

Appendix A: Detailed outline of ARTC's pricing methodology for the Final Indicative Services

This paper sets out ARTC's structure of charges and the methodology that ARTC has used to calculate its current estimates of proposed Indicative Access Charges for the Final Indicative Services for 2015. The figures in this Appendix have been drawn from ARTC's revised confidential financial model submitted on 12 June 2014.

The information in this Appendix is for illustrative purposes and to provide transparency to stakeholders on the underlying methodology used by ARTC to determine the estimates of the Final Indicative Access Charges for 2015. The figures in this Appendix are based on current best available information to ARTC and are subject to change. ARTC will provide the ACCC with revised Final Indicative Access Charges for the 2015 calendar year shortly based on the actual contracted coal volumes and forecast costs associated with those contracted coal volumes. As part of the ACCC's final decision on the Final Indicative Services variation, the ACCC intends to assess ARTC's revised Final Indicative Access Charges when they are submitted to the ACCC. The Indicative Access Charges approved by the ACCC will apply in the 2015 calendar year and the section 4.20 process in the HVAU will not apply.

For further information on the proposed Indicative Access Charges, stakeholders can refer to Chapter 5 of this Position Paper, ARTC's variation application, and ARTC's supporting documentation including the guiding principles at Attachment A to the supporting documentation. These guiding principles are the same guiding principles that applied to the Initial Indicative Services. ARTC submits it intends to apply these guiding principles in determining Indicative Access Charges and charges for non-Indicative services following approval of the proposed Indicative Services in order to maintain the existing level of pricing transparency and consistency.

Structure of access charges applying on ARTC's rail network

Coal producers contract for paths with ARTC based on their expected volumes (coal tonnes). ARTC charges the producers a combination of an actual usage charge and a take-or-pay (TOP) charge per thousand gross tonne kilometre (**kgtkm**), referred to as a non-TOP and TOP component respectively.

The non-TOP component of the charge is designed to cover the 'direct costs' of the rail network, which are specifically defined in the HVAU as variable maintenance costs. Producers only pay the non-TOP component of the charge for the contracted paths that they actually use in the calendar year.

The TOP component of the charge covers all remaining operating and capital costs of the rail network, including all fixed costs. Producers pay the TOP component of the charge for all contracted paths irrespective of whether or not they actually use those paths in the calendar year.

Existing and proposed access charges and train configurations applying on ARTC's rail network

The following tables set out the 2014 access charges that currently apply on ARTC's rail network for the existing Indicative Services and the access charges that are proposed to apply for 2015 for the proposed Indicative Services. Note that the existing 82 wagon 25 TAL Indicative Service is proposed to be replaced by the 82 wagon 30 TAL Indicative Service from 2015.

Table 1: Existing 2014 access charges and train configuration / characteristics¹

	Non-TOP component \$/kgtkm (excl. GST)	TOP component \$/kgtkm (excl. GST)	Train configuration / characteristics
In Pricing Zone 1			
Indicative Service 1 96 wagon 30 TAL	0.909	9.893	30 tonne maximum axle load 60 kph maximum speed (loaded) 80 kph maximum speed (empty) 96 wagon train length 1543 metres maximum train length section run times as per applicable Hunter Valley standard working timetable
Indicative Service 2 82 wagon 25 TAL	0.875	11.466	25 tonne maximum axle load 80 kph maximum speed (loaded) 80 kph maximum speed (empty) 82 wagon train length 1350 metres maximum train length section run times as per applicable Hunter Valley standard working timetable
In Pricing Zone 2			
Indicative Service 1 96 wagon 30 TAL	2.632	8.298	30 tonne maximum axle load 60 kph maximum speed (loaded) 80 kph maximum speed (empty) 96 wagon train length 1543 metres maximum train length section run times as per applicable Hunter Valley standard working timetable
In Pricing Zone 3			
Indicative Service 1 82 wagon 25 TAL	1.496	9.635	25 tonne maximum axel load 80 kph maximum speed (loaded) 80 kph maximum speed (empty) 82 wagon train length

¹ ARTC's website <http://www.artc.com.au/Content.aspx?p=229>, accessed on 1 July 2014.

	Non-TOP component \$/kgtkm (excl. GST)	TOP component \$/kgtkm (excl. GST)	Train configuration / characteristics
			1350 metres maximum train length section run times as per applicable Hunter Valley standard working timetable

Table 2: Proposed 2015 access charges and train configurations / characteristics²

	Non-TOP component \$/kgtkm (excl. GST)	TOP component \$/kgtkm (excl. GST)	Train configuration / characteristics
In Pricing Zone 1			
Indicative Service 1 96 wagon 30 TAL	1.023	9.551	30 tonne maximum axle load 60 kph maximum speed (loaded) 80 kph maximum speed (empty) 96 wagon train length 1543 metres maximum train length section run times as per applicable Hunter Valley standard working timetable
Indicative Service 2 82 wagon 30 TAL	1.032	10.675	30 tonne maximum axle load 60 kph maximum speed (loaded) 80 kph maximum speed (empty) 82 wagon train length 1330 metres maximum train length section run times as per applicable Hunter Valley standard working timetable
In Pricing Zone 2			
Indicative Service 1 96 wagon 30 TAL	1.689	8.011	30 tonne maximum axle load 60 kph maximum speed (loaded) 80 kph maximum speed (empty) 96 wagon train length 1543 metres maximum train length section run times as per applicable Hunter Valley standard working timetable
In Pricing Zone 3			
Indicative Service 1 82 wagon 30 TAL	1.718	12.660	30 tonne maximum axle load 60 kph maximum speed (loaded) 80 kph maximum speed (empty)

² ARTC's Public Response to the ACCC's Information Request, dated 12 June 2014.

	Non-TOP component \$/kgtkm (excl. GST)	TOP component \$/kgtkm (excl. GST)	Train configuration / characteristics
			82 wagon train length 1330 metres maximum train length section run times as per applicable Hunter Valley standard working timetable

For services other than those identified as the Indicative Services in each Pricing Zone, ARTC has some discretion as to what charges apply taking into account a range of factors that are set out in section 4.15 of the HVAU. ARTC is required to publish all charges on its website to ensure transparency amongst industry participants. The HVAU allows producers to raise a dispute about prices relating to these non-Indicative Services, which the ACCC may be called upon to arbitrate.

Overview of ARTC’s pricing methodology

As set out above, the non-TOP component of the access charges is intended to cover variable maintenance costs. At a very high level, ARTC estimates total variable maintenance costs for the Indicative Service in each Pricing Zone by applying forecast variable cost rates to expected volumes. ARTC then divides by total gtkm so as to determine the non-TOP component of charges for the benchmark Indicative Service (Indicative Service 1 in Pricing Zone 1). For Indicative Services other than the benchmark Indicative Service, ARTC has regard to average axle load and average speed to calculate the relative impacts on variable maintenance costs and differentiates charges accordingly.

The TOP component of the charge covers all remaining operating and capital costs of the rail network, including all fixed costs. ARTC estimates the Economic Cost for the Constrained Network and the unconstrained sections of the Network using cost and volume estimates. To estimate 2015 Indicative Access Charges, ARTC uses the existing TOP component of charges for the benchmark Indicative Services as a starting point. For Indicative Services other than the benchmark Indicative Services in each Pricing Zone, ARTC has regard to maximum axle load and maximum speed, total cycle gross mass³ and coal throughput to calculate the relative impacts on fixed maintenance costs, network capacity and coal chain capacity respectively and differentiate charges accordingly.

Once the TOP component of the charges for all services has been determined, ARTC then adjusts the TOP component for all services in the Constrained Network by the same amount so as to ensure that expected revenue recovers the Economic Cost (excluding any variable maintenance costs covered by the non-TOP component of charges) in the Constrained Network. For the unconstrained sections of the Network, the TOP component is also adjusted to ensure the maximum possible recovery of the Economic Cost.

ARTC’s methodology for calculating the non-TOP component of access charges for 2015

The following provides the steps that ARTC has taken to calculate the non-TOP component of access charges for 2015. Detailed calculations for 2015 are provided later in this paper.

³ Total cycle gross mass is calculated as 2*train tare mass + train payload.

Step 1—ARTC calculates non-TOP component for the benchmark Indicative Service in each Pricing Zone

ARTC forecasts the total variable maintenance costs for each train service type (for both Indicative Services and others) in each Pricing Zone using expected volumes (coal tonnes) and forecast variable cost rates.

ARTC then calculates the non-TOP component for the benchmark Indicative Service in each Pricing Zone (identified as Indicative Service 1 in each Pricing Zone) by dividing the total variable maintenance costs for the service type by total gtkm for the service type.

Step 2—ARTC calculates variable maintenance pricing differentiation factor to apply to other Indicative Services in each Pricing Zone

Having regard to average axle load and average speed and assuming that the variability of maintenance costs with axle load is 45 per cent and with speed is 50 per cent, ARTC calculates the relative impacts of Indicative Services other than the benchmark Indicative Service in each Pricing Zone. The following table sets out the variable maintenance pricing differentiation factors that ARTC has calculated to apply for 2015 based on current best available information.

Table 3: Non-TOP component variable maintenance pricing differentiation factors⁴

Pricing Zone	Indicative Service 96 wagon 30 TAL	Indicative Service 82 wagon 30 TAL
1	1.000	1.009
2	1.000	n/a
3	n/a	1.000

Step 3—ARTC calculates non-TOP component for other services by applying the pricing differentiation factors

ARTC then applies the relevant variable maintenance pricing differentiation factor to the benchmark Indicative Service in each Pricing Zone to calculate the non-TOP component for other Indicative Services in that Pricing Zone.

ARTC's methodology for calculating the TOP component of access charges for 2015

The following provides the steps that ARTC takes to calculate the TOP component of access charges. Detailed calculations are provided later in this paper.

Step 1—ARTC calculates fixed maintenance pricing differentiation factor to apply to Indicative Services other than the benchmark Indicative Service in each Pricing Zone

Having regard to maximum axle load and maximum speed and assuming that the variability of maintenance costs with axle load is 45 per cent and with speed is 50 per cent, ARTC calculates the relative impacts of Indicative Services other than the benchmark Indicative Service in each Pricing Zone. The following table sets out the fixed maintenance pricing

⁴ ARTC's Public Supporting Submission, dated 31 January 2014.

differentiation factors that ARTC has calculated to apply for 2015 based on current best available information.

Table 4: TOP component fixed maintenance pricing differentiation factors⁵

Pricing Zone	Indicative Service 96 wagon 30 TAL	Indicative Service 82 wagon 30 TAL
1	1.000	1.000
2	1.000	n/a
3	n/a	1.000

Step 2—ARTC calculates network capacity differentiation factor to apply to Indicative Services other than the benchmark Indicative Service each Pricing Zone

ARTC submits that each Indicative Service is assumed to consume a single train path regardless of size. However, because pricing is on a per gtkm basis, there needs to be a conversion of the ‘price per train path’ into ‘price per gtkm’ as the ‘cost’ without this conversion would differ with differing train sizes. ARTC has provided an example shown in Table 5 below of how this calculation occurs in its application documents.⁶

Table 5: TOP component conversion of the ‘price per train path’ into ‘price per gtkm’

	Indicative Service	Train ‘X’
Tare mass (t)	1,000	500
Payload (t)	8,000	4,000
Total Cycle Gross Mass (t)	10,000	5,000
Distance travelled (km)	100	100
gtkms generated	1,000,000	500,000
Differentiation factor	1.0	0.5

The following table sets out the network capacity pricing differentiation factors that ARTC has calculated to apply for 2015.

Table 6: TOP component network capacity pricing differentiation factors

Pricing Zone	Indicative Service 96 wagon 30 TAL	Indicative Service 82 wagon 30 TAL
1	1.000	0.866
2	1.000	n/a
3	n/a	1.000

⁵ ARTC’s Public Supporting Submission, dated 31 January 2014.

⁶ ARTC’s Public Supporting Submission, dated 31 January 2014, p. 32.

Step 3—ARTC calculates coal chain capacity differentiation factor to apply to Indicative Services other than the benchmark Indicative Service in each Pricing Zone

ARTC submits that Coal Chain Capacity is measured by throughput such that a tonne of coal carried on the most efficient train would consume the least coal chain capacity compared to other trains.

The HVCCC models coal throughput (million tonnes per annum (mtpa)) for each train service type. ARTC uses the HVCCC modelled throughput to then calculate the relative impact of Indicative Services other than the benchmark Indicative Service. Importantly, ARTC submits that, because throughput is measured with respect to the Hunter Valley Coal Chain as a whole, there is little justification for differentiating between Pricing Zones. The following table sets out the Coal Chain Capacity pricing differentiation factors that ARTC has calculated to apply for 2015 based on current best available information.

Table 7: TOP component coal chain capacity pricing differentiation factors

Pricing Zone	Indicative Service 96 wagon 30 TAL	Indicative Service 82 wagon 30 TAL
1	1.000	0.900
2	1.000	n/a
3	n/a	1.00

Step 4—ARTC calculates weighting to be given to each differentiation factor in determining a combined differentiation factor to apply to Indicative Services other than the benchmark Indicative Service each Pricing Zone

ARTC submits that differentiation based on maintenance impacts are weighted by reference to the proportion of maintenance expenditure forecast in the Economic Cost for each Pricing Zone. The remaining weightings in each Pricing Zone are then allocated equally to the coal chain capacity and network capacity pricing differentiation factors. The following table sets out the weighting that ARTC has given to each of the differentiation factors for 2015 based on current best available information.

Table 8: Weighting for pricing differentiation factors⁷

Pricing Zone	Maintenance	Coal Chain Capacity	Network Capacity
1	20%	40%	40%
2	31%	34%	34%
3	19%	41%	41%

However, because maintenance expenditure has a variable and a fixed component, ARTC adjusts the weighting of the maintenance factor in TOP component calculations based on the proportion of fixed maintenance expenditure forecast in the Economic Cost (excluding variable maintenance costs). ARTC then rebalances the weighting allocated to the coal chain capacity and network capacity pricing differentiation factors to make up 100 per cent. The following table sets out the rebalanced weightings that ARTC has given to each of the differentiation factors for 2015.

⁷ ARTC's Public Supporting Submission, dated 31 January 2014.

Table 9: Rebalanced weighting for pricing differentiation factors⁸

Pricing Zone	Fixed Maintenance	Coal Chain Capacity	Network Capacity
1	11.50%	44.25%	44.25%
2	17.65%	41.17%	41.17%
3	10.66%	44.67%	44.67%

These rebalanced weightings are based on current best available information for the 2015 calendar year. These weightings are likely to change for the revised Final Indicative Access Charges for 2015 and for subsequent years depending on (i) the forecast variable and fixed maintenance expenditure in subsequent years; and (ii) the forecast Economic Cost in subsequent years.

Step 5—ARTC calculates the combined pricing differentiation factor to apply to Indicative Services other than the benchmark Indicative Service each Pricing Zone

ARTC combines the pricing differentiation factors by applying the rebalanced weightings to each of the TOP component pricing differentiation factors in each Pricing Zone. The following table sets out the combined pricing differentiation factor that ARTC has calculated to apply to calculate the TOP component of charges for 2015 based on current best available information.

Table 10: TOP component combined pricing differentiation factors

Pricing Zone	Indicative Service 96 wagon 30 TAL	Indicative Service 82 wagon 30 TAL
1	1.000	1.118
2	1.000	n/a
3	n/a	1.000

Step 6—ARTC calculates the TOP component of charges by applying the combined pricing differentiation factors to existing Indicative Service access charges

ARTC uses the access charges currently applying to the existing benchmark Indicative Service in each Pricing Zone as a starting point and then applies the above combined pricing differentiation factors to determine the TOP component of charges for other services.

Step 7—ARTC adjusts the TOP component of charges so that expected revenue is close to the cap

ARTC is subject to a revenue cap, such that revenue received from access charges in any calendar year is no more than the Economic Cost of the rail network. ARTC forecasts economic cost (excluding variable maintenance costs) for each Pricing Zone based on expected capital and maintenance programs, cost and volume estimates. When prices are applied to forecast volumes, the resulting revenue should be close to Economic Cost where possible.

⁸ As presented in, or derived from figures contained within, ARTC's Confidential Pricing Differentiation Model – Pricing Differentiation and 2015 Economic Cost tabs, revised version dated 12 June 2014.

For the 2015 Indicative Access Charges, ARTC has adjusted the TOP component for all services in Pricing Zones 1 and 2 by [c-i-c] per cent⁹ to ensure that expected revenue does not exceed Economic Cost and has adjusted the TOP component for all services in Pricing Zone 3 by [c-i-c] per cent¹⁰. ARTC has stated that the increase in Pricing Zone 3 reflects ARTC's intent to maximise cost recovery in Pricing Zone 3 (including recovery of previous capitalised losses) in 2015.¹¹

Detailed calculations for the non-TOP component of access charges for 2015

The following sets out the detailed calculations at each step for the non-TOP component of access charges.

Step 1—ARTC calculates non-TOP component for the benchmark Indicative Service in each Pricing Zone

Having regard to forecast variable costs and forecast gtkm, the non-TOP component for the benchmark Indicative Service in each Pricing Zone is calculated using the following formula:

*Non TOP*_{Indicative Service 1} =

$$\frac{\text{Forecast Total Variable Cost}_{\text{Indicative Service 1}}}{\text{Forecast Total GTKM}_{\text{Indicative Service 1}}}$$

Pricing Zone 1 – Indicative Service 1 (96 wagon 30 TAL)

$$\begin{aligned} &= [\text{c-i-c}]^{12} \\ &= \$1.023 \end{aligned}$$

Pricing Zone 2 – Indicative Service 1 (96 wagon 30 TAL)

$$\begin{aligned} &= [\text{c-i-c}]^{13} \\ &= \$1.689 \end{aligned}$$

Pricing Zone 3 – Indicative Service 1 (82 wagon 30 TAL)

$$\begin{aligned} &= [\text{c-i-c}]^{14} \\ &= \$1.718 \end{aligned}$$

Step 2—ARTC calculates variable maintenance pricing differentiation factor to apply to Indicative Services in each Pricing Zone

Having regard to average axle load and average speed and assuming that the variability of maintenance costs with axle load is 45 per cent and with speed is 50 per cent, the relative impacts on variable maintenance costs are calculated using the train configurations set out in the table below and the following formula:

⁹ ARTC's Confidential Ceiling Test Model – Price Inputs tab, revised version dated 12 June 2014.

¹⁰ ARTC's Confidential Ceiling Test Model – Price Inputs tab, revised version dated 12 June 2014.

¹¹ ARTC's Response to the ACCC's information request, dated 12 June 2014.

¹² ARTC's Confidential Ceiling Test Model – Price Inputs tab, revised version dated 12 June 2014.

¹³ ARTC's Confidential Ceiling Test Model – Price Inputs tab, revised version dated 12 June 2014.

¹⁴ ARTC's Confidential Ceiling Test Model – Price Inputs tab, revised version dated 12 June 2014.

Variable Maintenance Differentiation Factor_{Service X} =

$$\frac{\text{Variable Maintenance Impact (Loaded)}_{\text{Service X}} + \text{Variable Maintenance Impact (Empty)}_{\text{Service X}}}{2}$$

where Variable Maintenance Impact is calculated as follows:

Variable Maintenance Impact_{Service X} =

$$\left[1 + \left(\left(\frac{\text{Average Axle Load}_{\text{Service X}}}{\text{Average Axle Load}_{\text{Indicative Service 1}}} - 1 \right) \times \text{Axle Load Variability} \right) \right] \\ \times \left[1 + \left(\left(\frac{\text{Average Speed}_{\text{Service X}}}{\text{Average Speed}_{\text{Indicative Service 1}}} - 1 \right) \times \text{Speed Variability} \right) \right]$$

Table 11: Train configurations and resulting variable maintenance differentiation factors¹⁵

	Pricing Zone 1		Pricing Zone 2	Pricing Zone 3
	Indicative Service 1 96 wagon 30 TAL	Indicative Service 2 82 wagon 30 TAL	Indicative Service 1 96 wagon 30 TAL	Indicative Service 1 82 wagon 30 TAL
Locos	3	3	3	3
Wagons	96	82	96	82
Wagon tare	22.0	22.5	22.0	22.5
Loco tare	134	134	134	134
Maximum axle load	30	30	30	30
Average axle load (loaded) ¹⁶	29.76	29.72	29.76	29.72
Average axle load (empty) ¹⁷	6.35	6.61	6.35	6.61
Average speed (loaded)	47	47	56	48
Average speed (empty)	66	66	57	72
Axle load variability	0.45	0.45	0.45	0.45
Speed variability	0.50	0.50	0.50	0.50

¹⁵ ARTC's Confidential Pricing Differentiation Model – Maintenance Differentiation, revised version dated 12 June 2014.

¹⁶ ARTC has calculated Average axle load (loaded) as follows: [(Wagons x 4 x Maximum axle load) + (1.1 x Locos x Loco tare)] / [(Locos x 6) + (Wagons x 4)]

¹⁷ ARTC has calculated Average axle load (empty) as follows: [(Wagons x Wagon tare) + (1.1 x Locos x Loco tare)] / [(Locos x 6) + (Wagons x 4)]

	Pricing Zone 1		Pricing Zone 2	Pricing Zone 3
	Indicative Service 1 96 wagon 30 TAL	Indicative Service 2 82 wagon 30 TAL	Indicative Service 1 96 wagon 30 TAL	Indicative Service 1 82 wagon 30 TAL
Variable maintenance differentiation factor	1.000	1.009	1.000	1.000

By way of example, the calculation of the variable maintenance differentiation factor for Indicative Service 2 (82 wagon 30 TAL) in Pricing Zone 1 is as follows:

$Variable\ Maintenance\ Impact\ (Loaded)_{Indicative\ Service\ 2} =$

$$\left[1 + \left(\left(\frac{29.72}{29.76} - 1\right) \times 0.45\right)\right] \times \left[1 + \left(\left(\frac{47}{47} - 1\right) \times 0.50\right)\right] = 0.999$$

$Variable\ Maintenance\ Impact\ (Empty)_{Indicative\ Service\ 2} =$

$$\left[1 + \left(\left(\frac{6.61}{6.35} - 1\right) \times 0.45\right)\right] \times \left[1 + \left(\left(\frac{66}{66} - 1\right) \times 0.50\right)\right] = 1.018$$

$Variable\ Maintenance\ Differentiation\ Factor_{Indicative\ Service\ 2} =$

$$\frac{0.999 + 1.018}{2} = 1.009$$

Step 3—ARTC calculates non-TOP component for other services by applying the pricing differentiation factors

ARTC uses the following formula to calculate the non-TOP component for other services:

$NonTOP_{Service\ X} =$

$$Variable\ Maintenance\ Differentiation\ Factor_{Service\ X} \times NonTOP_{Indicative\ Service\ 1}$$

Pricing Zone 1 – Indicative Service 2 (82 wagon 30 TAL)

- A pricing differentiation factor of 1.009 is applied to Pricing Zone 1 Indicative Service 1 (96 wagon 30 TAL) non-TOP component of \$1.023
 $= 1.009 \times \$1.023$
 $= \$1.032$

Detailed calculations for the TOP component of access charges for 2015

The following sets out the detailed calculations at each step for the TOP component of access charges.

Step 1—ARTC calculates fixed maintenance pricing differentiation factor to apply to Indicative Services other than the benchmark Indicative Service each Pricing Zone

Having regard to maximum axle load and maximum speed and assuming that the variability of maintenance costs with axle load is 45 per cent and with speed is 50 per cent, the relative impacts on fixed maintenance costs are calculated using the train configurations set out in the table below and the following formula:

*Fixed Maintenance Differentiation Factor*_{Service X} =

$$\left[1 + \left(\left(\frac{\text{Maximum Axle Load}_{\text{Service X}}}{\text{Maximum Axle Load}_{\text{Indicative Service 1}}} - 1 \right) \times \text{Axle Load Variability} \right) \right] \\ \times \left[1 + \left(\left(\frac{\text{Maximum Speed}_{\text{Service X}}}{\text{Maximum Speed}_{\text{Indicative Service 1}}} - 1 \right) \times \text{Speed Variability} \right) \right]$$

Table 12: Train configurations and resulting fixed maintenance differentiation factors¹⁸

	Pricing Zone 1		Pricing Zone 2	Pricing Zone 3
	Indicative Service 1	Indicative Service 2	Indicative Service 1	Indicative Service 1
	96 wagon 30 TAL	82 wagon 30 TAL	96 wagon 30 TAL	82 wagon 30 TAL
Locos	3	3	3	3
Wagons	96	82	96	82
Wagon tare	22.0	22.5	22.0	22.5
Loco tare	134	134	134	134
Maximum axle load	30	30	30	30
Maximum speed (loaded)	60	60	60	60
Maximum speed (empty)	80	80	80	80
Axle load variability	0.45	0.45	0.45	0.45
Speed variability	0.50	0.50	0.50	0.50
Fixed maintenance differentiation factor	1.000	1.000	1.000	1.000

¹⁸ ARTC's Confidential Pricing Differentiation Model – Maintenance Differentiation, revised version dated 12 June 2014.

By way of example, the calculation of the fixed maintenance differentiation factor for Indicative Service 2 (82 wagon 30 TAL) in Pricing Zone 1 is as follows:

*Fixed Maintenance Differentiation Factor*_{Indicative Service} =

$$\left[1 + \left(\left(\frac{30}{30} - 1 \right) \times 0.45 \right) \right] \times \left[1 + \left(\left(\frac{60}{60} - 1 \right) \times 0.50 \right) \right] = 1.000$$

Step 2—ARTC calculates network capacity differentiation factor to apply to Indicative Services other than the benchmark Indicative Service each Pricing Zone

Having regard to tare mass and payload, the relative impacts on network capacity are calculated using the figures set out in the table below and the following formula:

*Network Capacity Differentiation Factor*_{Service X} =

$$\frac{\text{Total Cycle Gross Mass}_{\text{Service X}}}{\text{Total Cycle Gross Mass}_{\text{Indicative Service 1}}}$$

Table 13: Tare mass, payload and resulting network capacity differentiation factors¹⁹

	Pricing Zone 1		Pricing Zone 2	Pricing Zone 3
	Indicative Service 1	Indicative Service 2	Indicative Service 1	Indicative Service 1
	96 wagon 30 TAL	82 wagon 30 TAL	96 wagon 30 TAL	82 wagon 30 TAL
Tare mass (t)	2 514	2 247	2 514	2 247
Payload (t)	9 400	8 000	9 400	8 000
Total cycle gross mass (t) ²⁰	14 428	12 494	14 428	12 494
Network Capacity differentiation factor	1.000	0.866	1.000	1.000

By way of example, the calculation of the network capacity differentiation factor for Indicative Service 2 (82 wagon 30 TAL) in Pricing Zone 1 is as follows:

*Network Capacity Differentiation Factor*_{Indicative Service 2} =

$$\frac{12\,494}{14\,428} = 0.866$$

¹⁹ Based on train mass data for the FIS provided at Table 5 of Attachment B Supporting Documentation to the variation application

²⁰ ARTC calculates Total Cycle Gross Mass as follows: (2 x Tare mass) + Payload

Step 3—ARTC calculates coal chain capacity differentiation factor to apply to Indicative Services other than the benchmark Indicative Service each Pricing Zone

The HVCCC models coal chain capacity for various test train configurations, which found the following based on Scenario 3 (i.e. assumption that the Gunnedah Basin network will move to the same axle load and train length configurations as the central and western Hunter Valley). The following table sets out the HVCCC modelled coal chain capacity for the test configurations used in the development of the Final Indicative Services.

Table 14: HVCCC modelled coal chain capacity²¹

Test	Axle Load (t)	Train Length (m)	Payload (t)	Scenario 3 Coal Chain Capacity
1	15	691	2 226	53.400
2	25	824	3 358	64.670
3	25	1 276	5 400	160.000
4	30	1 307	8 036	172.220
5	30	1 544	9 408	191.270
6	30	1 606	9 800	190.720
7	30	1 698	10 388	193.040
8	30	1 791	10 976	192.830
9	35	1 544	11 328	194.680
10	35	1 606	11 800	195.040
11	35	1 698	12 508	195.780
12	35	1 791	13 216	197.330
13	35	1 874	13 688	192.660
14	35	1 936	14 160	191.180

ARTC uses the HVCCC modelled coal chain capacity and linear interpolation to calculate the coal chain capacity for the Indicative Services. The linear interpolation formula is as follows:

Coal Chain Capacity_{Service X} =

$$y_0 + (y_1 - y_0) \frac{z_{Service X} - z_0}{z_1 - z_0}$$

²¹ Based on operational data at Table 2 and derived from Coal Chain Capacity data points at Figure 3 of Attachment B Supporting Documentation to the variation application.

Where:

$$z_{Service X} = \text{payload for Service X}$$

$z_0 = \text{payload for the closest service that does not exceed payload for Service X}$

$y_0 = \text{Coal Chain Capacity for the service corresponding to } z_0$

$z_1 = \text{payload for the closest service that exceeds payload for Service X}$

$y_1 = \text{Coal Chain Capacity for the test service corresponding to } z_1$

ARTC then calculates the Coal Chain Capacity differentiation factors in accordance with the following formula:

Coal Chain Capacity Differentiation Factor_{Service X} =

$$\frac{\text{Coal Chain Capacity}_{Service X}}{\text{Coal Chain Capacity}_{Indicative Service 1}}$$

Table 15: Payload, coal chain capacity using linear interpolation and resulting coal chain capacity differentiation factors²²

	Pricing Zone 1		Pricing Zone 2	Pricing Zone 3
	Indicative Service 1	Indicative Service 2	Indicative Service 1	Indicative Service 1
	96 wagon 30 TAL	82 wagon 30 TAL	96 wagon 30 TAL	82 wagon 30 TAL
Payload (t)	9 400	8 000	9 400	8 000
Coal Chain Capacity	191.16	175.05	191.16	175.05
Coal Chain Capacity differentiation factor	1.000	0.900	1.000	1.000

By way of example, the calculation of the coal chain capacity differentiation factor for Indicative Service 2 (82 wagon 30 TAL) in Pricing Zone 1 is as follows:

Coal Chain Capacity_{Indicative Service 1} =

$$172.22 + (191.27 - 172.22) \frac{9400 - 8036}{9408 - 8036} = 191.16$$

Coal Chain Capacity_{Indicative Service 2} =

$$160 + (172.22 - 160) \frac{8000 - 5400}{8036 - 5400} = 172.05$$

²² Based on data at Table 11 of Attachment B Supporting Documentation to the variation application.

Coal Chain Capacity Differentiation Factor_{Indicative Service 2} =

$$\frac{172.05}{191.16} = 0.900$$

Step 4—ARTC calculates weighting to be given to each differentiation factor in determining a combined differentiation factor to apply to Indicative Services other than the benchmark Indicative Service each Pricing Zone

The following table sets out the weighting that ARTC has given to each of the differentiation factors for 2015.

Table 16: Weighting for pricing differentiation factors²³

Pricing Zone	Maintenance	Coal Chain Capacity	Network Capacity
1	20%	40%	40%
2	31%	34%	34%
3	19%	41%	41%

ARTC adjusts the weighting of the maintenance factor in TOP component calculations based on the proportion of fixed maintenance expenditure forecast in the Economic Cost by applying the following formulas and the costs forecasts set out in the table below:

*Fixed Maintenance Weighting*_{Pricing Zone X} =

$$\left[100\% \div \left(\text{Proportion Fixed Maintenance}_{\text{Pricing Zone X}} + \text{Coal Chain Capacity Weighting} + \text{Network Capacity Weighting} \right) \right] \times \text{Proportion Fixed Maintenance}_{\text{Pricing Zone X}}$$

Where Proportion of Fixed Maintenance is calculated as follows:

*Proportion Fixed Maintenance*_{Pricing Zone X} =

$$\frac{\text{Fixed Maintenance}_{\text{Pricing Zone X}}}{\text{Full Economic Cost}_{\text{Pricing Zone X}} - \text{Variable Maintenance}_{\text{Pricing Zone X}}}$$

Table 17: Forecast maintenance and economic cost for 2015²⁴

Pricing Zone	Variable maintenance (\$million)	Fixed maintenance (\$million)	Economic Cost (\$million)
1	30.14	26.27	282.75
2	11.91	7.49	62.57
3	15.33	13.32	153.09

ARTC then rebalances the remaining weightings for Network Capacity and Coal Chain Capacity to be equally weighted using the following formula:

²³ ARTC's Public Supporting Submission, dated 31 January 2014.

²⁴ ARTC's Confidential Pricing Differentiation Model – 2015 Economic Cost tab, revised version dated 12 June 2014.

$$\text{Coal Chain Capacity Weighting}_{\text{Pricing Zone } X} = \text{Network Capacity Weighting}_{\text{Pricing Zone } X} = \\ (100\% - \text{Fixed Maintenance Weighting}_{\text{Pricing Zone } X}) \div 2$$

Based on the 2015 forecasts costs provided by ARTC in confidential modelling, the following table sets out the rebalanced weightings that ARTC has given to each of the differentiation factors in the TOP component calculations estimated as part of ARTC's variation application for 2015.

Table 18: Rebalanced TOP component weightings for differentiation factors²⁵

Pricing Zone	Fixed Maintenance	Coal Chain Capacity	Network Capacity
1	11.50%	44.25%	44.25%
2	17.65%	41.17%	41.17%
3	10.66%	44.67%	44.67%

By way of example, based on best current available information, the calculation of the rebalanced weightings for Pricing Zone 1 is as follows:

$$\text{Proportion Fixed Maintenance}_{\text{Pricing Zone 1}} =$$

$$\frac{26.27}{282.75 - 30.14} = 0.1040$$

$$\text{Fixed Maintenance Weighting}_{\text{Pricing Zone 1}} =$$

$$[100\% \div (10.40\% + 40\% + 40\%)] \times 10.40\% = 11.50\%$$

$$\text{Coal Chain Capacity Weighting}_{\text{Pricing Zone 1}} = \text{Network Capacity Weighting}_{\text{Pricing Zone 1}} =$$

$$(100\% - 11.50\%) \div 2 = 44.25\%$$

Step 5—ARTC calculates the combined pricing differentiation factor to apply to Indicative Services other than the benchmark Indicative Service in each Pricing Zone

The combined differentiation factors are calculated as follows:

Overall differentiation factor for the TOP component of charges =

$$\begin{aligned} & (\text{Fixed Maintenance Weighting} / \text{Fixed Maintenance Differentiation Factor}) \\ & + (\text{Coal Chain Capacity Weighting} / \text{Coal Chain Capacity Differentiation Factor}) \\ & + (\text{Network Capacity Weighting} / \text{Network Capacity Differentiation Factor}) \end{aligned}$$

²⁵ As presented in, or derived from figures contained within, ARTC's Confidential Pricing Differentiation Model – Pricing Differentiation and 2015 Economic Cost tabs, revised version dated 12 June 2014.

Table 19: Combined overall differentiation factors

	Fixed Maintenance	Coal Chain Capacity	Network Capacity	Overall ²⁶
In Pricing Zone 1				
Indicative Service 1 96 wagon 30 TAL train	= 0.1150 / 1.000	= 0.4425 / 1.000	= 0.4425 / 1.000	1.000
Indicative Service 2 82 wagon 30 TAL train	= 0.1150 / 1.000	= 0.4425 / 0.900	= 0.4425 / 0.866	1.118
In Pricing Zone 2				
Indicative Service 1 96 wagon 30 TAL train	= 0.1765 / 1.000	= 0.4117 / 1.000	= 0.4117 / 1.000	1.000
In Pricing Zone 3				
Indicative Service 1 82 wagon 30 TAL train	= 0.1066 / 1.000	= 0.4467 / 1.000	= 0.4467 / 1.000	1.000

Steps 6 and 7—ARTC calculates the TOP component of charges by applying the combined pricing differentiation factors to 2014 Indicative Service access charges and then adjusts the TOP component of charges so that expected revenue is close to Economic Cost in Pricing Zones 1 and 2 and achieves maximum recovery of Economic Cost in Pricing Zone 3.

The ACCC notes that the percentage adjustment factor applied by ARTC is relevant for the Indicative Access Charges in the 2015 calendar year, however, may not be relevant or subject to change in subsequent years.

Pricing Zone 1 – Indicative Service 1 (96 wagon 30 TAL)

- The 2014 TOP component for Pricing Zone 1 Indicative Service 1 (96 wagon 30 TAL) is used as the starting point and then an overall differentiation factor is applied
- An adjustment of [c-i-c] per cent is then applied to align revenue with Economic Cost and that forms the Indicative Access Charge for 2015.

Pricing Zone 1 – Indicative Service 2 (82 wagon 30 TAL)

- The 2014 TOP component for Pricing Zone 1 Indicative Service 1 (96 wagon 30 TAL) is used as the starting point and then an overall differentiation factor is applied.
- An adjustment of [c-i-c] per cent is then applied to align revenue with Economic Cost and that forms the Indicative Access Charge for 2015.

Pricing Zone 2 – Indicative Service 1 (96 wagon 30 TAL)

- The 2014 TOP component for Pricing Zone 2 Indicative Service 1 (96 wagon 30 TAL) is used as the starting point and then an overall differentiation factor is applied.

²⁶ Derived from comparison of proposed TOP Charges for Final Indicative Services. ARTC's Confidential Ceiling Test Model – Price Inputs tab, revised version dated 12 June 2014.

- An adjustment of [c-i-c] per cent is then applied to align revenue with Economic Cost and that forms the Indicative Access Charge for 2015.

Pricing Zone 3 – Indicative Service 1 (82 wagon 30 TAL)

- The 2014 TOP component for Pricing Zone 3 Indicative Service 1 (82 wagon 25 TAL) is used as a starting point to calculate the 2014 TOP component for Pricing Zone 3 Non-Indicative Service (82 wagon 30 TAL)
- Then the overall differentiation factor is applied.
- An adjustment of [c-i-c] per cent is then applied to maximise cost recovery in Pricing Zone 3 (including recovery of previous capitalised losses) in 2015 and that forms the Indicative Access Charge for 2015.