WIK-Consult • Final Report

Study for the Australian Competition and Consumer Commission

Assessment of the Incremental Costs of Pricing Zone 3 Access Holders' Use of Pricing Zone 1 and 2 of the Australian Rail Track Corporation's Hunter Valley Rail Network

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Bad Honnef, 30 September 2015

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Abbreviations and Variables

AB	Asset Base
ACCC	Australian Competition and Consumer Commission
ARTC	Australian Rail Track Corporation
CAPEX	Capital expenditure
FCC	Fixed component of costs
FY	Financial Year
GTK	Gross tonne kilometres
HV	Hunter Valley
HVAU	Hunter Valley Coal Network Access Undertaking
i	Index of Line Segments ($i \in \{1,2, \dots 49\}$)
IC	Incremental costs
IDC	Interest during construction
j	Index for activities and projects
LS	Line Segment
MPC	Mine-Port-Combination
MPM	Major Periodic Maintenance
NETCAPEX	Net capital expenditure
PZ	Pricing Zone
RAB	Regulatory asset base
RCRM	Routine Corrective and Reactive Maintenance
ROA	Return on assets
t	Index of time ($t \in \{2008/09,\ 2009/10\ , 2010/11, H2\ 2011, 2012, 2013\}$)
Tkm	Train kilometres
TSLRIC	Total service long-run incremental cost
VCC	Variable component of costs
τ	Index of year of asset addition ($\tau \in \{2008/09,\ 2009/10\ , 2010/11, H2\ 2011, 2012, 2013\}$)

Executive Summary

This report was prepared between June and September 2015 for the Australian Competition and Consumer Commission (ACCC). The ACCC has commissioned WIK-Consult (WIK) to review and assess the costs of the Australian Rail Track Corporation's (ARTC's) Hunter Valley rail network, which is regulated through the Hunter Valley Coal Network Access Undertaking (HVAU). WIK-Consult is a German economic consultancy, and has cooperated with engineering experts from TÜV Rheinland for this project.

The authors have reviewed ARTC's annual compliance submission as provided under Section 4.10 of the HVAU for the 2013 calendar year and have assessed the approach used by ARTC to allocate its costs between the different Pricing Zones (PZ) of its Hunter Valley rail network. The ACCC's project specifications for this report were to:

- review and assess the extent to which costs vary with use by access holders, in particular those originating in Pricing Zone 3, adopting a long-run perspective
- estimate the incremental costs of Pricing Zone 3 Access Holders' use of Pricing Zones 1 and 2, and the stand-alone costs of Pricing Zones 1 and 2 Access Holders for 2013.

The HVAU provides that access revenues must at least meet the Direct Cost imposed by each Access Holder and should meet, as an objective, the incremental cost of each Access Holder's use of the network. ARTC currently assesses Direct Costs imposed by traffic using only short-run variable maintenance cost whereas the HVAU refers to incremental costs. The objective of this report thus is to quantify this incremental cost.

A common measure for incremental costs in regulated infrastructure industries is Total Service Long Run Incremental Cost (TSLRIC). TSLRIC measures the difference in cost between producing a service and not producing it. This implies that all costs are avoidable in the long-run. In light of practical considerations related to data availability, we present an admittedly conservative approach to estimating the incremental cost of PZ 3 Access Holders' use of PZ 1 and PZ 2.

Our estimation of incremental costs consists of two major tasks: First, we reviewed ARTC's costing methodology and assessed ARTC's operating and capital expenditures. Our analysis included costs related to 116 maintenance activities reported by ARTC and more than 400 capital expenditure projects related to replacement, renewal and capacity enhancements carried out in the Hunter Valley rail network since 2008. For each activity and project, we assessed the share of incremental costs and the key cost drivers. Second, we developed a spreadsheet model to estimate the incremental cost of PZ3 Access Holders' use of PZ1 and PZ2 for 2013. The underlying calculations are based on the results of our engineering assessment and input data from ARTC.

Our estimate of incremental cost is conservative (and does not consider cost elements to be incremental if there is any doubt), as it

- for maintenance costs, generally follows ARTC's methodology and only adjusts cost allocation factors for few of the 116 maintenance activities carried out by ARTC in 2013. Allocation factors were revised where our engineering assessment of how much costs vary with use departs from ARTC's assumptions.
- does not identify any incremental costs that may be included cost categories "maintenance overhead" and "network control" (reported by ARTC) because insufficient detail was available from ARTC to review those costs.
- for the cost resulting from replacement investments on line segments used by PZ3 Access Holders, allocates only a share of those to PZ3 Access Holders based on their share on total volume of traffic. As coal mines in PZ3 are currently being developed, volumes are small compared to volumes in the more mature mines in PZ1 and PZ2. Therefore, PZ3 is allocated a relatively small share of cost from replacement investments, based on 2013 traffic.
- for the cost resulting from capacity enhancement (on line segments that are used by PZ3 Access Holders), allocates to PZ3 Access Holders only a share of those costs that reflects their (smaller) share in total traffic volume.
- considers only costs for capacity enhancement and replacement investments since 1 July 2008 because sufficient data that would be needed to include earlier capital expenditures to our estimation was not available from ARTC for this project.

For the period after 1 July 2011 (the day the HVAU took effect), comprehensive information was available on the different investment projects, allowing us to assess incremental costs resulting from these investments reliably. For investments between July 2008 and June 2011, less detail was available from ARTC on investment projects. Consequently, this report presents model results separately that include, or exclude, investments made between 2008 and 2011.

For 2013, and not considering any investments made before July 2011, we estimate the incremental cost of PZ3 Access Holders' use of PZ1 and PZ2 to be **A$ 10,531,754** and stand-alone costs of PZ1 and PZ2 Access Holders to be **A$ 286,173,256**. Additionally including investments between July 2008 and July 2011, our estimates are **A$ 14,582,884** for the incremental cost of PZ3 Access Holders' use of PZ1 and PZ2, and **A$ 282,122,125** for the stand-alone costs of PZ1 and PZ2 Access Holders.

	PZ3 Access Holders' use of PZ1 & PZ2: reported and estimated cost	All Access Holder's use of PZ1 & PZ2: share of Full Economic Costs of PZ1 & PZ2
Direct Cost (reported by ARTC)	A$ 2,497,914	10.6%
Incremental Cost (WIK estimate, including investments 2011-2013)	A$ 10,531,754	34.6%
Incremental Cost (WIK estimate, including investments 2008-2013)	A$ 14,582,884	43.3%

The first column of the table above compares our estimation of incremental costs to the Direct Costs that are allocated to PZ3 Access Holders in ARTC's submission for 2013. The second column of the table compares the share of Direct Cost and incremental cost for all Access Holder's traffic in PZ1 & PZ2 on the Full Economic Cost of PZ1 & PZ2. ARTC's Direct Costs for all Access Holder's traffic in PZ1/2 account for 10.6% of the Full Economic Cost of PZ1/2 whereas our model estimates incremental costs for all Access Holder's traffic in PZ1/2 to be 43.3% of the Full Economic Cost of PZ1/2 (including investments since 2008, or 34.6% of the Full Economic Cost excluding investments before July 2011).[1]

1 Considering traffic and costs in PZ1 only (without PZ2), ARTC's Direct Cost for all Access Holder's traffic account for 8%, and our models estimates incremental costs for all Access Holder's traffic to 49% of Full Economic Cost (including investments since 2008, or 38% of the Full Economic Cost excluding investments before July 2011).

1 Introduction

1.1 The Hunter Valley Rail Network

On 5 September 2004, the Australian Rail Track Corporation (ARTC) commenced a 60-year lease of the Hunter Valley rail network in New South Wales. The Hunter Valley rail network is part of the Hunter Valley Coal Chain and is largely utilized by coal producers to transport coal from the mines to the Port of Newcastle. In 2013, contracted coal volumes were around 158 million tonnes.[2]

Figure 1 The Hunter Valley rail network

Source: ARTC.

In order to distinguish between different segments of the Hunter Valley rail network (due to the period of the opening of mines in different zones), ARTC classifies segments of the network into different pricing zones:

- Pricing Zone 1 consists of relatively old mines that already existed long before 2005. PZ1 is described as 'constrained' because demand is high and ARTC is

2 ARTC (2013), *2013-2022 Hunter Valley Corridor Capacity Strategy*, June 2013.

able to recover the costs of providing the service from access holders and generate revenue up to the cap given in each year.

- Pricing Zone 2 consists of newer mines. PZ2 was described as 'unconstrained' until 2007-2008 and is now constrained because demand increased. ARTC is able to recover the costs of providing the service from access holders and generate revenue up to the cap given in each year.
- Pricing Zone 3 is currently being developed and consists of recently opened mines and prospective mines. Currently PZ3 is described as 'unconstrained' because demand is low and ARTC is unlikely to recover an amount sufficient to cover costs of providing the service yet.

Figure 1 provides an overview of the Hunter Valley rail network and illustrates that all Access Holders from Pricing Zones 2 and 3 traverse Pricing Zone 1.

1.2 The Hunter Valley Access Undertaking

The June 2011 Hunter Valley Coal Network Access Undertaking (HVAU) regulates access to the network and provides for an annual compliance assessment to be carried out by the Australian Competition and Consumer Commission (ACCC) each calendar year. As part of this assessment, the HVAU provides for the ACCC to determine whether ARTC has incurred prudent and efficient expenditure, rolled forward the regulatory value of its assets and reconciled revenues received with the applicable ceiling revenue limits (which are based on economic costs) in accordance with the HVAU.

ARTC's approach to reconciling revenue with applicable ceiling revenue limits under the HVAU is based on an access charge (per thousand GTK) for each segment that consists of two components (a two-part tariff):

- A variable charge (non-TOP component) is set to cover Direct Cost.
- A fixed charge (TOP component) is set to recover remaining operating and capital costs.

Under the Competition and Consumer Act 2010, regulated access prices should generate expected revenue that is at least sufficient to meet the efficient costs of providing access.[3] The HVAU provides that access revenues must at least meet the Direct Cost imposed by each Access Holder and that they should meet the incremental

3 Competition and Consumer Act 2010, Sect. 44ZACA.

cost of Access Holders' use of the network.[4] In ARTC's submissions to the ACCC, Direct Costs imposed by traffic are currently calculated as short-run variable maintenance cost, and do not include any other cost than (a portion of) maintenance cost. This approximation of incremental cost by direct cost may possibly be adequate in a very short-run perspective. In a long term perspective, however, direct costs are only a subset of incremental costs, and this approximation ignores other incremental cost that relate to network usage.

1.3 Objective of this study

This report was prepared between in June and September 2015 for the Australian Competition and Consumer Commission (ACCC). The ACCC has commissioned WIK-Consult (WIK) and its subcontractor TÜV Rheinland (TÜV) to review and assess the costs of the Australian Rail Track Corporation's (ARTC's) Hunter Valley rail network, which is regulated through the Hunter Valley Coal Network Access Undertaking (HVAU). WIK-Consult is German economic consultancy, and has cooperated with engineering experts from TÜV Rheinland for this project.

The authors of this report have reviewed ARTC's annual compliance submissions as provided for under Section 4.10 of the HVAU for the 2013 calendar year and have assessed the approach used by ARTC to allocate its costs between the different Pricing Zones (PZ) of its Hunter Valley rail network. In particular, WIK and TÜV

- reviewed and assessed the extent to which costs vary with the use by access holders, in particular those originating in Pricing Zone 3, adopting a long-run perspective
- estimated the incremental cost of Pricing Zone 3 Access Holders' use of Pricing Zones 1 and 2, and the stand-alone of Pricing Zones 1 and 2 Access Holder for 2013.

This report summarises the results of our investigation into ARTC's financial model and approach to cost allocation and presents our approach to estimating the incremental cost of PZ3 Access Holders' use of PZ1, and the results.

Section 2 outlines the study methodology. Section 3 describes our understanding and assessment of ARTC's cost methodology and ARTC's financial model. Section 4 sets out our approach to estimate the incremental costs of Pricing Zone 3 Access Holders' usage of the infrastructure in Pricing Zone 1 of the Hunter Valley rail network. Section 5 provides our technical assessment of cost variability for the different cost elements.

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4 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.

Section 6 presents the spreadsheet model we have developed to estimate incremental costs and Section 7 states the model results.

WIK and TÜV gratefully acknowledge the constructive assistance provided by ARTC and coal miners in the Hunter Valley. They generously contributed their time and expertise in responding to our questions and follow up inquiries. While gladly acknowledging the assistance of all, the authors are, of course, solely responsible for the final report, including any errors it may contain.

2 Study Methodology

In order to assess the costs of ARTC's Hunter Valley rail network cost allocation, we have reviewed ARTC's annual compliance submissions as provided for under Section 4.10 of the HVAU for 2013. The reviewed submissions include:

- ARTC's Annual Compliance Report including confidential appendices on capital expenditures and the regulatory asset base.
- Attachments to the Annual Compliance Report, including capital consultation documents, Details on minor capital expenditures, evidence of Access Holder endorsement of CAPEX, the annual true-up test, ARTC's Maintenance Report 2012.
- ARTC's confidential Ceiling Test Model and documentations supporting the model. The Excel spreadsheet model includes several workbooks. The primary workbook is the [redacted] which sources input data from four additional workbooks.
- ARTC's responses to ACCC information requests including supporting data and supporting documentations, including details on operational expenses of major maintenance activities.

Additionally, we reviewed:

- Various public information on ARTC and the Hunter Valley Coal Chain Coordinator, including Annual Reports, Pricing Schedules, ARTC's rail maintenance reference documents and guidelines, the Hunter Valley Corridor Capacity Strategy, and Rail Capacity Group (RCG) monthly reports.
- Various previous decisions and regulatory documents published by the ACCC and the Independent Pricing & Regulation Tribunal (IPART), including public consultations and documents relating to other rail network Access Undertakings.

We held several meetings with the ARTC and coal miners in the Hunter Valley:

- Conference call with Idemitsu on 30 June 2015,
- Meeting with BHP on 1 July 2015 in Newcastle, NSW,
- Meeting with Whitehaven on 1 July 2015 in Newcastle, NSW,
- Meeting with Glencore on 2 July 2015 in Newcastle, NSW,
- Meeting with Rio Tinto on 2 July 2015 in Newcastle, NSW,
- Conference calls with ARTC on 9 July 2015 and 31 July 2015.
- Visit to PWCS and NCIG terminals in Kooragang, and spot checks on rail infrastructure near Newcastle.

Subsequent to the meetings and the review of the annual compliance submissions and supporting document, ACCC and WIK/TÜV have addressed follow-up questions to and the ACCC requested additional information from ARTC.

Based on the review, we assessed the amount of costs that vary with the volume of traffic and identified adequate cost drivers. To estimate the incremental costs of PZ3 Access Holders' use of PZ1 and the stand-alone costs of PZ1, we developed a spreadsheet model.

3 Observations on ARTC's Costing Methodology

ARTC's financial model of the HVAU is based on a combinatorial cost test, which was introduced to the economic literature by Baumol and Sidak[5]. Smart (1999) provided an exposition on how the combinatorial cost test is applied to the New South Wales Rail Access Regime, which was heavily based on ARTC's Hunter Valley Rail Network.[6] Generally, the combinatorial cost test can be used to test whether the revenues generated from an Access Holder or combinations of Access Holders are:

- equal to or greater than the incremental cost of serving a customer or a combination of customers ('Floor Limit');
- no greater than the stand-alone cost of servicing a customer or combination of customers ('Ceiling Limit').

The combinatorial cost test allows a monopoly infrastructure provider to break-even in aggregate and detects whether customers or groups of customers are overcharged (revenue greater stand-alone costs) while incurring economic loss on other customers or groups of customers (revenue below incremental costs), i.e. cross-subsidisation from one group of customers to another group of customers.[7]

3.1 Our understanding of ARTC's financial model

ARTC's combinatorial cost test, the Ceiling Test Model, is a Microsoft Excel spreadsheet which uses matrix multiplication techniques to calculate the Access Revenues and the Full Economic Costs across the 'line segments' (LS) utilised by combinations of mines. This allows for cost tests for any mine-to-port combination in the network.

The ARTC HVAU has defined the Ceiling Limit (stand-alone costs) and Floor Limit (incremental costs) as follows:

- "Access Revenue from every Access Holder must at least meet the Direct Cost imposed by that Access Holder. For each Segment or group of Segments,

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5 Baumol, William and Gregory Sidak (1994), *Towards Competition in Local Telephony*, The MIT Press, Cambridge; Baumol, William and Gregory Sidak (1994), *Transmission Pricing and Stranded Cost in the Electric Power Industry*, The MIT Press, Cambridge.

6 Smart, Mike (1999), *Solving the Riddle of Combinatorial Logic*, 23rd Australian Transport Research Forum Perth Western Australia, 29 September – 1 October 1999, pp. 789-801.

7 See Faulhaber, Gerald (1975), 'Cross-Subsidization: Pricing in Public Enterprises', *American Economic Review*, 65(5), pp. 966–977; Note that economic cross-subsidisation can still occur even if the provider does not overcharge a group of customers as long as it charges a group of customers below incremental costs.

Access revenue from Access Holders should, as an objective, meet the Incremental Cost ("Floor Limit")."[8]

- "Access revenue from any Access Holder, or group of Access Holders must not exceed the Economic Cost of those segments which are required on a standalone basis for the Access Holder or group of Access Holders ("Ceiling Limit")."[9]

ARTC's approach to reconciling revenue with applicable ceiling revenue limits under the HVAU is based on an access charges (per thousand GTK) for each segment that consists of two components (two-part tariff):

- A variable charge (non-TOP component) is set to cover Direct Cost, i.e. efficient variable maintenance expenditure. The non-TOP component is charged on a non-take-or-pay basis.
- A fixed charge (TOP component) is set to recover remaining operating and capital costs. The TOP component is charged on a take-or-pay basis.

The mines with revenue close to (either just below or above) Economic Cost for the relevant Line Segments are referred as 'Constrained Group of Mines' and the Line Segments comprise the constrained network. For the constrained Group of Mines (in 2013: those in Pricing Zone 1 and Pricing Zone 2), revenues above and below Stand Alone Costs (i.e. Full Economic Cost less revenues received from Pricing Zone 3 users) are settled each year via 'Under & Over' accounts.

3.2 Our understanding of ARTC's costing methodology

The core of ARTC's financial model, the Ceiling Test Model, comprises two cost categories: Direct Costs and Economic Cost.

Direct Cost

According to the HVAU, variable component of costs ("VCC") are the basis for Direct Cost.[10] Direct Costs are defined as "maintenance expenditure, including major periodic maintenance that varies with the usage of the network, and may include other costs that vary with the usage of the network but excluding depreciation, assessed on an efficient basis".[11]

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8 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.2, p.26.
9 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.3, p. 27.
10 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.13, p. 39.
11 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 14.1, p. 83.

In the Ceiling Test Model, Direct Costs are determined by the variable track maintenance costs. ARTC calculates the variable track maintenance costs by splitting the maintenance costs of each maintenance activity into a variable and a fixed share of costs, based on an engineering assessment. ARTC differentiates between two kinds of maintenance activities:[12]

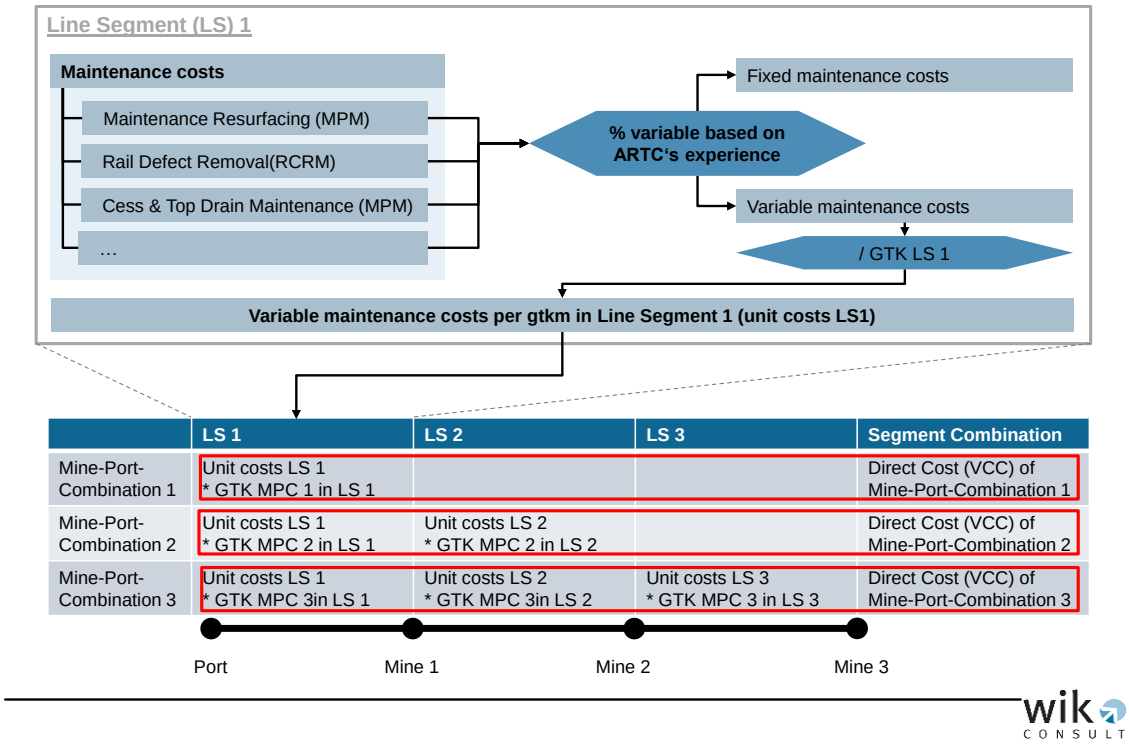
- Routine Corrective and Reactive Maintenance (RCRM) are scheduled activities used to inspect or service asset conditions on a routine basis. Routine activities are completed more often than once a year and include different track inspections cycles, track patrolling, fettling (replacing broken track components), corridor maintenance, fence maintenance and signal testing.
- Major Periodic Maintenance (MPM) are cyclical/planned activities that maintain the level of routine inspections and reduce the level of reactive or corrective maintenance. These activities can also give rise to the renewal of the original useful life of an asset MPM is completed on track Sectors at intervals of more than one year.

ARTC's Annual Compliance submissions include a description of the top six maintenance activities for each year with data provided on Price Zone level and the assumed split between variable and fixed share of costs for each of these activities. Only in its 2012 Compliance Submission, ARTC provided a short qualitative assessment of the fixed share of the maintenance activities.[13] For this study, ARTC has provided similar information for all maintenance activities in response to a request from the ACCC.

12 *CONFIDENTIAL SUBMISSION:* ACCC Information Request, *ARTC 2012 Annual Compliance Submission – Hunter Valley Maintenance Report*, November 2013, p. 17.

13 *CONFIDENTIAL SUBMISSION:* ACCC Information Request, *ARTC 2012 Annual Compliance Submission – Hunter Valley Maintenance Report*, November 2013, p. 25.

Figure 2 Stylized illustration of ARTC's determination of Direct Costs



Source: WIK-Consult.

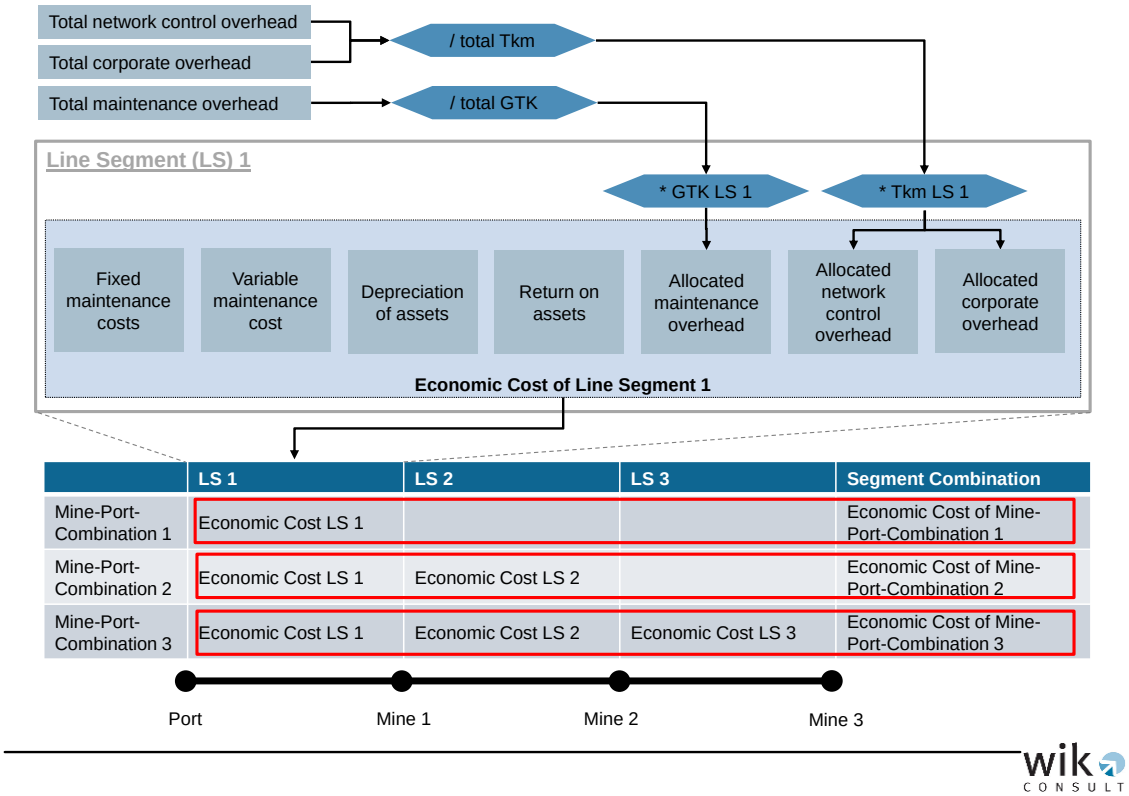
In the Excel Ceiling Test Model, ARTC provides the aggregated figures on variable maintenance costs per Line Segment without any further information on activities. In a separate Excel workbook, ARTC calculates the variable unit costs per Line Segment by dividing the variable maintenance costs by traffic volume, i.e. GTK, of each Line Segment. The Line Segment unit costs (c/GTK) are then used to determine the total variable costs, i.e. the Direct Costs, for the traffic of each mine-to-port combination by multiplying the unit costs with the respective GTK in each relevant Line Segment. Figure 2 illustrates ARTC's methodology in a stylized manner.

Economic Cost (stand-alone cost)

The HVAU defines the economic cost of a segment, which shall be assessed on a stand-alone basis, as sum of segment-specific costs (including depreciation of and return on segment-specific assets), allocated non-segment specific costs (including depreciation of and return on non-segment specific assets) and costs applicable to additional capacity.[14]

14 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.5, p. 30.

Figure 3 Stylized illustration of ARTC's determination of Economic Cost



Source: WIK-Consult.

Note: Total and Line Segment Tkm and GTK refer either to the constrained network or the unconstrained network subject to the Line Segment's assignment. Line segments that form part of constrained port-mine-combination are part of the constrained network.

In ARTC's Ceiling Test Model, Full Economic Costs are determined for the Mine-Port-Combinations as sum of Economic Cost of each Line Segment that forms part of the Mine-Port-Combination, i.e. the sum of

- allocated maintenance overheads,
- allocated network control and terminal costs,
- allocated corporate overheads,
- variable maintenance cost per Line Segment,
- fixed maintenance costs per Line Segment,
- depreciation of Line Segment assets, and
- return on Line Segment assets.

For the three overhead categories (maintenance overhead, general overhead, and network control), ARTC distinguishes two numbers for the input, i.e. one number for the

constrained network and one number for the unconstrained network, which are distributed across the segments. Maintenance overheads are distributed to the Line Segments by (constrained or unconstrained) GTK while corporate overhead and network control overhead are distributed across the Line Segments by (constrained or unconstrained) train kilometres.

The fixed and variable maintenance costs (Direct Cost) as well as depreciation of and return on assets are provided as input per Line Segment.

ARTC determines the depreciation of and return on assets in a separate Excel workbook. For each Line Segment, the average asset value is calculated as the average of the opening and closing value in the Compliance Year. The return results from multiplying the average asset value with the permitted (real pre-tax) rate of return of 9.10%.[15] Depreciation is calculated for each calendar year, using a straight-line methodology with respect to specific assets and the estimate of the remaining useful life of the assets.[16]

Figure 3 illustrates ARTC's methodology of cost allocation and Economic Costs determination for each Line Segment and each Mine-Port-Combination in a stylized way.

3.3 Remarks on ARTC's financial model and costing methodology

This section provides some remarks on ARTC's Ceiling Test Model and cost allocation methodology.

1) Transparency of spreadsheets could be improved

ARTC's documentation of the spreadsheet model[17] states that the primary workbook [redacted] sources input data from four additional workbooks. In fact, the workbook itself sources input data to some of these additional workbooks which complicates the analysis and reduces transparency. Additionally, this complicates the review of the model in previous compliance periods, as input sources were missing in the H2 2011 Compliance Submissions.

Some of the data in the workbooks is hard coded. ARTC states in its documentation that this is to limit the number of required sources. In order to increase transparency

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15 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.8, p. 32.
16 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.7, p. 31.
17 *CONFIDENTIAL SUBMISSION:* ARTC (2013), *2011 ARTC Hunter Valley Coal Network Access Undertaking – Documentation Supporting ARTC Ceiling Test and Regulatory Asset Base Models*, January 2013, p. 2.

and to facilitate reviews of the Compliance Submissions by ACCC, ARTC could include additional information on the sources of hard-coded data. In particular, sources of aggregated data are not always clear and not always consistent with figures on the same activities / projects on alternative aggregation levels.

We understand that the spreadsheets in ARTC's spreadsheet model are adjusted for each compliance year and we appreciate ARTC's change log in each Excel file. However, to increase transparency, ARTC may consider reviewing the necessity for cross-linkages between the workbooks and to use consistent spreadsheet names, in particular for the minor and major CAPEX data in the [redacted] which rolls forward the regulatory asset base (RAB).

2) Suggestions for further improving the approach to determine variable costs

ARTC's approach to determining variable costs (Direct Costs) and the documentation of this approach in the Excel files, in our view, offer some points for improvements:

ARTC provides variable and fixed maintenance costs on Line Segment level in the [redacted] whereas the figures on maintenance activities and the share between fixed and variable maintenance costs is provided on PZ level in the supporting submission. This does not allow for a comparison of data and a review of correct application of ARTC's approach in the Ceiling Test model without further worksheets (which were provided by ARTC upon request).

ARTC assesses the variability of maintenance costs using 25%-steps. While we acknowledge the need to simplify assumptions to make them manageable, we find that this approach leads to significant distortions in total allocated variable maintenance costs. In particular, using 25%-steps seems inadequate in cases where maintenance activities with traffic "very much" (but not 100%) or "very little" (but not zero). For example, if a small share of costs of a specific maintenance activity is considered fixed, the assumption of 75% variability instead of 100% may lead a high share of costs unconsidered and may have a significant effect on Direct Cost. For this reason, an approach with lower steps for cost variability may be appropriate.

3) Allocation of overheads depends on sequencing of calculating steps

This remark relates to ARTC's methodology for distributing overhead costs, namely maintenance overhead, network control overhead and corporate overhead cost, to Line Segments: ARTC distributes overhead costs to the line segments according to the volume of traffic (GTK or Tkm) in each Line Segment. In doing so, ARTC first distinguishes between overhead of the constrained and the unconstrained network and allocates them according to the constrained and unconstrained volume of traffic. This approach shifts allocated overhead between Line Segments and Pricing Zones in comparison to a direct allocation of total overhead according to total traffic volume.

Table 1 Comparison of ARTC's overhead allocation to an approach without distinction of constrained and unconstrained traffic

Source: WIK-Consult based on ARTC cost data (confidential).

Table 1 above illustrates the difference in allocated overhead costs between ARTC's approach and an approach with equal distribution without distinction of constrained and unconstrained traffic. While we could not identify any systematic distortion that gives an advantage or disadvantage to a specific Pricing Zone, we do not understand the reasons for ARTC's approach (perhaps due to the restricted information on maintenance and network control overhead costs that was available for this project).

4) Approach to determining depreciation of RAB assets

ARTC annually rolls forward and depreciates the RAB for each Line Segment according to the formula set out in HVAU[18], i.e. the closing value of assets equals the CPI adjusted opening value of assets minus depreciations plus the net capital expenditures, i.e. capital expenditures in the current year minus disposals plus interest during construction.

18 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.4(b), p. 29.

We have some remarks with regard to ARTC's application of this methodology:

Notion of DORC: ARTC refers to its approach to determine the regulatory asset base as "depreciated optimised replacement costs" (DORC). By definition, the DORC of an asset is the written-down replacement cost of its optimal or most efficient replacement (in an engineering or cost efficiency sense). In fact, ARTC's approach is a roll forward of book values without a determination of the real replacement costs of assets and without consideration of any optimization or efficiency adjustment. In that sense, the notion of DORC may be confusing.

Assumptions on useful lifetimes: ARTC uses a useful-life approach for depreciations as set out in the HVAU[19]. The expected remaining life time for assets in each segment is based on the expected remaining life of mines in the Hunter Valley instead of the expected life time of the specific assets. Additionally, ARTC assumes a remaining life time of 21 years (beginning in 2011[20]) for all Pricing Zones although the HVAU allows for different depreciation rates for the Pricing Zones and expected remaining life time for new mines in PZ2 and PZ3 may be longer.[21] Specifically, ARTC assumes a remaining lifetime of 21 years for 2011, 20 years for 2012, 19 years for 2013 etc. That way, the end of useful lifetimes is assumed to be 2032 for all assets, including assets that in reality are expected to be used much longer (e.g. some new infrastructure build in 2013), or are known to be worn down and replaced long before 2032.

Specific consideration of CPI leads to high depreciation: ARTC rolls forward the RAB in each line segment by using the CPI adjusted opening balance of new assets and the annual depreciations on the CPI adjusted opening balance. Additionally, ARTC takes into account a CPI adjustment of the accumulated depreciations on assets in the respective Line Segment. In our understanding, this CPI adjustment on previous years' (accumulated) depreciation yields higher accumulated depreciations and – as a consequence – a lower closing balance / lower RAB in each year. Moreover, ARTC's approach includes the opportunity that negative asset values may be added to RAB. Given the annual roll forward of the cumulated asset base in each Line Segment, the addition of several negative asset values may yield significant distortions.

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19 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.7, p. 31.

20 ARTC uses a remaining lifetime of 21 years for 2011, 20 years for 2012, 19 years for 2013, etc. That way, the end of useful lifetime is assumed to be 2032, including assets that are in reality expected to last much longer (e.g. some new infrastructure build in 2013), or are known to be worn down and replaced long before 2032.

21 Booz&Co (2009), *Mine Life Assessment – Hunter Valley Region, Report prepared for ARTC*, February 2009.

Table 2 Example – Remaining life approach and ARTC's application

Our understanding of the useful remaining life approach					
Year	RAB / adjusted Net	CPI adj.	Depreciation	Accumulated Depreciation	RAB close
1	1000.0	25.0	-205.0	-205.0	820.0
2	1025.0	25.6	-210.1	-415.1	635.5
3	1050.6	26.3	-215.4	-630.5	446.4
4	1076.9	26.9	-220.8	-851.3	252.5
5	1103.8	27.6	-226.3	-1077.5	53.9

ARTC's application of the remaining life approach						
Year	RAB / adjusted Net	CPI adj.	Depreciation	CPI adjustment on previous year's depreciation	Accumulated Depreciation	RAB close
1	1000.0	25.0	-205.0		-205.0	820.0
2	1025.0	25.6	-210.1	-5.13	-416.3	614.4
3	1050.6	26.3	-215.4	-10.41	-633.9	402.5
4	1076.9	26.9	-220.8	-15.85	-858.2	184.1
5	1103.8	27.6	-226.3	-21.46	-1089.4	-41.0

Source: WIK-Consult.

Table 2 above illustrates the difference between our understanding of an expected remaining life time approach and ARTC's application with a simple example: we assume the addition of one asset with a value of 1,000 in the first year with a remaining life of 5 years (i.e. a depreciation rate of 20%). The annual CPI is assumed to be constant of 2.5% and there is no addition or disposal of assets during the 5 years period.

5) Minor technical observations

We have some minor remarks on details in ARTC's calculations in the spreadsheet models:

The annual depreciation of assets is calculated as the sum of the depreciation in the current year and the sum of depreciations of previous years. While assets added in H2 2011 are depreciated in the compliance years 2012 and 2013 with a remaining life of 20.75 years, which is in line with the guidelines of the HVAU, the remaining life was assumed to be 21 years in the H2 2011 compliance period. As a consequence total depreciations on assets in H2 2011 and, as depreciations are rolled forward via the CPI adjustment, depreciations in the following years seem too high. This issue was already addressed by ACCC in the 2012 Compliance Assessment. ARTC responded that they will adjust their financial model to correct the depreciation of H2 2011 assets in H2 2011

(i.e. the worksheet FL 2011 H2) using a remaining life time of assets of 20.75 years.[22] In the 2013 submission, this error is still present.

ARTC calculates new major assets as the sum of amount added to the RAB in the year plus interest during construction. There seems to be some inconsistency or errors in the application of this methodology [redacted] The 2013 calculations compliance submission includes additions to the RAB of all major CAPEX projects independent of the commission period. The 2012 calculations include only additions to RAB of projects commissioned between 01/01/2012 and 31/12/2012 and did not include additions to RAB (at 31/12/2012) from projects commissioned prior to 31/12/2011. The compliance submission for the compliance period H2 2011 (as of March 2013) lists major capital expenditures of $ 14,106,878 in Line Segment 966 (Project 692260 - Burilda Passing Loop Phase 6) which are not included in the calculation of the RAB Floor Limit although the worksheet "Summary all major Projects" states that this value is added to the RAB.

22 *CONFIDENTIAL SUBMISSION*, ARTC (2012), Confidential Response to ACCC Information Request Dated 24 October 2013, Question 20, p. 1.

4 Our Approach to Incremental Cost

Incremental costs are defined as costs that a firm incurs in providing a service relative to not providing that service at all. The question whether costs are incremental or not depends crucially on the considered time horizon. To summarize: In economic literature and regulatory practice, incremental costs are often assessed in a long-run perspective. In contrast, ARTC approximates incremental costs by short-run Direct Costs. Our approach estimates incremental costs understood as costs that are avoidable in the long term. Due to limitation of the data available for this project, however, we consider our approach to be quite conservative compared to incremental cost models used in other industries.

4.1 Economic concept of incremental costs

In the economics literature, incremental costs are the additional costs that a firm incurs in providing a service relative to not providing that service at all. Faulhaber (1975)[23] introduced the concepts of standalone cost and incremental cost in the context of economic cross-subsidisation: The incremental cost of a service or combination of services is the additional cost of providing that service or a combination of services over and above the monopoly's cost of providing all the remaining services.[24]

In the context of the HVAU, the incremental costs of providing access to the network to only one group of Access Holders (say those of PZ3) is the difference in total costs of providing below rail services to all Access Holders minus the total costs of providing below rail services to all Access Holders other than those of PZ3. For example, if the total cost of providing below rail services to Access Holders in PZ1, PZ2 and PZ3 were A$100; but the cost of providing the below rail service only to PZ1 and PZ2 Access Holders is A$70, then the incremental cost of providing the below rail service to PZ3 Access Holders is A$30.

In the economic literature, it is commonly understood that the incremental costs of providing a service to one firm can be determined by calculating the costs that could be avoided if that service were no longer provided to the firm.

The question of which costs could be avoided if a service was removed is subject to the considered time horizon. While variable or direct costs are avoidable immediately,

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23 Faulhaber, Gerald (1975), 'Cross-Subsidization: Pricing in Public Enterprises', *American Economic Review*, 65(5), pp. 966–977.

24 Faulhaber, Gerald (2002), 'Cross-Subsidy Analysis With More than Two Services', Wharton School, University of Pennsylvania, p. 1.

incremental costs include costs that could be avoided in a long-run perspective. In economic theory, the distinction between "short run" and "long run" is based on a firm's ability to unwind its fixed costs. In the context of "long run incremental costs", the term 'long run' refers to a period long enough so that all of a firm's costs become variable or avoidable"[25].

A common measure for incremental cost in practice are Total Service Long Run Incremental Cost (TSLRIC). According to our understanding LRAIC (long-run average incremental cost) is not a different cost concept than TSLRIC but just a different expression for the same cost standard. In our understanding TSLRIC include overhead costs which sometimes highlighted by using the term TSLRIC+.

TSLRIC measures the difference in cost between producing a service and not producing it. TSLRIC is LRIC in which the increment is the total service which jointly use the infrastructure. In the context of the HVAU, a TSLRIC approach would mean that the differences in costs between the provision of a rail network that ensures only basic coverage of all mines and the costs for the provision of the existing HV rail network would be considered incremental. The approach would assess the costs for a single-track rail network for marginal traffic, e.g. one train per year, without consideration of necessary infrastructure to allow for multiple usage be a number of above-rail providers, e.g. passing loops etc., and compare the costs with the costs of the current HV rail network. In other industries, there are also implementations of TSLIRC where the costs for the basic coverage are attributed to the total service increment.

4.2 Assessment of ARTC's approach

Applying incremental costs as a relevant standard to the HVAU is consistent with the approach taken by the ACCC to define incremental costs in other regulated industries.

- In telecommunications, the ACCC uses the concept of total service long-run incremental cost (TSLRIC) which "is the incremental or additional costs the firm incurs in the long term in providing the service, assuming all of its other production activities remain unchanged. It is the cost the firm would avoid in the long term if it ceased to provide the service"[26].
- For postal service regulation, the ACCC states that "[t]he incremental cost of a service is defined as the additional cost incurred in producing that service (in addition to the other services the firm produces). Another way of considering

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25 Federal Communications Commission (FCC), *The first report and order re local competition*, Common Carrier Docket 96-98, 1996, paragraph 677.

26 ACCC (1997), *Access pricing principles – Telecommunciations, a guide*, July 1997, p. 28.

incremental cost is to ask what costs would be avoided, in the long run, if the service were no longer offered"[27].

In ARTC's HVAU Ceiling Test Model, Direct Costs determine the revenue Floor Limit and are apparently used as a proxy for the incremental costs being the "variable component of costs (VCC)"[28]. The HVAU defines direct costs as maintenance expenditure, including major periodic maintenance that varies with usage of the network. Direct costs may include other costs that vary with the usage of the network but "exclude depreciation"[29].

From our perspective, direct costs can only be an adequate approximation of short-run incremental costs. In the longer run, direct costs are only a subset of incremental costs. More costs could be avoided if a service or a segment was no longer provided. In particular, incremental costs include depreciation and costs of capital for assets if the specific assets are related to the provision of additional capacity, or are otherwise required because of network usage.

In our understanding, the ARTC substantially underestimates incremental costs by equating them with short-run variable maintenance costs.

4.3 Definition of incremental costs for our assessment

In light of the data available for this project, we have adopted an approach to incremental costs that builds on ARTC's data, submission and methodology to the maximum possible extent rather than following a TSLRIC approach.

Our approach thus provides a conservative estimation of incremental costs. We consider four elements of incremental cost in our approach:

1. The first element is the incremental maintenance costs: These include the short-run variable maintenance costs and the increment of maintenance overhead costs which could be avoided in a long term perspective if PZ 3 were removed from the HV rail network. The focus of our assessment is on the question how costs vary with traffic and which elements determine the costs of each maintenance activity, i.e. the cost drivers.

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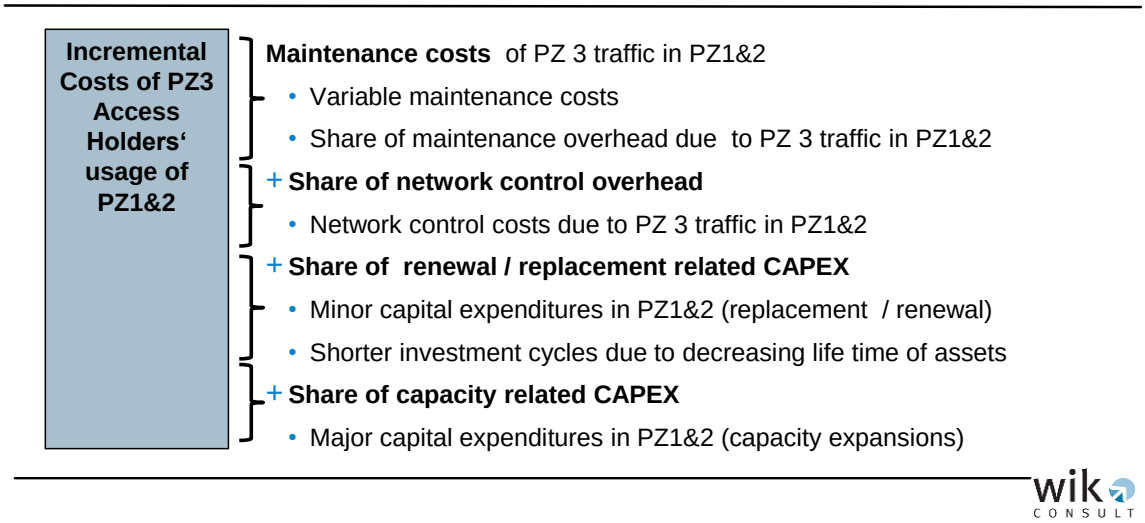
27 ACCC (2014), *Test for assessing cross-subsidies*, June 2014, p.5.
28 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.13, p. 39.
29 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 14.1, p. 83.

2. The second element includes the incremental network control costs and the question, how network control costs are influenced by the volume of traffic and which amount of network control costs could be avoided in the long term if certain segments would be removed from the network.

3. The third element consists of capital expenditures for renewal and replacement of infrastructure assets. This includes activities and projects related to depreciation for wear and tear by traffic as well as the consideration of shortened investment cycles due to decreasing life time of infrastructure assets with increasing usage.

4. The fourth element is capital expenditures which are related to capacity enhancements of the rail network according to the (expected growth of) volume of traffic. The assessment focusses on the amount of capacity enhancing capital expenditures that could be avoided if traffic volume would stay constant.

Figure 4 Our approach to incremental cost



Source: WIK-Consult.

Our approach is conservative as it does not consider some cost elements which could be seen as incremental in a long-run perspective. In particular, we do not consider:

- Corporate overhead cost: If PZ3 was removed from ARTC's rail network, there might be effects on corporate overhead and on corporate overhead allocation to the HV rail network (as allocation of total corporate overhead is based on train km in the different ARTC networks). However, in this report, we considered corporate overhead as common costs which are not avoidable.
- Regulatory Asset Base:
    - Our approach focuses on the existing Hunter Valley rail network since mid-2008. For periods before mid-2008, no data on investment projects and related additions to the RAB were available from the ARTC. Our

model analyses which of the new assets that were added to the RAB since can be considered as incremental.

- Due the lack of available data before 2008, we have to consider all costs related to existing assets before mid-2008 as not avoidable. Additionally, due to the historic development and the requirements of the current and previous Access Undertakings, ARTC does not hold a directory of specific assets but rolls forward the asset base for single Line Segments since it took over the leasing of the HV rail network in 2005. As a consequence, data on the asset inventory is not available.

In addition, our approach leads to a conservative estimation of incremental costs because we restrict our analysis on CAPEX projects commissioned since mid-2008 (or, in a separate calculation, for projects commissioned since the current HVAU took effect in mid-2011). Projects prior to July 2008 are not considered in our model even though there might be CAPEX in PZ 1 prior to H2 2008 that relates to the expected growth in traffic volume from PZ 3 Access Holders. Development of PZ3 had been planned in 2008, and already begun in 2011, and there may have been rail network investments in PZ1 at the time that related to the development of PZ3. The reason for not considering this CAPEX for our estimate is that relevant data for investment projects prior to 2008 was not available, at least not in the same form, and this CAPEX therefore could not be included in our model the same way as investments after 2008.

5 Technical Assessment of Cost Variability

5.1 Documents assessed

In order to determine the incremental costs of Pricing Zone 3 Access Holders' use of Pricing Zone 1 and 2, we reviewed and assessed the maintenance costs and other main costs like the investments into the network separately.

For the maintenance activities the split between fixed and variable costs was assessed while for assessing the investments the minor and major CAPEX projects were subject of the evaluation.

The following list gives a short overview over maintenance activities and investment projects reviewed:

- Number of maintenance activities: 117 in total, 80 relevant activities (carried out in Line Segments in PZ1/2 used by PZ3 Access Holders) assessed.
- Number of minor CAPEX projects: 427 in total, 227 relevant projects (carried out in Line Segments in PZ1/2 used by PZ3 Access Holders) assessed.
- Number of major CAPEX projects: 65 in total, 27 relevant projects (carried out in Line Segments in PZ1/2 used by PZ3 Access Holders) assessed.

The assessment of the maintenance activities was based on the analyses of the following documents provided by ARTC as a respond on the information request by ACCC:

- Item 1: Maintenance costs for the 2013 calendar year by maintenance activity, including a detailed break-down of fixed and variable maintenance costs maintenance activity and segment.[30]
- Item 2. Maintenance activity descriptions with details of split between fixed and variable allocation and an explanation outlining the details of the split of and the basis upon which the split has been applied.[31]

The information in both documents were split into the two maintenance cost categories "Routine Corrective and Reactive Maintenance" (RCRM) and "Major Periodic Maintenance" (MCM).

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30 *CONFIDENTIAL: ACCC Information Request, ARTC Information pertaining to the Annual Compliance Assessment for 2013 dated 10 July 2015,* [redacted]

31 CONFIDENTIAL: *ACCC Information Request, ARTC Information pertaining to the Annual Compliance Assessment for 2013 dated 10 July 2015*, [redacted]

The investment projects, i.e. major and minor CAPEX projects, were identified on the information stated in the [redacted]. Additionally, ARTC provided sheets with data on minor and major CAPEX projects carried out in FY 2008/09, FY 2009/10, and FY 2010/11.

The information taken from the assessed documents mentioned above were backed by the various RCG Monthly Reports starting in December 2012 continuing January to December 2013 and finishing with the July 2014 report. Additionally, ARTC provided the following supporting documents as a respond on the information request by ACCC:

- RIG submissions – Project approvals with project descriptions for FY 2008/09, FY 2009/10 and FY 2010/11.
- Detailed description of selected minor and major CAPEX projects for the period FY 2008/09 to FY 2010/11.

Further information about the different activities was taken from the ARTC's "Hunter Valley Corridor Capacity Strategy Consultation" Documents[35] and the ARTC document "RCG Hunter Valley Pricing Zone 1, Corridor Capital, January 2013 – June 2014"[36].

5.2 Engineering assessment

The engineering assessment of the split into incremental and fixed maintenance costs was based on a project-by-project approach in comparison with empirical values derived from other operators depending on the level of detail found in the documents provided.

Before starting the assessment work a comprehensive set of significant drivers with direct impact on the costs and cost categories was identified. As main cost drivers the following were defined:

- Gross tonne kilometers (GTK)
- Train-kilometers (Tkm)

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32 *CONFIDENTIAL,* ARTC (2013), H2 *2011 Annual Compliance Assessment Documents,* [redacted].

33 *CONFIDENTIAL,* ARTC (2013), *2012 Annual Compliance Assessment Documents,* [redacted]

34 *CONFIDENTIAL,* ARTC (2014), *2013 Annual Compliance Assessment Documents,* [redacted].

35 ARTC, *Hunter Valley Corridor Capacity Strategy Documents*, https://www.artc.com.au/projects/hv-strategy/.

36 ARTC (2012), *RCG Hunter Valley Pricing Zone 1, Corridor Capital*, January 2013 – June 2014, November 2012

- Time of use (time)
- Safety level
- Maintenance level
- Level of operating costs

Assessment of Maintenance Costs (RCRM and MCM)

The assessment of the maintenances costs was an evaluation of the ARTC´s approach of the cost allocation of the different activities between the two cost categories "fixed" and "variable" and how and to which extent maintenance costs do vary with usage.

In a first step, each maintenance activity was reviewed and the cause identified before the corresponding cost drivers of the particular activity were allocated. In a second step the relative cost share of each activity caused by the different cost drivers was estimated and the variable percentage was defined.

Both "Routine Corrective and Reactive Maintenance" (RCRM) and "Major Periodic Maintenance" (MCM) were handled in the same way.

Assessment of capital expenditures

ARTC differentiates its CAPEX projects in two main categories:[37]

- Major CAPEX projects refer to projects related to investment into capacity. The capital expenditures in these projects are related to asset enhancements driven by the need for a higher network capacity.
- Minor CAPEX projects are deemed to be more reinvestments into the infrastructure, i.e. the replacement and renewal of assets.

Since per definition Major CAPEX is mainly linked to capacity enhancement projects the different projects were assessed questioning their sole necessity to facilitate capacity growth.

The minor CAPEX projects were assessed according to the maintenance activities. The cause for each project was identified and the main cost drivers were assigned to define the incremental cost. An important part of the engineering assessment was the review of underlying assumptions and definitions.

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37 ARTC (2014), *2013 Capital Consultation – Hunter Valley Coal Network*, May 2014.

5.3 Results of our assessment

It should be mentioned that for both the assessment of maintenance costs as well as the assessment major and minor CAPEX projects, generally the allocation of costs followed the approach of ARTC as long there was no reason to deviate from ARTC's assumptions and values.

5.3.1 Maintenance activities

The engineering assessment qualified the allocation of the maintenance costs into fixed and variable maintenance costs done by ARTC to be generally plausible. The assumption of ARTC to apportion the variable resp. fixed costs in 25%-steps (i.e. assuming a cost variability of 0%, 25%, 50%, 75%, or 100%) to both categories are regarded to be a good and practicable approach.

We also agree that maintenance cost of permanent way / track superstructure, e.g. rerailing, rail defects repair, rail and turnout grinding, resurfacing and ballast cleaning are caused mainly by traffic and in particular by volume rather than time. It can be said that costs caused by track subgrade is more related to GTK while investments into the signalling or radio system are in correlation to Tkm.

While the wear of the track depends on transport volume, the signalling-related maintenance depends from time as well as from usage whereas train-km (Tkm) are more relevant than GTK. In this respect even if pad replacement has to be seen as maintenance of a part of superstructure the wear of the pads is seen as depending more on time than on the wear of rails.

However where the cost positions reach higher amounts and where the main cost drivers are GTK or Tkm (indicating for incremental cost) and where "minor fixed component", "small fixed component" or alike wordings describe that just a small part of the costs are driven by time and are hence fixed, even the smallest step (25%) leads in our opinion to a too big distortion.

Therefore the cost allocations were slightly adjusted in smaller steps and towards more realistic portions for incremental (GTK / Tkm depending) or fixed (time) related costs. Table 3 below shows the result of our assessment and provides an overview of the adjusted values:

Table 3 Assessment of incremental cost share – maintenance costs

Category	Cost Types	% incremental (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Cost driver (incremental)	Cost driver (fixed)
RCRM	163 - Rail Defect Removal	75	90	GTK	time
MCM	168 Rerailing - Minor	75	90	GTK	time
	171 - Rail Grinding	75	90	GTK	time
	172 - Turnout Grinding	75	90	GTK	time
	187 - Turnout Steel Component Replacement	75	90	GTK	time
	203 - Maintenance Resurfacing	75	90	GTK	time
	205 - Turnout Resurfacing	75	90	GTK	time
	226 - Pad Replacement	50	75	GTK	time

Source: TÜV / WIK.

The following bullets provide a brief explanation for our assessment and the modification of ARTC's assumption on cost variability of maintenance activities:

- 163 – Rail Defect Removal
  We agree with ARTC's assessment that the majority of rail defects is related to volume but that there are inherent manufacturing issues which support a small fixed element. Therefore we assessed a cost variability of 90%.
- 168 Rerailing – Minor
  We agree with ARTC's assessment that the majority of defects in rail creating the need for replacement is directly related to network volumes but that a small fixed component is justified due to issues not related to volume such as manufacturing faults. Therefore we assessed a cost variability of 90%.
- 171 - Rail Grinding
  We agree with ARTC's general assessment that the majority of rail degradation corrected by rail grinding is linked to network volumes - damage and wear on the rails increase in line with volumes. A small component of work performed by rail grinding is the removal of surface rust and wheel burns therefore not network volume dependent - supporting a small fixed component. Therefore we assessed a cost variability of 90%.
- 172 - Turnout Grinding
  We agree with ARTC's assessment that the majority of rail degradation corrected by turnout grinding is linked to network volumes - damage and wear on the rails increase in line with volumes. A small component of work performed by rail grinding is the removal of surface rust and wheel burns therefore not

network-volume dependent - supporting a small fixed component. Therefore we assessed a cost variability of 90%.

- 187 - Turnout Steel Component Replacement
  We agree with ARTC's assessment that most of the turnout steel component replacement is clearly linked with network volumes as the wear on these components increases proportionately with tonnage. However as per rerailing, there is an element of the turnout steels that require replacement due to issues with manufacture and therefore not network volume related. Therefore we assessed a cost variability of 90%.
- 203 - Maintenance Resurfacing
  We agree with ARTC's assessment that geometry degradation is primarily based on network volume but that underlying geotechnical issues and environmental factors support a small fixed component. Therefore we assessed a cost variability of 90%.
- 205 - Turnout Resurfacing
  We agree with ARTC's assessment that geometry degradation is primarily based on network volume but that underlying geotechnical issues and environmental factors support a small fixed component. Therefore we assessed a cost variability of 90%.
- 226 - Pad Replacement
  We agree with ARTC's assessment that pad replacement occurs when the pads between the rail and the sleeper are worn or no longer ineffective. Wear occurs proportionally with network volume however environmental factors and age play a role in effectiveness of the pad. It is therefore considered appropriate that this activity contains a fixed share. Therefore we assessed a cost variability of 75%.

5.3.2 Maintenance overhead costs

Further information on the origin and allocation of the maintenance overhead costs was requested by WIK and TÜV but the additional information provided by ARTC was not sufficient for our purpose.

Hence a break-down of the maintenance overhead costs into incremental and fixed proportions was not possible so ARTC's costs estimation was taken over into the calculation without changes.

5.3.3 Network control costs

Similar to the maintenance overheads further information on the origin and allocation of the network control costs was also requested by WIK and TÜV but the additional figures provided by ARTC were not sufficient for our purpose.

Hence a break-down of the network control costs into variable and fixed proportions was not possible so ARTC's costs estimation was taken over without changes.

5.3.4 Minor CAPEX projects

Based on the relatively poor level of detailed information on minor CAPEX projects the assumption was made that minor CAPEX projects are rather reinvestments than asset enhancements. The given figures were assessed and reviewed project by project.

Concordant with the maintenance cost allocation the assessment of the minor CAPEX projects has led to similar findings in respect of cost allocation of the different main cost drivers time, GTK or Tkm and the resulting cost distribution into time and volume (GTK, Tkm). In addition to the three main cost driver GTK, Tkm and time, safety was identified as cost driver for the radio upgrade. It can be said that costs caused by track subgrade is more related to GTK while investments into the signalling or radio system are in correlation to Tkm.

For some cost types Tkm were identified and named as main cost driver instead of no. of trains. It has to be mentioned that in this context Tkm incorporate the number of trains and that there is no impact on the outcome of our incremental cost estimation.

We agree with ARTC that the approach to apportion the variable resp. fixed costs in 25%-steps (i.e. assuming a cost variability of 0%, 25%, 50%, 75%, or 100%) to the different cost drivers and origins is practicable in general. But when reaching the limits it seems to be a too rough approach so that smaller steps were favoured. Hence in the limits, i.e. for very small fixed (variable) share: 90% and 10% were chosen.

For an easier presentation of the outcomes of the assessment, the different minor CAPEX projects were grouped into eight main categories as laid out in Table 4 below.

Table 4 Assessment of incremental cost share – Minor CAPEX projects

Cost Types	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Cost driver (incremental)	Cost driver (fixed)
Rerailing	0	90	GTK	time
Point machine replacem / Point motor renewal	0	50	Tkm	time
Signaling System investments/upgrades	0	50	Tkm	time
Track strengthening / upgrading	0	75	GTK	time
Turnout renewal with 60kg rail	0	75	GTK	time
Radio Upgrade, additional channels	0	25	Tkm	safety
Track Pads replacement	0	75	GTK	time
Flash Butt Welding	0	75	GTK	time
Repair of signalling equipment (relay boards)	0	25	Tkm	time
Installation of rail lubricators	0	50	GTK	time
Upgrading of structural deficiencies	0	75	GTK	time

Source: TÜV / WIK.

It can be said that analogous to the maintenance costs, the minor CAPEX are investments into asset replacement to keep the technical standard on the level needed rather than investments into capacity enhancement.

Again investments for permanent way / superstructure, e.g. rerailing, track and turnout renewal are seen to be caused more by traffic and volume than by time while signalling and radio communication related investments are more time than Tkm related.

The following bullets provide brief explanations for our assessment of the cost variability of the minor CAPEX projects:

- Rerailing
  Our assessment is that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
- Point Machine replacement / Point motor renewal
  Our assessment is that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
- Signalling System investments/upgrades
  Our assessment is that the need for signalling system investments/upgrades is

caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.

- Track strengthening / upgrading
  Our assessment is that the need for track strengthening and upgrading is more caused by volume rather than time. Therefore we assessed a cost variability of 75%.
- Turnout renewal with 60kg rail
  Our assessment is that the need for turnout renewals with an upgrade to 60kg rails is more related to volume than to time. Therefore we assessed a cost variability of 75%.
- Radio Upgrade, additional channels
  Our assessment is that the need for a radio upgrade and also for additional channels is related to both, safety and traffic but more safety than traffic. Therefore we assessed a cost variability of 25%.
- Track Pads replacement
  Our assessment is that the need for a replacement of the track pads is more related to volume than time. Therefore we assessed a cost variability of 75%.
- Flash Butt Welding
  Our assessment is that the need for flash butt welding is more related to volume than time. Therefore we assessed a cost variability of 75%.
- Repair of Signalling Equipment (Relay Boards)
  Our assessment is that the need for a upgrade of the signalling equipment is related to both, safety and traffic but more safety than traffic. Therefore we assessed a cost variability of 25%.
- Installation of Rail Lubricators
  Our assessment is that the need to install rail lubricators is driven by both volume and the need to reduce maintenance costs. Therefore we assessed a cost variability of 50%.
- Upgrading of Structural Deficiencies
  Our assessment is that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.

5.3.5 Major CAPEX projects

The major CAPEX projects are almost all asset enhancement driven projects propelled by the need for a higher network capacity due to higher transport volumes needed.

In this respect reducing maintenance impacts respectively increasing operational flexibility are also seen as a form of capacity enhancement.

The Major CAPEX projects under assessment can be categorized in the following rough types:

- Track extensions, 3rd road and duplication
- Junction Upgrades / Junction remodelling
- Departure Road
- 80 km/h Running Stage
- Provisioning Facility
- Terminal Upgrade.

Since those projects are generally not required in case of no increase of traffic volume they are deemed to be 100% volume related, hence incremental.

When assessing the major CAPEX GTK was identified as main cost driver rather than Tkm since there might be some major CAPEX investments into the increase of the capacity which will have an impact on the transport volume and not on the number of trains (e.g. increase of axle load, increase of length of trains).

5.4 Axle Load Differentiation Factor

The axle load of the trains has a significant impact on the life time on the engineering structures and in particular on the grade of wear of the track superstructure and its components rails and points. Hence it was considered to respect this fact by implementing a differentiation factor for the different axle loads used by the trains traversing Zone 1.

This approach follows ARTC´s proposal for the future access charges as laid down in the "Position Paper – Final Indicative Services variation"[38]. We agree to the non-TOP differentiation factor of **0.969** for 25t axle load trains in comparison to the 30t axle load trains. This factor is independent from the length of train.

ARTC´s approach to add a surcharge (factor 1.009) to the 86 wagon trains in comparison to the 96 wagon trains was not followed for the allocation of the maintenance costs since this factor is driven by the level of capacity and not by the level of wear and the reduction life time of the infrastructure.

38 ACCC (2014), Position Paper – Australian Rail Track Corporation's Hunter Valley Coal Network Access Undertaking – Final Indicative Services variation, 1 August 2014, pages 37-38.

6 Incremental Cost Model

In our Incremental Cost Model, in general, there are three kinds of sheets: input sheets either with variable inputs or raw data (which is derived from ARTC's confidential compliance submissions) as well as our assessment of the incremental share of activities and CAPEX projects, output sheets with the incremental cost estimation of PZ3 Access Holders' use of PZ1 and PZ2 and sheets with auxiliary calculations to derive the model results.

6.1 Model structure, input data and key parameters

The spreadsheet model consists of 15 worksheets, listed below. To limit the required number of workbooks, the input data from ARTC's confidential spreadsheet model is hard coded into the worksheets and sources for the hardcoded data is provided in the Excel file.

Table 5 Worksheets in our spreadsheet model

Worksheet	Brief description
Contents	Content of the Excel model and legend (cells, worksheets)
Result	Model output: Estimate of the incremental cost of PZ3 Access Holders' use of PZ1 & PZ2 and estimate of the stand-alone costs of PZ 1 & PZ 2
Results per MPC	Model output: Estimate of the incremental cost and comparison with ARTC's variable costs per Mine-Port-Combination
Variables	Definition of the model input variables and key parameters
Appendix A	Input variables: WIK-Consult & TÜV's assessment of the incremental share of activities and projects and the appropriate cost drivers
CAL_IC MPC	Estimation of the incremental costs per Mine-Port-Combination and calculation of the variable costs per Mine-Port-Combination based on ARTC's figures
CAL_IC	Auxiliary calculation to derive the incremental cost estimate per Line Segment and cost driver
CAL_CoC	Auxiliary calculation and roll-forward of the incremental asset bases and calculation of the return on and depreciation of the asset bases
CAL_CoC_preH2 2011	
INP_GTK	Model input data: ARTC figures on volume of traffic, Mine-Port-Combinations, maintenance costs, capital expenditures, etc.
INP_Tkm	
INP_MPC	
INP_Raw data	
INP_MinorCAPEX	
INP_MajorCAPEX	
INP_IDC	

Source: WIK-Consult.

The spreadsheet model uses matrix multiplication techniques to estimate the incremental costs of across the Line Segments in ARTC's Hunter Valley rail network utilised by a number of mines. The model allows for the estimation of incremental costs for all Mine-Port-Combinations included in ARTC's Ceiling Test Model, including those with PZ3 Access Holders' use of PZ1 & PZ2. The result of the incremental cost estimates are provided in the worksheet *Result* and *Result per MPC*.

The results are derived from two major calculation steps, which are executed in separate worksheets: First, we estimated the single elements of incremental costs defined in Section 4.3 per Line Segment in the worksheet *CAL_IC*. Secondly, we calculated the incremental costs for the relevant Mine-Port-Combinations in worksheet *CAL_IC MPC*.

The calculations to estimate the incremental costs are sourced from seven worksheets (indicated by the prefix *INP_*) which contain the input data from ARTC's annual HVAU compliance submissions H2 2011 to 2013 and ARTC's CAPEX data for FY 2008/09 to FY 2010/2011. Table 6 provides an overview of relevant input data and its sources.

Table 6 Input data used in our Excel Spreadsheet Model

Input data	Description	Source
Line Segments (LS)	Data, e.g. length, on 35 Line Segments of the ARTC HV rail network including 20 segments used by PZ3 traffic.	ARTC Ceiling Test Model, worksheet Mine-Line Section Map
Mine-Port-Combinations (MPC)	Composition of and data on 47 Mine-Port-Combinations utilized in the HV rail network including 7 relevant MPC with PZ3 traffic.	ARTC Ceiling Test Model, worksheet Mine Line Section Map
Traffic volume (2013: Tkm, GTK, number of trains)	Data on train kilometres and gross tonne kilometres for constrained and for unconstrained traffic per Line Segment and per Mine-Port-Combination and the number of trains per MPC	ARTC Ceiling Test Model, worksheets Trainkm, Mine Inputs, Variable Costs
Maximum axle load (2013)	Axle load used in 2013 per Mine-Port-Combination	ARTC submission dated 24th July 2015: [redacted]
Maintenance cost by activity (2013)	Maintenance costs for 76 Routine Corrective and Reactive Maintenance activities, including 50 RCRM activities carried out in Line Segments utilized by PZ 3 traffic, and cost data for 41 Major Periodic Maintenance activities, including 31 MPM activities in Line Segments utilized by PZ 3 traffic. The data includes ARTC's assessment of cost variability and the cost data for each activity on Line Segment level.	ARTC submission dated 24th July 2015: [redacted]
Maintenance overhead cost (2013)	ARTC's total maintenance overhead costs and allocated maintenance overhead costs per Line Segment.	ARTC Ceiling Test Model, worksheet Line Section Costs
Network control overhead cost (2013)	ARTC's total network control overhead costs and allocated network control costs per Line Segment.	ARTC Ceiling Test Model, worksheet Line Section Costs
Minor Capex projects (H2 2008-2013)	Cost data of minor CAPEX projects, including projects carried out in Line Segments used by PZ 3 traffic, for the period mid 2008 to 2013.	ARTC Compliance Submissions: [redacted], worksheets Minor Capex (2013), 2012 Corr Cap PZ 1,2&3 (2012), Corridor Capital Adds Summary (H2 2011) ARTC submissions: [redacted]
Major Capex projects (H2 2008-2013)	Cost data of major CAPEX projects, including projects carried out in Line Segments used by PZ 4 traffic for the period mid 2008 to 2013.	ARTC Compliance Submissions: [redacted], worksheets Major Capex (2013), Summary Project Allocation (2012), Summary all Major Projects (H2 2011) ARTC submissions: [redacted]
Interest during construction (H2 2008 – 2013)	Data on interest during construction for major CAPEX projects for the period mid 2008 to 2013.	ARTC Compliance Submissions: [redacted], worksheets Table 4-Appendix F IDC (2013), Table 4 IDC (2012, H2 2011) ARTC submissions: [redacted]

Source: WIK-Consult.

Additionally, the model uses general input variables, e.g. CPI data or depreciation rates, from the worksheet *Variables* and the results from our assessment of the increment of project and activity costs and the respective cost drivers from worksheet *Appendix A*. The key parameters include

- **Return on assets (ROA):** In the model, we apply the permitted real pre-tax rate on return from of 9.10%[39] to calculate the return on the "incremental asset base".
- **Expected useful remaining life (RL_t):** To calculate the depreciations and to roll-forward the "incremental" asset base, we followed ARTC's approach: linear depreciation using a remaining life approach. For assets added before H2 2011, we followed ARTC's approach applied in the NSW Rail Access Undertaking and use a remaining life time of 31 years for assets added in FY 2008/09, 30 years for assets added in FY 2009/2010, and 29 years for assets added in FY 2010/11.[40] Starting in H2 2011, we used the remaining life time defined in the HVAU, i.e. a remaining life time of 21 years for existing assets in H2 2011, 20.75 years for assets added in H2 2011, 20 years for assets added in 2012 and 19 years for assets added in 2013. This yields depreciations rates of 4.82% in H2 2011, 5.0% in 2012 and 5.26% in 2013.
- **Weight for new assets (w_t):** According to HVAU[41] Section 4.7 (c) and NSW Rail Access Undertaking Section 3.2 (c), new assets are charged for half of the period in the year of commission. Therefore, we used the weight 0.5 for assets added in the years 2008/09, 2009/10, 2010/11, 2012 and 2013 and a weight of 0.25 for assets added in H2 2011.
- **Inflation rate (CPI_t):** The roll forward of the asset base and the depreciation takes into account the annual inflation rate, determined by the Consumer Price Index (CPI) for the September quarter of the preceding year.[42]
- **GTK adjustment factor:** ARTC proposed to apply a differentiation factor in its Pricing Schedule to take account for the different impact of axle loads and speeds on maintenance costs. We agree that axle load of the trains has a significant impact on the state and condition of below-rail infrastructure. Therefore we incorporated an adjustment in our incremental cost estimation to consider that the different train types may yield different incremental costs and

39 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.8, p. 32.
40 NSW Rail Access Undertaking, Schedule 3, Section 3.2 (c) iii.
41 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.7 (c), p. 32.
42 ARTC (2011), *Hunter Valley Coal Network Access Undertaking*, 23 June 2011, Section 4.4 (b), p. 29.

applied ARTC's adjustment factor of 0.969 for PZ3 trains with 25t maximum axle load.[43]

- **Incremental share of costs ($\%IC_j$):** The percentages of each activity's or project's costs considered incremental, i.e. driven by specific traffic, are the key parameter in our estimation. The input data relates to the incremental share of all relevant projects and maintenance activities, i.e. those carried out in Line Segments used by PZ3 Access Holders, and appropriate cost drivers.

The values for the incremental share of costs are the central parameters of our model. They have been determined carefully based on the engineering assessment summarised in chapter 5 of this report. For a detailed account of the values and our reasoning see Appendix A.

6.2 Estimation of incremental costs

The estimation of the incremental costs per Line Segments is based on two major calculation steps. The first step is the determination of the elements that constitute incremental costs per Line Segment, executed in the worksheet *CAL_IC* which uses auxiliary calculation results from the worksheet *CAL_CoC*.

Incremental cost per Line Segment and per cost driver

The first element is incremental maintenance costs, which are calculated in worksheet *CAL_IC.* Our approach is illustrated in Figure 5 in a stylized manner. We distinguish two kinds of incremental maintenance costs per line segment: short-run variable costs of single maintenance activities and allocated incremental maintenance overhead costs. First, we used ARTC's allocation of maintenance overhead costs per Line Segment by constrained and unconstrained GTK and assessed the incremental share of these. Secondly, we assessed the cost variability of the single maintenance activities j and multiplied this incremental share ($\%IC_j$) with the costs in each Line Segment i to obtain the incremental maintenance costs.

$$\sum_j Maintenance\ costs_{activity\ j,LS\ i} * \%IC_j = Incremental\ maintenance\ costs_{LS_i}$$

The incremental maintenance costs per GTK are derived by dividing the total incremental maintenance costs by the GTK of the respective Line Segment.

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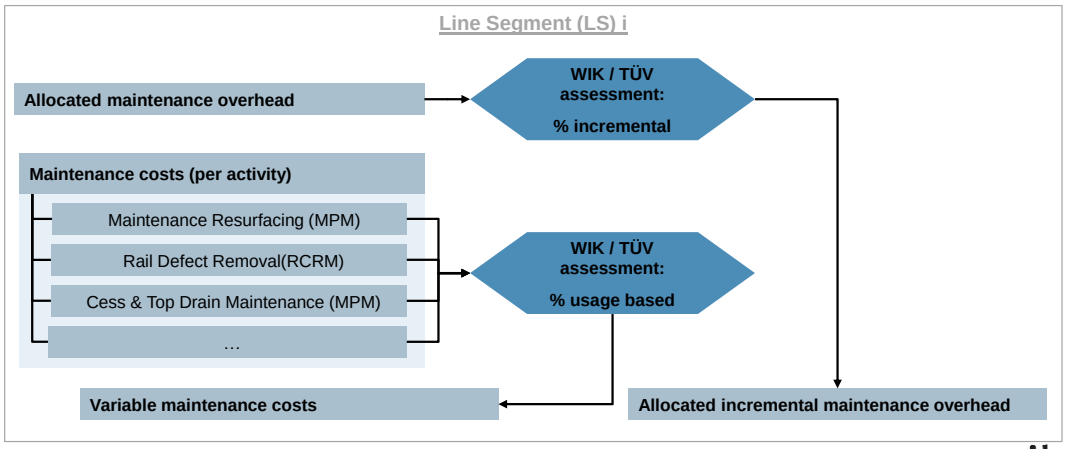
43 ACCC (2014), *Application to vary the 2011 Hunter Valley Coal Network Access Undertaking to provide for the adaption of the final indicative services and charges in accordance with Section 4.18 (b) – Supporting Documentation*, January 2014, p. 30. See Chapter 5.4.

Note that no detailed information on maintenance overhead costs was available from ARTC for this project and therefore ARTC's assumptions could not be assessed in this study. In our model estimating we followed ARTC's assumptions that all maintenance overhead costs are fixed. As a result, we possibly underestimate the incremental cost.

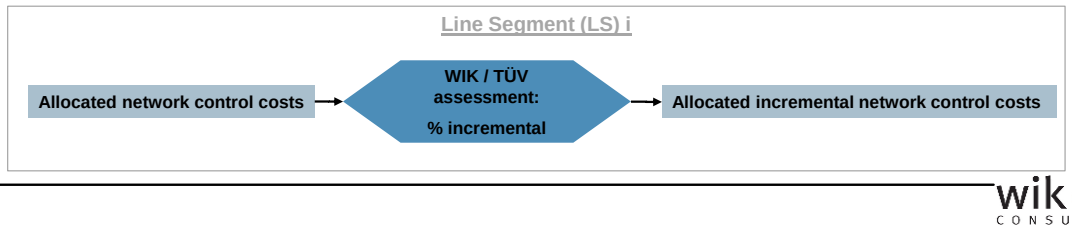
Figure 5 Our approach to incremental maintenance costs



Source: WIK-Consult.

The second element is incremental network control overhead costs, which are estimated in worksheet *CAL_IC*. Note that no detailed information on network control costs was available from ARTC for this project and therefore ARTC's assumptions could not be assessed in this study. In our model estimation we followed ARTC's assumptions that all network control costs are fixed. As a result, we possibly underestimate the incremental cost. Figure 6 illustrates our general approach in a stylized manner.

Figure 6 Our approach to incremental network control costs

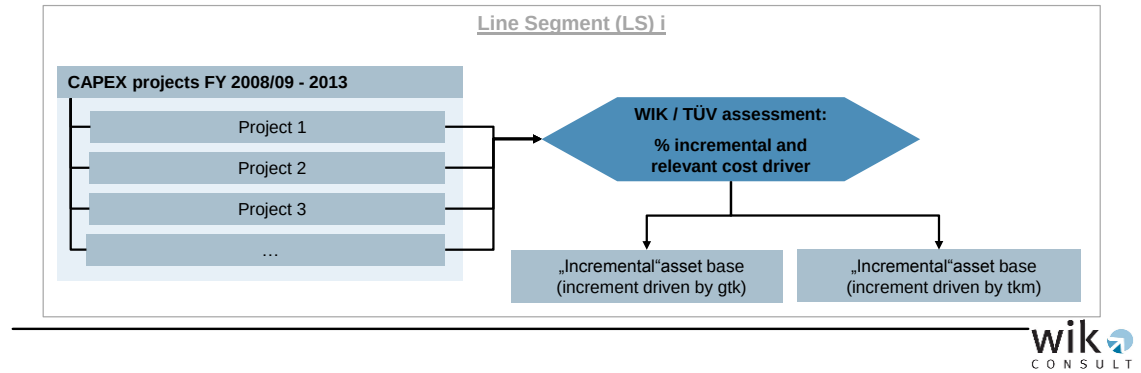


Source: WIK-Consult.

The third element of incremental costs is the incremental share of capital expenditures (CAPEX). For our purpose, we assessed the incremental share of assets in ARTC's minor and major CAPEX projects for the period FY 2008/09 to 2013 and identified two relevant cost drivers: gross tonne kilometres (GTK) and train kilometres (Tkm). Based

on the two cost drivers, we derived two "incremental" asset bases per Line Segment, one for each cost driver. Based on the "incremental" asset bases, we calculated the return on and depreciation of the incremental assets in the worksheet *CAL_CoC*. Figure 7 illustrates our approach in a stylized manner.

Figure 7 Our approach to incremental CAPEX



Source: WIK-Consult.

The fourth element of the incremental costs is incremental capital expenditures and the related cost of capital. The calculation, executed in worksheets *CAL_COC and CAL_COC_preH2 2011*, include several steps:

- First, the incremental values of minor and major CAPEX projects in the considered years were allocated to the single Line Segments to calculate two incremental asset bases: one for incremental assets driven by GTK and incremental assets driven by Tkm.
- Secondly, we adapted ARTC's methodology, i.e. the useful remaining life approach for depreciation, to derive and to roll forward the asset bases for each Line Segment.
- Thirdly, we derived the return on "incremental" assets by applying the permitted rate of return (real, pre-tax) to the average asset base value in 2013.

Due to the lack of data and documentations, we could not include CAPEX projects prior to FY 2008/09. Therefore, we used an initial asset base in period FY 2008/09 of zero. This yields a conservative estimation of incremental costs and any positive initial asset base would increase the incremental cost estimate.

ARTC's approach is set out in the HVAU. Section 4.4 (b)(iii) states that the closing value of assets (asset base AB) in year t for Line Segment i is given by

$$AB_{t,i,END} = AB_{t,i,START} * (1 + CPI_t) + NETCAPEX_{t,i} - DEPRECIATION_{t,i}$$

whereas the net capital expenditures ($NETCAPEX$) are the capital expenditures, i.e. assets added, including interest cost during construction (IDC) minus any disposal of assets in the Line Segment, i.e.

$$NETCAPEX_{t,i} = CAPEX_{t,i} - DISPOSAL_{t,i} + IDC_{t,i}.$$

The annual depreciation amount in each year is the sum of the annual depreciation of the CPI-adjusted opening value of capital expenditures of previous years and the depreciation of capital expenditures of the current year for half of the period.

The value of new incremental assets, i.e. the $CAPEX_{t,i}$ of Line Segment i in period t, is determined by multiplying the assessed incremental share of each project ($\%IC_j$) with the value of the respective project added to RAB in the periods. The sum of all projects commissioned in year t is the incremental asset base of Line Segment i in this year, i.e.

$$CAPEX_{t,i} = \sum_j \%IC_j * Value\ project\ j\ in\ period\ t$$

The same approach applies for the calculation of interest during construction for incremental assets.

Depreciation for the assets is derived by using a useful remaining life time approach, which implies a constant depreciation amount for assets (plus a CPI adjustment) and a constant depreciation rate over the expected remaining life time. The depreciation rate is determined by the remaining life time in the year of the addition of the asset (τ). The depreciation amount in year t of an asset added in year τ is given by

$$DEPRECIATION_{t,\tau,i} = \sum CPI\ adjusted\ CAPEX_{t,\tau,i} * d_\tau.$$

This approach allows calculating the depreciation and the capital costs (return on assets) of the incremental asset bases using the remaining life times and permitted rate of return used in the HVAU.

The example in Figure 8 illustrates our calculations to determine the asset base and the relevant depreciations in the different periods.

Figure 8 Example – Determination and roll forward of the asset base

year	Remaining life time of new assets (years)	Depreciation rate (d_t=1/remaining life)	CPI
1	21	4.76%	2.5%
2	20	5.00%	2.5%
3	19	5.26%	2.5%

Asset Base		Line Segment i	Formulas
	AB_1_START	-	
1	+ CAPEX_1	1,000.0	
	- Depreciation_1	23.8	=CAPEX_1 * d_1 * 0.5
	AB_1_END=AB_2_START	976	
2	+ CPI adjustment	24.4	=AB_2_START * CPI
	+ CAPEX_2	1,000.0	
	- Disposals year 1 assets	-	
	- Depreciation year 1 assets	48.8	=CAPEX_1 * (1+CPI) * d_1
	- Depreciation year 2 assets	25.0	=CAPEX_2 * d_2 *0.5
	AB_3_END=AB_3_START	1,927	
3	+ CPI adjustment	48.2	
	+ CAPEX 2013	1,000.0	
	- Disposals year 1 assets	-	
	- Disposals year 2 assets	-	
	- Depreciation year 1 assets	50.0	=CAPEX_1 * (1+CPI) * (1+CPI) * d_1
	- Depreciation year 2 assets	51.3	=CAPEX_2 * (1+CPI) * d_2
	- Depreciation year 3 assets	26.3	=CAPEX_3 * d_3 * 0.5
	AB_3_END	2,847	
	Average AB year 3	**2,387**	=(AB_3_START + AB_3_END) / 2
	Depreciation year 3	**128**	=Year 3 Depr. of year 1 assets + Year 3 Depr. of year 2 assets + year 3 Depr. of year 3 assets
	Return on AB year 3	**217**	=Average AB year 3 * permitted ROA

Source: WIK-Consult.

In the example, we assume an annual CPI of 2.5% and annual incremental CAPEX including interest during construction of 1,000. The incremental asset base is rolled forward each year by adjusting it to the CPI development, annual disposals and the sum of depreciations of all incremental assets. The annual real depreciation amount for assets is constant while the nominal value varies with the CPI (and loss on disposal adjustments which are not considered in the example). New assets are depreciated for half of the period of their addition.

Given the four elements of incremental costs, we determine the incremental costs per cost driver, i.e. per GTK and per Tkm, for each Line Segment as the sum of all incremental cost components of the respective cost drivers. Table 7 illustrates these calculations in a stylized manner.

Table 7 Our approach – Estimation of incremental costs per Line Segment

	Cost driver	% incremental	LS 1	LS 2	…
Incremental maintenance costs activity 1	GTK	$\%IC_1$	Ic_ma1_LS1	Ic_ma1_LS2	…
Incremental maintenance costs activity 2	GTK	$\%IC_2$	Ic_ma2_LS1	Ic_ma2_LS2	…
…	…	…	…	…	…
Incremental maintenance costs activity j	GTK	$\%IC_j$	Ic_maj_LS1	Ic_maj_LS2	…
Allocated incremental maintenance overhead	GTK	$\%IC_{MO}$	ic_mo_LS1	ic_mo_LS2	…
Allocated incremental network control cost	Tkm	$\%IC_{NC}$	ic_nc_LS1	ic_nc_LS2	…
Depreciation of "incremental" assets (driven by Tkm)	Tkm		ic_dTkma_LS1	ic_dTkma_LS2	…
Return on "incremental" assets (driven by Tkm)	Tkm		ic_rTkma_LS1	ic_Tkma_LS2	…
Depreciation of "incremental" assets (driven by GTK)	GTK		ic_dGTKa_LS1	ic_dGTKa_LS2	…
Return on "incremental" assets (driven by GTK)	GTK		ic_rGTKa_LS1	ic_rGTKa_LS2	…
Incremental cost per GTK (IC_GTK)			$\frac{\sum IC_{gtk_{LS1}}}{gtk_{LS1}}$	$\frac{\sum IC_{gtk_{LS2}}}{gtk_{LS2}}$	…
Incremental cost per Tkm (IC_TKM)			$\frac{\sum IC_{tkm_{LS1}}}{tkm_{LS1}}$	$\frac{\sum IC_{tkm_{LS2}}}{tkm_{LS2}}$	…

Source: WIK-Consult.

Incremental costs of relevant Mine-Port-Combinations

The second major step is the estimation of the incremental costs of the relevant Mine-Port-Combination, which is executed in worksheet *CAL_MPC*. We use matrix calculation techniques to determine the incremental costs per Line Segment in each Mine-Port-Combination. For this purpose, the vectors of incremental costs per Line segment per GTK ($\boldsymbol{IC_{GTK}}$) and per Tkm ($\boldsymbol{IC_{TKM}}$) are multiplied the accompanying matrices (with the adjusted[44]) gross tonne kilometres ($\boldsymbol{GTK}$) and train kilometres ($\boldsymbol{TKM}$), i.e.

44 The GTK are adjusted for different grade of wear of the infrastructure. See Chapter 5.4.

$$IC_{GTK} * GTK + IC_{TKM} * TKM$$

$$= (IC_{GTK_{LS1}} \quad IC_{GTK_{LS2}} \quad \dots \quad IC_{GTK_{LSi}}) * \begin{pmatrix} GTK_{MPC1_{LS1}} & GTK_{MPC1_{LS2}} & \dots & GTK_{MPC1_{LSi}} \\ GTK_{MPC2_{LS1}} & GTK_{MPC2_{LS2}} & \dots & GTK_{MPC2_{LSi}} \\ \dots & \dots & \dots & \dots \\ GTK_{MPCn_{LS1}} & GTK_{MPCn_{LS1}} & \dots & GTK_{MPCn_{LS1}} \end{pmatrix}$$

$$+ (IC_{TKM_{LS1}} \quad IC_{TKM_{LS2}} \quad \dots \quad IC_{TKM_{LSi}}) * \begin{pmatrix} TKM_{MPC1_{LS1}} & TKM_{MPC1_{LS2}} & \dots & TKM_{MPC1_{LSi}} \\ TKM_{MPC2_{LS1}} & TKM_{MPC2_{LS2}} & \dots & TKM_{MPC2_{LSi}} \\ \dots & \dots & \dots & \dots \\ TKM_{MPCn_{LS1}} & TKM_{MPCn_{LS1}} & \dots & TKM_{MPCn_{LS1}} \end{pmatrix}$$

The result of this calculation is a 49x65-matrix with the incremental costs of each of the 49 Line Segment of the Hunter Valley rail network for all 65 Mine-Port-Combinations included in ARTC's Ceiling Test model. This allows us to calculate the incremental costs for each Access Holder's use of each Pricing Zone or combination of Pricing Zones.

Table 8 Example – Estimation of the incremental cost per Mine-Port-Combination

		Line Segment 1	Line Segment 2	Line Segment 3
Incremental cost per traffic unit		10	20	15
Traffic volume	Mine-Port-Combination 1	20	-	-
	Mine-Port-Combination 2	30	40	-
	Mine-Port-Combination 3	50	60	80
Incremental cost per Line Segment and Mine-Port-Combination	Mine-Port-Combination 1	200	-	-
	Mine-Port-Combination 2	300	800	-
	Mine-Port-Combination 3	500	1,200	1,200

Source: WIK-Consult.

Table 8 provides a simple example for a rail network with 3 Line Segments and 3 Mine-Port-Combinations and only one cost driver (e.g. GTK) to illustrate our calculations: First, the vector of incremental cost per unit traffic is calculated (row 1 in Table 8). Multiplying the vector with the matrix of traffic volume (row 2 to 5 in Table 8), yields a 3x3 matrix with the incremental costs per Line Segment for each Mine-Port Combination are (row 6 to 8 in Table 8). This allows estimating the incremental cost of traffic for each Line Segment and Mine-Port-Combination. Assuming that Line Segment 1 forms Zone 1 and Line Segments 2 and 3 form Zone 2, we can derive the incremental costs of Zone 2 users in Zone 1, i.e. 300+500=800.

7 Model results

Not considering any investments made before July 2011, we estimate the incremental cost of PZ3 Access Holders' use of PZ1 and PZ2 to be **A$ 10,531,754.** If we additionally include investments between July 2008 and July 2011, our incremental cost estimates rises to **A$ 14,582,884**. This figure compares to Direct Costs of A$2,497,914 that ARTC currently allocates to PZ3 Access Holders (for use of infrastructure in PZ1 and PZ2).

The stand-alone costs of PZ 1 and PZ 2 Access Holders amount to **A$286,173,256** (ignoring investments before July 2011) and **A$ 282,122,125** (including investments since July 2008). This is calculated by subtracting the incremental cost of PZ3 users from the Full Economic Cost in PZ1 and PZ2 reported by the ARTC (A$296,705,010)[45].

Our estimate of incremental cost is conservative (and does not consider cost elements to be incremental if there is any doubt), as it

- for maintenance costs, generally follows ARTC's methodology and only adjusts cost allocation factors for few of the 117 maintenance activities carried out by ARTC in 2013. Allocation factor were revised where our engineering assessment of how much costs vary with use departs from ARTC's assumptions.
- does not identify any incremental costs that may be included cost categories "maintenance overhead" and "network control" (reported by ARTC) because no sufficient detail was available from ARTC to review those costs.
- for the cost resulting from replacement investments on line segments used by PZ3 users, allocates only a share of those to PZ3 users based on their share on total volume of traffic (GTK or train-km). As coal mines in PZ3 are currently being developed, volumes are small compared to volumes in the more mature mines in PZ1 & PZ2, and therefore, PZ3 is a allocated a relatively small share of cost from replacement investments, based on 2013 traffic.
- for the cost resulting from capacity enhancement (on line segments that are used by PZ3 Users), allocates to PZ3 users only a share of those costs that reflects their (smaller) share in total traffic volume.
- considers only costs for capacity enhancement and replacement investments since 2008 because sufficient data that would be needed to include earlier

45 *CONFIDENTIAL SUBMISSION*, ARTC (2014), [redacted] Line Section Costs.

capital expenditures to our estimation was not available from ARTC for this project.

For the period after 1 July 2011 (the day the HVAU took effect), comprehensive information was available on the different investment projects, allowing us to assess incremental costs resulting from these investments reliably. For investments between July 2008 and June 2011, less detail was available from ARTC on investment projects, and our assessment. Consequently, this report presents model results separately that include, or exclude, investments made between 2008 and 2011.

ARTC reports "variable costs", i.e. Direct Costs of A$18,576,331 for the above rail services in PZ1 of the Hunter Valley rail network related to coal mines. In total, our model yields incremental costs for the traffic originating from all Pricing Zones in PZ1 of A$112,645,792 (including investments since 2008) which accounts for approximately half (49%) of the Full Economic Costs in PZ1 and PZ2 reported by ARTC. If we include only investments since mid-2011, incremental costs for the traffic originating from all Pricing Zones in PZ1 amount to A$86,881,503, or 38% of the of the Full Economic Costs in PZ1 and PZ2. In comparison, the Direct Costs currently reported by ARTC only account for around 8% of Full Economic Costs of PZ1.

Appendix A

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Maintenance (by activity)					
RCRM	006 - Consumables E/W (RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	012 - Supervisors & Vehicles(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	100 - Routine Inspections - Track (RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	101 - Detailed Inspections - Structures(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	103 - Worksite Protection	100	100	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	104 - Routine Inspections - Overbridges RCRM	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	106 - Routine Inspect - Underbridges (RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	107 - Routine Inspect - Culverts & Misc(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	108 - Routine Inspect - Closed Lines(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	109 - Routine Inspections - Turnouts	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	111 - Routine Inspections - Right of Way(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	121 - Callouts Track & Structures RCRM	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	141 - Pest Control (RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
RCRM	142 - Facilities, Housekeeping and Stores Mana	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	143 - Fire Prevention(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	144 - Vegetation Control - Reactive (RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	146 - Right of Way Maintenance (RCRM)	0	0		access roads and walkways
RCRM	148 Urban Fencing - Repair(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	150 - Access Road Maintenance(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	160 - Ultrasonic Rail Examination(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	161 - Rail Lubrication RCRM	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	162 Ultrasonic Testing - Ongoing(RCRM)	100	100	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	163 - Rail Defect Removal(RCRM)	75	90	GTK	We agree with ARTC's assessment that the majority of rail defects is related to volume but that there are inherent manufacturing issues which support a small fixed element. Therefore we assessed a cost variability of 90%.
RCRM	164 - Wheel Burn Removal(RCRM)	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	165 - Insulated Rail Joints RCRM	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	166 - Welded Track Stability RCRM	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	174 - Ultrasonic Test Car (RCRM)	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	180 - V Crossing Maintenance(RCRM)	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
RCRM	181 - Turnout Maintenance - Reactive RCRM	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	200 Track Geometry Fault Repairs(RCRM)	75	75	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	201 - Reactive Track Geometry Correction RCRM	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	209 - Track Geometry Recording(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	216 - Survey Monument Maintenance(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	225 - Fastening Maintenance(RCRM)	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	232 - Spot Resleepering(RCRM)	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	244 Culvert Cleaning(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	248 - Underbridge: Reactive Repairs RCRM	25	25	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	249 - Overbridge: - Reactive Repairs RCRM	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	257 Overbridge Works (CRN)(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	260 - Level Crossing Reactive Maintenance - ci	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	266 - Culvert Reactive Corrective Maint(RCRM)	25	25	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	284 - Mud hole Rectification - Dig outs RCRM	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	288 - Terminal Drainage (RCRM)	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
RCRM	301 Siding Maintenance(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	302 - Third Party Support RCRM	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	320 Rest House Maintenance(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	322 Stores Management(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	323 - Training RCRM	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	325 - Facilities Maintenance(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	326 - Signal Equipment Building Maintenance(RC	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	327 Wayside Detection Systems -(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	328 WILD Maintenance RCRM	50	50	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	700 - InspectTesting&Minor Repairs - Lvl X RCR	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	701 - InspectTesting&MinorRepairs-Signals RCRM	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	702 - InspectTesting&MinorRepairs-PointsInterl	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	703 - InspectionTesting&MinorRepairs-CableandL	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	704 Voice Radio Maintenance(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
RCRM	705 - SCADA Telemetry Maintenance(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	706 Other Comms System Maintenance(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	707 - Signals High Voltage Power Supply - Inspect, Test & Repairs	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	708 Inspections - Comms Towers(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	710 - Callouts Signalling RCRM	50	50	Tkm	WIK&TÜV agree with ARTC's assessment of cost variability. However, it can be said that costs caused by signalling or radio system are driven by tkm instead gtk.
RCRM	712 - Inspections - Signals & Comms(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	722 VicTrack Communications Maintenance(RCRM	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	733 Training - Signals & Comms(RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	771 - Track Lead Replacement(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	775 - Signal Box Maintenance (RCRM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
RCRM	776 - InspectTesting&MinorRepairs-ControlandIn	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	777 - InspectTesting&MinorRepairs-TrackCircuit	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	778 - Inspect&MinorRepairs-Enclosures/Location	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	779 - InspectTesting&Minor Repairs -SigsPowerS	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
RCRM	780 - Inspection & Minor Repairs - Other Comms	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	786 - InspectTesting&MinorRepairs-WaysideEquip	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	807 Comms Systems Modif (RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	820 - Signage Maintenance(RCRM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
RCRM	915 Expense Recovery MPM	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	110 - Engineering Investigations MPM	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	145 - Vegetation Control - Planned(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	147 - Rural Fencing - Replacement(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	149 - Urban Fencing - Replacement(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	168 Rerailing - Minor(MPM)	75	90	GTK	We agree with ARTC's assessment that the majority of defects in rail creating the need for replacement is directly related to network volumes but that a small fixed component is justified due to issues not related to volume such as manufacturing faults. Therefore we assessed a cost variability of 90%.
MPM	171 - Rail Grinding(MPM)	75	90	GTK	We agree with ARTC's general assessment that the majority of rail degradation corrected by rail grinding is linked to network volumes - as volumes increase so does the damage and wear on the rails. A small component of work performed by rail grinding is the removal of surface rust and wheel burns therefore not network volume dependant - supporting a small fixed component. Therefore we assessed a cost variability of 90%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
MPM	172 - Turnout Grinding(MPM)	75	90	GTK	We agree with ARTC's assessment that the majority of rail degradation corrected by turnout grinding is linked to network volumes - as volumes increase so does the damage and wear on the rails. A small component of work performed by rail grinding is the removal of surface rust and wheel burns therefore not network volume dependant - supporting a small fixed component. Therefore we assessed a cost variability of 90%.
MPM	183 - Turnout Retimbering(MPM)	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	187 - Turnout Steel Component Replacement(MPM)	75	90	GTK	We agree with ARTC's assessment that most of the turnout steel component replacement is clearly linked with network volumes as the wear on these components increases proportionately with tonnage. However as per rerailing, there is an element of the turnout steels that require replacement due to issues with manufacture and therefore not network volume related. Therefore we assessed a cost variability of 90%
MPM	203 - Maintenance Resurfacing MPM	75	90	GTK	We agree with ARTC's assessment that geometry degradation is primarily based on network volume but that underlying geotechnical issues and environmental factors support a small fixed component. Therefore we assessed a cost variability of 90%
MPM	205 - Turnout Resurfacing MPM	75	90	GTK	We agree with ARTC's assessment that geometry degradation is primarily based on network volume but that underlying geotechnical issues and environmental factors support a small fixed component. Therefore we assessed a cost variability of 90%
MPM	206 - Ballasting(MPM)	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	214 - Survey Monument Restoration(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	220 - Resleepering - Timber(MPM)	75	75	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	221 Resleepering - Steel(MPM)	75	75		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	226 - Pad Replacement(MPM)	50	75	GTK	We agree with ARTC's assessment that pad replacement occurs when the pads between the rail and the sleeper are worn or no longer ineffective. Wear occurs proportionally with network volume however environmental factors and age play a part with the effectiveness of the pad. It is therefore considered appropriate that this activity contains a fixed share. Therefore we assessed a cost variability of 75%.
MPM	230 - Yard & Siding - Track Rehabilitation(MPM	50	50	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	242 - Bridge Transoms(MPM)	50	50	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
MPM	247 - Tunnel Maintenance(MPM)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	252 - Culvert Structural Repairs or Cleaning M	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	258 - Steel Underbridge Repairs(MPM)	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	259 - Concrete/Masonry Underbridge Repairs(MPM	25	25	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	261 - Track & Civil - Level Crossing Maintenance (MPM)	25	25	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	264 Timber Underbridge Repairs(MPM)	25	25		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	280 - Cutting, Embankment Maintenance & Geotec	0	0	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	281 - Cess & Top Drain Maintenance(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	285 - Shoulder Ballast Cleaning(MPM)	75	75	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	286 - Ballast Cleaning(MPM)	75	90	GTK	We agree with ARTC's assessment that ballast degradation is obviously linked to the network volume but that some degradation is also linked to other environmental issues and therefore - independent of volume - supporting a small fixed element. Therefore we assessed a cost variability of 90%
MPM	292 - Subsurface Drainage Maintenance(MPM)	0	0	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
MPM	293 - Mudholes Full Track Reconditioning(MPM)	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	294 - Ballast Undercutting(MPM)	75	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	324 Unscoped Works - Track & Civil(MPM)	75	75		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
MPM	335 - Removal Redundant of Infrast Not to be Replace(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	343 - Wayside Detection Systems - Component Re	25	25	Tkm	WIK&TÜV agree with ARTC's assessment of cost variability. However, it can be said that costs caused by signalling or radio system are driven by tkm instead gtk.
MPM	743 - Cable Replacement(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	754 - Pole Line Renewal(MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	758 - Location Case Replacement (MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	766 - Power Supply Upgrade (MPM)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
MPM	770 - Track Circuit Maintenance MPM	50	50	Tkm	WIK&TÜV agree with ARTC's assessment of cost variability. However, it can be said that costs caused by signalling or radio system are driven by tkm instead gtk.
MPM	794 - Signallig System Modification(MPM)	25	25	Tkm	WIK&TÜV agree with ARTC's assessment of cost variability. However, it can be said that costs caused by signalling or radio system are driven by tkm instead gtk.
MPM	796 - Equipment Access Maintenance(MPM)	0	0	GTK	Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Maintenance overhead	Asset Management	0	0		WIK/TÜV did not received data to assess the increment of maintenance overhead costs.
Network control costs					WIK/TÜV did not received data to assess the increment of network control costs.
Minor CAPEX (by project)					
Minor CAPEX	0915F8 - Progressive LED conversion In ports	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0915G1 - Renew 101 and 108 pts motors	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.

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Minor CAPEX	0916H9 - PTW No1 Departure	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0916K4 - walkways Throsby ck PTW, 165.524km	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0916M4 - Progressive LED conversion In ports Need	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0916M5 - Radio Comms Additional channels.	0	25	Tkm	We assume that the need for a radio upgrade and also for additional channels is related to both, safety and traffic but more safety than traffic. Therefore we assessed a cost variability of 25%.
Minor CAPEX	0916M9 - Turnout Renewal with 60kg Rail and concr	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0916P9 - Replace key components of weighbridges	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0917G5 - Rerail Waratah Up Coal (870m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0925G7 - Rerail Hanbury Up Coal (1100m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0926J7 - Hanbury Dive Track Pads: Continued Pad	0	75	GTK	We agree with ARTC's assessment that pad replacement occurs when the pads between the rail and the sleeper are worn or no longer ineffective. Wear occurs proportionally with network volume however environmental factors and age play a part with the effectiveness of the pad. It is therefore considered appropriate that this activity contains a fixed share. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0930BD - Upgrade Islington Weighbridge	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930H9 - Lamp Upgrades to LED	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930J8 - Progressive LED conversion In ports	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930L4 - Rerailing (CAP)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0930M2 - Point Machine Replacement(CAP)	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0930M3 - Signalling System Upgrades(CAP)	0	50	Tkm	We assume that the need for signaling system investments/upgrades ist caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0930M6 - Radio Upgrade Additional Channels.	0	25	Tkm	We assume that the need for a radio upgrade and also for additional channels is related to both, safety and traffic but more safety than traffic. Therefore we assessed a cost variability of 25%.
Minor CAPEX	0931G4 - North Fork lower access rd install cause	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0931J4 - Rerail Kooragang Up Nth Fork (1200m)	0	90	Tkm	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0931J5 - 141pts motor renewal kooragang	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0936J1 - Cess Drain Upgrade DC Sandgate-Thornton	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936L4 - 186A, 183D, 185D, fit in bearers, sphero	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936L5 - Detailed designs 1. Vic St 188.0km to ea	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936L6 - Install walkways, 173.930, 177.059-dn s	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936L7 - 173.085km replace poor pipe extension wi	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936M2 - Rerailing (CAP)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0936N3 - Point Machine Replacement(CAP)	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0936N4 - Track Strengthening / Upgrading(CAP)	0	75	GTK	We assume that the need for track strengthening and upgrading is more caused by volume than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0936O2 - Signalling System Upgrades(CAP)	0	50	Tkm	We assume that the need for signaling system investments/upgrades ist caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0936O3 - Alarm Management System Upgrade of the a	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0936P7 - Hexham Recon - Upgrade Formation from 1	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936R1 - Rerailing - 176.216 To 177.55 --> Rail M	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0936R2 - Rerailing - 173.286 To 174 --> Rail Metr	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0936R5 - Flash Butt Welding Programme remove ATW'	0	75	GTK	We assume that the need for track strengthening and upgrading is more caused by volume than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	093783 - Signals Repeater Devonshire street OB	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937I7 - Devonshire St footbridge renewal	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937I8 - Cess Drain inc cable relocate Turf Farm	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937K6 - Turf farm 189.900km - 190.500km Full dou	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937K9 - Rerail E Maitland UC - 2 Sites (4080m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0937M8 - Turnout Renewal(CAP)	0	75	Tkm	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume than to time. Therefore we assessed a cost variability of 75%
Minor CAPEX	0937O4 - 187.900-188.350 UP and DOWN coals High s	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937P3 - Rerailing - 187.993 To 189.182 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0937P8 - 192.250-192.450 Up / Dn Coal Track Recon	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937Q3 - Install and commission Alarm monitoring	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937W1 - Flash Butt Welding & 0947L9 - Track Strengthening/ Upgrading (CAP)	0	75	GTK	We assume that the need for track strengthening and upgrading is more caused by volume than time. Therefore we assessed a cost variability of 75%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0944G1 - Culvert Replacement at 193.966km	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0946H5 - Junction ST Part 1. Widen and stabilise	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0946I3 - Track Strengthening / Upgrading(CAP)	0	75	GTK	We assume that the need for track strengthening and upgrading is more caused by volume than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0946P1 - Turnout 420B Pts 194.079 Farley	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0947CC - Farley To Branxton	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947I3 - Renewal 209.989	0	75	Tkm	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0947J3 - Replace Axle counter evaluator boards	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947J8 - Rerail Lochinvar UM - 3 Sites (5350m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947K2 - Rerailing (CAP)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947L9 - Track Strengthening / Upgrading(CAP)	0	75	GTK	We assume that the need for track strengthening and upgrading is more caused by volume than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0947O3 - Rerailing - 198.421 To 199.133 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947O4 - Rerailing - 194.941 To 196.035 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947O5 - Rerailing - 199.785 To 200.289 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947O6 - Rerailing - 202.537 To 202.897 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947O7 - Branxton B frame - Turnout Renewal with	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0947P5 - Install axle Counter Evaluation Board	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947P6 - Install axle Counter Evaluation Board	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947P8 - Split point detection and EPO trial and	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947P9 - Install and commission Alarm monitoring	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948H7 - Black Ck Strengthening carry over **	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948J2 - 224.141,226.860,227.860, reline with new	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948L1 - Turnout Renewal(CAP)	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0948L7 - Rerailing (CAP)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0948N7 - Rerailing - 231.297 To 233.934 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0948O2 - Formation upgrade - 225.950 to 226.150 -	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948O3 - Culvert - Replacement - 222.190 ReLine.s	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948O4 - Culvert - Replacement - 224.141 - ReLine.	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948O8 - Install and commission axle counter rese	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948O9 - Install axle Counter Evaluation Board	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0948P1 - Install axle Counter Evaluation Board	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0951H7 - Replace SAR Multi feed track circuits	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0951H9 - Rerail Mt Thorley Up Branch (1000m)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0952F7 - install 2 Spherilocks 28A/B	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0955I2 - 240.011km Renew Up Main approach spans	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0955J1 - Signalling Design Singleton interlocking	0	50	Tkm	We assume that the need for signaling system investments/upgrades ist caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0955J4 - Detail design 55 and 56 crossover 1:12 S	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0955J9 - Rerail Singleton UM - 2 Sites (1050m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0955K4 - Rerailing (CAP)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0955L4 - Signalling System Upgrades(CAP)	0	50	Tkm	We assume that the need for signaling system investments/upgrades ist caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0955M3 - Track Strengthening / Upgrading(CAP)	0	75	GTK	We assume that the need for track strengthening and upgrading is more caused by volume than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0955O3 - Rerailing - 242.711 To 243.509 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0956H7 - Rerail Camberwell UM - 2 Sites (1000m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0956K5 - Rerailing - 247.051 To 247.377 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0956K6 - Rerailing - 249.04 To 249.295 --> Rail M	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0956L2 - Singleton - Formation upgrade - 244.400	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0956O3 - Rerailing 249.486 to 250 Rail Metres1028	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0957H4 - Sleeve & extend culvert - 256.429km	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0957J6 - Rerail Glennies Ck Up Main (2400m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0957M4 - Rerailing - 253.974 To 255.25 --> Rail M	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0958K2 - Rerailing - 264.9 To 265.3 --> Rail Metr	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0958K6 - Install axle Counter Evaluation Board -	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0958L6 - Newdell - 264.400 to 264.670 - Formation	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0959F8 - Construct Maintenance Siding - Kerrabee	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0959H2 - MUSCLE CK Bridge Modification	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0959H3 - Upgrade axle counter evaluator boards su	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0959H4 - Upgrade axle counter evaluator boards su	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0961H5 - Replace 2D cpts Muswellbrook	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0961K1 - 89B pts Design and part procurement	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0970J3 - Replace stringers Muscle Ck No. 4 and Hu	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0961N4 - Rerailing - 274.689 To 276.712 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0961O1 - Install axle Counter Evaluation Board	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0961O2 - Install axle Counter Evaluation Board	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0970J3 - Replace stringers Muscle Ck No. 4 and Hu	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0970L5 - Rerailing - 291.162 To 291.893 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0971I8 - Rerailing - 297.459 To 298.179 --> Rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0972J4 - Rerail Denman 2 Sites (2900m)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0972J5 - 325.009 Lower up Sydney cutting, Steel	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0972K1 - Rerailing (CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0972K2 - Wayside Detection Systems - New Install	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0972K5 - Level Crossing Upgrade (Civil)(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973AB - Upgrade axle counter evaluator boards	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973E1 - 2009/10 Murrumbo Maintenance Siding	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973I9 - Axle counter transmission mode replaceme	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973J3 - Upgrade LX incl signals 395.904km	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0973J4 - Replace RTE lubricators	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973K8 - Kerrabee Siding	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973K9 - Replace Axle counter evaluator boards	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973L5 - Rerail Kerrabee & Wollar (3900m)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973L7 - 331.250: Install Rubber Level crossing +	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973L9 - Rerailing (CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973N5 - Track Strengthening / Upgrading(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973O6 - Install Lubricators - 371.724 372.785 39	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973P1 - Construct maintenance siding Bylong loop	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973P9 - Rerailing 332.164 To 332.618 Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973Q1 - Rerailing 348.647 To 349.496 Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973Q2 - Rerailing 354.04 To 354.582 Rail M	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973Q3 - Rerailing 393.432 To 393.969 Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973R6 - Culvert - Replacement - 345.800 Pipes po	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0919G1 - Check Kevin Hure for details	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0919L1 - Renew PTW011 & PTW010 Bullock Island, De	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0923G4 - Design for replacement of SAR multi feed	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0938I1 - Melbourne st Up Main Renewal of 3 x stee	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0938I2 - UP Main 189.616 - 190.616 Turf Farm (BLX	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0938J4 - Renewal Wallis Ck mains UB	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0938J6 - Ballast Cleaning On the up main	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0938K1 - Rerail Thornton Down Main (2200m)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0962I7 - Culvert Replacement or Modification(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963AL - Rerailing - 301.561 To 302.250 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963DK - Ballast 100mm 30TAL upgrade 296.6-339.86	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963DM - Rerailing - 302.649 To 304.363 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963DP - Rerailing - 309.174 To 310.098 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963DW - Rerailing - 338.881 To 339.112 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963DY - 116475 - 2B Pts - Aberdeen Turnout Ren	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963I4 - Install UPS and Bypass Switches	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0963I7 - Sleeve & extend 5x culvert 298km-321km	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963I8 - 324.737km Parkville Renewal	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963K8 - 298.210,312.980,320.860,327.300,334.100	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963L5 - Rerail Murulla - 2 sites (2700m)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963L6 - Design , 52pts Togar and 51pts Aberdeen	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963L7 - HDFC procurement and delivery. Part inst	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963L8 - Subgrade and Ballast improvement	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963M2 - Rerailing (CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963M8 - Run up slab installation Togar	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963N8 - Turnout Renewal(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963L7 & 0963N9 - Procure & install 69,775 HDFC sleepers	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963O6 - Signalling System Upgrades(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963O7 - Install Level Crossing Kingdon St Scone	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963O8 - Emergency Crossing Muffet St Scone	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963P2 - Scone Yard. Upgrade loop to mainline sta	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0963P3 - 30 Tonne Axle Load Upper Hunter Valley	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963Q6 - Rerailing - 296.549 To 301.561 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963Q7 - Rerailing - 338.39 To 338.636 --> Rail M	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963Q8 - Rerailing - 335.4 To 336.255 --> Rail Me	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963Q9 - Rerailing - 328.064 To 328.426 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963R1 - Rerailing - 336.968 To 337.45 --> Rail M	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963R2 - 306.067 - Togar 51 Pts - Turnout Renewal	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963R9 - Culvert clean and reline (reinforced con	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0963S1 - Culvert clean and reline (reinforced con	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964J6 - Earthing upgrades and surge protection	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964J8 - Repair & extend 2x culverts - 343-344km	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964K1 - Track & Drainage Murrurundi-Willow Tree	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964K3 - Replace 2Fpts & 2Gpts Quirindi	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964L6 - Steel & Seal 333.933, 349.047,382.541,38	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964L7 - Detail design and prep Quipolly	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0964M2 - Rerail Murulla-Quirindi 5 Sites (10600m)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964M3 - Renew 53Cpts Kankool & 52pts Quipolly	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964M4 - HDFC procurement and delivery. Part inst	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964M5 - Subgrade and Ballast improvement	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964FF - 116495 - 53 Cpts - Upgrade of Kankool Ca	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964FG - 116497 - 51 Pts - Willow Tree Turnout R	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964FI - Ardglen loop - Rerail with NEW 60kghh ra	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964FJ - Willow Tree loop - Rerail with NEW 60kgh	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964JC - Rerailing - 364.814 To 364.865 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964JD - Rerailing - 371.591 To 372.797 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964JE - Ardglen land acquisition	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964K4 - MN Murrulla-Willow Tree (5 sites)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964L7 - Detail design and prep Quipolly	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964M3 - Renew 53Cpts Kankool & 52pts Quipolly	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964M5 - Subgrade and Ballast improvement	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0964N3 - Rerailing (CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964O5 - RELINES 336.4000, 339.900, 340.668	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964O9 - Level Crossing Upgrade (Civil)(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964P1 - QUIPOLLY Bridge Replacement 1,000,000	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964P2 - Turnout Renewal(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964M4 & 0964P3 - Procure & install 14,500 HDFC sleepers	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964P4 - Track Strengthening / Upgrading(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964Q3 - Signalling System Upgrades(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964S3 - Rerailing - 353.14 To 353.91 --> Rail Me	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964S4 - Rerailing - 340.791 To 343.385 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964S5 - Rerailing - 343.763 To 344.809 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964S6 - Rerailing - 345.911 To 346.858 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964S7 - Murulla 51Pts - Turnout Renewal with 60k	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964T4 - 359.675 to 360.12 - New sub-grade format	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0965H5 - HDFC procurement and delivery. Part inst	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0965H5 & 0965I4 - Procure & install 7,100 HDFC sleepers	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0965I8 - Level Crossing Upgrade (Civil)(CAP)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0965M2 - 137580 - 2JA Pts Werris Creek Turnout R	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0965M3 - 137576 2QB Pts Werris Creek Turnout Ren	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0966B7 - upgrade bracing, fix bearings and rivets	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0966B8 - Upgrading of UPS and Installation of AC	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0966C2 - Upgrade M13 Points with concrete	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0966C3 - Upgrade bracing at 3 locations	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0967A1 - 515.774 Boston St renew in rubber, 532.4	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0967B1 - Upgrading of UPS and Installation of AC	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0968A6 - upgrade bracing to meet capacity require	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0968A7 - Upgrading of UPS and Installation of AC	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0969B1 - 557.324km+ 561.802km install a steel cro	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0969B2 - Upgrading of UPS and Installation of AC	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0975F2 - Ulan-Gulgong signalling system	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0987A6 - 116712 - 51 Pts Quirindi -Turnout Renew	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0987A8 - 137568 - 106 Pts Werris Creek Turnout Re	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0987K2 - Rerailing - 379.200 To 380.000 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0987K4 - Rerailing - 387.482 To 388.142 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0987K6 - Rerailing - 393.713 To 394.259 --> Rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0987L1 - 116714 - 52B Pts Quirindi -Turnout Ren	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	7192E8 - Points diagnostic software development +	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	7192E9 - Autonomous track recording Vehicle	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	7192F1 - Crossover separation, remote microlock m	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	7192F3 - Signalling system upgrades - corridor	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0974B5 - Ulan upgrade UPS	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0974B4 - 433.170km Remove vegetation	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0974B3 - 428.804km Level approaches	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0974B2 - Renew 53PTS Ulan with in bearer point machines plus Catch Point to 60kg	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973D2 - Sandy Hollow B points	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0973C9 - Closure & removal of redundant level crossings	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C8 - Install load bearing ballast logs	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C7 - 416.312km Level approaches	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C6 - 415.115km Lower down Sydney	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C5 - 395.325km Lower down Sydney	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C4 - 378.492km & 379.208km LX approaches	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C3 - 362.828km Install steel, remove	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C2 - 358.017km Trees on Sydney side	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973C1 - 351.469km Improve UP side	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973B9 - Install steel panels	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097384 - Sandy Hollow Jct To Wilpinjong	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097343 - Bylong: Level crossing Install removable	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097340 - Kerrabee: install turnout and short siding	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097327 - 414.371km Level approaches, widen	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097325 - 417.926km Level upside approach	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	097324 - 371.301km Remove trees	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097323 - Sandy Hollow Jct To Wilpinjong	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097322 - 337.623km Widen cutting on UP side	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097319 - Sandy Hollow Jct To Wilpinjong	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0972C6 - 316.944km Raise both approaches	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0972C5 - Install steel panels	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0971B1 - 303.991km Remove down Sydney	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0971A9 - 299.017km LX sight distance	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	097132 - Bengalla Jct to Anvill Hill	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	097111 - Golden Highway level crossing	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	097049 - Muscle Ck #4: upgrade all stringers	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097048 - Hunter River truss span: upgrade ends	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097047 - Muswellbrook To Bengalla Jct (M'brook ballast logs)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	097029 - Install 2 x Top of rail lubricators - Ulan	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	096157 - Draytons Jct to Muswellbrook	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	096122 - Draytons Jct to Muswellbrook	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0959B3 - Install Airconditioning	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	095938 - 262.691km replace culvert	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0958C4 - Renew cabling Newdell	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0958C3 - Lidell: upgrade shear capacity	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0958C2 - Draytons Jtn: Upgrade Back ends to 60kg	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	095871 - Newdell Jct To Draytons Jct	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	095831 - Newdell Jct to Draytons Jct	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	095825 - Replace FIST Trial sleepers UP Main	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	095722 - Glennies Creek to Newdell Jct	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0956C1 - Rerailing UP Main: Worn rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	095668 - Glennies Ck, 1 upgrade all stringers	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	095636 - Camberwell Jct to Glennies Creek	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	095630 - Walkways: Glennies Ck	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0955C2 - Install Airconditioning	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0955C1 - Point Machine renewal	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0955B9 - Rerailing: Replace 53kg Down Main	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	095591 - Fit nose rollers: Singleton SNX's	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	095590 - Upgrade outstanding signals to LED	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	095588 - Install load bearing ballast logs	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	095539 - Whittingham to CamberwellJct	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	095228 - Fit switch and nose rollers: Wambo	0			Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	095208 - Saxonvale Jct to Mount Thorley-telemetry	0			Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	095116 - Upgrade Army Rd level crossing	0			Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0948C1 - Install Spherilok to 160 and 161 crossovers	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948B9 - Rerailing: Worn rail UP Main	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	094873 - Fit nose rollers: Minimbah crossovers	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	094871 - Join fibre at Branxton to ATM hut	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094851 - 220.942km Replace culvert	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094835 - Branxton to Whittingham	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947C6 - Install Spheriok to 120 and 122 crossovers	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0947C5 - 194.912,196.069,196.28,196.34 Culverts	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947C4 - Rerailing: UP Main worn	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	094788 - Farley to Branxton	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094761 - 203.844km Sleeve culvert	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094760 - 199.242km Sleeve culvert	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094759 - 198.040km Culvert sleeve	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094758 - Install crash barrier - Farley UB	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094736 - Farley to Branxton	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	094733 - Farley (concrete slabs plus ballast logs)	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	094627 - Repair damaged locations	0	25	Tkm	We assume that the need for a upgrade of the signalling equipement is related to both, safety and traffic but more safety than traffic. Therefore we assessed a cost variability of 25%.
Minor CAPEX	094617 - Maitland to Farley	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937C7 - Install Airconditioning	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937C6 - Pitnacree Creek: Foundation	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0937C4 - Rerailing UP Coal	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	093779 - 182.399km Sleeve culvert 07/08	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093778 - 173.085km Renew poor pipe	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	093777 - 173.930km Renew poor pipe	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093733 - Thornton To Maitland (via coal)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093730 - Melb St (concrete slab +ballast logs)	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0936B6 - Install Spherilok to 105 crossover	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936B5 - 182.781km Replace culvert	0	75	GTK	WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093672 - Install weighbridge	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093671 - Sandgate To Thornton (Steggles)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093633 - Sandgate to Thornton (via coal)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093631 - Renew box culvert extensions at 170.188k	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093128 - Install 4 x hirail takeoffs Sandgate-Kooragang	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930C9 - Lightning protection	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930C8 - Install Airconditioning	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930C7 - In bearer point drives	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0930C6 - Install Spherilok 120Apts	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930C5 - Point Machine renewal	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0930C4 - K'gang UB Install load bearing ballast logs	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0930C3 - Rerail No 4 departure Kgng	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0930C2 - Rerailing No2 arrival road Kgng	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	093069 - Kooragang East Jct to Kooragang Is	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	093048 - Upgrade lubricators to RTE delivery	0	50	GTK	We assume that the need to install rail lubricators is driven by both volume and the need to reduce maintenance costs. Therefore we assessed a cost variability of 50%.
Minor CAPEX	093045 - Repair damaged locations KBT, K1B & K23	0	25	Tkm	We assume that the need for a upgrade of the signalling equipement is related to both, safety and traffic but more safety than traffic. Therefore we assessed a cost variability of 25%.
Minor CAPEX	093028 - Install WSA in-bearer in coal contanimation	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	092632 - Hanbury Jct to Sandgate (via coal) Nose Rollers	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	092611 - Hanbury Jct to Sandgate (via coal)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	092524 - Waratah to Hanbury Jct (via coal)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	091727 - Install top of rail lubricators -Scholey st	0	50	GTK	We assume that the need to install rail lubricators is driven by both volume and the need to reduce maintenance costs. Therefore we assessed a cost variability of 50%.
Minor CAPEX	091716 - Scholey St Jct to Port Waratah	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0916C3 - Lightning protection	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0916C2 - Wayside Detection Systems - New Installation	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0916C1 - Install Airconditioning	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	091671 - 2F and 2F cpts Port Warstah	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	091669 - Morandoo loop renew LX enclosure	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	091646 - 124pts Morrando: Upgradeto 60kg flexi	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	091624 - 99 crossover Scholey St upgrade to 60kg	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	551200 - Ulan line removal of poles and linewire	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	456200 - 11kv Network at Port Waratah- Substation Upgrade (L/S 0916)	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0963B2 - Parville face tamp and Ballast - 963	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964B1 - Rail Straightening - 964	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964B2 - Install HD concrete sleepers - Ardglen - 964	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964B3 - Rerail with new 60kg HH rail - 964	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964B4 - Werris Creek Yard replace HV with LV - 964	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0964B5 - Renew M2 Turnout Werris Creek - 964	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0916E1 - Rerail CCL departure track with cascaded rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0916E3 - Complete and commission level crossing monitors for remote monitoring Port area	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0925E1 - 167.755 - 169.227 - multiple squats and low head height	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0930E1 - 176.276-177.131, 177.204-177.238, 177.204-179.151, 176.276-177.131 arrival and departure rds	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0930E2 - Renew front end on 142epts: special design to see if longer switch can be installed	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0930E4 - Kooragang - remove old concrete weighbridge	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930E5 - Install Spherilocks Kooragang Island	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0930I1 - Kooragang departure	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	093673 - Install flash butt welds up coal	0	75	GTK	We assume that the need for track strengthening and upgrading is more caused by volume than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0936E1 - 172.632-172.899 and 178.110-178.390 worn rails	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0936E2 - Sleeve or replace culvert: 182.781km	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936E3 - 170.188 Replace poor pipe extensions	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936E4 - 105D points install Spherilocks up coal Tarro	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0936E5 - LED installs 172 turnout signal and C118.8	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937E1 - Thornton: 102Bpts + 103Apts - renew in concrete with In Bearer drived and Spherilocks	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0937E2 - William St footbridge	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0937E3 - RAMSYS implementation	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0946E1 - 192.849-193.309 up main	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0947E1 - Install Crash Barrier on downside only: Wollombi RD UB	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947E2 - 196.561,201.480,202.103,215.189 - Barrell walls and arch cracked	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947E3 - Complete and commission level crossing monitors for remote monitoring Lochinvar,Belford,Whittingham, ArmyRd and Branxton	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0948E1 - 219.204-219.606 and 224.122-225.180 worn rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0948E2 - Black Creek: Capacity upgrade,remove track and fill, install cement grout to strenghten arch	0	75	GTK	We assume that the need for upgrading the structural deficiencies under 30 tonne axle loads is more related to volume than to time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0951E1 - 238.507 and 240.038 upgrade sighting distance, earthworks required	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0951E2 - Saxonvale branch upgrade signals to LED in branch line	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0955E1 - 240.416-240.93 worn rail	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0955E2 - Trial emergency point operation - 201,202,203pts and install Spherilocks Whittingham 200 C&D, 202 A&B, 202 C&D, 203 A&B	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0955E3 - Install sperolock Whittingham 200 C&D	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0957E1 - Circuit book upgrades	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0961E1 - Install new hot box detector	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0961E2 - Complete and commission level crossing monitors for remote monitoring Glennies Ck.Hebden Rd,Grasstree,Brook St, Limestone Rd	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0971E1 - Bengalla upgrade signals to LED in branch line	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	097260 - 2009/10 Remove DEN003,004,005&006	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0972E1 - 321.556-322.053 worn rail	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0972E2 - 312.552,320.456,322.698,327.880,328.187 - Barrell walls cracked	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973E2 - Install load bearing ballast logs to 9 x steel underbridges	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973E3 - 346.756,370.753 - Culvert roof opening and cracked barrell walls	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973E4 + 0973E5 - Level crossing upgrades - 360.361,369.778,391.997,399.591 and 417.340	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0973E6 - Complete and commission level crossing monitors for remote monitoring Ulan line,Ulan Town Rd, Ulan Mine Rd,Mangoola and Bylong	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973E7 - Install signal ladders Sandy Hollow,Kerrabee, Coggan Ck, Wollar, Wilpinjong, Ulan	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0974E1 - Level crossing upgrades - 425.213,426.525,433.696	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0974E2 - Remove level crossings - legal costs,physical removal and provision of fencing	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0916H7 - Port Waratah Weighbridge Renew/realign T	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0916H8 - Used HDEC from 111pts to 108Epts PTW	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0931G5 - Up North Fork	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0936J2 - UC Beresfield-Thornton (2 sites)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0937I6 - Renew Maitland HBD	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0947I4 - UM Farley - Greta (5 sites)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0948H8 - UM Branxton - Whittingham (3 sites)	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0951G2 - Install 2 spheriloks 204 A,B	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0952F6 - Wambo install UPS and bypass	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0955I1 - Install spherilocks 202 Cross Over,203pt	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0955I3 - UM Singleton - Camberwell	0	90	GTK	We assume that the majority of rail wear is related to volume but that there is still a small fixed time related element. Therefore we assessed a cost variability of 90%.
Minor CAPEX	0956G7 - Install switch rollers at mount Owen	0	50	Tkm	We assume that the need for point machine replacement resp. point motor renewal is caused by both, time and volume likewise. Therefore we assessed a cost variability of 50%.
Minor CAPEX	0957H5 - Design for 23 crossover renewal	0	75	GTK	We assume that the need for turnout renewals with an upgrade to 60kg rails is more related to volume rather than time. Therefore we assessed a cost variability of 75%.
Minor CAPEX	0958G1 - Replace Aerial line route Newdell to 164	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0961H3 - install UPS and bypass switch Drayton Mi	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0961H4 - Install 2 spherilocks 77A,B	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	097053 - Culvert Renewal	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0971F6 - Axle counter transmission mode replaceme	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0971F7 - Upgrade LX 295.562 , 302.031, 303.367km	0	0		WIK&TÜV agree with ARTC's assessment of cost variability.
Minor CAPEX	0972G9 - Denman HBD Install hot wheel detector	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973E5 - Removal of Level Crossings (Coggan Ck $8	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973I7 - Earthing upgrades and surge protection	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973I8 - install AC in signal huts	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0973J1 - Replace Worn out Point Machines	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Minor CAPEX	0973J2 - Close Level Crossings -Obriens + 2 other	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Minor CAPEX	0974F9 - Lamp Upgrades to LED	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX (by project)					
Major CAPEX	3585 - Maitland to Minimbah Third Road – Stage 1 – All Phases	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements. We assume that track extensions, 3rd road, is mainly driven by asset enhancement for higher network capacity resp. reduction of maintenance impacts through increasing operational flexibility
Major CAPEX	3884 - St Helliers to Muswellbrook Duplication	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements. We assume that track extensions, 3rd road, is mainly driven by asset enhancement for higher network capacity resp. reduction of maintenance impacts through increasing operational flexibility
Major CAPEX	5241 - Bengalla Crossing Loop	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5242 - Koolbury Passing Loop	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5255 - Maitland to Minimbah Third Road – Stage 2 – All Phases	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements by providing a We assume that track extensions, 3rd road, is mainly driven by asset enhancement for higher network capacity resp. reduction of maintenance impacts through increasing operational flexibility
Major CAPEX	5255 - Maitland to Minimbah Third Road – Stage 2 – All Phases	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements. We assume that track extensions, 3rd road, is mainly driven by asset enhancement for higher network capacity resp. reduction of maintenance impacts through increasing operational flexibility
Major CAPEX	5518 - Aerosol (Murrumbo) Valley Loop - 370km	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5677 - Radio Hut (Yarrawa) loop - 319 km	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5679 - Parkville Loop Extension	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5755 - Willipinjong Loop	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

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Major CAPEX	5757 - Bylong Loop Extension	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5811 - Nundah Third Track - All Phases	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements. We assume that track extensions, 3rd road, is mainly driven by asset enhancement for higher network capacity resp. reduction of maintenance impacts through increasing operational flexibility
Major CAPEX	5811 - Nundah Third Track - All Phases	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements. We assume that track extensions, 3rd road, is mainly driven by asset enhancement for higher network capacity resp. reduction of maintenance impacts through increasing operational flexibility
Major CAPEX	6724 - Bells Gate Passing Loop - All Phases	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	6891 - Pages River Passing Loop - All Phases	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	6892 - Chilcotts Creek Passing Loop - All Phases	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	6928 - Drayton Junction Upgrade (Capital)	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	8665 - No.3 Departure Road at KCT	0	50	GTK	We assume that the investment into a departure road is mainly driven by asset enhancement for higher network capacity but some share is also to provide higher buffering capacities at port.
Major CAPEX	8666 - KCT Bypass Road Realignment	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	657450 - Re-instatement of 104 Points Hexham - Phase 5	0	0		We did not assess this project as capital expenditures are negligible.
Major CAPEX	318406 - Post Commissioning Costs Sandgate	0	0		We did not assess this project as capital expenditures are negligible.
Major CAPEX	615660 - Maitland Junction/CBI	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	358560 - Maitland to Minimbah Third Road – Stage 1 – Phase 6	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	346801 - Newdell Junction Upgrade	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Major CAPEX	388401 - St Helliers to Muswellbrook Duplication	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	524160 - Bengalla Crossing Loop Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	567760 - Radio Hut (Yarrawa) Loop - 319km Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	551860 - Aerosol (Murrumbo) Valley Loop - 370km Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	575560 - Willipinjong Loop - Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	323215 - Metford Main - RailBAM (Bearing Acoustic Monitor)	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	323216 - Metford Main - WILD (Wheel Impact Load Detector	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	524260 - Koolbury Passing Loop 293km Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	567960 - Parkville Loop Extension 322km Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	568060 - Braefield Passing Loop 386km Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	692260 - Burilda Passing Loop Phase 6	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	357501 - Minimbah 80 kph running stage 1	0	100	GTK	We assume that investments into a higher running stage of 80 kph are mainly driven by asset enhancement for higher network capacity
Major CAPEX	357601 - Ulan Line Signalling & CTC (971/972 - 41.16/149.11 & 973/974 - 107.95/149.11)	0	100	GTK	We assume that level crossing upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	357602 - Ulan Line Level Crossing Upgrade	0	100	GTK	We assume that level crossing upgrade is mainly driven by asset enhancement for higher network capacity

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Major CAPEX	357801 - Muswellbrook Loop extension - 961	0	100	GTK	We assume that the need for loop extension is mainly driven by asset enhancement for higher network capacity
Major CAPEX	357901 - Antiene to Grasstree Stage 1 duplication - 0961	0	100	GTK	We assume that the need track duplication is mainly driven by asset enhancement for higher network capacity
Major CAPEX	358001 - Mangoola: New Crossing Loop 971/972	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	358002 - Wollar: New Crossing Loop - 973/974	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	358003 - Bylong passing loop Ulan line - 381 km - 973	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	358200 - Drayton Junction remodelling & upgrade	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	358303 - Ardglen: Crossing Loop Extension - 964	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	358304 - Willow Tree: Crossing Loop Extension - 964	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	358401 - Bi-Dir signalling Maitland to Branxton - 946/947	0	100	Tkm	We assume that investments provisioning facilitys are mainly driven by asset enhancement for higher network capacity
Major CAPEX	551900 - Worondi (Baerami) Loop - 348km	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	555400 - Bylong - Tunnel Ventilation investigations	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	567800 - Werris Creek Bypass	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	579400 - Hunter Valley Provisioning Facility	0	100	Tkm	We assume that investments provisioning facilitys are mainly driven by asset enhancement for higher network capacity
Major CAPEX	3582 - Drayton Junction remodelling & upgrade	0	100	GTK	We assume that junction upgrade is mainly driven by asset enhancement for higher network capacity
Major CAPEX	5519 - Worondi (Baerami) Loop - 348km - 0973	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

Cost category	Activity / Project	% variable (as assumed by ARTC)	% incremental (as assessed by WIK/TÜV)	Recommended cost driver (incremental cost)	Explanation
Major CAPEX	5554 - Bylong - Tunnel Ventilation investigations	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5754 - Baerami - Kerrabee (353km loop) - 0973	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5756 - 404km Loop - 0974	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5758 - 337km Loop - 0972	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5759 - Murrumbo Loop extension 378km - 0973	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	5799 - Terminal upgrade/extension - Kooragang Is.	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements.
Major CAPEX	5800 - Terminal upgrade/extension - Port Waratah	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements.
Major CAPEX	5814 - Mt Pleasant Loop - 0971	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements.
Major CAPEX	6387 - Capacity entering terminal areas	0	100	GTK	Project expenditures assesses incremental due to their relation to the capacity enhancements.
Major CAPEX	6467 - Ulan Passing Loop extension - 0974	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.
Major CAPEX	6924 - Muswellbrook Junction Bypass - 0961/0970	0			We did not assess this project as capital expenditures are negligible.
Major CAPEX	6927 - Bengalla Loop extension	0	0		Not assessed because activity affected Line Segments not used by PZ 3 traffic / not part of PZ1 or PZ2.

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