency's corporate overhead, project management costs, planning and environmental costs, technical management, community liaison and safety.

Insurance

This represents client insurance in addition to any provided by the Contractor.

4.4 Overall On-Costs

Included in the table below is a summary of the mark ups that have been applied to the Contractor's Direct Costs in respect of the combined Contractor's Indirects and Client's Costs, to arrive at a MEERA value for the particular Asset Class.

A detailed breakdown of this schedule of mark-ups is included in Appendix 2.

Table 4 Percentage Mark Up on Direct Costs

Asset Class	Class Description	% Mark Up on Direct Costs
BA	Ballast	100%
BR	Bridges	100%
CU	Culverts	100%
FN	Fencing	100%
GJ	Glued Insulated Joints	100%
GR	Track Grade	100%
LB	Lubrication	100%
LC	Level Crossings	108%
MS	Miscellaneous Structures	100%
RL	Rail	100%
SE	Signalling Equipment	115%
SL	Sleepers	100%
TC	Telecommunications	101%
TG	Track Geometry	Within RL
TO	Turnouts	100%

4.5 Optimisation

Under TPP 07-1 the modern equivalent asset must be adjusted for overdesign, overcapacity and redundant components by the process of optimisation. The basis for adjusting for optimisation is described in Section 4.3 of TPP 07-1 as follows:

The modern equivalent asset may have a different capacity, quality, configuration or useful life from the existing asset to be valued. In such cases the replacement cost of the modern equivalent asset is to be pro-rated to the economic benefits of the existing asset which should not exceed the anticipated needs as realistically determined by the entity, termed 'expected capacity in use'.

'Expected capacity in use' is the required level of economic benefits or output consistent with both the anticipated future growth in demand and the objective of minimising the whole-of-life cost of assets within an entity's business planning horizons. It assumes no improvement to the components of the economic benefits of the existing asset; i.e. capacity, quality of service and useful life.

Throughout the Gap to Turrawan database, there are many instances where the modern equivalent asset has different capacity, quality, configuration and/or useful life from the existing asset. On this basis, Evans & Peck has determined an optimisation factor to apply to the MEERA valuation for many of the assets.

Evans & Peck has applied optimisation factors based on our understanding of the following:

- ARTC's existing assets
- Current railway infrastructure technologies
- Historical data

Details of the optimisation factors and basis for calculation are included in Section 6 below.

4.6 Brownfields Construction rates

Evans & Peck has assumed a country brownfields construction methodology. This assumption is consistent with Section 4.2 of the NSW Treasury Standard TPP 07, the methodology of which underpins this valuation. The relevant section of that Standard quotes:

"In other words, replacement cost is the minimum that it would cost, in the normal course of business, to replace the existing asset with a technologically modern equivalent new asset with the same economic benefits, allowing for any differences in the quantity and quality of output and in operating costs."

The standard therefore requires that the replacement cost to be valued in the normal course of business. Such a construction methodology is, by definition, a brownfields environment; as opposed to construction in an entirely new scenario which implies a greenfield standard.

In developing the country brownfields assumptions, Evans & Peck, has been conservative in establishing benchmarks. It has assumed no night work, thus avoiding additional costs associated with working at night, including penalty rates. No additional costs have been assumed for loss of track access, such as the provision of alternative transport routes including access roads.

The country brownfields construction costs are therefore very similar to greenfield costs. However, the additional costs associated with greenfields developments such as land acquisition, access road construction, etc. have not been assumed in the cost calculation. The country brownfields rate is therefore conservative in assessing what is included against greenfield alternatives.

4.7 Escalation

All build-up of prices have been determined using market rates as at the first quarter in 2013. Therefore, no escalation needs to be applied to the re-valued assets at the date of this report.

4.8 Depreciation

Depreciation will be calculated in the following manner for each asset class:

Table 5 Depreciation calculation based on asset class

Asset Class	Class Description	Depreciation Calculation
BA	Ballast	Calculated based on gross utilisation
BR	Bridges	Asset condition survey or age of asset
CU	Culverts	Asset condition survey or age of asset
FE	Fencing	Asset condition survey or age of asset
GJ	Glued Insulated Joints	Calculated based on gross utilisation

Asset Class	Class Description	Depreciation Calculation
GR	Track Grade	Asset condition survey or age of asset
LB	Lubrication	Asset condition survey or age of asset
LC	Level Crossings	Asset condition survey or age of asset
MS	Miscellaneous Structures	Asset condition survey or age of asset
RL	Rail	Calculated based on gross utilisation
SE	Signalling Equipment	Age of asset
SL	Sleepers	Calculated based on gross utilisation
TC	Telecommunications	Asset condition survey or age of asset
TG	Track Geometry	Calculated based on gross utilisation
TO	Turnouts	Calculated based on gross utilisation

Where an asset has been assessed to be life expired based on its age in comparison with the expected life of the asset, it is assumed that because the asset is still in service that it has a minimum of 10% remaining life.

5 Assumptions / limitations

ARTC and Evans & Peck have agreed on a number of general assumptions and limitations to be applied to the revaluation. These assumptions are detailed below as follows:

Table 6 Assumptions and limitations applied to the revaluation

ID	Title	Assumption
1.	Brownfields	The valuation should be undertaken assuming the replacement assets are installed under railway Brownfields conditions (country), unless stated otherwise as discussed in Section 4. The brownfield country conditions are as per the existing railway.
2.	Removal of Existing Assets	No allowance has been included for removal of existing infrastructure for the replacement with new assets.
3.	Excavation	Excavation is generally assumed to be Other than Rock (OTR) unless specified.
4.	Contamination	Removal and disposal of contaminated material has been excluded.
5.	Client and Possession Costs	Client and possession costs are to be included as detailed in Section 4. The Brownfield country assumption requires work to be performed under possessions, however as its coal related, no alternative transport solutions are required.
6.	Authority fees and charges	Authority fees and charges are not included in the valuations. ARTC client costs are included as stated above.
7.	Out of hours work	Where appropriate, works incorporate out of hours or weekend rates. As outlined in 4.6, the conservative rates assumptions infer no night work and limited out of hours costs
8.	Buildings	The cost of buildings has not been included in the valuation, with the exception of signalling locations and buildings. Examples of buildings not included are station buildings and non-signalling equipment housings. Newcastle network control centre building is leased by ARTC and so excluded from the valuation.
9.	Land values	Land values have been excluded from the DORC
10.	Coal assets	The asset register has been extended to accommodate the passing loops and sidings associated with the coal assets that are utilised by, or support, the existing coal task between Gap and Turrawan.
11.	Goods & Services Tax	Goods & Services Tax (GST) is excluded from the assessment of values.

6 Development of the MEERA Standard for Gap to Turrawan

This section will consider the optimum configuration of the Gap to Turrawan railway in developing the MEERA standards. The optimum configuration of the railway has been determined in consideration of the purpose and capacity of the railway. This optimum configuration in turn informs the development of the MEERA standard for the specific asset classes.

6.1 Gap to Turrawan Network Utilisation

The existing network utilisation (FY2012) was derived from information provided by ARTC for the Gunnedah Basin, summarised in Table 6 below.

Table 7 Network Utilization

FY2012	Gap to Gunnedah	Gunnedah to Turrawan	Trains
	MGT		Trains
Coal	11.3	5.4	3,689
Non-Coal	4.5	4.5	3,097
Total	**15.8**	**9.9**	**6,786**

Historical utilisation information was also provided by ARTC for the period from 1998-99 which enabled gross tonnage calculation of 114.4MGT for Gap to Gunnedah and 77.7mGT for Gunnedah to Turrawan to be determined as being carried over the period from 1998/99. Further estimates were established that coal volumes started in approximately 1983 with only small amounts of coal being carried from Gunnedah up to 1998-99. Assuming that non-coal volumes were relatively constant prior to 1998-99 at around 1998-99 levels, historic consumption of the Gap to Gunnedah segment could be estimated at around 260MGT, and around 200MGT for the Gunnedah to Turrawan segment.

The existing network utilisation assumed for determination of the MEERA Standard is based on coal being around 11MGTpa for Gap to Gunnedah and 5MGTpa for Gunnedah to Turrawan (although this will vary over the segment based on mine production).

Currently traffic in Gap to Turrawan is limited to 25T axle load. Future forecasts for increased tonnages and axle loads are not relevant for this valuation which is based on existing asset performance and capacity.

The network utilisation is consistent with ARTC's Route Standards for the Heavy Haul Network NSW section H3, Werris Creek to Narrabri (including The Gap to Turrawan), which specifies the following train characteristics referred to as "Route Capacity" in Figure 5[2].

[2] http://www.artc.com.au/library/RAS_H3.pdf

ROUTE CAPACITY

ROUTE CAPACITY

WERRIS CREEK – NARRABRI			
Train Type	Maximum Speed (km/h)	Maximum Axle Load (tonnes)	
		Locos	Wagons
Freight	115	22.3	19.5
	100	22.8	20
	80	22.8	25
	65	22.8	25
Passenger			
XPT/Railcar	160	N/A	
Xplorer	145	N/A	
Diesel Haul	115	19	

Note: Route capacity applies where vehicle characteristics and conditions permit.

Figure 4 Route Capacity Gap to Turrawan

6.2 Track Alignment

In determining the optimal infrastructure alignment/configuration, the relevant load parameter is the usage of the capacity of the network at peak times, rather than the average usage of the track over a period of time.

The track sections between Gap and Turrawan are currently utilised by coal and other non-coal uses such as passenger and general freight. Up until several years ago, the predominant utilisation has been for non-coal traffic. However, strong development of existing and new coal mines since around the mid-2000s show that coal utilisation has significantly increased and currently represents an average utilisation of a little over 50% of all use on a train kilometres basis, and obviously much higher on a GTK basis.

The timing of the usage of these track sections by coal services is largely dependent on demand for coal stockpiles at the port to be replenished to meet shipping requirements. This demand is naturally 'chunky' due to the size of the coal requirement and the existence of only a few Gunnedah based mines, requiring campaign style and transport operations. In lower parts of the Hunter Valley, where a greater number of mines exist, steady network utilisation for coal can be more easily managed. On the other hand, coal utilisation of the Gap to Turrawan sections faces greater demand fluctuations. This could be expected to be the case irrespective of the degree of network utilisation by non-coal traffics.

A relevant determinant for the design of the network is the percentage of the network utilized by coal services at peak times. The graph below shows a cumulative frequency histogram of the percentage of coal trains versus all trains. It demonstrates that for 8% of the time, coal consumes 95-100% of the network and for over 25% of the time (around 2 days per week), coal consumes at least 80% of the network.

Therefore the design and capacity of the network inherent in the existing infrastructure alignment and configuration (other than those parts not utilised by coal) is appropriate to meet existing peak coal haulage service demand requirements.

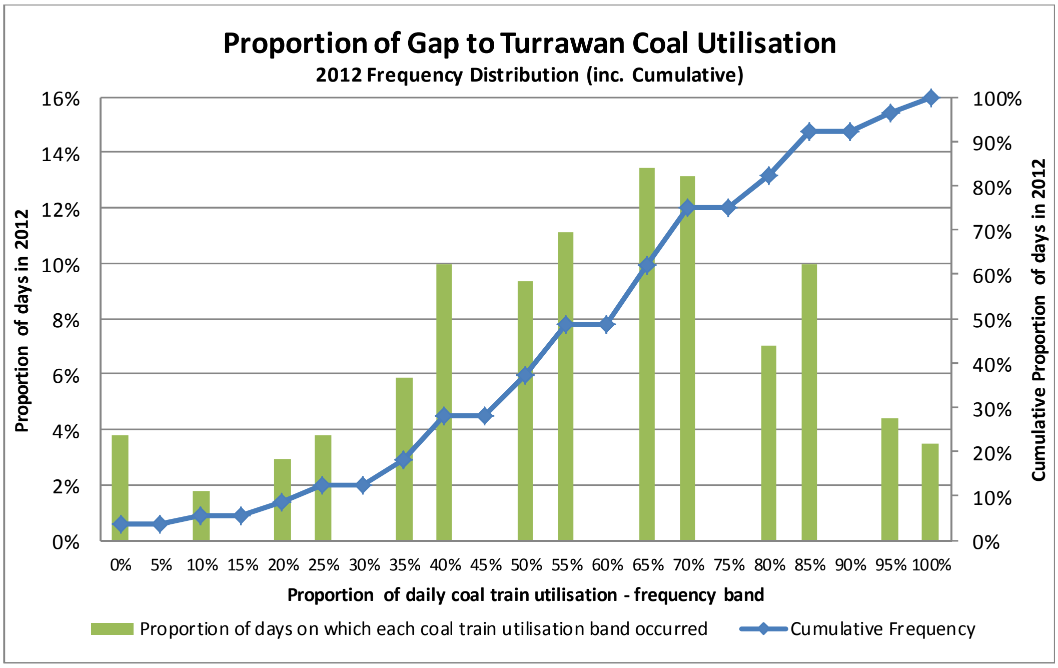

Figure 5 Segment Capacity Utilization Percentages

The map attached in Appendix 6 highlights (in red) those parts of the Gap to Turrawan alignment and configuration that are utilised for the benefit of the existing coal haulage task, and are relevant to this re-valuation. Those parts not shown in red are not utilised or required for coal haulage and have not been valued.

6.3 Ruling Grade

The ruling grade in this section is 1 in 50 for the empty train (heading north) and 1 in 75 for the loaded train (heading south)[3].

An optimum specification for ruling grade is not an issue that can be determined by reference to the infrastructure solely, since trains with sufficient locomotives can negotiate very steep grades. There is a trade-off between locomotive power provision and the cost of earthworks to provide a flatter grade.

On a whole of life basis, where the railway will be used for a long period the operating cost advantages of flatter grades and fewer locomotives could outweigh the increased capital cost of the infrastructure. This relationship will have dependencies associated with financing costs, tonnage, life profile of tonnage, construction costs and rolling stock costs.

For the particular section in consideration, as it is an old piece of infrastructure it is unlikely to have been optimised for the massive coal tonnages now contemplated. On that basis alone one could conclude that its current grade configuration is not optimal.

[3] 2008-2024 Interstate and Hunter Valley Rail Infrastructure Strategy 30 June 2008, ARTC, Table 15

However, since coal haulage contracts are at best only 10 years in duration it is not possible to carry out an optimisation exercise that matches the life of most of the assets of the railway with a guaranteed task. Whereas, where a new railway is built and which is owned by a mine, the ability to carry out a whole of life optimisation is possible given the control the miner has over the process. Hence we observe in the iron ore market, and possibly in the future the coal market of the Galilee Basin, willingness to design to a 1 in 300 grade which reduces operating costs over the life of the project but with a high initial capital cost.

The existing ruling grade of 1 in 75 is therefore considered to be close to optimal for the circumstances that currently exist for this section of line.

6.4 Component Specification

The current tonnage throughput on this section for coal is approximately 5-10 million gross tonnes depending on the segment. The gross tonnage utilisation on this railway is a significant tonnage and with axle loads of 25 tonnes, while not being the highest is Australia, indicates the need for a robust track structure.

This specification, despite it being part of the ARTC "Heavy Haul Network (HHN)", is very similar to ARTC's Interstate Mainline operating characteristics[4]. It varies only in the combination of speed and axle load of heavier freight wagons, but not in maximum axle load nor in passenger operations.

A 25t axle load wagon will immediately dictate the weight of rail as 60kg/m. This is the standard configuration across the whole of the Australian mainline network[5]. By comparison, a 30 tonne axle load would also require a 60 kg/m rail but it would be specially heat treated to be "head hardened". A 25 tonne axle load does not require the head hardened rail except for on low radius curves.

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. Concrete sleepers, as is the remaining ARTC interstate and ARTC heavy haul network, at a spacing of 600 mm, is standard.[6] The standardisation of the sleeper components and type also improves efficiency in purchase and maintenance.

The axle load will also determine the ballast depth which is specified by ARTC as 300mm depth and with a shoulder of 300 mm[7]. This depth is required to distribute the 25 tonne axle load to the weaker formation elements. The specification differs from that used on the interstate lines where the speeds and axle loads are very similar because the Gap to Turrawan section is categorised as being Heavy Haul, signifying that a larger percentage of traffic on the line will be utilising the maximum axle load conditions. On the Interstate network a greater variety of loads occur.

[4] http://www.artc.com.au/library/RAS_D51.pdf
[5] ARTC Code of Practice, Rail, Section 1
[6] ARTC Code of Practice, Sleepers and Fastenings, Section 2
[7] ARTC Code of Practice, Ballast, Section 4, "Shoulder" is that dimension laterally and horizontally from the end of the sleeper to the beginning of ballast repose

6.5 Benchmarking with other Jurisdictions

6.5.1 Western Australia

In Western Australia the Economic Regulation Authority (ERA) has accepted MEERA determinations for the Forrestfield to Kalgoorlie Standard Gauge Line where the operating parameters are similar[8]. This section of line being standard gauge and carrying 25 Million Gross Tonnes, with a large proportion being iron ore, is a very close fit to the Gap to Turrawan section in configuration and traffic profile.

In the ERA's "WestNet Rail's Floor and Ceiling Costs Review Final Determination on the Proposed 2009-10 Floor and Ceiling Costs", the ERA's published MEA (same meaning as MEERA) standard is repeated in Figure 7 below. The column "Forrestfield to Kalgoorlie" is the applicable track for the comparison with the Gap to Turrawan.

[8] http://www.erawa.com.au/cproot/7741/2/20090707%20WestNet%20Rails%20Floor%20and%20Ceiling%20Costs%20Review%20-%20Final%20Determination%20on%20the%20Proposed%202009-10%20Floor%20and%20Ceiling%20Costs.pdf

WNR Proposed MEA Standard for the Main Lines (excluding Terminal Ends) and Kwinana to Soundcem line.

Main line	Kwinana to Bunbury (SWM)	Brunswick to Premier	Kwinana - Soundcem	Forrestfield to Kalgoorlie (EGR)	Kalgoorlie to Leonora	Kalgoorlie to Esperance
Axle Load Freight (tn) & Max. Speed Freight (kph) [loaded/empty]	At 21tn: 115/115 (NG) At 23tn: 80/80 (NG)	At 21tn: 50/70 (NG)	24 tn (70/80)	At 21tn: 115/115 (DG & SG) At 23tn: 80/80 (DG & SG)	At 21tn: 50/70 (SG)	At 23tn: 70/80 (SG)
Max. Speed Passenger (kph)	160 (NG)	N/A	N/A	160 (SG)/100 (DG)	N/A	N/A
Ave. Formation height (m)	1.0	1.5 (Brunswick East to Worsley) 1.0 (Worsley to Hamilton & Worsley to Premier)	1.5	1.5	1.5	1.5
Rail (kg/m)	50	50	50	60	50	50
Ballast depth (mm)	250	250 (Concrete sleepers)[3] 150 (timber sleepers)[4]	250	300	200	250
Sleeper Type & spacing/km	Concrete/ 1,500	Concrete/1, 500 Timber/1,47 0	Concrete/1, 500	Concrete/1, 500	1 in 4 Steel/1,500	1 in 2 Steel/1,640

[3] For the section Brunswick East to Worsley

[4] For sections East and North of Worsley

Final Determination on WestNet Rail's Proposed Floor and Ceiling Costs for 2009-10 43

Figure 6 ERA's Agreed MEA Standards

The axle load shown in the first column does not mention 24 tonne but this is permissible under reduced speeds and is indicated in WestNet's own Access Seeker Information Pack[9]. In addition, an axle load of 25 tonne is permissible under further reduction of speed and is indicated in WestNet's Standard Gauge Code of Practice referred to in the ERA decision of 2004[10].

[9] http://authority.westnetrail.net.au/access/docs/Axle%20Loads.pdf

[10] http://www.erawa.com.au/cproot/5783/2/Determination%20Floor%20and%20Ceiling%20Final%2014%20Oct%2004.pdf

The parameters of the construction configuration are the same as for The Gap to Turrawan except that the sleeper spacing is 1,500 per km or a spacing of 667 mm instead of 600 mm.

6.5.2 Queensland

The Central Queensland Coal Network also provides a benchmark but with slightly different asset configuration.

The operating axle load on CQCN is 26.5 tonnes and on narrow gauge. One would immediately expect the assets to be of more robust construction than for standard gauge 25 tonne specification. This is borne out in the specification.

Civil Engineering Track Specifications (CETS) 7 & 4 & 2 specify the track structure and include:

- “Top 600”.
  This is a specification for the capping material on the formation which is considerable more robust than that provided on ARTC or WestNet tracks and is designed to overcome the wet conditions in that region. In addition, as the use of ballast depth of greater than 300 mm is not possible with narrow gauge track the formation material needs to be a better quality than for standard gauge.
- Head Hardened Rail for low radius curves.
  This measure is to prevent the higher axle loads from deforming the head of the rail. In addition as the axle load limit has increased since the Specification was produced, from 26 tonne to 26.5 tonne, the standard rail specification is now for head hardened 60kg/m rail throughout. This adoption is a decision based on the on-going cost of maintenance compared with the initial purchase cost of the rail. By means of comparison the 30 tonne axle load Hunter Valley network in NSW has standardised the use of head hardened rail.
- 300mm ballast of Type 1, which is the highest quality ballast and is specified on account of the combination of rainfall and annual tonnage.
- Concrete sleepers at 610mm spacing

Figure 8 shows an extract of the CETS 7 Standard where various track elements are specified.

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Track Structure CETS 7

Traffic Task: Axle Loads (tonnes)	Traffic Task: Speed (km/h)	Traffic Task: Total Tonnage (Mgt/a)	Trackss	Timber Sleeper Track Type	Steel Sleeper Track Type	Conc. Sleeper Track Type
	≤70	≤1.0	New	41-1 [1.]	41-7 [1.] (M7.5)	47-6
			Existing	31-1	31-7 (M6.5)	47-6
		>1.0	New	41-1	41-7 (M7.5)	47-6
			Existing	31-1	31-7 (M6.5)	47-6
>11 & ≤12.2	≤80	All	New	41-1	41-7 (M7.5)	47-6
			Existing	31-1	31-7 (M6.5)	47-6
>12.2 & ≤16	≤80	All	New	41-1	41-7 (M7.5)	50-6 [2]
			Existing	31-2	41-7 (M7.5)	47-6
	>80 & ≤100	All	New	41-2	41-7 (M7.5)	50-6 [2]
			Existing	41-1	41-7 (M7.5)	47-6
	>100 & ≤120	All	New	50-3 [2]	50-7 [2] (M8.5)	50-6 [2]
			Existing	47-3	47-7 (M7.5)	47-6
	>120 & ≤160	All	New	N/A	N/A	50-6
			Existing	N/A	N/A	47-6
>16 & ≤20	≤25	All	New	50-3	50-7 (M8.5)	50-6
			Existing	41-1	41-7 (M7.5)	47-6
	>25 & ≤100	All	New	50-3	50-7 (M8.5)	50-6
			Existing	47-3	47-7 (M7.5)	47-6
>20 & ≤26	≤25	All	New	N/A	60-7 (M10)	60-3
			Existing	47-3	47-7 (M10)	47-6
	>25 & ≤80	≤10.0	New	N/A	60-7 (M10)	60-3
			Existing	53-1	53-7 (M10)	53-3
		>10.0	New	N/A	N/A	60-4
			Existing	53-1	53-7 (M10)	53-3
Standard Gauge Tracks						
High Speed Passenger	≤160	All	New & Existing	1	N/A	1C
Passenger	≤115	All	New & Existing	1	N/A	1C
Freight	≤80	All	New & Existing	1	N/A	1C
Dual Gauge Tracks						

SAF/STD/0077/CIV/BUS Version 2.0 Page 6 of 16
Civil Engineering Track Standards

Figure 7 QR's CETS 7 Standard

6.6 Conclusion on MEERA Standard

Therefore, the MEERA track configuration to be adopted for the Gap to Turrawan section will be:

Formation:	Current formation and grades.
Rail:	60 kg/m AS standard carbon rail (straights) & 60kg/m AS head hardened for curves <450m radius
Sleepers:	Heavy duty concrete sleepers at 600 mm spacing
Ballast:	300 mm ballast under the sleeper, 300 mm shoulder.

The MEERA standard for other assets is discussed in detail for each asset type in Section 7 below.

7 Depreciated Optimised Replacement Cost Revaluation

Determination of the DORC has been undertaken using tailored methods and assumptions for each asset class, based on the specific characteristics of the asset class. This section explains the basis of the MEERA revaluation together with the optimisation and depreciation factors and key assumptions that have been adopted in the revaluation.

7.1 Track Ballast

7.1.1 Existing Assets

Information on the existing asset for track ballast has been provided anecdotally by ARTC asset managers and noting that the ballast is generally consistent with the MEERA standard.

7.1.2 MEERA Standard

The MEERA Standard for track ballast as detailed in section 6 above is assumed to be 300mm bottom ballast with a 600mm ballast shoulder width.

7.1.3 MEERA Price and Optimisation

Based on this MEERA standard the ballast has been priced by the kilometre, as displayed in the table below.

Table 8 Ballast MEERA Pricing

Code	Description	Rate	Mark-up	ORC rate/km	DORC rate/km
TRCK03	Ballast	$250,347	100%	$499,841	$103,637

There are no other standards of track ballast requiring an optimised price to be established.

7.1.4 Depreciation

Following consultation with ARTC, the ballast was assumed to have been installed based upon the following profile:

- 20% prior to 1973
- Balance on straight line average between 1973 and 1993
- No ballast replacement post 1993 except for the Gunnedah to Turrawan section installed in 2009

A useful life of ballast of 40 years has been assumed appropriate for a historically underutilized heavy haul railway, consistent with tax treatment of ballast as an asset.

The existing ballast is therefore assumed to be 80% life expired.

7.2 Bridges (BR)

7.2.1 Existing Assets

The existing bridge assets have been identified from the Bridge Management System database and individual data sheets. A total of 75 bridges were identified consisting of the following deck materials:

- Concrete – 68 bridges
- Steel – 6 bridges
- Timber – 1 bridge

The bridges were divided into abutment, piers and bridge deck for the purpose of the valuation.

ARTC has only provided information on the underbridges and on this basis overbridges have not been included in the valuation.

7.2.2 MEERA Standard

For the purpose of the revaluation of bridges, the MEERA has generally been assumed to be a concrete bridge consisting of the same number/volume of components as the original structure.

The only exception to the above rule is if the existing structure is steel, where the MEERA is also deemed to be steel.

7.2.3 MEERA Price and Optimisation

Evans & Peck has compiled unit rates for the relevant components (deck, piers and abutments), based on the form of construction (steel or concrete). These rates are then multiplied by the quantity identified in the ARTC bridge asset register to arrive at the cost of the component. The total value of the components is then added together to arrive at a total MEERA cost for the bridge.

Following the calculation of the bridge total, the MEERA value is adjusted for optimisation. The optimisation adjustment for the relevant component is dependent upon the existing type of construction. By way of an example, a MEERA which replaces an old timber bridge deck with a modern concrete bridge deck would be subjected to a much greater optimisation adjustment than a brick deck being replaced with a modern concrete deck. The optimisation factors which have been adopted for Bridges are included in Appendix 3.

7.2.4 Depreciation

The depreciation was based on comparing the age of the bridge with the expected life of the bridge based on the following:

- Concrete Bridge – 100 years
- Steel Bridge – 60 years
- Timber Bridge 40 years

The age of the bridge was assessed from a combination of the Ellipse data provided by ARTC and the bridge data sheets.

7.3 Culverts (CU)

7.3.1 Existing Assets

The existing culvert assets were determined from the Bridge Management System database provided by ARTC and consisted of masonry, concrete, steel and timber culverts.

The culverts were classified further into size (small, medium and large categories) and whether they consisted of a pipe section or box section.

7.3.2 MEERA Standard

For the revaluation of the culverts Evans & Peck has assumed the MEERA standard is a concrete box culvert.

7.3.3 MEERA Price and Optimisation

For the purposes of undertaking the valuation of the culverts the following assumptions were incorporated:

- Lineal metre rates for each culvert type & category were generated using cost planning principles and by reference to similar projects.
- Rates are based on the weighted average culvert width (rounded to the nearest standard culvert size) for each small, medium and large category.
- Pipe culverts exceeding 2100mm diameter have been uplifted by 25% on the basis they would be "special" constructions.
- Box / open culverts exceeding 4200mm width have been uplifted by 25% on the basis they would be "special" constructions.
- Open culverts have been priced at 90% of box culverts.
- Rates are inclusive of the following:
  - Excavation
  - Subgrade preparation
  - Supply of culverts
  - Installation of culverts
  - Backfill to culverts
  - End structures
  - Multiple cells

Following the calculation of the culvert total, the MEERA value has been adjusted for optimisation. The optimisation factors which have been adopted for culverts are included in Appendix 3.

7.3.4 Depreciation

The depreciation for culverts was calculated based on the assumed standard economic lifetimes used to calculate depreciation as contained in Appendix4, but summarised as follows:

Concrete 100 years

Masonry 100 years

Steel 50 years

Timber 30 years

7.4 Fencing (FE)

An allowance has been provided for stockproof fencing along the length of the rail segment. The assumption on the MEERA standard and the existing fencing in place include:

- Stockproof fencing assumed to run both sides of the track.
- Fencing to be timber post and three strands of barbed wire.

Table 9 Fencing MEERA pricing

Code	Description	Rate/km	Mark-up	ORC rate/km	DORC rate/km
FENC01	Fencing - Stockproof Fencing	$ 10,947	100%	$21,895	$7,298

7.5 Track Grade (GR)

Earthworks have been assumed to be installed in accordance with Hunter 200+ Infrastructure Guidelines, which has also been adopted as the MEERA standard.

The track grade for the Gap to Turrawan has been assumed to consist of the following components along the entire length of rail corridor:

- Ground re-profiling of variant depths
- 3m wide access road
- Provision of a cess drain
- Provision of a sub-soil drain in areas of cutting
- 150mm thick capping layer

Due to the varying ground profiles typically seen along the length of corridor, the ground re-profiling has been categorised into three parameters depending on topography. These consist of:

1. Earthworks tolerance +/-1m
2. Earthworks tolerance +/-2m
3. Earthworks tolerance +/-4m

Detailed information on the existing track grade has not been available to enable precise measurements to be established so estimates have been required to be made on the appropriate allocations of earthworks tolerances within the current asset register.

The methodology applied by Evans & Peck to establish the tolerance assumption is:

- Observed the video of AK Car runs on the network, particularly noting areas of high tolerance
- Engaged with separate, and independent, ARTC local experts to assess their estimate of the grade split.

This methodology provided an estimate as below:

Table 10 Earthwork tolerance

Description	% used in estimate	Approx. length applied to estimate
Earthworks tolerance +/-1m	60%	92km
Earthworks tolerance +/-2m	30%	40km
Earthworks tolerance +/-4m	10%	13km

The three estimates, whilst independently created, all provided similar splits. The Evans & Peck inspection of the AK Car Video highlighted that there are areas where the earthwork tolerance is in excess of 4 metres. Costing this area as if it was +/-4 metres is therefore considered to be a conservative approach through an underestimate of the costs of those sections of formation. An alternative approach would be to assume a higher percentage of the highest grade of earthworks, however Evans & Peck has adopted a conservative approach given the assumptive nature of this variable.

Table 11 Earthworks pricing

Code	Description	Rate/km	Mark-up	ORC rate/km	DORC rate/km
EAR01	Earthworks +/- 1m	$ 494,000	100%	$986,000	$494,000
EAR02	Earthworks +/- 2m	$777,000	100%	$1,551,000	$777,000
EAR03	Earthworks +/- 4m	$2,547,000	100%	$5,085,000	$2,547,000

The earthworks have been assumed to be 50% life consumed. 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.

Evans & Peck performed a desk-top study, so relied upon the advice of local experts supporting its reviews of the formation standard via the study of the AK Car video. The combination of these two processes suggested that a life expired assumption of 50% for the earthworks was a reasonable assumption.

7.5.1 Segment Allocations

For the allocation of DORC valuations by line segment presented in Section 8.2, earthworks have been allocated through use of gradient classifications as a proxy for the earthworks valuation classification.

Gradient diagrams were analysed and estimated for each segment where the length of track was allocated into certain grade categories being 1 in <100, 1 in 100-300, and 1 in >300. This assessment for the total network resulted in an apportionment to categories that was similar to the earthwork classifications above. Therefore, the gradient analysis for each segment was used as a proxy allocation variable for grade calculations by segment.

7.6 Glued Insulated Joints (GJ)

Provision has been made for glued insulated joints as per the locations identified within the asset register. The assumptions include:

- The installation location has vehicle access.

Table 12 Glued Insulated Joints MEERA pricing

Code	Description	Rate	Mark-up	ORC rate	DORC rate
GIJS01	Glued Insulated Joints	$ 3,700	100%	$6,882	$6,061

7.7 Lubrication (LB)

Provision for rail lubrication has been included as part of the DORC revaluation. Assumptions made include:

- Inclusion of a rail lubricator pump as part of the rates.
- The installation location has vehicle access.

Table 13 Lubrication MEERA pricing

Code	Description	Rate	Mark-up	ORC rate	DORC rate
RAIL01	Rail Lubrication	$ 11,675	100%	$23,310	$20,979

7.8 Level Crossings (LC)

Evans & Peck has compiled two level crossing rates

Both types of level crossing have been valued in accordance with ARTC Hunter 200+ track, Civil and Structure Infrastructure Guidelines, which has been adopted as the MEERA Standard.

The summary of the valuation is as follows:

Table 14 Level crossing types

Code	Description	Rate	Mark-up	ORC rate
LVLC01	Level Crossing – Road without Signalling	$86,600	108%	$180,369
LVLC02	Level Crossing – Road with Flashing Lights	$106,600	108%	$222,024

For the purposes of the revaluation of level crossings, Evans & Peck has made the following assumptions:

- All sections installed are to be precast modular units.
- Traffic management allowance has been included in the Contractor's Preliminaries.
- The crossings are on a sealed two lane country road.

7.9 Miscellaneous Structures (MS)

Miscellaneous structures, in the form of buffer stops and cattle stops, have been costed as part of the revaluation.

Table 15 Miscellaneous Structures MEERA pricing

Code	Description	Rate	Mark-up	ORC rate	DORC rate
BUFF01	Buffer Stop	$ 45,825	100%	$ 91,494	$ 54,896
SIGN01	Boards - Speed / Stop Boards and Miscellaneous Signs	$ 744	100%	$ 1,488	$ 1,228
LOAD01	Loading Structures	$ 20,000	100%	$ 39,932	$ 19,966

7.10 Rail (RL)

7.10.1 Existing Rail Asset

Information on the existing rail in the Gap to Turrawan section was detailed by ARTC, and the Ellipse Asset Register. Comments from ARTC regarding the existing rail asset are as follows:

- Rail between Gap and Narrabri is a mixture of 100lb (circa 1933 to1935), 107lb (circa 1936 to 1966) and 53kg rail (post 1970). ARTC was unable to reference an accurate mapping of the 100lb, 107lb and 53kg rail but estimated is that 95% of the rail would be either 100lb or 107lb.
- 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.
- The existing 100lb and 107lb rail could be expected to provide up to another 10 years of service under current traffic conditions before becoming 'life-expired' and needing to be replaced. There is a program in place to complete re-railing in 60kg rail over the next 10 years, although some of this work is likely to be accelerated to cater for increased axle loading on the coal trains rather than to specifically address life expiry.

Based on the comments from ARTC and other asset information provided by ARTC, the existing asset assumed is summarised as follows:

Table 16 Asset Summary

Section	Ch From	Ch To	Existing Rail Type	Installation Date	Comments
Gap to Gunnedah	416.00	464.81	107lb (AS 1936)	1966	ARTC stated remaining life to be 10 years.
Gunnedah	464.81	464.84	60kg SC	2002	29 track metres of 60kg rail between 464.812km and 464.841km, and possibly a small amount of 60kg rail on the main line at the connection to the Boggabri Coal Loop.
Gunnedah to Turrawan	464.84	514.00	107lb (AS 1936)	1966	ARTC stated remaining life to be 10 years.
Gunnedah to Turrawan	514.00	515.76	60kg SC	2009	

Gunnedah to Turrawan	515.76	547.60	107lb (AS 1936)	1966	ARTC stated remaining life to be 10 years.
Coal Sidings	Various		100lb	1935	ARTC stated remaining life to be 10 years.

7.10.2 MEERA Standard

The Gap to Turrawan network is currently based on 25T axle load consistent with the relevant requirements under section 4.4 of the HVAU, and this standard has been adopted as the basis for the MEERA Standard. Some upgrades are being undertaken that anticipate a 30T axle load, but these have been allowed within the optimisation factor against a MEERA.

Based on the analysis of the configuration of the Gap to Turrawan railway in section 6 above indicates that the MEERA track standard for this axle loading and Gross Tonnage would consist of:

- **Rail**: 60kg AS Straight / 60kg HH for Low Radius Curves <450m
- **Sleeper**: Concrete Heavy Duty 600mm spacing
- **Ballast**: 300mm bottom ballast & 600mm shoulder minimum.

7.10.3 MEERA Price and Optimisation

Evans & Peck has compiled a rate for rail based on the MEERA standard above. This rate is built up by the kilometre and will be applied to the rail line items as provided by ARTC.

The following assumptions for the MEERA standard track have been made:

- Capping layer and other earthworks has been allowed elsewhere.
- Allowances for removal of existing track have not been included.
- Track is delivered in 130m lengths on track vehicles.
- 60kg head hardened rail for curved rail with radius <450m.
- 60kg standard carbon for straight rail.
- Priced as being delivered to site.
- Rail grinding, tamping and stressing is included.

Table 17 Track Pricing

Code	Description	Rail Rate/km (Direct)	Mark-up	Rail Rate/km (incl. mark-up)
TRGM01	60kg Standard Carbon	$ 324,144	100%	$ 647,185
TRGM02	60kg Head Hardened	$ 351,425	100%	$701,655

Optimisation of existing rail in the Gap to Turrawan section must be undertaken in accordance with the NSW Treasury Policy Paper TPP07-01, which allows optimisation based on capacity, quality of service or useful life. In the case of rail, the most useful measure is useful life, as there is no real differentiation in capacity and quality of service between the rail classes.

The 60kg head hardened rate has been used to optimise the other rail type in the ARTC database, as displayed below:

Table 18 Track Optimisation

Code	Description	Optimisation Factor	Comment
TRCK02	107lb Standard Carbon	85%	Optimisation based on likely lifespan in service compared to 60kg HH.
TRCK03	100lb Standard Carbon	100%	Used only for sidings.

7.10.4 Depreciation

The depreciation of rail has been developed based on comparison of the expected asset life of the rail with the age of the rail.

The expected asset life of rail can be determined from three approaches as follows:

1) **Gross tonnage utilisation**: the gross tonnage of the network will generally govern the life of rail for track that experiences high freight utilisation, which generally exceeds 20 to 30 MGTpa.

2) **Rail Head Loss**: Rail wear resulting from the number of trains passing over the rail, maintenance activities (including rail grinding) and corrosion, which may govern the life of the rail where the overall utilisation of the track is relatively low.

3) **Condition and defects of rail in use:** this measure is determined from defects measurement and condition assessment of the rail in use, and is likely to be the governing factor where track has high axle loads & speeds, or axle loads & speeds that exceed the intended design of the track. These criteria may also govern rail life where the track is required to be maintained at a high standard due to use in high density passenger traffic or for high speed traffic.

The governing approach will be determined by the traffic type and level of utilisation for each section of track. In the case of Gap to Turrawan, the characteristic of the traffic is a heavy haul railway with low overall gross tonnage utilisation.

Gross Tonnage Utilisation

Benchmarks on the expected life of rail from previous valuations include as follows:

- Hunter Valley IPART 600MgT for 60kg SC rail.
- Queensland Regulator up to 1500MgT for 60kg SC rail.

Based on these approaches the expected life of the MEERA standard rail will be greater than120 years under the load conditions for Gap to Turrawan.

The Hunter Valley IPART benchmarks are likely to be influenced by rail in higher tonnage environments and of 107lb/yd and 94lb/yd historical records that would provide a lower average rail life than could be expected from the MEERA standard.

Rail Head Loss

The rail head loss can be calculated as the rail wear from gross tonnage passing over the rail and rail grinding. These calculations are included in Appendix 7 based on the following key assumptions:

- Traffic at 25T axle load
- head loss of 0.003 mm/MgT

- the grinding rate is likely to be 15MGT standard carbon. (See http://www.interfacejournal.com/features/07-10/UPgrinding/2.html or http://www.transportresearch.info/Upload/Documents/201206/20120608_095335_59993_INNOTRACK_d4.5.5-f3-guidelines%20for%20management%20of%20rail%20grinding.pdf)
- head loss for each rail grind of 0.25mm

Based on these assumptions 60kg SC rail is expected to last approximately 40 years. Where 60kg HH rail is used for curves the expected life is also balanced at approximately 40 years.

Based on the above rail age calculations, for Gap to Turrawan rail head loss is likely to the governing factor to determine the asset life of rail.

Condition and Defects

The majority of rail in service dates from the 1930s and was installed in the 1960s, indicates that condition and defects are unlikely to be a governing factor.

The existing rail may need to have increased intervention associated with the nature of the steel in older types of rail.

Governing Factor for Asset Life of Rail

The likely governing factor for asset life of rail is the rail head loss for rail based and the maintenance activities on the track. The expected asset life of rail for the MEERA Standard track of 60kg SC should be 40 years

The fact that the rail has survived for a significantly greater time than that indicated by the rail head loss calculation above is a reflection of the historic underutilization of the asset. Assessing the remaining life of the asset therefore reflects both that indicated by rail head loss incorporating an allowance for the historic utilization rates, as demonstrated by the gross tonnage calculations in Section 7.10.4.2 above.

The expected asset life for other grades of rail to determine optimisation and depreciation is estimated as follows:

Table 19 Rail Optimization Factors

Rail Grade	Assumed Asset Life	Optimisation Factor	Comment
107lb SC Main Line	34 years	85%	Rail head depth for 107lb is 40mm -v- 44mm for 60kg rail. Rail head wear limits under ATRC Engineer (Track & Civil) Code of Practice for 107lb is 23mm vs 26mm for 60kg rail Allow a conservative wear range of 14mm (107lb) and 16mm (60kgSC), to allow for replacement before reaching condemning limits. Wear range variance is 15% to be used for optimisation
100lb SC Siding	40 years	100%	Rail appears to be only used in sidings, likely to have lower rate of grinding.

Remaining Life Calculation

The remaining life based on the asset life for rail is calculated as follows:

Table 20 Remaining Life Calculation

Existing Rail Type	Rail Life	Installation Date	Remaining Life	Comments
107lb (AS 1936)	34 years	1966	10 years	Remaining life assumed to 10% of asset life
60kg SC	30 years	2002	29 years	
60kg SC	30 years	2009	36 years	
100lb Sidings	40 years	1935	10 years	No grinding will be occurring on this rail, so head loss is unlikely to be a factor. Suggest 10 years life which will ameliorate any impact on the overall valuation.

7.11 Signalling (SE)

Signalling has been valued based on the asset register and assuming the assets are installed in accordance with Hunter 200+ Guidelines. General assumptions for trackside signalling equipment include:

- The installed signalling assets are generally the MEERA standard, having been installed relatively recently. There are some exceptions for older assets, which are identified in the asset register.
- Equipment is supplied under ARTC Term Agreements where available and at the prices stipulated in these agreements.
- Equipment is assumed to be to current ARTC standards or optimised to an equivalent standard.
- Allowance includes provision for resources required to commission the signalling system into service.
- Allowance is for a typical installation.
- There is no allowance included for removal of existing equipment.

The signalling asset optimisation details and 2013 ORC values are displayed in the table below.

Table 21 Signalling Summary

Code	Description	Opt %	Uplift	ORC rate	DORC rate	Comment
CABL01	CABLE ROUTE BURIED		115%	$ 87,364,5957	$72,076,089	
PNTS01	MECHANICAL FACING POINTS LOCK	50%	115%	$ 57,075	$ 37,099	Optimise against PNTS03.
PNTS02	MECHANICAL POINTS	50%	115%	$ 57,075	$ 37,099	Optimise against PNTS03.
PNTS03	ELECTRIC POINTS		115%	$ 114,151	$ 82,189	
PRSY01	POWER SUPPLY 50V DC (RECTIFIED)		115%	$ 4,309	$ 3,555	

Code	Description	Opt %	Uplift	ORC rate	DORC rate	Comment
PRSY02	POWER SUPPLY 12V DC (RECTIFIED)		115%	$ 5,343	$ 4,408	
PRSY03	POWER SUPPLY 120V DC		115%	$ 5,343	$ 4,408	
PRSY04	DC/DC CONVERTER		115%	$ 4,309	$ 3,555	
PRSY05	SOLAR PANEL SUPPLY		115%	$ -	$ -	
PRSY06	TRANSFORMER SUPPLY 120V		115%	$ 150,822	$ 124,428	
PRSY07	TANSFORMER SUPPLY 415V		115%	$ 150,822	$ 124,428	
PRSY08	RECTIFIED SUPPLY 415V		115%	$ 75,411	$62,214	
PRSY09	MOTOR GENERATOR SUPPLY		115%	$ 64,638	$42,015	
RESW01	FORTRESS RELEASING SWITCH		115%	$ 54,578	$ 45,027	
SGCP01	CONTROL PANEL		115%	$ 17,237	$11,204	
SIGL01	LED TYPE SIGNAL		115%	$ 77,277	$63,754	
SINT01	MICROLOK INTERLOCKING		115%	$ 323,190	$266,632	
SINT02	MECHANICAL INTERLOCKING GROUND FRAME		115%	$ 64,638	$42,015	
SLOC01	STAFF HUT / RELAY ROOM		115%	$ 198,736	$163,958	No allowance for signalling equipment included within the hut.
SLOC02	WALK IN LOCATION / CUPBOARD		115%	$ 111,442	$ 91,940	No allowance for the equipment within the case.
SLOC03	POWER SUPPLY ROOM		115%	$ 198,736	$163,958	
TMTY01	TELEMETRY SYSTEM		115%	$ 9,068	$ 5,894	
TRCT01	RECTIFIED TRACK CIRCUIT		115%	$ 5,536	$ 3,599	
TRCT02	JEUMONT TRACK CIRCUIT		115%	$ 58,597	$ 48,342	

7.12 Sleepers (SL)

The existing sleepers on Gap to Turrawan include a number of different types of sleepers including Steel, Timber, Concrete and combined patterns.

The MEERA standard for sleepers as detailed in section 6 above is heavy duty concrete sleepers.

Evans & Peck has built up the rate per kilometre for concrete heavy sleepers as follows:

Table 22 Sleeper MEERA Pricing

Code	Description	Sleeper Rate (Direct)	Mark-up	ORC rate
SLPR01	Heavy Duty Concrete Sleepers	$291,583	100%	$ 582,173

This rate has been used to optimise the other sleeper types found in the Gap to Turrawan segment, as detailed in the table below:

Table 23 Sleeper Optimisation

Code	Description	Optimisation Factor
SLPR02	Steel	100%
SLPR03	Timber (1 in 4 Steel)	60%
SLPR04	Timber	50%
SLPR05	Timber transom or girder	50%

The depreciation for sleepers has been calculated based on the age of the sleepers against the life cycle length of the asset. The assumed life of the sleeper assets is as follows:

- Sleeper Type Assume Asset Life (years)
- Concrete Sleepers – 50
- Timber Sleepers – 20
- Steel Sleepers – 50
- Timber (1 in 4 steel) Sleepers – 30

The age of the sleepers for Gap to Turrawan generally dates from 1990 to 2008 with progressive concrete re-sleepering being undertaken more recently.

7.13 Telecommunications (TC)

Provision has been made for telecommunications items in the Gap to Turrawan railway segment:

Table 24 Telecommunications MEERA pricing

Code	Description	Rate	Mark-up	ORC rate	DORC rate
TELE01	Telstra Touchphone	$1,000	115%	$ 2,155	$ 1,077
TELE02	Kingfisher Telemetry	$10,000	115%	$ 21,546	$ 10,773
TELE03	Telstra Frame Relay	$1,500	115%	$ 3,232	$ 1,616
TELE04	WB Radio	$1,000	115%	$ 2,155	$ 1,077
TELE05	Radio Site/Tower	$1,000	115%	$ 2,155	$ 1,077
TELE06	Hawk Link	$1,000	115%	$ 2,155	$ 1,077

7.14 Turnouts (TO)

7.14.1 Existing Assets

The asset register identifies 45 turnouts associated with coal use on Gap to Turrawan. The turnouts generally consist of 53kg rail and were installed in approximately 1975.

7.14.2 MEERA Standard

Evans & Peck has developed a price build-up for a MEERA standard turnout, based on ARTC Hunter 200+ Infrastructure Guidelines.

For the purposes of the revaluation of turnouts, Evans & Peck has made the following assumptions:

- 250mm ballast depth
- Concrete bearers
- Tangential switches
- 60kg head hardened rail
- 8 welds and 4 closure welds
- Capping layer has not been included in the rate
- Materials are delivered by road and hi-rail vehicles
- Stressing / adjustments and rail grinding of the turnout have been included

7.14.3 MEERA Price and Optimisation

Turnout pricing is displayed in the table below.

Table 25 Turnout pricing

Code	Description	Rate	Mark-up	ORC rate
TURN01	Turnout General	$229,024	100%	$ 365,814

This rate has been used to optimise the other turnout types found in the Gap to Turrawan segment, as detailed in the table below:

Table 26 Turnout Optimisation

Code	Description	Optimisation Factor
TURN02	Turnout – 60kg rail	80%
TURN03	Turnout – 53kg rail	67%
TURN04	Turnout – 47kg rail	33%

7.14.4 Depreciation

The depreciation of turnouts was based on the remaining life calculated against the estimated useful life. The estimated useful life for the turnouts was assumed as follows:

- 53kg rail on timber or concrete bearers – 20 years
- 60kg rail on timber or concrete bearers – 30 years

7.15 Network Control Centre

7.15.1 Replacement value

The infrastructure associated with providing network control facilities to any part of the ARTC is not identified directly with any part of the network. Network control services provided by a particular facility relate to a broad part of the network. Consistent with the cost allocation approach provided for in the Hunter Valley Access Undertaking, where network control expenditure is allocated on a train kilometre basis to particular parts of the network (in the absence of more specific identification), ARTC has, in prior regulatory valuations, allocated estimates of the ORC associated with network control facilities to particular segments on the basis of train kilometres.

In 2006-07, ARTC undertook a substantial train control consolidation (TCC) project in NSW costing in the order of $80m, approved for inclusion in the RAB at the time. The project replaced a lot of older equipment with modern equipment and technology intended to deliver substantial savings in operational expenditure for users. Given the age of relevant existing assets remaining following this project it is likely that any asset valuation of relevant assets would be dominated by the recent substantial TCC project spend. As such, in more recent valuations, ARTC has taken as a reasonable proxy for an asset valuation associated with a network control applicable to segments in the Hunter Valley as an allocation on a train kilometre basis to that segment of that part of the TCC project spend incurred in relation to Newcastle network control, which provides services predominantly to the Hunter Valley coal network and some other relevant parts of the ARTC network (such as the north coast interstate mainline).

In a prior valuation provided to (and accepted by) the ACCC, ARTC determined a unit replacement cost for the relevant TCC assets to be applied across the relevant parts of the NSW rail network (including the Hunter Valley coal network) as $3.60 per train km applicable as at 1 July 2010. This becomes $3.85 upon inflation to 1 Jan 2013.

This unit rate has been applied to the Gap-Turrawan on the basis of an estimate of coal train kilometres provided by ARTC.

7.15.2 Consumption

TCC asset installation year (commissioned)	1 Jan 2007
Asset Life	20 years
% consumed as at 1 Jan 2013 (5 years).	25%
Remaining life	75%
TCC ORC (Gap-Turrawan allocation) as at 1 Jan 13	$689,000
TCC DORC	$516,750

8 Results

Following the assessment of the ARTC Infrastructure Assets, Evans & Peck has determined a Depreciated Optimised Modern Engineering Equivalent Replacement Asset (MEERA) Valuation of **$324,895,415** as detailed in the following table:

Table 27 DORC Summary

Asset Class	Asset Description	2013 ORC	2013 DORC	% Consumed
BA	Ballast	$ 73,108,274	$ 15,104,501	21%
BR	Bridges	$ 45,690,912	$ 23,509,414	51%
CU	Culverts	$ 10,849,935	$ 6,283,947	58%
FE	Fencing	$ 5,736,402	$ 1,912,134	33%
GJ	Glued Insulated Joints	$ 1,286,934	$ 1,133,328	88%
GR	Track Grade	$ 227,772,788	$ 113,886,394	50%
LB	Lubrication	$ 326,344	$ 293,709	90%
LC	Level Crossing	$ 7,353,880	$ 3,640,929	50%
MS	Miscellaneous Structures	$ 1,691,866	$ 949,626	56%
RL	Rail	$ 78,141,054	$ 14,417,067	18%
SE	Signalling Equipment	$ 134,399,285	$ 108,959,006	81%
SL	Sleepers	$ 56,723,983	$ 33,751,500	60%
TC	Telecommunications	$ 128,199	$ 64,638	50%
TG	Track Geometry	Included within Rail rate		
TO	Turnouts	$ 14,367,353	$ 989,223	7%
	TOTALS	**$ 657,577,206**	**$ 324,895,415**	**49%**

The above rates reflect January 2013 dollars. It can be seen that track assets and track grade (i.e. earthworks required to install the track) make up more than half of the revaluation cost.

The following exclusions apply to the above rates:

- Land values have been excluded.
- Stations have been excluded.
- Overbridges have been excluded.

Due to the unavailability of data, some installation dates and asset remaining lives have been assumed.

Including the Network control centre DORC allocation provided by ARTC this provides a total DORC for the Gap to Turrawan segment of **$325,412,165.**

8.1 Comparative Results

As outlined in Appendix 5, the most recent construction of an equivalent line was the Northern Missing Link (NML) component of the Goonyella to Abbott Point Expansion (GAPE) on Aurizon Limited's Queensland coal network.

This was a 69km expansion with a total cost (specified in the draft amendment to the Access Undertaking dated 5 September, 2012), including interest during construction of $511m (or $431m excluding interest during construction). This amounts to a rate of $7.4m/km ($6.1m/km excluding interest during construction).

The equivalent rate for the replacement cost calculation for Gap to Turrawan is $4.9m/km (or $5.3m/km if sidings are included).

Another recent construction of a broadly equivalent section of heavy haul track is the third track (triplication) installed between Maitland and Minimbah in the lower Hunter Valley. This involved the construction of 23km length of track (in addition to 2 existing main lines) and included other significant elements such as strengthening of the two existing main lines, earthworks excavation of around 1 million m3 , some property acquisition, structures and services, and new signalling.   Nevertheless, the industry endorsed $362.8m for inclusion in the Hunter Valley regulatory asset base for this work. In addition, around $40 +[Jackie]m in interest was incurred during construction. The industry endorsed amount results in a rate of $[Jackie]m/km ($15.8m/km excluding interest during construction).

The replacement cost calculation therefore provides a substantially conservative number when compared to recent cost outcomes of broadly equivalent sections of heavy haul track.

8.2 Results by Line Section

The calculation methodology has allowed for the determination of all values by line section.

The line sections within the Gap to Turrawan segment are as follows:

Table 28 Line Sections within Gap to Turrawan Segment

Section	Chainage From	Chainage To	Distance
Gap to Watermark Coal	416	447.1	31.1
Watermark Coal to Gunnedah Coal	447.1	480.075	32.975
Gunnedah Coal to Boggabri Coal	480.075	521.455	41.38
Boggabri Coal to Turrawan	521.455	548.485	27.03
Total			**132.485**

The summary of the ORC and DORC results by asset class and line section is provided in Tables 29 and 30 below:

Table 29 ORC Results by Line Section

	Asset Description	Gap to Watermark Coal ORC	Watermark Coal to Gunnedah Coal ORC	Gunnedah Coal to Boggabri Coal ORC	Boggabri Coal to Turrawan ORC	Unit	Total ORC
BA	Ballast	$ 17,377,354	$ 18,314,557	$ 22,515,722	$ 14,900,641	m	$ 73,108,274
BR	Bridges	$ 15,942,487	$ 5,960,554	$ 19,701,073	$ 4,086,798	m2	$ 45,690,912
CU	Culverts	$ 2,050,454	$ 5,818,534	$ 1,947,432	$ 1,033,515	no	$ 10,849,935
FE	Fencing	$ 1,355,639	$ 1,437,370	$ 1,803,741	$ 1,139,652	m	$ 5,736,402
GJ	Glued Insulated Joints	$ 192,696	$ 770,784	$ 227,106	$ 96,348	no	$ 1,286,934
GR	Track Grade	$ 56,943,197	$ 56,943,197	$ 56,943,197	$ 56,943,197	m	$ 227,772,788
LB	Lubrication	$ 23,310	$ 139,862	$ 116,551	$ 46,621	no	$ 326,344
LC	Level Crossing	$ 1,664,974	$ 2,775,096	$ 1,345,892	$ 1,567,917	no	$ 7,353,880
MS	Miscellaneous Structures	$ 91,494	$ 1,074,668	$ 525,704	$ -	no	$ 1,691,866
TG	Rail	$ 18,331,097	$ 20,037,094	$ 25,045,556	$ 14,727,307	m	$ 78,141,054
SE	Signalling Equipment	$ 28,895,326	$ 39,542,269	$ 39,158,195	$ 26,803,495	m	$ 134,399,285
SL	Sleepers	$ 14,952,258	$ 17,538,501	$ 16,010,764	$ 8,222,460	no	$ 56,723,983
TC	Telecommunications	$ 32,050	$ 32,050	$ 32,050	$ 32,050	no	$ 128,199
TG	Track Geometry						
TO	Turnouts	$ 2,926,514	$ 4,101,692	$ 4,773,875	$ 2,565,272	no	$ 14,367,353
	TOTAL	**$ 160,778,849**	**$ 174,486,227**	**$ 190,146,858**	**$ 132,165,272**	**m**	**$ 657,577,206**

Table 30 DORC Results by Line Section

	Asset Description	Gap to Watermark Coal DORC	Watermark Coal to Gunnedah Coal DORC	Gunnedah Coal to Boggabri Coal DORC	Boggabri Coal to Turrawan DORC	Unit	Total DORC
BA	Ballast	$ 3,475,471	$ 3,662,911	$ 4,985,991	$ 2,980,128	m	$ 15,104,501
BR	Bridges	$ 3,660,503	$ 4,472,862	$ 14,273,809	$ 1,102,240	m2	$ 23,509,414
CU	Culverts	$ 1,137,350	$ 3,654,006	$ 1,031,224	$ 461,367	no	$ 6,283,947
FE	Fencing	$ 451,880	$ 479,123	$ 601,247	$ 379,884	m	$ 1,912,134
GJ	Glued Insulated Joints	$ 170,398	$ 678,290	$ 199,853	$ 84,786	no	$ 1,133,328
GR	Track Grade	$ 28,471,598	$ 28,471,598	$ 28,471,598	$ 28,471,598	m	$ 113,886,394
LB	Lubrication	$ 20,979	$ 125,875	$ 104,896	$ 41,958	no	$ 293,709
LC	Level Crossing	$ 716,643	$ 1,549,557	$ 612,608	$ 762,120	no	$ 3,640,929
MS	Miscellaneous Structures	$ 54,896	$ 595,280	$ 299,449	$ -	no	$ 949,626
TG	Rail	$ 3,151,406	$ 3,833,920	$ 4,864,162	$ 2,567,579	m	$ 14,417,067
SE	Signalling Equipment	$ 23,668,492	$ 31,837,973	$ 31,743,241	$ 21,709,300	m	$ 108,959,006
SL	Sleepers	$ 12,791,583	$ 15,103,972	$ 4,575,486	$ 1,280,459	no	$ 33,751,500
TC	Telecommunications	$ 16,160	$ 16,160	$ 16,160	$ 16,160	no	$ 64,638
TG	Track Geometry	Included within Track rate					
TO	Turnouts	$ 682,853	$ -	$ 306,369	$ -	no	$ 989,223
	TOTALS	**$ 78,470,212**	**$ 94,481,528**	**$ 92,086,095**	**$ 59,857,581**	**m**	**$ 324,895,415**

Appendix 1 – Asset Groupings

Equipment Class	Asset Grouping	Item Description
BA	TRCK03	BALLAST
BR	BRID01	UNDERBRIDGE – CONCRETE
BR	BRID02	UNDERBRIDGE – STEEL
BR	BRID03	UNDERBRIDGE – TIMBER
CU	CULV01	CULVERT – CONCRETE
CU	CULV02	CULVERT – STEEL
CU	CULV03	CULVERT – BRICK
CU	CULV04	CULVERT – TIMBER
FE	FEN01	FENCING – STOCKPROOF
GJ	GIJS01	GLUED INSULATED JOINT (GIJ)
GR	EAR01	EARTHWORKS – TOLERANCE +/-1M
GR	EAR02	EARTHWORKS – TOLERANCE +/-2M
GR	EAR03	EARTHWORKS – TOLERANCE +/-4M
LB	RAIL01	RAIL LUBRICATOR
LC	LVLC01	LELVEL CROSSING – ROAD WITHOUT SIGNALLING
LC	LVLC02	LELVEL CROSSING – ROAD WITH FLASHING LIGHTS
MS	BUFF01	SLIDING BUFFER STOP
MS	SIGN01	SPEED/STOP BOARDS AND MISCELLANEOUS SIGNS
MS	LOAD01	LOADING STRUCTURE
RL	TRGM01	60KG STANDARD CARBON
RL	TRGM02	60KG HEAD HARDENED
RL	TRCK02	53KG STANDARD CARBON
SE	CABL01	CABLE ROUTE BURIED
SE	PNTS01	MECHANICAL FACING POINTS LOCK
SE	PNTS02	MECHANICAL POINTS
SE	PNTS03	ELECTRIC POINTS
SE	PRSY01	POWER SUPPLY 50V DC (RECTIFIED)
SE	PRSY02	POWER SUPPLY 12V DC (RECTIFIED)
SE	PRSY03	POWER SUPPLY 120V DC
SE	PRSY04	DC/DC CONVERTER
SE	PRSY05	SOLAR PANEL SUPPLY
SE	PRSY06	TRANSFORMER SUPPLY 120V
SE	PRSY07	TANSFORMER SUPPLY 415V
SE	PRSY08	RECTIFIED SUPPLY 415V
SE	PRSY09	MOTOR GENERATOR SUPPLY
SE	RESW01	FORTRESS RELEASING SWITCH
SE	SGCP01	CONTROL PANEL
SE	SIGL01	LED TYPE SIGNAL

Equipment Class	Asset Grouping	Item Description
SE	SINT01	MICROLOK INTERLOCKING
SE	SINT02	MECHANICAL INTERLOCKING GROUND FRAME
SE	SLOC01	STAFF HUT / RELAY ROOM
SE	SLOC02	WALK IN LOCATION / CUPBOARD
SE	SLOC03	POWER SUPPLY ROOM
SE	TMTY01	TELEMETRY SYSTEM
SE	TRCT01	RECTIFIED TRACK CIRCUIT
SE	TRCT02	JEUMONT TRACK CIRCUIT
SL	SLPR01	HEAVY DUTY CONCRETE SLEEPER
SL	SLPR02	STEEL SLEEPER
SL	SLPR03	TIMBER (1 IN 4 STEEL) SLEEPERS
SL	SLPR04	TIMBER
SL	SLPR05	TIMBER TRANSOM OR GIRDER SLEEPERS
TC	TELE01	TELSTRA TOUCHPHONE
TC	TELE02	KINGFISHER TELEMETRY
TC	TELE03	TELSTRA FRAME RELAY
TC	TELE04	WB RADIO
TC	TELE05	RADIO SITE / TOWER
TC	TELE06	HAWK LINK
TO	TURN01	TURNOUT GENERAL
TO	TURN02	TURNOUT – 60KG RAIL
TO	TURN03	TURNOUT – 53KG RAIL
TO	TURN04	TURNOUT – 47KG RAIL

Appendix 2 – MEERA pricing model

Ref	BROWNFIELDS COUNTRY		MISC COSTS		CONTRACTORS COSTS						CLIENT COSTS					TOTAL MARK UP
Ref	Asset	Contractors Direct Costs	Unmeasurable Items (Enviro etc)	Subtotal *(B + C)*	Prelims	Design	Subtotal *(F + G)*	Value *(H*E)*	OH&P	Value *(J*I)*	Delivery Agency	Client Insurance	Possession & Bussing	Total Markup on Contractors Costs *(H+J+K+L)*	Value *(K*O)*	Total Markup on Contractors Direct Cost
		A	*B*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
TG	Rail, sleepers and ballast	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
FE	Fencing	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
BR	Bridges	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
LC	Level Crossings	100%	5%	105%	30%	15%	45%	1.52	14%	1.74	20%	Incl	Incl	20%	2.08	108%
CU	Culverts	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
TO	Turnouts	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
MS	Miscellaneous Structures	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
LB	Lubrication	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
TU	Tunnels	100%	5%	105%	30%	9%	39%	1.46	14%	1.66	20%	Incl	Incl	20%	2.00	100%
SE	Signalling Equipment	100%	5%	105%	30%	20%	50%	1.58	14%	1.80	20%	Incl	Incl	20%	2.15	115%

Appendix 3 – Optimisation values

Bridge Decks

The table below identifies current allocation of bridge deck types, the replacement construction assumed by Evans & Peck, and the optimisation factor applied in this revaluation.

Current Asset	Replacement Asset	Optimisation Factor
Concrete	Concrete	100%
Assumed Concrete	Concrete	100%
Brick	Concrete	80%
Masonry	Concrete	80%
Steel	Steel	100%
Timber	Steel	40%
Wrought Iron	Steel	60%
Unallocated	Concrete	80%

Bridge Piers

The table below identifies current allocation of bridge pier types, the replacement construction assumed by Evans & Peck, and the optimisation factor applied in this revaluation.

Current Asset	Replacement Asset	Optimisation Factor
Cylinder (Metal Filled)	Concrete	90%
Brick	Concrete	80%
Masonry	Concrete	80%
Concrete	Concrete	100%
Steel	Steel	90%
Steel (Trestle)	Steel	90%
Timber (Trestle)	Steel	40%
Unallocated	Concrete	80%

Bridge Abutments

The table below identifies current allocation of bridge abutment types, the replacement construction assumed by Evans & Peck, and the optimisation factor applied in this revaluation.

Current Asset	Replacement Asset	Optimisation Factor
Brick	Concrete	80%
Brick & Concrete	Concrete	90%
Concrete	Concrete	100%
Masonry	Concrete	80%
Timber	Concrete	40%
Unallocated	Concrete	80%

Culvert Optimisation

Current Asset	Replacement Asset	Optimisation Factor
Brick	Concrete	80%
Brick & Concrete	Concrete	80%
Cast Iron	Concrete	60%
Concrete	Concrete	100%
Concrete & Masonry	Concrete	90%
Concrete & Steel	Concrete	80%
Earthenware	Concrete	50%
Masonry	Concrete	80%
Brick / Masonry / Stone	Concrete	80%
Steel	Concrete	60%
Brick & Steel	Concrete	80%
Timber	Concrete	40%
Unallocated	Concrete	80%

Sleepers

Current Asset	Replacement Asset	Optimisation Factor
Heavy Duty Concrete	Heavy Duty Concrete	
Timber (1 in 4 Steel)	Heavy Duty Concrete	60%
Timber	Heavy Duty Concrete	40%
Timber Transom or Girder	Heavy Duty Concrete	40%

Track

Current Asset	Replacement Asset	Optimisation Factor
Track – 60kg Standard Carbon	Turnout – 60kg Head Hardened	80%
Turnout – 53kg Standard Carbon	Turnout – 60kg Head Hardened	67%

Turnouts

Current Asset	Replacement Asset	Optimisation Factor
Turnout – 60kg	Turnout – 60kg Head Hardened	80%
Turnout – 53kg	Turnout – 60kg Head Hardened	67%
Turnout – 47kg	Turnout – 60kg Head Hardened	33%

Signalling

Current Asset	Replacement Asset	Optimisation Factor
Cable Route Buried		
Mechanical Facing Points Lock	Electric Points	50%
Mechanical Points	Electric Points	50%
Electric Points		
Power Supply 50V DC (Rectified)		
Power Supply 120V DC (Rectified)		
Power Supply 120V DC		
DC/DC Converter		
Solar Panel Supply		
Transformer Supply 120V		
Transformer Supply 415V		
Rectified Supply 415V		
Motor Generator Supply		
Fortress Releasing Switch		
Control Panel		
LED Type Signal		
Miscellaneous Signs		
Microlok Interlocking		
Mechanical Interlocking Ground Frame		
Staff Hut/Relay Room		
Walk in Location/Cupboard		
Power Supply Room		
Telemetry System		
Rectified Track Circuit		
Jeumont Track Circuit		

Appendix 4 – Assumed Standard Economic Lifetimes

Asset Class	Asset Grouping	Item	Standard Economic Lifetime
BR	BRID01	UNDERBRIDGE - CONCRETE	100
BR	BRID02	UNDERBRIDGE - STEEL	100
BR	BRID03	UNDERBRIDGE - TIMBER	40
CU	CULV01	CULVERT - CONCRETE	100
CU	CULV02	CULVERT - STEEL	50
CU	CULV03	CULVERT - BRICK	100
CU	CULV04	CULVERT - TIMBER	30
FE	FEN01	FENCING - STOCKPROOF	30
GJ	GIJS01	GLUED INSULATED JOINTS	25
GR	TRCK03	TRACK GRADE (BALLAST ONLY)	50
LB	LUBR01	CALTEX904 LUBRICANT	20
LC	LVLC01	LEVEL CROSSING - UNSIGNALLED	40
LC	LVLC02	LEVEL CROSSING - SIGNALLED	40
MS	BUFF01	SLIDING BUFFER STOP	50
MS	BUFF02	TIMBER BUFFER STOP	30
MS	CATT01	CATTLE STOP	40
MS	LOAD01	LOADING STRUCTURE	40
RL	RAIL01	53KG RAIL	34
RL	RAIL02	60KG RAIL	40
SE	CABL01	CABLE ROUTE	40
SE	PNTS01	MECHANICAL FACING POINTS LOCK	20
SE	PNTS02	MECHANICAL POINTS	20
SE	PNTS03	ELECTRIC POINTS	25
SE	PRSY01	POWER SUPPLY 50V DC (RECTIFIED)	40
SE	PRSY02	POWER SUPPLY 12V DC (RECTIFIED)	40
SE	PRSY03	POWER SUPPLY 120V DC	40
SE	PRSY04	DC/DC CONVERTER	40
SE	PRSY05	SOLAR PANEL SUPPLY	20
SE	PRSY06	TRANSFORMER SUPPLY 120V	40
SE	PRSY06	TRANSFORMER SUPPLY 240V	40
SE	PRSY07	TANSFORMER SUPPLY 415V	40
SE	PRSY07	UPS SUPPLY 415V	20
SE	PRSY08	RECTIFIED SUPPLY 415V	40
SE	PRSY09	GENERATOR SUPPLY	20
SE	RESW01	FORTRESS RELEASING SWITCH	40
SE	SGCP01	CONTROL PANEL	20
SE	SIGL01	LED TYPE SIGNAL	40

SE	SIGN01	MISCELLANEOUS SIGNS	40
SE	SINT01	MICROLOK INTERLOCKING	40
SE	SINT02	MECHANICAL INTERLOCKING GROUND FRAME	20
SE	SLOC01	STAFF HUT / RELAY ROOM	40
SE	SLOC02	WALK IN LOCATION / CUPBOARD	40
SE	SLOC03	POWER SUPPLY ROOM	40
SE	TMTY01	TELEMETRY SYSTEM	20
SE	TRCT01	RECTIFIED TRACK CIRCUIT	20
SE	TRCT02	JEUMONT TRACK CIRCUIT	40
SL	SLPR01	CONCRETE SLEEPER	50
SL	SLPR02	STEEL SLEEPER	50
SL	SLPR03	TIMBER SLEEPERS	20
SL	SLPR04	TIMBER (1 IN 4 STEEL) SLEEPERS	30
SL	SLPR05	TIMBER TRANSOM OR GIRDER SLEEPERS	20
TC	TELE01	TELSTRA TOUCHPHONE	20
TC	TELE02	KINGFISHER TELEMETRY	20
TC	TELE03	TELSTRA FRAME RELAY	20
TC	TELE04	WB RADIO	20
TC	TELE05	RADIO SITE / TOWER	40
TC	TELE06	HAWK LINK	20
TG	EAR01	EARTHWORKS - TOLERANCE +/- 1M	100
TG	EAR02	EARTHWORKS - TOLERANCE +/- 2M	100
TG	EAR03	EARTHWORKS - TOLERANCE +/- 4M	100
TO	TURN01	TURNOUT- 60KG CONCRETE	30
TO	TURN02	TURNOUT - 60KG TIMBER	30
TO	TURN03	TURNOUT - 53KG TIMBER	20
TO	TURN04	TURNOUT - 53KG CONCRETE	20
TO	TURN05	TURNOUT - 47KG CONCRETE	15
TO	TURN06	TURNOUT - 47KG TIMBER	15

Appendix 5 – Northern Missing Link Construction Costs

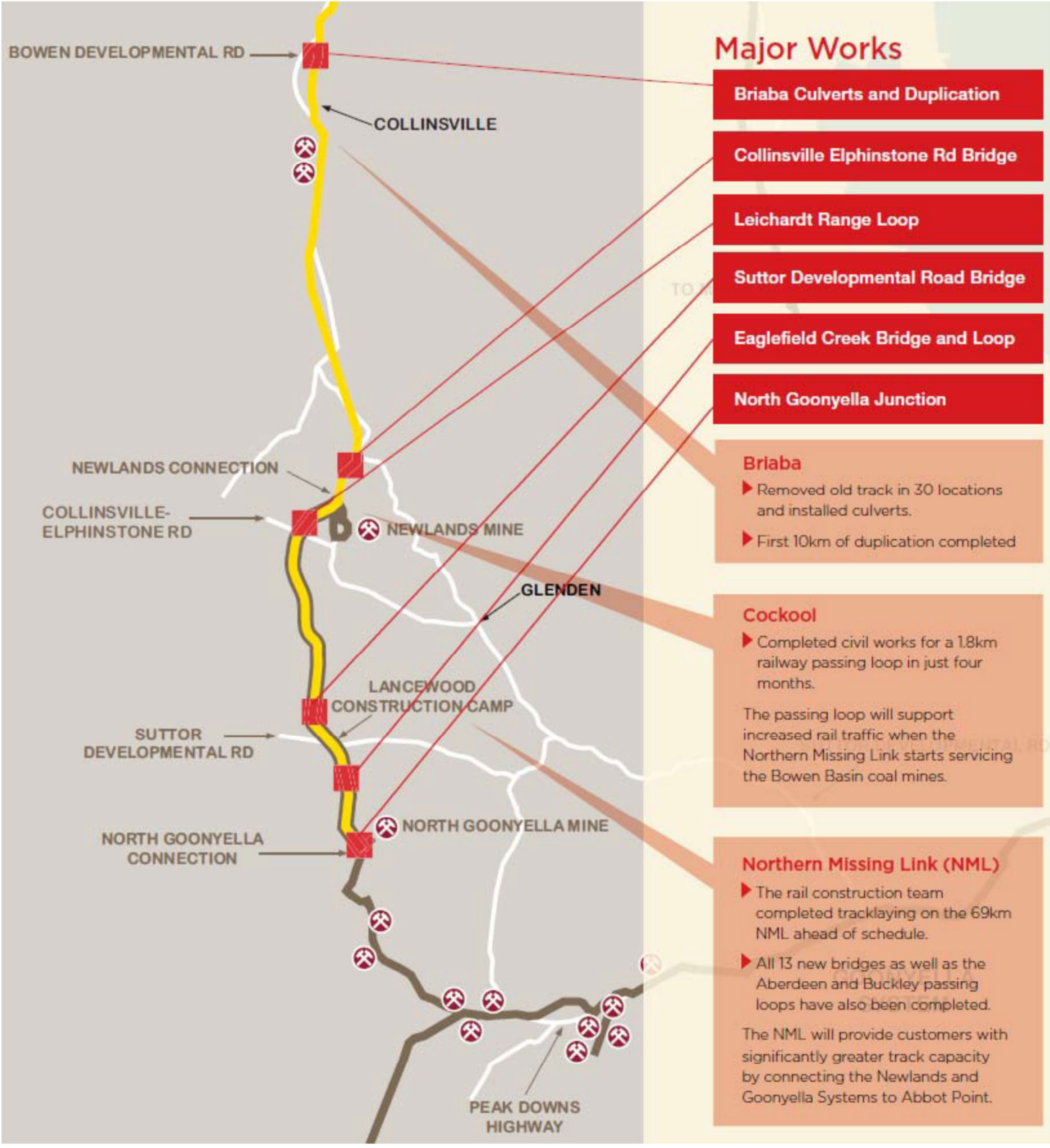
The Northern Missing Link (NML) is a 69km greenfield rail link within Aurizon Limited's Queensland Coal Network. It is the most recent benchmark for the construction of a heavy haul rail in eastern Australia specifically for the transport of coal. As it is narrow gauge, ceteris paribus, costs would be expected to be less than for the standard gauge system used in the Hunter Valley. The NML connects the Goonyella coal rail system to the Newlands coal rail system. In the amendment to Aurizon Network's Access Undertaking with the Queensland Competition Authority, dated 5 September 2012, the following costs were stated for the construction of the NML:

- $510.9m including interest during construction
- $431.3m excluding interest during construction

On a $m/km basis, the construction costs are therefore:

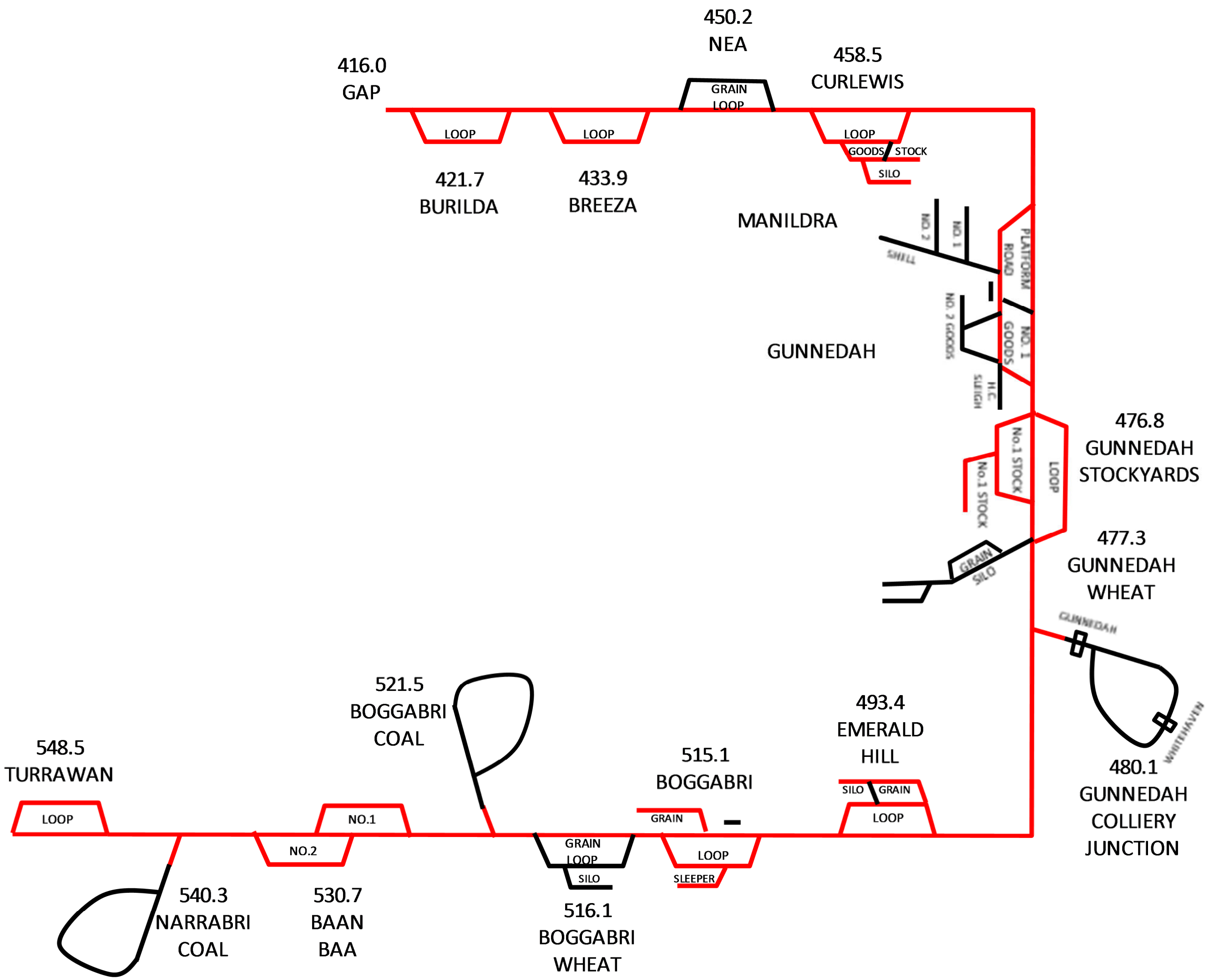
- $7.4m/km including interest during construction
- $6.1m/km excluding interest during construction

The forecast haulage volumes on the NML are 10.55 nmtpa.



BOWEN DEVELOPMENTAL RD
COLLINSVILLE
NEWLANDS CONNECTION
COLLINSVILLE-
ELPHINSTONE RD
NEWLANDS MINE
GLENDEN
LANCEWOOD
CONSTRUCTION CAMP
SUTTOR
DEVELOPMENTAL RD
NORTH GOONYELLA
CONNECTION
NORTH GOONYELLA MINE
PEAK DOWNS
HIGHWAY
Major Works
Briaba Culverts and Duplication
Collinsville Elphinstone Rd Bridge
Leichardt Range Loop
Suttor Developmental Road Bridge
Eaglefield Creek Bridge and Loop
North Goonyella Junction
Briaba
Removed old track in 30 locations and installed culverts.
First 10km of duplication completed
Cockool
Completed civil works for a 1.8km railway passing loop in just four months.
The passing loop will support increased rail traffic when the Northern Missing Link starts servicing the Bowen Basin coal mines.
Northern Missing Link (NML)
The rail construction team completed tracklaying on the 69km NML ahead of schedule.
All 13 new bridges as well as the Aberdeen and Buckley passing loops have also been completed.
The NML will provide customers with significantly greater track capacity by connecting the Newlands and Goonyella Systems to Abbot Point.

Appendix 6– Network Map



Appendix 7 – Rail Life Simulation

RAIL LIFE SIMULATION

Instructions 1) All boxes highlighted in green are inputs into this model and must be checked prior to use.
2) Check the "Actual Period Between Grinds (MGT)" table for compliance to local grinding practice - change where necessary
3) Select "Traffic Type" and "Rail Type" from drop down menus to reflect local conditions
4) Check assumptions related to head height, condemning limits and head removal due to grinding
5) In table "Tonnage Profile" ensure that the MGT projection for the local section is accurate
6) Theoretical wear rate is dependant on rail type, traffic type and curvature - more details needed to confirm this figure
7) Rail is assumed to be replaced during the year that condemning limit is reached
8) For graphical output refer to worksheet "Simulation Chart"

RAIL LIFE SIMULATION INPUTS

Traffic Type	HDFT		**Start Head Height**	44	mm
Rail Type	HH		**Condemning Limit**	26	mm
Theoretical Wear Rate	0.003	mm/MGT	**Head Removal per Grind**	0.25	mm

Tonnage Profile for Section of Track (MGT)

Year	MGT	Year	MGT	Year	MGT
1	5	16	5	31	5
2	5	17	5	32	5
3	5	18	5	33	5
4	5	19	5	34	5
5	5	20	5	35	5
6	5	21	5	36	5
7	5	22	5	37	5
8	5	23	5	38	5
9	5	24	5	39	5
10	5	25	5	40	5
11	5	26	5	41	5
12	5	27	5	42	5
13	5	28	5	43	5
14	5	29	5	44	5
15	5	30	5	45	5

Actual Period Between Grinds (MGT)

Curve (m)	Loaded Coal Traffic 30 TAL		Heavy Duty Freight Traffic ≥ 23 TAL		General Freight Traffic < 23TAL	
	SC	HH	SC	HH	SC	HH
≤ 450	1	2	1	2	2	5
450 - 900	1	2	1	2	2	5
> 900	2	5	2	5	5	7

****Notes** Empty Coal Traffic and Passenger Traffic fall under "General Freight Traffic"

RAIL LIFE SIMULATION OUTPUTS

RAIL LIFE	Hunter Average	>900m	450 - 900m	<450m
Years	20.0	45	28	28
Cumulative MGT	212	225	140	140

RAIL LIFE SIMULATION (RAW DATA)

		> 900 m						450-900 m						< 450 m					
		Theoretical			Cumulative			Theoretical			Cumulative			Theoretical			Cumulative		
Year	Cumulative MGT	Grinding Loss (mm)	Wear Loss (mm)	Head Height (mm)	Head Loss (%)	Head Loss (mm)	Life Expired?	Grinding Loss (mm)	Wear Loss (mm)	Head Height (mm)	Head Loss (%)	Head Loss (mm)	Life Expired?	Grinding Loss (mm)	Wear Loss (mm)	Head Height (mm)	Head Loss (%)	Head Loss (mm)	Life Expired?
0				44.0	0%	0.00	NO			44.0	0%	0.00	NO			44.0	0%	0.00	NO
1	5	0.25	0.02	43.7	1%	0.27	NO	0.63	0.02	43.4	1%	0.64	NO	0.63	0.02	43.4	1%	0.64	NO
2	10	0.25	0.02	43.5	1%	0.53	NO	0.63	0.02	42.7	3%	1.28	NO	0.63	0.02	42.7	3%	1.28	NO
3	15	0.25	0.02	43.2	2%	0.80	NO	0.63	0.02	42.1	4%	1.92	NO	0.63	0.02	42.1	4%	1.92	NO
4	20	0.25	0.02	42.9	2%	1.06	NO	0.63	0.02	41.4	6%	2.56	NO	0.63	0.02	41.4	6%	2.56	NO
5	25	0.25	0.02	42.7	3%	1.33	NO	0.63	0.02	40.8	7%	3.20	NO	0.63	0.02	40.8	7%	3.20	NO
6	30	0.25	0.02	42.4	4%	1.59	NO	0.63	0.02	40.2	9%	3.84	NO	0.63	0.02	40.2	9%	3.84	NO
7	35	0.25	0.02	42.1	4%	1.86	NO	0.63	0.02	39.5	10%	4.48	NO	0.63	0.02	39.5	10%	4.48	NO
8	40	0.25	0.02	41.9	5%	2.12	NO	0.63	0.02	38.9	12%	5.12	NO	0.63	0.02	38.9	12%	5.12	NO
9	45	0.25	0.02	41.6	5%	2.39	NO	0.63	0.02	38.2	13%	5.76	NO	0.63	0.02	38.2	13%	5.76	NO
10	50	0.25	0.02	41.4	6%	2.65	NO	0.63	0.02	37.6	15%	6.40	NO	0.63	0.02	37.6	15%	6.40	NO
11	55	0.25	0.02	41.1	7%	2.92	NO	0.63	0.02	37.0	16%	7.04	NO	0.63	0.02	37.0	16%	7.04	NO
12	60	0.25	0.02	40.8	7%	3.18	NO	0.63	0.02	36.3	17%	7.68	NO	0.63	0.02	36.3	17%	7.68	NO
13	65	0.25	0.02	40.6	8%	3.45	NO	0.63	0.02	35.7	19%	8.32	NO	0.63	0.02	35.7	19%	8.32	NO
14	70	0.25	0.02	40.3	8%	3.71	NO	0.63	0.02	35.0	20%	8.96	NO	0.63	0.02	35.0	20%	8.96	NO
15	75	0.25	0.02	40.0	9%	3.98	NO	0.63	0.02	34.4	22%	9.60	NO	0.63	0.02	34.4	22%	9.60	NO
16	80	0.25	0.02	39.8	10%	4.24	NO	0.63	0.02	33.8	23%	10.24	NO	0.63	0.02	33.8	23%	10.24	NO
17	85	0.25	0.02	39.5	10%	4.51	NO	0.63	0.02	33.1	25%	10.88	NO	0.63	0.02	33.1	25%	10.88	NO
18	90	0.25	0.02	39.2	11%	4.77	NO	0.63	0.02	32.5	26%	11.52	NO	0.63	0.02	32.5	26%	11.52	NO
19	95	0.25	0.02	39.0	11%	5.04	NO	0.63	0.02	31.8	28%	12.16	NO	0.63	0.02	31.8	28%	12.16	NO
20	100	0.25	0.02	38.7	12%	5.30	NO	0.63	0.02	31.2	29%	12.80	NO	0.63	0.02	31.2	29%	12.80	NO
21	105	0.25	0.02	38.4	13%	5.57	NO	0.63	0.02	30.6	31%	13.44	NO	0.63	0.02	30.6	31%	13.44	NO
22	110	0.25	0.02	38.2	13%	5.83	NO	0.63	0.02	29.9	32%	14.08	NO	0.63	0.02	29.9	32%	14.08	NO
23	115	0.25	0.02	37.9	14%	6.10	NO	0.63	0.02	29.3	33%	14.72	NO	0.63	0.02	29.3	33%	14.72	NO
24	120	0.25	0.02	37.6	14%	6.36	NO	0.63	0.02	28.6	35%	15.36	NO	0.63	0.02	28.6	35%	15.36	NO
25	125	0.25	0.02	37.4	15%	6.63	NO	0.63	0.02	28.0	36%	16.00	NO	0.63	0.02	28.0	36%	16.00	NO
26	130	0.25	0.02	37.1	16%	6.89	NO	0.63	0.02	27.4	38%	16.64	NO	0.63	0.02	27.4	38%	16.64	NO
27	135	0.25	0.02	36.8	16%	7.16	NO	0.63	0.02	26.7	39%	17.28	NO	0.63	0.02	26.7	39%	17.28	NO
28	140	0.25	0.02	36.6	17%	7.42	NO	0.63	0.02	26.1	41%	17.92	NO	0.63	0.02	26.1	41%	17.92	NO
29	145	0.25	0.02	36.3	17%	7.69	NO	0.63	0.02	25.4	42%	18.56	YES	0.63	0.02	25.4	42%	18.56	YES
30	150	0.25	0.02	36.1	18%	7.95	NO	0.63	0.02	24.8	44%	19.20	YES	0.63	0.02	24.8	44%	19.20	YES
31	155	0.25	0.02	35.8	19%	8.22	NO	0.63	0.02	24.2	45%	19.84	YES	0.63	0.02	24.2	45%	19.84	YES
32	160	0.25	0.02	35.5	19%	8.48	NO	0.63	0.02	23.5	47%	20.48	YES	0.63	0.02	23.5	47%	20.48	YES
33	165	0.25	0.02	35.3	20%	8.75	NO	0.63	0.02	22.9	48%	21.12	YES	0.63	0.02	22.9	48%	21.12	YES
34	170	0.25	0.02	35.0	20%	9.01	NO	0.63	0.02	22.2	49%	21.76	YES	0.63	0.02	22.2	49%	21.76	YES
35	175	0.25	0.02	34.7	21%	9.28	NO	0.63	0.02	21.6	51%	22.40	YES	0.63	0.02	21.6	51%	22.40	YES
36	180	0.25	0.02	34.5	22%	9.54	NO	0.63	0.02	21.0	52%	23.04	YES	0.63	0.02	21.0	52%	23.04	YES
37	185	0.25	0.02	34.2	22%	9.81	NO	0.63	0.02	20.3	54%	23.68	YES	0.63	0.02	20.3	54%	23.68	YES
38	190	0.25	0.02	33.9	23%	10.07	NO	0.63	0.02	19.7	55%	24.32	YES	0.63	0.02	19.7	55%	24.32	YES
39	195	0.25	0.02	33.7	23%	10.34	NO	0.63	0.02	19.0	57%	24.96	YES	0.63	0.02	19.0	57%	24.96	YES
40	200	0.25	0.02	33.4	24%	10.60	NO	0.63	0.02	18.4	58%	25.60	YES	0.63	0.02	18.4	58%	25.60	YES
41	205	0.25	0.02	33.1	25%	10.87	NO	0.63	0.02	17.8	60%	26.24	YES	0.63	0.02	17.8	60%	26.24	YES
42	210	0.25	0.02	32.9	25%	11.13	NO	0.63	0.02	17.1	61%	26.88	YES	0.63	0.02	17.1	61%	26.88	YES
43	215	0.25	0.02	32.6	26%	11.40	NO	0.63	0.02	16.5	63%	27.52	YES	0.63	0.02	16.5	63%	27.52	YES
44	220	0.25	0.02	32.3	27%	11.66	NO	0.63	0.02	15.8	64%	28.16	YES	0.63	0.02	15.8	64%	28.16	YES
45	225	0.25	0.02	32.1	27%	11.93	NO	0.63	0.02	15.2	65%	28.80	YES	0.63	0.02	15.2	65%	28.80	YES

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