Economic Regulation Authority

Draft determination of Arc Infrastructure depreciated optimised replacement costs and depreciation schedule

Attachment 2: Total construction replacement cost

26 March 2026

D308544

Acknowledgement of Country

At the ERA we value our cultural diversity and respect the traditional custodians of the land and waters on which we live and work.

We acknowledge their continuing connection to culture and community, their traditions and stories. We commit to listening, continuously improving our performance and building a brighter future together.

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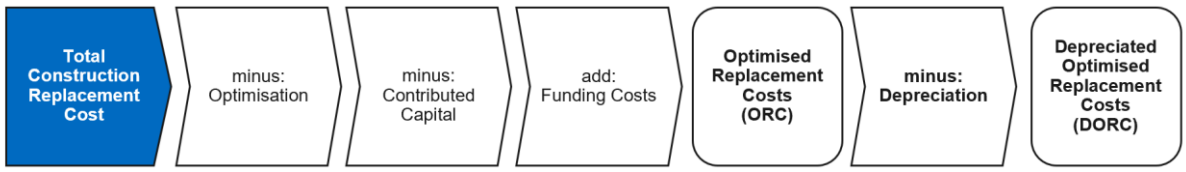
Note

This attachment relates to the total construction replacement cost component of the DORC.

This attachment forms part of the ERA's draft determination on the Arc DORC and Arc Depreciation Schedule. It should be read in conjunction with all other parts of the draft determination, which comprises of the following documents and attachments:

- Overview
- ERA's draft determinations of depreciated optimised replacement costs by route section
- ERA's draft determinations of depreciated optimised replacement costs (model)
- ERA's draft determinations of depreciation schedule (model)
- Attachment 1: Information used by the ERA
- **Attachment 2: Total construction replacement costs (this document)**
- Attachment 3: Optimisation
- Attachment 4: Capital contributions
- Attachment 5: Funding cost during construction
- Attachment 6: Depreciation
- Attachment 7: DORC summary
- Attachment 8: Depreciation schedules

Attachment 2. Summary



The determination of a DORC for a route requires an assessment of the total construction replacement cost for the route. The total construction replacement cost is an assessment of the delivery and installation cost of an asset, prior to consideration of its utilisation or its financing.

Arc's Costing Principles provide that the asset replacement cost in its initial regulatory asset base will be calculated as the lowest current cost to replace the railway infrastructure with a modern equivalent asset. The term modern equivalent asset is not defined in the Code but is commonly regarded as a contemporary asset that serves the same purpose to the asset that is being valued.

Arc's Costing Principles state that the scope of the modern equivalent asset will meet the closest comparable service standard to the existing asset.

Arc's Costing Principles also provide that the asset replacement cost will be based on costs typical for efficient entities developing assets at scale, considering variations relating to geography and local factors at each route section. The Costing Principles provide that asset replacement costs would include:

- material and construction costs
- design development, project and construction management costs.

Material and construction costs are generally referred to as construction replacement costs. Design project and construction management costs are referred to as railway owner's costs. Together, these two components comprise total construction replacement costs.

Arc did not provide a total construction replacement cost of assets on this basis (that is, inclusive of railway owners costs). In its model, Arc applied railway owner's costs after optimisation.[1]

Arc provided construction replacement costs only at a network group level, and not at a route section level. Arc's report showed construction replacement costs aggregated into 14 geographic network groups.[2]

[1] Arc's Costing Principles are not clear on this matter. RPI has advised that it is proper practice to apply railway owner's costs prior to optimisation.

[2] Arc did not provide a rationale for providing results on this basis.

The ERA has produced an assessment of construction replacement costs for each required route. This assessment required aggregation of asset populations provided by Arc on a track section basis in its model, in order to assemble a complete and correct population of assets for each route section nominated in Arc's Costing Principles. The ERA has not relied on any automated aggregation of track section asset data in Arc's model and has manually aggregated track section data into the appropriate route sections. We have assessed total construction replacement costs by adding railway owner's costs to construction replacement cost for each route.

As Arc did not provide construction replacement costs or total construction replacement costs by route section, it is not possible to provide a comparison of the Arc and ERA assessments of costs on this basis.

The ERA's assessment of construction replacement costs by asset class is shown below, aggregated across all route sections for which determinations of DORC must be made. The table shows a comparison with Arc's assessment of construction replacement costs by asset class on a network-wide basis. The Arc network-wide costs are derived by summing the costs shown in Arc's statement, which are shown on a network group basis.

Table 2.1: Construction replacement cost by asset class ($ million)

Asset class	Sub-assets	Arc proposal	ERA
Right of Way	Clearing & grubbing, Cuttings/embankments, Formation, Access roads	2,287	1,591
Civil Structures	Bridges, Tunnels, Culverts, Level Crossings	840	630
Track	Ballast, Sleepers, Rail, Turnouts	12,103	10,824
Signals and Communications	Fibre Optic, Signalling and Control Systems, Control Centre Assets, Communication, Radio Masts	4,309	2,146
Buildings	Buildings (Control Centres, Maintenance Facilities and Other Buildings)	162	145
Associated Track Structures	Pedestrian Level Crossings	36	34
Miscellaneous	Plant and Equipment, Walkways, Signage	140	137
Total all assets		**19,876**	**15,507**

Source: ERA analysis and Arc Infrastructure Applicable Railway Infrastructure DORC Final Report (GHD) Table 4.12

We assessed the aggregate of construction replacement costs across all routes as $15,507 million. This is $4,369 million lower than Arc's proposal of $19,876 million.

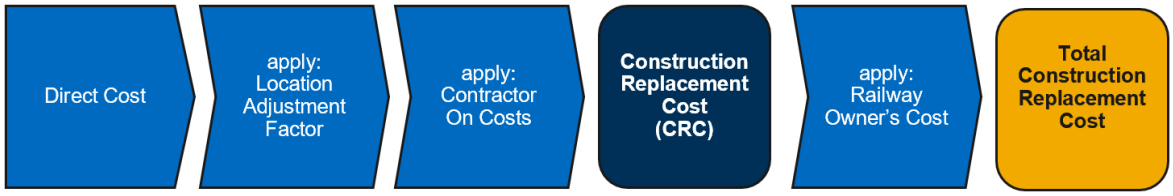
The ERA's assessment of total construction replacement cost for each route section is equal to the construction replacement cost for each route uplifted by 19.3 per cent for railway owner's costs.

Total construction replacement cost

1. The construction replacement cost for each route (or route section) forms the foundation of the depreciated optimised replacement cost for each route.[3] It is the full cost to replace the railway infrastructure comprising the route with a modern equivalent asset, inclusive of direct costs, location adjustment factors, contractor indirect costs and railway owner's costs.[4]

2. Figure 2.1 details the components of total construction replacement cost, which is considered by the ERA to be a typical structure for assessment of replacement costs for railway infrastructure.[5]

Figure 2.1: Total construction replacement cost components



3. Total construction replacement cost is equal to the sum of:

   - Construction replacement cost: the cost of materials and construction as delivered by a contractor.
   - Railway owner's cost: includes design costs, planning and development, project and construction management costs incurred by the railway owner.[6]

4. The construction replacement cost for a route is equal to the product of the modern equivalent asset quantities and the sell rate summed across all asset classes. The sell rate is the sum of the direct job cost and contractor's on-costs.

5. The direct job cost is the per unit cost of providing the asset which is specified as the modern equivalent asset. Direct job cost is the contractor's unit cost of procuring and installing the asset prior to consideration of contractor's on-costs.

6. Contactor's on-costs are:

   - Location adjustment factor: an adjustment factor applied to the unit costs of assets to account for differing construction costs across geographical regions.
   - Contractor indirect cost: indirect costs associated with the construction job, being:
     – contractor's overheads and site preliminaries.

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[3] A route is defined in Part 1 of the Code as meaning those parts of the railways network and associated infrastructure to which this Code applies, and includes part of a route. A route section is defined in Part 1 of the Code as meaning the sections of the railways network into which the network is divided for management and costing purposes. These terms are used interchangeably in the Code.

[4] The Code does not provide a definition of modern equivalent asset. An example of a commonplace definition of modern equivalent asset is provided at Asset Valuation Definitions | Plant and Equipment Valuation NSW as "An asset that has been designed and produced using contemporary techniques and/or materials. The asset serves the same purpose or operates similarly to the asset that is being valued."

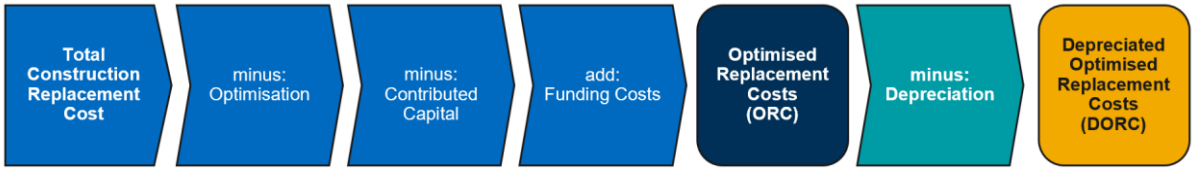
[5] And recommended by RPI.

[6] Sometimes referred to as DPCM for design project and construction management

– contractor's risk allowance and profit margins.

7. In the process of determining depreciated optimised replacement cost, the assessed total construction replacement cost must then be adjusted to optimise the assets, to deduct any capital contribution amounts and to add funding costs to arrive at an optimised replacement cost. The optimised replacement cost is then depreciated to determine a depreciated optimised replacement cost. This process is shown in Figure 2.2.

Figure 2.2: DORC flow chart



8. Arc's Costing Principles detail that the asset replacement cost used in the initial regulatory asset base will be the lowest current cost to replace the railway infrastructure based on the modern equivalent asset. The MEA scope will be defined on the basis that it meets the closest comparable service standard to the existing asset.[7]

9. Arc's Costing Principles detail that the key capital cost drivers that will be used to provide the modern equivalent asset will be: [8]

- the operating standards (axle load, maximum speed, maximum train length)
- population of supporting infrastructure (bridges, culverts)
- topography of route (gradient and track curvature).

10. Arc's Costing Principles state that the asset replacement cost will include provisions for:[9]

- design development, planning and approval costs
- material costs
- construction costs
- project and construction management costs
- funding (opportunity) costs.

11. The Costing Principles also state:[10]

- The cost of cuttings and embarkments made prior to the commencement of the Code will not be included in the asset replacement cost used in the Initial Regulatory Asset Base.
- The asset replacement cost will include amortised amounts of the costs of acquiring any interest in or access to land incurred after the commencement of the Code.

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7 Arc infrastructure, *Costing Principles*, 11 July 2024, p. 10.

8 Arc infrastructure, *Costing Principles*, 11 July 2024, p. 10.

9 Arc infrastructure, *Costing Principles*, 11 July 2024, p. 10.

10 Arc infrastructure, *Costing Principles*, 11 July 2024, p. 10.

- Design development, planning and approval costs, construction costs, and project and construction management costs will be based on those typical for efficient entities developing an asset of this scale, considering variations in cost relating to distance, geography and local factors at each route section.

12. The owner's funding costs during construction are calculated separately to the total construction replacement cost for the route. The ERA details this cost component separately in Attachment 5 Funding Cost During Construction.

13. This attachment details the ERA's assessment of total construction replacement cost underpinning the determination of DORC for each route. Detailed costs for the routes are in the ERA's model published with this draft decision.

14. This attachment is structured and sets out as follows:

- **General framework to undertake the total construction replacement cost assessment** – detail on the general approach to estimating cost and common assumptions that apply to the replacement work.
- **Approach to assessing total construction replacement cost** – the steps and methodology involved in estimating total construction replacement cost.
- **Location adjustment factor** – the factor that recognises geographical differences in cost.
- **Contractor indirect cost** – the contractor's indirect costs.
- **Railway owner's cost** – the owner's design, project and construction management costs.
- **Asset classes and types (Direct Costs)** – assessing the costs associated with each of the asset classes and types.
  - Right of Way – Clearing and Grubbing
  - Right of Way – Cuttings and Embankments
  - Right of Way – Formation
  - Right of Way – Access Roads
  - Civil Structures – Bridges
  - Civil Structures – Tunnels
  - Civil Structures – Culverts
  - Associated Track Structures – Level Crossings
  - Track – Ballast
  - Track – Sleepers
  - Track – Rail
  - Track – Turnouts
  - Buildings
  - Miscellaneous
- **Total construction replacement cost** – summarises the final estimates of the total construction replacement costs for each route.

General framework to undertake the cost assessment

Arc Infrastructure Statement

15. A description of Arc's modelling method is provided in Arc's report which was submitted as part of its statement.[11]

16. The Arc report provides a description of its *Construction Replacement Cost Unit Cost Rate*.[12] This measure is equivalent to the "sell rate" referred to in above, which is the term used in ERA's modelling.

17. Arc's description of its *Construction Replacement Cost Unit Cost Rate* says that the unit rate is the sum of the contractor's direct and indirect cost components.

18. In Arc's report, the *Construction Replacement Unit Cost Rate* is shown as being calculated in the following manner:

    Construction Replacement Unit Cost Rate =

    [Contractor's Direct Cost x Location Adjustment Factor] + Contractor's Indirect Costs

19. The Arc report provides that the *Contractor's Direct Costs* are the unit costs of constructing the works.[13] This measure is equivalent to the "direct job cost" referred to above, which is the term used in ERA's modelling.

20. The Arc report provides that three standard estimating methods have been applied to develop the *Direct Replacement Cost* for each asset, and that the selection of method depended upon the level of information available for each asset. These methods can be summarised as follows:[14]

    - Analogous Estimating - Analogous estimating is a top-down estimation technique for estimating the cost resources and durations of projects, typically used for an order of magnitude (or an initial) cost estimate. This basis of estimating applies knowledge from previous projects to determine either updated unit rates or an overall scope for cost elements. This method relies heavily on one or more projects being very similar to the project being estimated. The reference (analogous) project is typically one previously finished, is currently under execution, is in tender for construction, or has a completed final design level estimate. Items, quantities and unit costs from the analogous project are used as a basis for estimating the current project. Similar costs from the reference project can be used to estimate other groups, categories, elements and items of total project cost.

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11 Italicised wording below indicated terms used by Arc in its model which are not used by RPI or by the ERA in models or reports. These terms are unique to Arc's model and statements. References to the equivalent terms used by RPI and ERA are provided where appropriate.

12 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 21. The Construction Replacement Unit Cost Rate is analogous to the "Sell Rate" described elsewhere in this document

13 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 22.

14 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 22.

- Parametric Estimating – Parametric estimating is a quantitative approach to determine the expected cost based on historic or market data. The basis of parametric estimating is applying known or accurate unit rates to known quantities to arrive at a figure for elements of scope. This method is primarily used to support development of scoping or early design estimates where very little project definition is available. Major historical data and other parameters are used to calculate the cost of various items of work.
- Analytical Estimating – Analytical estimating is a method of determining project costs or timelines by breaking down tasks into smaller components and calculating detailed first principles estimates. This estimating technique is the most accurate estimating technique, but the most time consuming.

21. The Arc report does not describe how these three standard estimating methods interact with the steps previously described for building a *Direct Replacement Cost* from the *Construction Replacement Cost Unit Rate.*

22. Arc's report provides that its assessment of depreciated optimised replacement cost aligns with an AACE (Association for the Advancement of Cost Engineering) Class 5 estimate with an accuracy of -20 per cent to -30 per cent on the low side and +30 per cent to +50 per cent on the high side.

23. Section 4.3 of Arc's report describes the application of Location Adjustment Factors to the *Direct Construction Costs* (unit rates). The factors are said to account for the variation in construction costs between different locations and are a percentage uplift from the costs of construction in Perth and reflect GHD's experience of relative construction costs in the regions.[15]

24. Section 4.4 of Arc's report describes the application of contractor's indirect costs to the *Direct Construction Costs* (unit rates). Contractor's indirect costs are factored into the *Construction Replacement (Unit) Cost Rate* after the application of location factors to the *Contractor's Direct Cost*.[16] The Arc report provides a definition of contractor's indirect costs which aligns with the definitions provided elsewhere in this document as follows:

    - Overheads, profits and preliminaries – These costs represent the cost of doing business for the contractor, which is recovered in addition to the capital works. These cover the contractor's supervision, maintenance and support, construction equipment and vehicles, cranage, temporary facilities, services and utilities, operating expenses, office running costs, small tools overheads and fees.
    - Contractor's risk allowance – This is to cover the risk premium that an experienced contractor would include in developing their tender price, to allow for unexpected, exogenous and non-insurable events that may occur during construction and could impact construction cost. This might include flooding of excavations or equipment breakdowns.

[15] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 23.

[16] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 24.

25. Arc's report states that contractor's indirect costs are expressed as percentage uplifts, and that they are based on recently tendered similar works in Western Australia, adjusted as appropriate for any change in circumstances. Indirect costs are therefore reflective of the current market at the valuation date. The percentages are based on professional judgement of a qualified cost estimator based on recently tendered similar works and intended to be representative of realistic construction costs for an experienced and responsible contractor.[17]

26. Arc's contractor's indirect costs are calculated as compounding percentages of direct costs factored by location, and are as follows:

- Risk Allowance 5 per cent
- Contractor's Preliminaries 30 per cent
- Contractor's Overheads and Profit 9.5 per cent

27. Contractor's indirect costs are discussed under "Contractor Indirect Costs" below.

28. The methods described in Arc's report, for the modelling of construction replacement costs are not implemented as described in the model provided by Arc.

29. Arc's model determines a construction replacement cost by multiplying the direct unit costs by the asset populations for each track section, then multiplying the resulting direct cost amount by the location factor, and then applying each of the contractor's indirect cost uplifts to reach a construction replacement cost.

30. Arc's model does not calculate a total construction replacement cost as described in Figure 2.1 above. That is, Arc does not apply railway owner's costs to a construction replacement cost to arrive at a total construction replacement cost.

31. Railway owner's costs are applied to the optimised replacement cost, that is, following the optimisation of *Construction Replacement Costs* and prior to the considerations of deprecation required to calculate the depreciated optimised replacement cost. The (un-optimised) *Construction Replacement Costs* provided by Arc in its model do not incorporate railway owner's costs.

32. For this reason, it is reasonable only to compare the *Construction Replacement Cost* proposed by Arc with the construction replacement cost arrived at by the ERA, and not with the total construction replacement cost arrived at by the ERA.

Route section cost allocation

33. Arc's model is constructed on the basis of track sections. Track sections are a sub-sections of route sections which comprise routes. There are 1,785 track sections identified in Arc's model.

34. The model enables the track section data to be aggregated into the 48 sections identified in Schedule 1 to the Code, or into 14 network group totals. This is achieved by a MS Excel filter function built into the model. The filter function does not enable an aggregation into the 221 route sections required by Arc's Costing Principles.

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[17] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 24.

35. Arc's report provided determinations of DORC for 127 route sections, principally by aggregating the 88 separate CBH sidings nominated in its Costing Principles into two route sections (narrow gauge and standard gauge CBH spurs).

36. Arc's statement of its determinations of DORC, which was provided separately to its report and its model, provided determinations of DORC for 217 route sections.

37. Arc did not provide a determination of DORC for all of the route sections nominated in its Costing Principles.

Comments in submissions

Aurizon

38. Aurizon submitted that Arc's statement has given no consideration to ERA's established regulatory precedent (previous estimates of replacement value). Aurizon stated that Arc's assessed asset replacement costs are, in many cases, far higher than reasonable given construction comparators, ERA precedent and GHD's own assessment undertaken for the ARTC Interstate Network.[18]

39. Aurizon submitted, as an example, that track replacement costs are more than double GHD's own assessed replacement costs for ARTC. Reducing track replacement costs to previous benchmarked rates would reduce the track construction cost by around $6 billion, and would, in isolation, reduce Arc's DORC value by around $4.2 billion.[19]

CBH

40. CBH submitted that Arc should remove all proposed asset-specific mark-ups from signalling and communication / control system assets, including specialist contractor preliminaries (35 per cent) and specialist contractor overheads and profits (20 per cent).[20]

CCIWA

41. CCIWA submitted that the unit rate calculation is higher for Arc Infrastructure relative to previous ERA Determinations, and the ARTC valuation, due to the order of operations, for example, when location adjustment factors are applied.[21]

KML

42. KML submitted that Arc has failed to provide sufficient data at the route section level, and identified significant errors and inconsistencies in Arc's calculations, particularly for right of way, track and civil structures.[22]

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18 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 4.

19 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 4.

20 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 29.

21 Chamber of Commerce and Industry WA, *Submission Rail Access: Current Consultations*, 11 August 2025, pp. 1-2.

22 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 28.

43. KML submitted that there are unreasonable assumptions in Arc's statement in relation to asset quantities. KML engaged a professional railway engineering consultant to review the engineering assumptions and technical issues for core assets (right of way, civil structures, track). KML provided alternative rates and quantities for these asset categories.[23]

44. KML referred to alternative AACE (Association for the Advancement of Cost Engineering) measures with 5 classes of precision and stated that Arc had employed the least precise (class 5) estimate, where a class 1 estimate should have been used.[24]

RP Infrastructure advice

45. RPI recommended the inclusion of railway owner's costs prior to optimisation and indicated that these costs should be included in the total construction replacement costs.[25]

46. RPI has equated Arc's application of 19.0 per cent railway owner's costs post-optimisation to an equivalent figure of 19.3 per cent applied pre-optimisation. This applies in average across all route sections and for the particular mix of assets and optimisation amounts proposed by Arc in its model.

47. RPI noted that Arc's statement provides that their assessment of depreciated optimised replacement cost aligns with an AACE Class 5 estimate. RPI has advised that consideration of this type of estimate in the context of a regulatory valuation is not appropriate, as AACE accuracy classes are relevant to real project delivery estimates, and include contingencies and scope maturity risk margins.[26]

48. RPI did not provide costs on a direct job cost basis. RPI provided costings as "construction replacement cost unit rates", which are network level totals of total construction replacement costs on a per-network kilometre basis. That is, RPI's costings for each asset class are for the total construction replacement cost (including railway owner costs) over the whole of the network.

49. The RPI report states that its unit rates reflect works being undertaken by efficient contractors in a brownfields environment, but unencumbered by any existing rail traffic. RPI reported that unit rates are independently established and developed from first principles and benchmarked against rates from infrastructure projects including dedicated major interstate rail projects and projects within states.[27]

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23 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, pp. 25-27.

24 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 14.

25 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, pp. 21-23.

26 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, section 2.5.2, p. 13.

27 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, p. 17.

50. RPI considered that the use of typical unit construction rates sourced from contractor supply quotes is a notated 'best practice' method, used across Australian engineering estimates.[28]

51. RPI unit rates are established on the following criteria:

- base date of estimate is Quarter 4, 2024
- excludes project risk and contingency
- unit rates are not escalated.

52. RPI allocated costs in each asset class to route sections on a route-kilometre basis.[29]

ERA Considerations

53. This section details the ERA's assessment of Arc's approach to calculating construction replacement costs, and Arc's common assumptions.

54. In assessing total construction replacement cost for the draft decision, the ERA has considered Arc's proposal, the RPI report and stakeholder submissions.

55. The ERA notes that stakeholders have raised concern with the size of Arc's proposed total construction replacement cost, some elements of Arc's approach and with the extent of markups to construction costs.

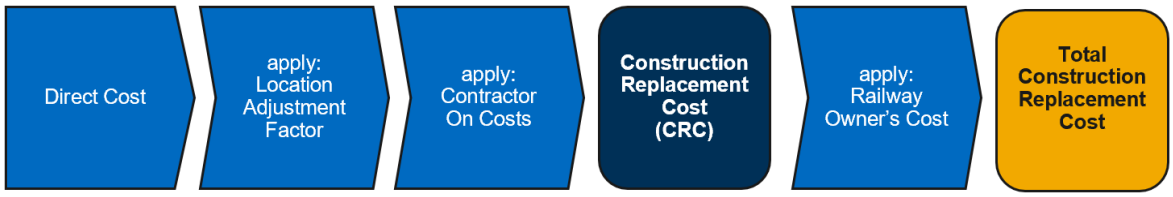
Total Construction Replacement Cost

56. The ERA utilised the following process to calculate total construction replacement cost detailed in Figure 2.3.

[28] Department of Infrastructure, Transport, Regional Development, Communication and the Arts, Australian Government, *Guidance note 2 – Base Cost Estimation*, Version 2, November 2023.

[29] With the exception of assets installed on particular routes only.

Figure 2.3: ERA Total Construction Replacement Cost components



57. Figure 2.3 describes the following methodology used by the ERA in its model for each asset class:

- Ascertain the direct job cost (a unit rate) for the asset class.
- Apply uplifts for contractor indirect costs. Contractor indirect costs are location adjustment factor and contractor on-costs. These contractor indirect costs represent the additional costs for the contract to perform the work, over and above the direct job cost.
- Calculate a construction replacement cost, which combines direct costs and contractor indirect costs.
- Apply a 19.3 per cent uplift to construction replacement costs for railway owner's costs. These railway owner's costs factor in the owner's project management and planning costs.
- Calculate a total construction replacement cost, which combines the construction replacement cost and the railway owner's cost.

58. The ERA has constructed a MS Excel model to provide total construction replacement costs for the required 221 route sections. The ERA has not relied on any automated aggregation of track section asset data in Arc's model, and has manually aggregated track section data into the appropriate route sections.

59. We note that Arc has not provided an equivalent to total construction replacement cost in its model as it applies railway owners' costs after optimisation of the construction replacement cost.

60. We agree with Arc's method for assessing construction replacement cost prior to that point. The ERA notes that Arc's multiplication of unit cost rates with modern equivalent asset quantities in its model happens in a different order to that adopted by RPI and by the ERA, but the different methodologies equate.

Route section cost allocation

61. RPI has provided sell rates (inclusive of location adjustment factors and contractors on-costs) at the aggregate level (for all routes in total) and has allocated this total to routes by asset count or by route length.[30] This method smears the impact of location factors over all route sections, and reduces the accuracy of the cost estimation at the route section level.

[30] The sell rate is the sum of the direct job cost and contractor's on-costs.

62. The ERA has isolated the Arc location factors (provided in Arc's report by geographic region) to identify them separately at the route section level. The appropriate location factors have been applied to each route section when calculating the construction replacement cost for each asset class.

Common assumptions

63. As a complete reconstruction of the entire network infrastructure and associated facilities is being assessed, it is assumed that maintenance facilities (including plant and equipment) are not in place. Under different circumstances the use of owners' facilities would allow the railway owner to employ Tier 2 or Tier 3 (supply only) contractors, and to do a portion of the install work itself using its own crew.

64. Construction, by the railway owner, of a new greenfields route, as an addition to an already existing network, was assumed by the Code prior to amendment and in Arc's previous costing principles. This is a capital works proposition which would be managed by the railway owner itself or by the railway owner and subcontractors.[31] The railway owner is not assumed to manage construction for replacement under the amended Code, as the construction task is the entire network infrastructure, including workshops and manufacturing facilities (required for the railway owner to undertake this work), and so the construction job is assumed to be undertaken by a third-party contractor.

65. For this determination, Arc must therefore rely on quotes from Tier 1 contractors for design, procurement, materials transport and construction of the entire network.[32] Tier 1 contractors would manage their own contracts with Tier 2 or 3 contractors.[33] Arc would have no business arrangement or contact with Tier 2 contractors or Tier 3 suppliers throughout the construction program.

66. Arc's Costing Principles stipulates a brownfield project profile, which results in additional management and overheads costs associated with building around existing infrastructure.[34]

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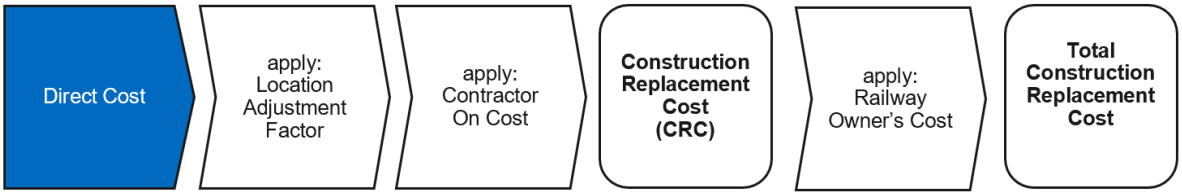
31 For example, in the 2014 determination, Arc (Brookfield Rail at the time) specified rail quoted as plain carbon or head hardened rail supplied in 27.5m lengths with delivery to Midland for welding into 110m lengths. With the availability of its own manufacturing facilities at Midland, flashbutt welding (three welds) at Midland was accepted as the most cost effective way of providing rail strings. These strings were then to be transported by train in 110m lengths to site and welded together[31] under an inhouse or contracted tracklaying program

32 Arc cannot undertake construction projects without the necessary manufacturing workshop facilities in place.

33 ConsultANZ Recruitment, *Understanding the differences between Australia's Tier 1, Tier 2, and Tier 3 Contractors*, url: https://www.consultanz.com.au/tier-1-tier-2-tier-3-contractors/

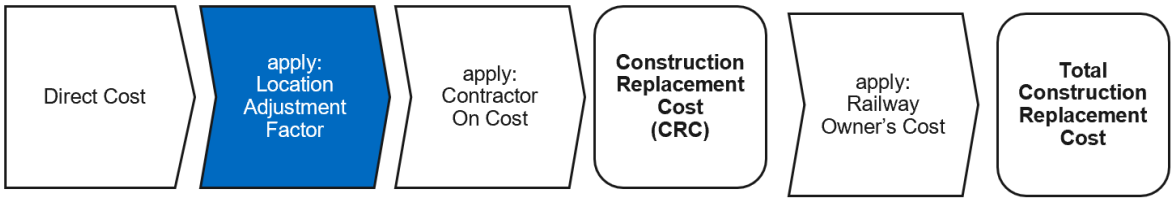
34 Arc Infrastructure Costing Principles May 2024, page 12. Arc's 2014 Costing Principles stipulated a greenfields project profile which enables infrastructure to be developed unencumbered by other infrastructure already in place.

Direct Costs



67. Direct cost are assessed in detail below in the asset classes and types assessment section.

Location Adjustment Factor



68. Location adjustment factors are an uplift applied to contractor's direct and indirect costs to adjust for cost factors associated with delivery and installation to a specific geographic location.

Arc Infrastructure Statement

69. In its report, Arc detailed that it applied a location adjustment as part of the unit rate build-up.[35]

70. Arc's model applied location factors post-construction cost calculation, that is as part of the cost build up.

71. Location factors employed by Arc are outlined spatially in Figure 4-2 (page 23) of the Arc report. For example, the location adjustment factor uplift factors for routes in the Metro network group is 1.0, providing an uplift of zero per cent. The factor for all sidings and customer facilities (spurs) is 1.2, providing an uplift of 20 per cent. Location factors are described by Arc on a network group basis, which does not provide a definitive indication of location factors by route section, except where route sections are clearly located within a network group area.

Comments in submissions

Aurizon

72. Aurizon submitted that the use of location adjustment factors is an accepted approach when valuing assets in regional and remote areas. Aurizon submitted that Arc has applied significantly higher location factors than previously accepted by ERA, with no evidence to support its adjustments.[36]

73. Aurizon submitted that the approach adopted by GHD in preparing the ARTC interstate network DORC provides a robust and verifiable approach to location adjustment factors, based on regional uplift factors from Rawlinson's Australia Construction Handbook.[37]

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35 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 21.

36 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 4.

37 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 17.

CBH

74. CBH submitted that Rawlinson's Construction Handbook should be utilised as a basis for location adjustment factors. CBH noted that the Rawlinson's based adjustment is reflected in the location adjustment factor for the "Central Zone" in Arc's statement.[38]

Pacific National

75. Pacific National submitted that Arc's location factors (ranging from 1.1 in the Avon Valley to 1.5 in the eastern goldfields and Kalgoorlie-Esperance areas) are not supported. Pacific National submitted that several factors may cause construction costs to be higher in the Perth metropolitan area (conducting works in confined areas, dealing with environmental and social impacts etc).[39]

RP Infrastructure advice

76. RPI has advised that it accepts all location adjustment factors from Arc as reasonable. RPI has referred to a Genus Advisory report in order to establish reasonableness.[40]

77. RPI's reports discussed stakeholders' support for Rawlinson's Construction Handbook, and the appropriateness of Arc's location factors. The Rawlinson price book is focused on traditional building construction works and the application of those location factors is not recommended for rail infrastructure works.[41]

78. RPI advised that location cost factors are determined by the source location of materials, the location of contractors' depots and the availability of local resources, accommodation availability, and construction demand within the locality. RPI has advised that, without a detailed assessment of each location relative to material suppliers, and the availability of appropriate resources, required to deliver the works, the use of Rawlinson's as a source of location factors should not be preferred over Arc's reckoning of location factors.[42]

79. RPI advised that the five locality factors specified by Arc in its model for centralised procurement, are reasonable in terms of the geographical distances between those parts of the network.[43]

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38 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 11.

39 Pacific National, *Submission Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule*, 11 August 2025, p. 1.

40 Genus Advisory report to IPART, 2025, Updating IPART's cost benchmarks for local infrastructure items.

41 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, p. 13.

42 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, p. 13.

43 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, p. 13.

ERA Considerations

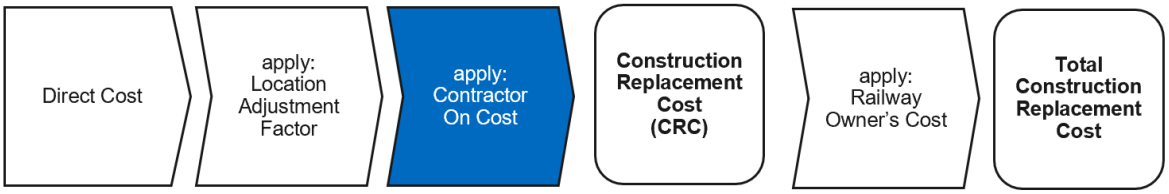
80. For this assessment, the ERA has, in its model, provided costings on a route basis, in a way which preserves all contractor's uplifts including location adjustment factors relevant to each route section.

81. The ERA notes that location factors utilised in previous cost determinations applied to gross replacement value costings of specific routes in isolation, and not for a complete reconstruction of the network from scratch.

82. The ERA considers that the adoption of location factors which may apply in circumstances where infrastructure may already exist to assist in the delivery of assets to the construction site is not relevant in the absence of that supporting infrastructure.

83. The ERA accepts Arc's proposed location adjustment factors, on the basis that these represent specific geographic factors related to route location and are railway specific. The ERA has applied Arc's proposed location factors by route section in its calculations.

Contractor On Costs



84. Contractor on-costs are uplifts to direct job cost unit rates which are applied after location adjustment factor uplifts.

85. Unlike location adjustment factors which are applied differentially across the network by geographic area, contractor on cost are applied uniformly to all routes.

86. Contractor on-costs are:

- Contractor's risk allowance – this is a margin for pricing risk.
- Contractor's preliminaries – this covers on-site preliminaries, such as access roads for construction, fencing, workers facilities.
- Contractor's overheads and profit margins – these are margins for running costs and profit, conceived in the normal commercial sense.

Arc Infrastructure Statement

87. As a part of calculating construction replacement costs, Arc applied the following contractor on-costs uplifts to location factor-adjusted direct job cost unit rates loadings by track section:[44]

- Contractors risk allowance: + 5 per cent
- Contractor's preliminaries: + 30 per cent
- Contractor's overhead and profit: + 9.5 per cent.

88. Arc stated that it has compounded contractor's on-costs for the purpose of establishing contractor's on-costs.

Comments in submissions

AEMC

89. AMEC submitted that there is a significant loading for specialist contractors (55 per cent) and principal contractors (44.5 per cent), which is out of step with other precedents.[45]

[44] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 6 June 2025, p. 24.

[45] Association of Mining and Exploration Companies, *Submission on Depreciated Optimised Replacement Cost (DORC) valuation of Arc Infrastructure's railway assets*, July 2025, p. 5.

Aurizon

90. Aurizon submitted that the 49.5 per cent margin for contractor on costs is excessive given previous benchmarks set by GHD for ARTC, and having regard to the 1-2 per cent margin for contractor on-costs in a previous ERA determination.[46]

91. Aurizon referred to a potential double-counting of railway owner's costs and contractor's on-costs for signalling. Aurizon submitted that where subcontractors are appointed, it should be assumed that the contractor margin will be shared among contractors, depending on the scope and scale of their assigned work and responsibility.[47]

CBH

92. CBH submitted that Arc has applied compounding on cost factors that amount to a 49.5 per cent mark up on direct costs.[48]

93. CBH submitted that the ERA should adopt the uplifts used in the 2014 Determination of costs for Brookfield Rail (relevant to a CBH proposal) which was 1-2 per cent for contractor indirect costs.[49]

CCIWA

94. CCIWA submitted that combined margins for contractor on costs and Arc's project management costs, which equate to an approximately 80 per cent markup on direct costs exceeds the 17.5 per cent to 22 per cent assumed in prior ERA determinations and the ARTC valuation.[50]

KML

95. KML submitted that Arc's contractor indirect costs are calculated on a compound basis, sequentially adding 5 per cent risk margin, 30 per cent preliminaries and 9.5 per cent overheads and profit to direct costs, resulting in a 50 per cent escalation of direct job cost unit rates.[51]

96. KML submitted that the on-costs in the Arc statement result in a 62 per cent uplift on direct material and labour costs. KML cited the ERA 2014 cost determination for Brookfield Rail contractor indirect costs of 1-2 per cent across its asset costing is a reasonable rate for this class of indirect costs.[52]

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46 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 16.

47 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 16.

48 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 12.

49 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 12-13.

50 Chamber of Commerce and Industry WA, *Submission Rail Access: Current Consultations*, 11 August 2025, pp. 1-2.

51 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 28.

52 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 28.

RP Infrastructure advice

97. RPI has applied the following on-costs to direct job cost unit rates:

- Contractor's risk allowance: +5 per cent
- Contractor's on-site overheads/preliminaries: +25 per cent
- Contractors margin: +9.5 per cent.

98. RPI has advised, based on its experience with infrastructure projects of this size, that these are typical mark-ups for contractor's on-costs.

99. RPI has advised that all contractor on costs proposed by Arc, apart from preliminaries, are consistent with those incurred by Tier 1 contractors who would be capable of undertaking construction projects at the scale required.

ERA Considerations

100. The ERA agrees with RPI's recommendation that the following contractor on-costs be applied:

- Contractor's risk allowance : +5 per cent
- Contractors on-site overheads/preliminaries: +25 per cent
- Contractor's margin: +9.5 per cent

101. The ERA agrees with RPI's recommendations in relation to contractor on-costs because RPI has advised that they are consistent with those incurred by Tier 1 contractors who would be capable of undertaking construction projects at the scale required. A comparison of the contractor on-costs quoted by Arc, and the ERA appears in Table 2.2.

Table 2.2: Contractor on costs

	Arc	ERA
Contractor's risk allowance:	+5 per cent	+5 per cent
Contractor's preliminaries:	+30 per cent	+25 per cent
Contractor's margin:	+9.5 per cent	+9.5 per cent

102. CBH and KML submitted that the compounding of contractor's on-costs is not appropriate and that each on cost should be applied to the base amount and the differentials added.

103. RPI has provided advice that Arc's method for compounding of contractor on costs is appropriate.

104. The ERA has examined the Arc model and agrees with RPI that the margins have been applied in the appropriate way and in the way indicated in Arc's report.

105. For previous determinations (under the GRV regulatory scheme) the ERA's consultants advised that in the circumstances the 1 or 2 per cent margins proposed by Brookfield Rail (at the time) were reasonable for that class of construction replacement cost estimate.[53]

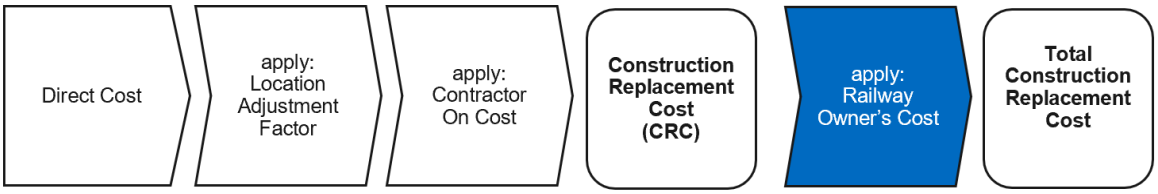
106. The ERA recognises that contractor on-costs are higher when Tier 1 contractors are employed, as the contractor shoulders the bulk of the project risk and overheads associated with the job, rather than those being absorbed by the railway owner.

107. Further, the construction replacement costs provided for the current assessment are for the hypothetical replacement of the entire Arc rail network spanning across Western Australia. This is a major commission, and in practice would require the availability of suitable contractors, resources, plant and materials at a scale exceeding the requirements for any real-world scenario. Contractor's working within the infrastructure industry would command higher margin levels in these theoretical circumstances.

108. The ERA therefore considers that the 1-2 per cent contractors margins allowed for in 2014 are not appropriate to apply to projects undertaken by Tier 1 contractors in a brownfields environment.

[53] A greenfields build, employing the railway owner's own facilities and crew.

Railway Owner's Cost



109. Railway owner's costs are design, project and construction management costs. Planning and design costs occur prior to construction and entail all design activities, from initial feasibility studies to detailed design necessary for construction.

Arc Infrastructure Statement

110. Arc's statement allows for the following railway owner's costs, as an uplift on construction replacement costs:

- Planning and design costs (4 per cent)
- Planning and development costs (5 per cent)
- Project and construction management costs (7 per cent)
- Corporate and other costs (3.0 per cent).

111. The total of railway owner's costs proposed by Arc is 19.0 per cent.

112. Arc does not apply railway owner's costs to the construction replacement cost to arrive at a total construction replacement cost for each route. Arc instead applied railway owner's costs to the optimised construction replacement cost.

Comments in submissions

Aurizon

113. Aurizon referred to a potential double-counting of railway owner's costs and contractor's on-costs for signalling.[54]

114. Aurizon submitted that preliminary planning and development approval costs should not be included, as the valuation assumes the corridor is already assembled and earthworks complete.[55]

[54] Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 16.

[55] Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 29.

CBH

115. CBH submitted that Arc has compounded indirect cost factors that amount to a 49.5 per cent mark up on direct costs, and that a further 22 per cent in railway owner's costs are applied. CBH notes that this results in an 80 per cent uplift on direct material and labour costs.[56]

116. CBH expressed concern that "the allowance for railway owner overheads and corporate costs are inappropriate as they have no obvious causal connection with the lowest cost replacement of the infrastructure." [57]

117. CBH considered that the ERA should adopt the uplifts used in the 2014 Determination of costs for Brookfield Rail (relevant to a CBH proposal) which was a 20 per cent design construction project management margin as a railway owner's cost.[58]

118. CBH submitted that design costs and concept/feasibility studies are not required when specifications are known, and that planning and development approval can be assumed to be in place. CBH cited the ERA's 2014 cost determination for Brookfield Rail:[59]

    - "The 'hypothetical' replacement of infrastructure which already exists is on the basis that all routes are fully designed and optimised".
    - "As the costs associated with all land corridors in place at the commencement of the Code are not included in the infrastructure capital costs, it is assumed all necessary approvals are in place".

119. It noted the combined contract management and supervision costs amount to over $2 billion (a combined rate of 12 per cent) which is "inordinately high" and with no direct equivalent in the ARTC depreciated optimised replacement cost report prepared by GHD.[60]

CCIWA

120. CCIWA submitted that combined margins for contractor on costs and Arc's project management costs, which equate to an approximately 80 per cent markup on direct costs exceeds the 17.5 per cent to 22 per cent assumed in prior ERA Determinations and the ARTC valuation.[61]

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56 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 12.

57 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 40.

58 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 12-13.

59 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 40.

60 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 40.

61 Chamber of Commerce and Industry WA, *Submission Rail Access: Current Consultations*, 11 August 2025, pp. 1-2.

RP Infrastructure advice

121. RPI has equated the application of 19.0 per cent railway owner's costs applied post-optimisation to an overall figure of 19.3 per cent applied pre-optimisation. This equation applies in average across all route sections and for the particular mix of assets and optimisation amounts proposed by Arc in its model.

122. RPI provided a breakdown of the components of railway owner's costs proposed by Arc and advised that it believes the percentage amounts are reasonable.

123. RPI has applied an uplift of 19.3 per cent for railway owner's costs to all construction replacement costs to arrive at total construction replacement costs.

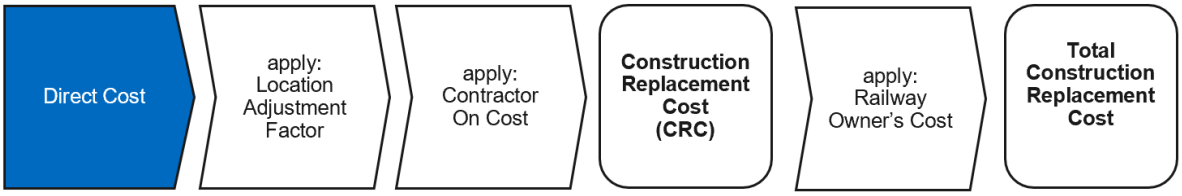
ERA Considerations

124. The ERA considers the railway owner's costs are a valid cost component in a DORC estimate. This recognises the design, project and construction management costs are legitimate costs incurred in project delivery.

125. The ERA has accepted RPI's advice that 19.3 per cent railway owner's costs is acceptable. The ERA considers that these are in line with current industry standards for projects of this scope. In all previous cost determinations for WestNet Rail and Brookfield Rail, the ERA has applied a margin of 20.0 per cent for railway owner's costs.

126. In this assessment, the ERA has applied an uplift of 19.3 per cent for railway owner's costs to all construction replacement costs to arrive at total construction replacement costs.

Asset classes and types assessment



127. The Arc railway network is made of many asset classes spread across routes.

128. This section provides an assessment of asset populations and construction costs as detailed in Table 2.3.

Table 2.3: Asset classes and asset types cost estimates to be assessed

Asset class	Asset type
Right of Way	Earthworks - Clearing and Grubbing
	Earthworks - Cuttings and Embankments
	Formation
	Access Roads
Civil Structures	Bridges
	Tunnels
	Culverts
Associated Track Structures	Level Crossings
Track	Ballast
	Sleepers
	Rail
	Turnouts
Signalling and Control Systems	Fibre Optic Network
	Signalling and Control Systems
	Control Centre Assets
	Communication
	Radio Masts
Buildings	Buildings, Control Centres, and Maintenance Facilities
Miscellaneous	Miscellaneous, Plant and Equipment

Right of Way – Earthworks: Clearing & Grubbing

129. For an undeveloped site, the railway corridor needs to be prepared for bulk earthworks. This includes:

- Clearing and grubbing (removal of vegetation to expose topsoil) and carting to stockpile.
- Stripping topsoil layer to remove the soft top layer and associated organics unsuitable for railway subgrade. The depth of grubbing may vary across a network, depending on the specification of the route, and local circumstances.

130. Earthworks must provide a proof-rolled surface to support the laying of ballast. Clearing and grubbing is required in all circumstances:

- at the base of the embankments or top of the cuttings (cuttings and embankments are detailed in the next section)
- if there are no cuttings or embankments, at the base of the formation layer to allow for compaction and formation placement
- if there is no formation, at the base of the ballast layer to allow for compaction and ballast placement.

131. There are some related works which occur across components of other right-of-way assets, for example, building formations and access roads require very similar civil works (limestone grading and compaction) and at similar cost in some cases.

Arc Infrastructure Statement

132. Arc proposed a construction replacement cost for clearing and grubbing of $67 million, comprising 0.3 per cent of its construction replacement cost across all asset classes of $19,876 million.

133. Arc has submitted that clearing and grubbing works (a component of earthworks) may be included only if completed since 2000.

134. The area cleared and grubbed since 2000 has been estimated by Arc at 8,636,530 m^2 on the Mullewa to Tilley Junction route. Arc has submitted that minimum land areas have been used and direct costs have been developed using parametric estimating methodology.[62]

135. As a response to a request for further information, Arc advised that it had omitted to incorporate contractors on-costs with its unit price of $4 per m^2, and that the correct direct cost should be $7.77 per m^2.

[62] Parametric estimating is an approach to determining expected cost based on historic or market data. The determination of an estimate is based on a statistical (or assumed) correlation between a parameter and a cost or time value. This observed correlation is then scaled to the size of the current project. To calculate the cost or duration per parameter, a set of historical data is required. This could be obtained from previous projects publicly available, market data or agencies that provide statistics for benchmarking.

136. In a response to a request for further information, Arc advised the area to be cleared and grubbed should be 852,289 m^2 which is the length of the Mullewa to Tilley Junction route of 87.1 km with an average width of 9.8m. In Arc's model the area to be cleared and grubbed was shown as 8,636,531 m^2 due to excessive width of clearing, which were shown in the model as 146 metres.

137. Arc advised that the corridor is an undeveloped site and would need to be prepared through clearing and grubbing and the topsoil would need to be stripped to an average 0.5 metres across the network, in accordance with similar work in Western Australia.

138. Arc's applicable costing principles require that the cost of developing the railway infrastructure must be made on a brownfields basis. This means that the costs should include costs associated with building around existing infrastructure.

139. Arc refers to this in its report, providing that the brownfields approach must allow for the construction and use of assets not owned by the railway owner but necessary to enable the construction of assets owned by the railway owner that are required for the service. Therefore, Arc has assumed:[63]

- costs of developing the site from a virgin site include the acquisition of the land corridor, the clearing and grubbing of the site and the creation of cuttings and embankments
- costs of land purchase and the costs of cuttings and embankments made prior to the commencement of the Code are not included in the asset replacement cost used in the DORC
- expenditure since the commencement of the Code to create capacity, or expand the network, or improve standards or efficiency, are included
- infrastructure is costed as though it were constructed without existing traffic on the rail
- planning and development costs to the extent that they are required to integrate with existing infrastructure are included.

Comments in submissions

Aurizon

140. Aurizon submitted that the clearing and grubbing included by Arc was part of the 2011-12 upgrade of the Mullewa to Tilley line. Aurizon advised that as the construction is for an existing corridor, the clearing and grubbing required would only need to be minimal.[64]

141. Aurizon submitted that the area nominated is higher than what would be required for the ~100 km corridor. Aurizon noted the cost per metre was clarified by Arc but there was no supporting information on the area proposed.[65]

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63 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 25.

64 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 17.

65 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 17.

CBH

142. CBH indicated its understanding that the clearing and grubbing costs provided by Arc relate to the track from Mullewa to Tilley. CBH advised the stripping 0.5 m is excessive and 0.1 to 0.15 m is generally sufficient for clearing and grubbing purposes, and that Arc should use an average stripping depth of 0.125 m.[66]

143. CBH advised that if the clearing and grubbing area relates to the track from Mullewa to Tilley, it would provide for an average corridor width of 86 m which is higher than reasonably required.[67]

KML

144. KML submitted that the clearance area for the 98 km route from Mullewa to Tilley Junction is unreasonable with Arc implying an average clearance width of 88 metres while standard industry practice should be 40 metres which would result in a clearance area of 3,924,000 m^2.[68]

145. KML further submitted that the revised direct cost rate of \$4 per m^2 rate is excessively high. KML advised for a haul distance of 1 kilometre a reasonable direct rate is approximately \$0.3 per m^2 while a haul distance of 10 kilometres a reasonable direct rate is approximately \$2 per m^2.[69]

RP Infrastructure advice

146. RPI examined clearing and grubbing requirements for routes comparable in specification and geographic isolation to the Mullewa to Tilley route.

147. RPI advised that the unit rates of \$7.77/m^2 provided by Arc in its clarified information is above the upper end of the range of costs.

148. RPI advised that a rate of \$6.28 per m^2 inclusion of location adjustment is reflective of the scope for clearing and grubbing of the Mullewa to Tilley Junction route section. RPI recommended a construction replacement cost of \$54.2 million for clearing and grubbing.

66 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 14.

67 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 14.

68 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 15.

69 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 15.

ERA Considerations

149. The ERA has determined a construction replacement cost for clearing and grubbing of $7.0 million. This compares to a cost of $67.1 million proposed by Arc.

150. The ERA considers that the RPI figure of $54.2 million is excessive due to it being based on the inaccurate embankment width numbers in Arc's model. RPI did not identify or correct this dimension. The ERA has accepted RPI's recommended rate of $6.28/$m^2$ as it reflects an assessment of similar work.

151. In response to an information request, Arc provided a corrected clearing and grubbing area of 852,289 m^2. This compares to 8,636,530 m^2 that was originally provided in Arc's report.

152. The ERA has used a total of 852,289 m^2 as the appropriate dimension for clearing and grubbing on the Mullewa-Tilley route. This is consistent with a width of 9.8 metres.

153. The ERA notes that clearing and grubbing costs proposed by Arc relate only to the Mullewa to Tilley Junction route, as this is the only route for which clearing and grubbing costs have been incurred since 2000.

154. The ERA has noted the comments in submissions relating to various alternative specifications for the clearing and grubbing which would be required to establish the Mullewa to Tilley Junction route at 21TAL.

155. The ERA is aware that the new Mullewa to Tilley route is built on the same alignment as the one it replaces. The formation varies from the original formation by up to 12 metres in some places.

156. The ERA considers that brownfields planning and development costs required to integrate with existing infrastructure are not applicable to the Mullewa to Tilley Junction route which were incurred prior to 2000.

157. The ERA expects that an amount of clearing and grubbing is required to establish the route at 21TAL, and to remediate any organic ingress since 2000. The ERA considers that the bulk of clearing and grubbing costs to establish the route on a brownfields basis were incurred prior to 2000.

158. The ERA has adjusted Arc's construction replacement cost figure by adopting the 25 per cent contractor preliminaries as recommended by RPI over the 30 per cent proposed by Arc.

159. The ERA has accepted the amended area estimation put forward by Arc of 852,289 m^2 with a unit rate of $6.28 per m^2 which results in the total cost of $5.4 million after also adjusting the contractor preliminaries proposed by Arc.

Right of Way – Earthworks: Cuttings and Embankments

160. Cuttings and embankments are sometimes required to form an alignment on which the required formation may be laid.

Arc Infrastructure Statement

161. Arc proposed a construction replacement cost for cuttings and embankments of $18.3 million, comprising 0.1 per cent of its construction replacement cost for all assets.

162. Arc proposed earthworks only in relation to the rebuilt Mullewa to Tilley Junction route (89kms). The route was upgraded from 16 to 21 Tonne Axle Load (TAL) in 2011. The upgrade was built on the same alignment, but earthworks to formation height was increased by 0.5 m (to accommodate higher axle loads) with a corresponding increase in the width of the formation, in turn determining the width of the cutting or embankment.

163. Arc advised that an efficient contractor would use material from cuttings to fill embankments and assumes:[70]

- cut material would be suitable for use as fill
- all cut material would be hauled to stockpile within the site, then hauled from stockpile to fill
- cut material would have a net bulking factor of 1.2 when compacted to be used in embankments.

164. Arc advises there is a shortfall of 241,761 m^3 of fill material which would be most efficiently sourced from an external quarry.

Comments in submissions

Aurizon

165. Aurizon submitted that in excluding land and earthworks (including cuttings and embankments) except those acquired/constructed since 2000, the valuation should assume that the corridor is in place and consider the costs of replacing the network from that point. Aurizon submitted that GHD has excluded the cost of pre-2000 land and earthworks but has otherwise fully reflected the cost and time required to assemble the corridor and prepare it for track construction.[71]

CBH

166. CBH submitted it is not reasonable to assume 100 per cent cut to stockpile to fill as an efficient contractor would aim to minimise double handling of material and the costs should be adjusted to minimise double handling of material.[72]

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70 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 26.

71 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 18.

72 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 14-15.

167. For right-of-way assets, for assets not owned by the asset owner, but necessary to enable construction, regulatory precedent allows for the time to construct these assets, but not the cost of these assets.[73]

KML

168. KML submitted the material excavated in formation preparation would produce 94,774 m^3 of material which would further reduce the fill volume to 146,990 m^3.[74]

Pacific National

169. Pacific National submitted that the ERA should carefully review the scope of the DORC valuation to ensure that the assets the Costing Principles require to be included have been properly defined and the relevant capital works and costs excluded. In particular:[75]

- formation assets (account for $2.7 billion of the ORC)
- access roads (account for a large proportion of the ORC and are approximately 50 per cent depreciated).

170. Pacific National submitted that these two costs should be treated as part of "cuttings and embankments", as they were in place prior to the commencement of the Code.

RP Infrastructure advice

171. RPI advised the cost provided by Arc for cuttings and embankments on the Mullewa to Tilley Junction route was reasonable at $18.3 million.[76]

ERA Considerations

172. The ERA has estimated a construction replacement cost for cuttings and embankments of $17.6 million. This compares to a cost of $18.3 million proposed by Arc.

173. The reason for the difference between the ERA determined construction replacement cost for cuttings and embankments and that proposed by Arc is the adoption by the ERA of contractor preliminaries of 25 per cent in place of the 30 per cent used by Arc. The use of Arc's units rates and the 25 per cent contractor preliminary results in the least cost for embankments.

174. Absent evidence from Arc that its proposed 30 per cent is justified the ERA considers the lower value (25 per cent) for contractor preliminaries is more consistent with achieving the objective of the *Railways Access Act 1998,* which is to encourage the efficient use of, and investment in, railway facilities by facilitating a contestable market for rail operations. The ERA considers the lower value will better deliver the desired outcomes.

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73 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 14.

74 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 16.

75 Pacific National, *Submission Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule*, 11 August 2025, p. 1.

76 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, p. 21.

175. The ERA has considered the advice of RPI, and matters raised in submissions. The ERA understands that there is potential for overlap in scope and cost allocation between the various components of right-of-way assets.

176. In particular, the ERA has noted concerns of stakeholders that there may be a potential for the inclusion of unnecessary costs in the consideration of right of way earthworks already in place at the time the lease was provided to the leaseholder.

177. These considerations are laid out in further sections addressing right of way formation and access roads.

178. The costs of cuttings and embankments apply only to the Mullewa to Tilley Junction route and that these costs constitute only a small fraction of total construction costs in the context of the valuation of the entire network.

Right of Way – Formation

179. Formation is material that is placed on top of earthworks to provide a stable foundation for track and to distribute operating loads to the subgrade soil beneath.

180. Formation is required where high levels of reliability are required, such as on frequently travelled lines, or where high axle loads are run. For these sections of track, the modern equivalent formation replacement would need to be in accordance with current construction standards.[77]

181. Parts of the Arc network were not originally created with formation and some sections remain without it today. Arc has advised that, on these routes, the subgrade has been sufficiently compacted, by years of train movements, to provide adequate support for the required level of service.

182. If the network were to be replaced today, it would need to comply with current standards, which may require a formation layer.

Arc Infrastructure Statement

183. Arc proposed a construction replacement cost for formation of $1,595 million, comprising 8.0 per cent of its construction replacement cost for all assets.

184. Arc has provided a zero cost of formation for routes that are currently built without formation. This is in accordance with the requirement of the Costing Principles that the MEA shall provide the closest comparable service standard to the existing asset.

185. To provide the closest comparable service standard to the existing asset on these sections (where level of service is defined in terms of axle loads), the MEA would need to compact the subgrade – effectively replicating the compaction that years of train movements has achieved. The construction tasks on these track sections would be:

- clear and grub
- strip topsoil layer
- proof-roll the subgrade to compact.

186. For the purposes of this assessment, Arc's replacement cost for formation assumes that an average depth of 230 mm (as a minimum) is sufficient. Standard construction detailing also requires formation extend 3.5 metres either side of the track centre line. This equates to 1.6 cubic metres of formation per linear metre of track.

187. Construction of formation requires:

- excavation to a depth of 230 mm
- disposal of excavated material off-site
- trimming and compaction of subgrade
- filling to subgrade with 230 mm thick limestone foundation
- trimming and compaction to limestone formation level.

[77] This requires that formation achieves a California Bearing Ratio (CBR) of 20.

188. Arc submitted that it has estimated the cost rates for this activity from rates seen in the current market for projects including similar infrastructure in Western Australia. This included the allowances for site location, contractor overheads, profits, preliminaries and risk.

189. Formation has been priced using parametric estimating methodology to determine appropriate direct unit costs.

Comments in submissions

CBH

190. CBH submitted that formation costs should adopt a total formation width of 6.0 metres for narrow gauge and 6.5 metres for standard gauge in place of Arc's 7.0 metre assumption for all gauges.[78]

191. CBH submitted that all formation costs associated with areas of the network that have no formation should be removed.[79]

KML

192. KML submitted that Arc incorrectly treats formation as an independent activity, improperly incorporating 204km into the cost base, whereas only 98km route from Mullewa to Tilley Junction is constructed post-2000.[80]

RP Infrastructure advice

193. RPI advised that a 7.0 metre formation over all routes is an appropriate basis to provide a formation costing.

194. RPI converted Arc's costing to a figure of $\$50.44/m^2$.[81]

195. RPI advised that a 'sell rate' of up to $\$53.03/m^2$ would be reasonable referring to benchmark prices for other rail projects currently in both execution and planning phases.[82]

196. RPI recommended a construction replacement cost of $1,677 million for formation.

ERA Considerations

197. We have estimated a construction replacement cost for formation of $1,567 million. This compares to a cost of $1,595 million proposed by Arc.

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78 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 15-16.

79 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 15-16.

80 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 16.

81 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 18.

82 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 18.

198. All components of formation have been recalculated based on Arc's lower costing. The ERA adjusted contractor's preliminaries to 25 per cent from the 30 per cent included by Arc. This difference accounts for the divergence between Arc's proposed construction replacement cost and the ERA's assessment.

199. Arc has included formation requirements only for those routes which currently are on formations. Arc has specified this to ensure that the MEA is consistent with the current level of service on those routes.

200. We have verified that Arc included only 98 km of formation for the Mullewa-Tilley route in its model. We have included 98 km of formation in the ERA's model for this route.

201. Arc's nominated formation areas, as applied to the various sections of the network (narrow, standard and dual gauge), are considered appropriate.

Right of Way – Access Roads

202. Rail corridor access roads are private service roads that run adjacent/parallel to sections of track to allow vehicle access for inspections and maintenance.

203. Access roads are typically cut in conjunction with major earthworks, and the location of access roads are fixed in the process of undertaking earthworks, to the extent that they are required to undertake earthworks.

Arc Infrastructure Statement

204. Arc proposed a construction replacement cost for access roads of $606.5 million, comprising 3.0 per cent of its construction replacement cost for all assets.

205. Arc specified access roads to provide a comparable level of service to the existing assets. On this basis, access roads across the network are assumed to be cleared and improved unsealed dirt tracks 3.5m wide (sufficient for single lane access), along one side of the track only, as this is least cost.[83]

206. Arc used rates between $0.09 million/km to $0.15 million/km depending on the location due to location factors.[84] The rate applied to construct access roads included:

- vegetation clearing
- topsoil removal
- subgrade improvement
- subgrade preparation.

207. The rates are based on recently tendered rates for similar tasks in Western Australia and include the allowances. Arc advised the source for the data is from similar tasks in Western Australia and states there is some variation in rate across the network due to location factors.

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83 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 30.

84 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 30.

Comments in submissions

Aurizon

208. Aurizon submitted that Arc has undertaken a high-level desktop assessment, with little reference to actual age or condition. Aurizon noted that no evidence is provided as to whether access road assets are installed.[85]

209. Aurizon considers that the extent that access roads are doubtful is due to other equivalents to access roads being available and some areas of the network not requiring permanent access roads.[86]

210. Aurizon submitted that as access roads have a design life of ten years, if access roads are not maintained for ten years they should not be considered as required on the Arc network.[87]

211. Aurizon submitted that the rate scaled up from the ERA's previous 2013 benchmark should be $9,833/km when scaling up using the PPI Index – road and bridge construction Western Australia.[88]

CBH

212. CBH submitted that access roads should be excluded under a brownfield construction methodology because they were valued in a greenfield context in the ERA 2014 determination and that it is reasonable to assume in a brownfield context that access roads already exist. CBH further advised that during the ARTC DORC valuation, GHD assumed access roads were already in place. [89]

213. CBH considers that the vegetation and clearing portion of the cost attributable to access roads is analogous to clearing and grubbing and should be removed.[90]

214. CBH submitted that if access roads must be included, a width and depth of 3 metres and 50mm would be appropriate as reflected in the ERA 2014 determination. CBH also noted that the rates in Arc's statement were much higher when compared with the ERA 2014 determination and submitted the rate should be scaled down.[91]

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85 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 19.

86 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 19.

87 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 19.

88 Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 20.

89 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 14.

90 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 16-17.

91 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 16-17.

KML

215. KML submitted that access roads should be treated as cutting and embankments and, as no new access roads were built after 2000, the cost should not be included. Under a conservative interpretation KML state that the cost scope should be strictly confined to the 98 km Mullewa to Tilley Junction route constructed after 2000.[92]

216. KML submitted that the reasonable rate for access roads with a width of 7 m to be $49,738 per km. Given the access road width, KML advises that an adjustment should be made by applying 60 per cent of the unit rate to bring a revised unit rate of $29,842 per km. [93]

RP Infrastructure advice

217. RPI converted Arc's costing for access roads to a figure of $28.77/m^2 as the Arc rate was provided on a per km basis.[94]

218. RPI advised that roading is typically costed on a square metre basis and not a kilometre length basis, as the volume depends on the road profile. This reflects the same approach taken with formation.

219. RPI advised that a 'sell rate' of $45.05/m^2 is reasonable referring to benchmark prices for current rail maintenance access roads projects.[95] RPI provided a recommended construction replacement cost of $949.5 million.

ERA Considerations

220. The ERA includes construction replacement cost for access roads of zero. This compares to a cost of $606.5 million proposed by Arc.

221. Submissions have raised potential for access roads to be formed as a necessary part of earthworks and formations, and that access roads are not an appropriate inclusion alongside some routes, where they do not currently exist. Submissions argue that if no new roads have been formed since 2000, that they should be excluded.

222. The ERA considers that the inclusion of costs for access roads must be assessed in terms of access roads assets in place at the time the network was leased, and the incidence of costs associated with those assets incurred prior to 2000.

223. The proportion of the network serviced by access roads has not been provided by Arc. Arc's statement does not provide any information describing the location of access roads, or their construction dates.

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92 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 16.

93 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, pp. 16-17.

94 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 18.

95 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 18.

224. The ERA has excluded access roads costs from this determination on the following basis:

- access roads were in place at the time the lease was sold
- the network is not currently fully serviced by access roads
- formation and access roads are similar civil structures and may have been made concurrently to enable the making of formations.

225. Arc has failed to substantiate its proposed costs for access roads and in the absence of adequate data supporting Arc's proposal the ERA has given no weight to the value Arc has proposed after taking into account the above considerations.

226. In the absence of adequate data demonstrating the extent to which access roads are currently installed, the evidence that a portion of the network is not serviced by access roads and uncertainty with respect to the extent to which access roads are formed up with formations, the ERA has arrived at a construction replacement cost of zero for access roads.

Question 2.1

Do stakeholders have accurate information relating to the location of access roads, where they exist?

Question 2.2

Do stakeholders have a view as to whether access roads are formed up as a necessary precursor to some earthworks elements, to enable those earthworks to proceed?

Civil Structures – Bridges

227. Bridges allow for rail traffic to be elevated over obstacles (eg roads, rivers, gullies etc).

Arc Infrastructure Statement

228. Arc proposed a construction replacement cost for bridges of $485.8 million, comprising 2.4 per cent of its total construction replacement cost for all assets. Total bridge square meterage provided in Arc's model and report is 25,750$m^{2,}$ which equates to a cost of $18,865/$m^2$.

229. Arc has 229 bridges on its network.[96] The distribution of bridges across the network by network group is summarised in Arc's statement, categorised in five different bridges types.[97] Tables 4.8 to 4.11 in Arc's statement show the dimensions and costs for each type of bridge nominated by Arc. [98]

230. Arc provided costs for 'type 1' bridges (large precast box culverts) on a dollar per metre basis, and costs for the other four types of bridges on a cost per square metre basis.

231. Arc's specification of the modern equivalent asset for the bridges was based on its consideration of:[99]

- function of the existing structure type, required loading and span
- site location, ease of transportation and cranage requirements
- ongoing maintenance requirements over structure life.

232. Arc's data for the bridges on Arc's network included the following parameters:[100]

- bridge length
- bridge height
- bridge width
- number of spans and span length
- year of installation (where known).

233. Arc has advised that the bridge length and width data for all bridges in Arc's network were individually verified through satellite imagery.[101]

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96 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 32.

97 The location of bridges is described by Arc on a network group basis, which does not provide a definitive indication of bridges by route section. For this assessment, the ERA has provided, in its Excel costing model, a transformation of bridge costings from a network group basis to a route section basis, in a way which preserves all contractor's uplifts relevant to each route section. GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 34.

98 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, pp. 34-35.

99 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 32.

100 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 32.

101 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 33.

234. Arc has scoped its MEA to meet the closest comparable service standard to the existing asset. Arc has based the spans of MEA bridge replacement types on the structural depth where feasible and the existing span depths.[102]

235. A 24-tonne load rating was assumed for all bridges based on typical maximum axle loads on the network as provided by Arc, and with unrestricted operating speed.[103]

236. Five alternative modern structural forms were developed to retain the same service level as the existing assets. The structural forms were selected according to the principles shown in Table 4.7 of Arc's report. The structural forms reflect common rail type structures used in WA, either by the PTA or mining corporations. Due allowance has been made in adjustments for the assumed Arc loading compared to that required by these other rail operators. All structure types are based on ballasted sections.[104]

237. Arc submitted that the applicable span ranges shown in Table 4.7 of its report are based on typical application in Arc's consultant's experience and are the range within which each MEA type is likely to be the least cost and most efficient alternative.[105]

238. Arc provided as supplementary information, that two bridges were not included in the asset count in its model or report. The ERA published this advice as part of additional supporting material.

239. Arc's report and model showed a total of 25,750m^2 of bridge across the five bridge types. The ERA has included the additional bridges square meterage provided by Arc and has based its assessments on a bridge area of 27,598 m^2.

Comments in submissions

CBH

240. CBH submitted that the ERA should validate the proposed bridge costs as they are unreasonably high compared with historical benchmarks and should adopt escalated bridge rates for the ERA 2014 determination in the absence of other reasonable bridge rates.[106]

KML

241. KML noted significant revisions in Arc's supplementary materials increasing cost of bridges from $38.4 million to $66.5 million. KML submitted that the direct unit rate for type 1 bridges is $3,732/m^2, as opposed to Arc's equivalent $315,000/m^2.[107]

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102 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 33.

103 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 33.

104 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 33.

105 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 33

106 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 19.

107 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 17.

242. KML submitted that type 4 bridges originally had $8,500/m^2$, but this was revised to $57,612/m^2$, claiming increases are due to "abnormal bridge height." KML notes that only 60 per cent of bridge costs are affected by height. A doubling of cost would represent a reasonable upper limit, with $11,900/m^2$ for this type of bridge recommended by KML. [108]

RP Infrastructure advice

243. RPI reported that the construction replacement cost for all bridges provided by Arc equates to $9,480/m^2$ overall.

244. RPI advised that a sell rate of up to $10,482/m^2$ is typical for concrete bridges built on several other rail projects.[109]

245. On this basis, RPI recommended a construction replacement cost of bridges of $537.2 million.

ERA Considerations

246. The ERA estimates a construction replacement cost for bridges of $505.9 million. This compares to a cost of $485.8 million proposed by Arc.

247. This higher construction replacement cost is partly the result of Arc identifying two bridges missing from its model. The inclusion of these bridges resulted in an additional 1,848 m^2 of bridges being assessed, for a total of 27,598 m^2.

248. The ERA has incorporated the missing bridge data into its model and classified all bridges by the bridge types nominated in Arc's model. A cost build up was made by applying Arc's costings for these difference bridge types to the revised square metre dimensions.

249. RPI did not provide separate costings for the five bridge types shown in Arc's report. The ERA has assessed the area of each bridge type and used Arc's costings for each of these bridge types on the basis that this assessment is more accurate than applying one rate per square metre across all bridge types, as per RPI's recommendation. The ERA also applies contractor's preliminaries of 25 per cent in place of the 30 per cent used by Arc.

250. The ERA has considered CBH's views that escalated 2014 bridges cost should be used in the absence of other reasonable bridge rates which was quoted at $4,430 to $6,846 per m^2. CBH did not provide a source for this estimate.

251. The ERA considers that the proximity of Arc's submitted costing equivalent of $9,480/m, KML's suggested costing of up to $11,900/m^2$ for height-adjusted bridges, and RPI's costing of $10,482/m^2$ indicates the reasonableness of the range of estimates provided to the ERA.

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108 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 17.

109 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 19.

252. The ERA, in accepting the construction replacement cost proposed by Arc, has modified the figure by adopting the 25 per cent contractor preliminaries as recommended by RPI over the 30 per cent proposed by Arc. This difference accounts for the disparity between Arc's proposed construction replacement cost and the ERA's assessment of construction replacement cost.

Civil Structures – Tunnels

253. Tunnels are installed on railway networks, allowing road assets (owned by others) to pass over the rail.

Arc Infrastructure Statement

254. Arc proposed a construction replacement cost for tunnels of $64.2 million, comprising 0.3 per cent of its construction replacement cost for all assets.

255. Four tunnels have been identified across the network as shown in the Arc report:[110]

- Esperance – Esperance Wharf 1 tunnel
- Narngulu – Geraldton 2 tunnels
- Woodbridge South – Forrestfield 1 tunnel

256. Arc has assumed that the MEA dimensions of the replacement tunnel assets would be the same as the existing tunnels. This is on the basis that the MEA is to be defined to meet the closest comparable service standard to the existing asset.[111]

257. Arc has submitted that the relatively shallow excavation depth dictates that the least cost modern equivalent method of construction for tunnels of this type is most likely cut and cover. This method of construction involves excavating the trench, constructing the tunnel within the trench, then reinstating the surface above.[112]

258. In a brownfield setting, where the tunnels would be constructed under operating roads, it is likely that a contractor would construct these tunnels from the surface downwards. In this method, the side walls are constructed first, possibly as bored piles or slurry walls. The surface is then excavated and the roof slab constructed. Top side infrastructure can then be reinstated whilst excavation of the tunnel and base slab construction continues from below. This minimises the duration of any traffic diversions.[113]

259. Arc advised that the four tunnels across the network are MEA's as they have used the cut and cover method of construction. In its submission Arc has used a total length of tunnels of 723 metres.[114] Arc's construction replacement cost for tunnels was $64.2 million, giving an average cost of tunnels of $88,749 per metre.

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110 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 36.

111 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 36.

112 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 36.

113 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 36.

114 This includes twice the length of tunnels designated dual track, as these tunnels are each treated as two tunnels.

Comments in submissions

CBH

260. CBH considered the direct unit rate for tunnels provided by Arc to be reasonable.[115]

RP Infrastructure advice

261. RPI advised that it has reviewed the rate provided by Arc, and that the rate was reasonable.[116]

ERA Considerations

262. The ERA has determined a construction replacement cost for tunnels of $61.7 million. This compares to a cost of $64.2 million proposed by Arc.

263. The ERA notes RPI's recommendation that the construction cost for tunnels provided by Arc is reasonable, and CBH submitting that the Arc direct unit rate was reasonable.

264. The ERA, in accepting the direct job cost proposed by Arc, has modified the figure by adopting the 25 per cent contractor preliminaries as recommended by RPI over the 30 per cent proposed by Arc. This difference accounts for the divergence between Arc's proposed construction replacement cost and the ERA's assessment of construction replacement cost.

[115] CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 19.

[116] RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 6 January 2026, p. 19.

Civil Structures – Culverts

265. Culverts are reinforced structures, typically precast concrete, designed to safely carry water flow underneath railway tracks, to prevent damage to the railway infrastructure.

Arc Infrastructure Statement

266. Arc proposed a construction replacement cost for culverts of $290.2 million, comprising 1.5 per cent of its construction replacement cost for all assets.

267. Arc submitted that there are 6,614 culverts totalling over 115 km in length across the Arc network. Arc's MEA specification for culverts includes reinforced concrete pipes with a minimum 600mm diameter.[117]

268. Arc submitted that it has reviewed dimensions of all culverts and the MEA was selected on the following basis:[118]

- All culverts would be reinforced concrete pipes as these are the least cost option that is readily available and provide the same level of service as the existing assets.
- A minimum of 600mm diameter standard culvert sizing has been applied throughout. Smaller diameter culverts are available, but would result in a greater whole-of-life cost because of the increased maintenance commitment (smaller culverts are more prone to blockages, thus resulting in extra maintenance effort).
- Where no culvert length is known, the average length of all culverts across the network was used.

269. Arc has provided a count of culverts by network group. The totals at network level are:[119]

Table 2.4: Total Number of Culverts by diameter

Culvert Diameter (mm)	600	900	1200	1500	1800	2400	3000	3600
Total No.	5,033	562	214	216	213	242	107	27

270. The average construction replacement cost and total replacement cost by network group is shown in tables 4-15 to 4-17 of Arc's report.[120]

[117] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 37.

[118] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 37.

[119] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 38.

[120] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, pp. 38-39.

Comments in submissions

CBH

271. CBH submitted that Arc should adopt a direct unit cost of $410/m for 600mm culverts based on costs published in Rawlinson's Australian Construction Handbook 2025.[121]

KML

272. KML submitted that Arc's average rate for 1200mm culverts is stated as $13,900/m, but this is not consistent with the rates for 900mm and 1500mm culverts. On this basis KML recommends decreasing that rate from $13,900/m to $2,332/m.[122]

273. KML submitted that the costs provided by Arc are marginally higher than KML would have expected, but the overall impact is negligible.[123]

RP Infrastructure advice

274. RPI has advised its view that Arc has significantly under-valued culverts. RPI has rationalised pipe sizing and a revised unit cost applicable to 600mm pipes has been applied across the linear meterage indicated by Arc. RPI's higher value is reflective of its cost database.[124]

275. RPI recommended a cost for culverts estimated on this basis at $782.4 million.

ERA Considerations

276. The ERA estimates a construction replacement cost for culverts of $61.9 million. This compares to a cost of $290.2 million proposed by Arc.

277. The ERA found that three culvert lengths in the Arc model for three routes (Goomalling to McLevie, Amery to Muckinbudin, York to Brookton) appear to be overstated, being an order of magnitude 1,000 times the typical culvert length shown for other culverts on all routes in the model. The appropriate culvert lengths have been reviewed from information in the Arc statement and supporting information, and the ERA's model was updated.

278. The ERA considers that if Arc's culvert lengths for the three route sections noted above were reduced to the average length of all culverts, that Arc's submitted construction cost would be lower. The ERA expects that RPI's recommended construction cost would also be lower (by the same proportion) in this circumstance, as RPI has costed culverts on the basis of the lengths shown in the Arc model.

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121 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 19.

122 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 18.

123 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 18.

124 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 19.

279. The ERA does not have confidence in the culvert lengths used by Arc to calculate culvert construction costs. The ERA agrees with KML's submission that Arc's value is only marginally higher than KML would have expected, if it were based on the culvert lengths reported by Arc.

280. The ERA, has used a total culvert length of 47 kms, compared to Arc's proposed length of 115 km. This adjustment included a larger reduction for the bigger diameter culverts. The ERA has used the per metre construction rates proposed by Arc.[125] In accepting these rates, the ERA has modified the figure by adopting the 25 per cent contractor preliminaries as recommended by RPI over the 30 per cent proposed by Arc.

[125] In part, RPI provided a recommendation for the cost of 600mm pipe which was much higher than Arc's submitted cost.

Track – Ballast

281. Railway track ballast is a layer of crushed stone or gravel beneath railway sleepers that provides stability, drainage, and load distribution for the track.

282. Ballast is essential for supporting the weight of trains, restraining lateral movement of the track, preventing vegetation growth, and preventing water accumulation by allowing it to drain freely. The sharp edges of the crushed stone interlock to create a stable structure that holds the track in place.

283. The volume of ballast, when combined with sleeper spacing and formation stiffness, impacts the maximum axle loads the track can accommodate.

Arc Infrastructure Statement

284. Arc proposed a construction replacement cost for ballast of $1,351 million, comprising 6.8 per cent of its construction replacement cost for all assets.

~~285.~~ Arc submitted that it has specified the MEA for ballast based on all track being ballasted to the same depth as is currently in place. At the same time, Arc submitted that it does not have ballast depth or profile data, and cannot provide current ballast depths. Arc has assumed 250-300mm on all routes.

286. The replacement cost has been based on an average ballast density of 1.7 tonnes per cubic metre, using material sourced within 1.5 hours of the installation location.

287. Arc's submission equated the 250-300mm specification with the minimum standard set by the Australian Standard AS7630 (2017).[126]

Comments in submissions

Aurizon

288. Aurizon submitted that the ballast depth should be specified according to the maximum axle load, speed and length rather than on the current ballast depth.[127]

289. Aurizon submitted that the location supply rates of ballast are inconsistent, as the 2014 cost determination stated the supply rates to Kalgoorlie were 4 per cent higher than metro but Arc has employed a 50 per cent location adjustment factor for this determination.[128]

[126] Ballast material is assumed to be an 'aggregate and rock for engineering purposes' as per AS 2758 Part 7.

[127] Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, pp. 21-22.

[128] Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, pp. 22-23.

CBH

290. CBH submitted it was not able to see a reference to a minimum of 250mm of ballast depth in the Australian standard. CBH also noted AS7639 Track Structure and Support (2022) states "ballast depth generally varies between 200mm and 500mm". CBH also submitted that Arc appears to assume ballast specifications are the same for all gauges as it is standardised per kilometre. CBH advised the following ballast depth should be used:[129]

- NG mainline: 200mm
- NG siding: 200mm
- SG / DG mainline: 300mm
- SG / DG siding: 250mm.

291. CBH submitted that the ballast density should be 1.6 tonnes per m^3. This would be consistent with the ERA 2014 determination. CBH reverse calculated and stated that Arc used a direct supply and cart rate of ~$32 per tonne and an install rate of ~$40 per metre. CBH advised the reverse calculated unit rates seem unreasonable and are higher than escalated values from the ERA 2014 determination.[130]

KML

292. KML submitted that the assumptions regarding cross-sectional area calculations remain undisclosed.[131]

293. KML submitted that Arc's statement incorrectly applies the standard gauge ballast thickness standard (250-300mm) to the narrow gauge Midwest Line. KML stated that Arc's Code of Practice requires narrow gauge ballast thickness of 200mm (a reduction of 50-100mm compared to the reported standard), leading to significant deviations in the base assumptions for ballast quantities.[132]

294. KML referred to Arc's ballast cost of $78.2 million (supply and cart $54.6/$m^3$ and distributing, shaping and profiling of $23.6/$m^3$). Back calculations indicate the reported quantity is approximately 1,000,000m^3, however, applying the narrow gauge standard of 200mm with a cross sectional volume of 1.26m^3 per linear meter across a total track length of 304km results in a reasonable total ballast volume of 383,380m^3.[133]

295. KML submitted that Arc's failure to disclose the underlying assumptions for cross sectional area calculations makes it impossible to verify the reported rate. KML's consultant referred to a quarry quotation in Geraldton and the supply and cartage unit rate for ballast is approximately $71.74/$m^3$, without considering location factors.[134]

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129 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 23.

130 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 23.

131 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 19.

132 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 19.

133 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 19.

134 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 19.

RP Infrastructure advice

296. RPI's recommended costing for track (ballast, sleepers and rail) is for the installation of 60kg rail, on full depth concrete sleepers placed on minimum 300mm depth ballast.

297. Ballast is based on 300mm depth below sleeper, with ballast material obtained from a quarry within the vicinity of the track location, transported to site via truck and installed along the alignment. RPI has advised that 250mm is a reasonable minimum ballast depth for modern narrow gauge constructions, but that 300mm is costed on the basis that it is the standard bulk profile.[135]

298. RPI has provided a costing based on linear measurements. The ERA has confirmed that the Arc model does not contain adequate data to construct the modern equivalent asset in terms of a standard profile (width by depth).

299. RPI advised the construction replacement cost rate used by Arc is $256 per track metre. RPI has recommended an equivalent rate of $354 per track metre.[136]

300. On this basis, RPI recommended a cost of ballast of $1,865 million.

ERA Considerations

301. The ERA estimates a construction replacement cost for ballast of $1,859 million. This is 37.6 per cent higher than Arc's proposed cost of $1,351 million.

302. In 2014, the modern equivalent asset for ballast submitted by Brookfield Rail (Arc's predecessor), and approved by the ERA, provided an MEA for a ballast depth of 300mm for all narrow, standard and double gauge routes. The MEA was based on a ballast density of 1.6 tonnes/m^3 and the MEA provided for the use of concrete sleepers on all routes.

303. The modern equivalent asset for ballast in this determination has not been described adequately and is presently defined only by the ballast density (1.7 tonnes per m^3) and a depth range of between 250-300mm on all routes.[137]

304. The ERA does not have ballast profile data for any routes on the Arc network. This data does not appear in Arc's model.

305. The ERA accepts RPI's per route kilometre cost of ballast based on 300mm depth ballast. Despite the RPI cost being greater, the ERA accepts RPI's ballast profile as it supports RPI's specification of 60 kg rail across the network. This leads to the least cost outcome for the combined expenditure for rail, ballast and sleepers.

306. The ERA has noted KML's submission that the ballast indicated on the Midwest line is the standard gauge ballast profile, even though the line is a narrow gauge line. This track was initially laid as standard gauge on dual gauge sleepers and 300mm ballast, and was re-railed to narrow gauge prior to commissioning.

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135 Correspondence with RPI.

136 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 24 October 2025, p. 26.

137 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 43.

307. The ERA considers that Arc's specification of 300mm ballast on the Midwest line is consistent with the remainder of its ballast modern equivalent asset, said to coincide with what is actually on the ground.

308. The ERA considers that the ballast specification provided as a modern equivalent asset by Brookfield Rail for the 2014 determination is a reasonable specification to apply across the Arc network. This specification, which applied to routes relevant to CBH's 2013 access proposal, is 300mm depth on a standard profile at a ballast density of 1.6 tonnes per m^3.

309. Application of this specification to RPI's costing of ballast would require a reduction in cost of 6 per cent (being the difference between 1.7 and 1.6 tonnes per m^3).

310. The ERA has noted submissions referring to differences between ballast supply and install rates determined by the ERA in 2014 and the proposed rates applying to Arc's current determinations. The ERA considers that the costs of installing ballast for the construction of selected routes on an existing network (as per the 2014 determination) will be less than the costs of installing ballast across the whole network. This is due to availability/supply issues, and due to the likelihood that location factors will be more pronounced across regional areas for a replacement of the whole network, than they might be for construction of discreet sections, where a greater proportion of ballast requirements may be met locally.

311. The ERA, in accepting the construction replacement cost proposed by RPI, has modified the figure by reducing ballast density by 6 per cent from 1.7 to 1.6 tonnes per m^3, and by adopting the 25 per cent contractor preliminaries as recommended by RPI over the 30 per cent proposed by Arc.

Track – Sleepers

312. Sleepers are the beams which support railway tracks, holding them apart at a prescribed distance (railway gauge), and transferring the weight of the train to the ballast and the formation underneath.

313. Railway track sleepers have been made of water-resistant wood, steel or concrete. Concrete sleepers are the modern industry standard due to their strength, durability and low maintenance, and availability.

Arc Infrastructure Statement

314. Arc proposed a construction replacement cost for sleepers of $2,894 million, comprising 14.6 per cent of its construction replacement cost for all assets.

315. Arc advised that the existing network contains concrete, steel and timber sleepers. 73 per cent of the existing sleepers are installed at a density of between 1,250 and 1,500 per track kilometre. Twenty five per cent are installed at more than 1,500 per track kilometre and a minority (2 per cent) at less than 1,250 per track kilometre.[138] The total number of sleepers specified in Arc's model was 7,089,570.

316. Arc's cost of $2,894 million for 7,089,570 sleepers amounts to a construction replacement cost of $408 per sleeper.

317. Arc proposed that if the network were to be replaced today, it would need to comply with current standards which typically require sleeper density of 1,500 per track kilometre. This would mean 5 per cent more sleepers than exist on the network.[139]

318. Sleeper spacing, when combined with ballast depth and formation stiffness, impacts the maximum axle loads the network can accommodate. Arc has proposed, as the replacement cost is to be based on the closest comparable level of service to the existing network, that the replacement cost be based on replicating the existing sleeper spacing.[140]

319. Arc advised that neither timber nor steel sleepers are readily available in the current market. The closest comparable alternative available at least cost are concrete sleepers. These sleepers are the standard product in use today and have been specified by Arc as the efficient asset with the closest comparable service standard to the existing asset.[141]

320. Arc proposed a construction replacement cost for sleepers (by network group) in table 4-20 (page 42) of the Arc report. The totals are shown in Table 2.5.

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138 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 42.

139 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 42.

140 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 42.

141 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 42.

Table 2.5: Arc sleeper construction replacement cost total

	Track Length (km)	Number of Sleepers	Sleeper Supply Rate ($m per km)	Install Rate ($m/km)	Total ($ million)
TOTAL	**5,270**	**7,089,570**	**6.62**	**0.90**	**2,893.9**

Comments in submissions

CBH

321. CBH submitted that Arc has not differentiated sleepers by gauge, even though narrow and standard/dual gauge sleepers differ in terms of length weight and cost.[142]

322. CBH submitted that the corresponding sleeper prices used in the 2014 cost determination escalated by the increase in the Australian Road and Bridge Construction index (32 per cent) would be (a) narrow gauge $158 per (b) standard gauge $184 per and (c) dual gauge $224 per.[143]

323. CBH submitted that the following sleeper rates provided by its Tier 1 contractor should apply (a) narrow gauge $146 per (b) standard gauge $170 per, and (c) dual gauge $232 per.[144]

RP Infrastructure advice

324. RPI's recommended costings for track (ballast, sleepers and rail) is for the installation of 60kg rail, on full depth concrete sleepers placed on minimum 300mm depth ballast.

325. RPI calculated a weighted average rail sleeper supply rate based on current supply rates for NG, SG and DG sleepers, and Arc's sleeper count. RPI applied the weighted average rate to the total number of sleepers. Per unit cost of sleepers is the typical supply price for a full depth concrete sleeper being delivered to site on flat bed wagons and positioned with a "spider" sleeper laying plant.

326. RPI quoted a sell rate (including all location effects and contractor's on-costs) of $260 per sleeper. RPI advised this is based on current unit rates for concrete sleepers included in tender returns and contractors cost estimates.

327. RPI has assessed sleeper costs on a per-sleeper basis. Over the entire network, the location factor implied in RPI's analysis is 20 per cent on average. The ERA has examined Arc's model, and has determined that the location factor implied by Arc's analysis is 30 per cent on average.

328. In its cost calculations, RPI included a 10 per cent margin for contractor's profits, rather than the 9.5 per cent proposed by Arc and endorsed by RPI in its report.

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142 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 22.

143 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 22.

144 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 22.

329. RPI has recommended a construction replacement cost for sleepers of $1,842 million.

ERA Considerations

330. The ERA estimates a construction replacement cost for sleepers of $1,988 million. This is 31.3 per cent lower than Arc's proposed cost of $2,894 million.

331. The ERA has used the construction replacement cost rate of $216 per sleeper. This is equivalent RPI's recommended rate, but with the inclusion of only 9.5 per cent as contractor's profit margin.

332. The ERA has reviewed the sleeper count by gauge for each of the 1,784 track sections in Arc's model. The totals are detailed in Table 2.6.

Table 2.6: Arc sleeper count by gauge

	Total kms	No. Timber	No. Concrete	No. Steel
Narrow Gauge	3 598	2 352 607	701 136	1 570 559
Standard Gauge	1 357	656 631	915 258	439 190
Dual Gauge	312	5 846	448 335	8

333. The majority of sleepers on the network are narrow gauge sleepers. Narrow gauge route length is 65 per cent of the total, Standard gauge route length is 26 per cent of the total, and dual gauge route length is 6 per cent.

334. The ERA has considered the sleeper prices suggested by CBH in its submission. The ERA considers the price suggested by CBH, as a "Tier 1 contractor price" to be too low.

335. In its model, Arc has provided a cost for sleepers on a per sleeper basis. Arc's report shows sleeper cost on a dollar per route kilometre basis.

336. The ERA considers that the approach applied by RPI provides the most representative cost to replace the current sleeper configuration with concrete sleepers as a modern equivalent.

337. Given the lack of adequate information from Arc and balancing the information it has been presented with in submissions, the ERA considers RPI's representative cost for sleepers is reasonable notwithstanding the application by RPI of 20 per cent location factor loading and 10 per cent contractor's profit margins, amounts which the ERA considers should be 30 per cent and 9.5 per cent respectively.

338. The ERA has calculated sleeper costs on a per sleeper basis and has applied the location factors relevant to each route, which results in an average location factor adjustment of 30 per cent. The ERA has applied a 9.5 per cent margin for contractor's profit.

Track – Rail

339. Rails are hot-rolled steel beams designed to provide a strong, smooth surface for trains while supporting all lateral forces and wear.

340. The Australian Rail Standard provides for five rail profiles, namely 31 kg/m, 41 kg/m, 50 kg/m, 60 kg/m and 68 kg/m.

341. The 60 kg rail is the common standard for mainlines due to its high strength and ability to handle high speeds and heavy loads. The 60 kg rail has a lower long-term cost, despite having a higher initial cost. Over the long term, the benefits of 60 kg rail, in terms of track strength and extended rail life, outweigh the higher initial installation cost.

342. All current Australian re-railing projects use 60 kg rail. An example is the rail upgrade project between Adelaide and Tarcoola, where the older 41 kg rail is being replaced with 60 kg rail. All 41 kg rail on the ARTC network is being progressively replaced with 60 kg rail. The production of 41 kg rail in Australia has ceased, making replacement more complex and costly.

Arc Infrastructure Statement

343. Arc proposed a construction replacement cost for rail of $7,402 million, comprising 37 per cent of its construction replacement cost for all assets.

344. Arc provided rail costs on a per track kilometre basis. Arc's cost of $7,402 million for a track length of 5,270 kms equates to a construction replacement cost of $1.4 million per track kilometre.[145]

345. Arc's network comprises 41, 50 and 60 kg/m rail. The modern equivalent asset for rail was selected on the following basis:[146]

- Arc specified a minimum track weight of 41 kg/m as this is readily obtained by Arc, although it is not an industry standard product, and is specified on sections of track where this is closest to the existing rail weight. Otherwise, a minimum of 50 kg track has been specified.
- Rail weights are detailed by 1,785 track sections in Arc's model, and totals are assigned to network groups but not by applicable route.
- Arc submitted that the Public Transport Authority (PTA) currently use of 50 kg/m on ballasted track for all replacement rail projects and 60 kg/m in turnouts and concrete slab track.
- The modern equivalent asset for all sections using rail with weight between 51 kg/m and 60 kg/m specifies 60 kg/m, as this is the next readily available rail weight (and therefore least cost) with the closest comparable service standard to the existing asset.
- Arc has installed 50 kg and 60 kg head-hardened rail (as specified in the modern equivalent asset) where the use of this type of rail is related to tight radius curves.

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145 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, Table 4-19, p. 41.

146 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 124.

High lateral loads at curves with a tight radius result in significant grinding of the rail. The use of hardened steel minimises the wear and therefore results in lower whole-of-life costs.

- Although head-hardened rail costs are more expensive than standard rail costs, for the purposes of this assessment, the same (lower) rate has been used by Arc for head-hardened rail because it makes up just three per cent of the network and would therefore not have a material cost impact.

346. Arc's length of rail across allocated to network groups is detailed in Table 2.7.

Table 2.7: Arc Rail Length by network group

Network Group	Track Length (km)	41 kg/m rail (km)	50 kg/m rail (km)	60 kg/m rail (km)
Metro	108	0	280	32
EGR	830	21	1,678	171
Midwest	304	234	101	272
EBL	422	0	740	105
LBL	266	2	530	0
SWM	280	129	382	49
Collie	70	0	136	4
MR	569	188	945	5
Central	694	388	761	240
GSR	481	2	799	160
Lakes	278	163	392	0
CBH Sidings	110	61	139	20
Sidings & Other	44	9	69	19
Non-Operational	814	1,585	43	1
Total	**5,270**	**2,782**	**6,994**	**1,077**

Source: GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 41.

347. The table provides length of track and length of rail (i.e. length of rail is two times the track length for single track, and three times track length for dual gauge single track). This is extended by the supply and install rate, which varies because of the remoteness of the location, to the total construction replacement cost.[147]

348. Arc's rail cost across network group is detailed in Table 2.8.

[147] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 41.

Table 2.8: Arc rail cost

Network Group	Track Length (km)	41 kg/m rail ($m/km)	50 kg/m rail ($m/km)	60 kg/m rail ($m/km)	Install Rate ($m/km)	Total CRC ($m)
Metro	108	-	0.34	0.37	0.19	**165.5**
EGR	830	0.38	0.43	0.45	0.24	**1,264.1**
Midwest	304	0.43	0.44	0.48	0.25	**426.7**
EBL	422	-	0.51	0.56	0.29	**674.9**
LBL	266	0.50	0.51	-	0.29	**421.1**
SWM	280	0.40	0.41	0.45	0.23	**355.6**
Collie	70	-	0.41	0.45	0.23	**88.7**
MR	569	0.43	0.44	0.48	0.25	**780.3**
Central	694	0.40	0.41	0.45	0.23	**886.6**
GSR	481	0.43	0.44	0.48	0.25	**667.3**
Lakes	278	0.43	0.44	-	0.25	**379.9**
CBH Sidings	110	0.41	0.44	0.47	0.24	**148.6**
Sidings & Other	44	0.43	0.38	0.39	0.21	**58.2**
Non-Operational	814	0.43	0.44	0.45	0.24	**1,084.9**
Total	**5,270**					**7,402.4**

Source: GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 41.

349. The costs detail the relative cost for each network group, reflecting variations in on-costs and location price factors.

Comments in submissions

CBH

350. CBH submitted that Arc has proposed using 50 kg/m and 60 kg/m rail on the Burakin to Beacon route, which currently operates with 30kg/m rail. CBH submitted that 41 kg/m should be specified in this region (as was specified in ERA's 2014 Determination for Brookfield Rail).[148]

351. CBH provided a detailed list of recommended weights and unit costs for different gauges relevant for track replacement costs. [149]

[148] CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 19.

[149] CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 20.

KML

352. KML submitted that the current assignment of rail types to specific routes lacks alignment with actual infrastructure conditions and is not supported by sufficient engineering justification. Detailed commentary includes:[150]

- 60 kg/m rails – Arc's Report states 272 km (i.e. equivalent to 136 km track) but this is only applicable to Mullewa to Tilley Jn route. The reasonable quantity would be 196.2 km (98.1 km track)
- 50 kg/m – Arc's Report states 101km (50.5 km track) but Narngulu to Mullewa route should be equipped with 208.8 km (104.4 km track)
- 41 kg/m – Arc's Report states 234 km (117 km track), but remaining route from Tilley Jn to Maya should be equipped with 202.2 km (101.1 km track).

353. KML stated that following a correction based on actual supply rates for Pilbara delivery in the fourth quarter 2024, 41 kg/m supply rate should be $148 per metre. The Arc report originally cited $430 per metre, later adjusting this to $348 per metre. Likewise, the reasonable supply rate for 50 kg/m is $159, with the Arc report much higher than this (originally $440 and $353 in supplementary materials). Finally, for 60 kg/m rail, the reasonable supply rate is $181 per metre, rather than the rates put forward by Arc (originally $480 and $376 in supplementary tables). KML stated that "even though Arc has revised the direct rates, it still overestimates the supply costs for all rail types." [151]

RP Infrastructure advice

354. RPI agreed that the current rail configuration may be taken as the modern equivalent asset.

355. RPI advised that the current standard specification for bulk construction is 60 kg rail. While there are opportunities to substitute alternative weights, this depends on availability at scale and whether lower weight rail must be specially manufactured. Any specially made rail is likely to be more expensive, and therefore uneconomic, compared to 60 kg rail.

356. In relation to the KML statement "actual supply rates for Pilbara delivery in the fourth quarter 2024, 41 kg/m supply rate should be $148 per metre" RPI has advised that 41 kg rail is not currently manufactured in Australia, except by special order, and consequently at a higher price.

357. RPI's recommended costings for track (ballast, sleepers and rail) is for the installation of 60 kg rail, on full depth concrete sleepers placed on minimum 300mm depth ballast.

358. RPI has provided a unit rate based on current unit rates included in tender returns and contractor's cost estimates for 60 kg rail. RPI has quoted a sell rate of $1.1 million per track kilometre on this basis.

359. RPI did not allow for 3 rails on route sections which are dual gauge. Dual gauge routes comprise 6 per cent of Arc's network by route length.

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150 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, pp. 18-19.

151 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 18.

360. RPI has assessed rail costs on a per-kilometre track basis.

361. Over the entire network, the location factor implied in RPI's analysis is 20 per cent on average.

362. In its cost calculations, RPI included a 10 per cent margins for contractor's profits, rather than the 9.5 per cent proposed by Arc and endorsed by RPI in its report.

363. RPI provided a cost of $5,706 million for replacing the network with 60 kg rail on this basis.

ERA Considerations

364. The ERA estimates a construction replacement cost for rail of $6,277 million. This is 15 per cent lower than Arc's proposed cost of $7,402 million.

365. The rail asset class is Arc's largest asset component by CRC value. However, Arc's DORC Final Report only provides a one page analysis on rail assets.[152]

366. The ERA has examined the rail weights for each of the 1,785 track sections in Arc's model.

367. The ERA has re-allocated some rail weights between route sections. Arc has used the original MEA rail size for some tracks sections. The ERA has adjusted these to the existing rail size shown in Arc's model. This has had the effect of re-allocating some 50 kg track to 41 kg, and reallocating some to 60 kg. The net effect of this is to increase Arc's base cost of rail slightly overall.

368. The corrected totals by rail weight for all track sections are detailed in Table 2.9.

Table 2.9: ERA track by rail weight

Rail Weight	Rail Track Length km	Percentage of total
41 kg	2,922	54%
50 kg	1,410	26%
60 kg	1,094	20%
Total	5,427	100%

369. The majority of the rail on the network is 41 kg rail (54 per cent). The 50 kg rail is 26 per cent of the total, and 60 kg rail is 20 per cent.

[152] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 41.

370. The ERA has considered the prices suggested by KML for alternative rail weights. In conjunction with the meterage of each weight of rail recorded in Arc's model, this would provide a direct cost for rail of $1.6 billion which is 77 per cent less than the Arc quote and 71 per cent less than the RPI quote. KML's direct costs would be an outlier from the range of costs established by Arc and RPI. KML did not substantiate its suggested prices.

371. The ERA has calculated rail costs on a per track kilometre basis based on RPI's quote. As mentioned above, at paragraph 361, the location factor implied in RPI's analysis is 20 per cent on average. The ERA has examined Arc's model, and has determined that the location factor implied by Arc's analysis is 29 per cent on average. RPI provided a network-wide quote for rail, which effectively smeared location factors across the entire network. The ERA has costed rail on the basis of three rails on dual gauge routes and has applied the proper location factors for each route.

372. The ERA applies 60 kg rail across the network. The ERA recognises that a large percentage of the network is currently serviced with rail weights less than 60 kg. In considering efficient delivery of the replacement of the network, the ERA has reviewed RPI's standardised 60 kg rail cost including its associated cost implications for sleepers and ballast. The ERA considers that the standardised 60 kg rail approach is consistent with modern equivalent asset delivery and can be done at a delivered cost cheaper than that quoted by Arc for the different rail weights.

373. In using 60 kg rail across the network, to ensure consistency with sleepers and ballast, the ERA has accepted RPI's quotes on sleepers and ballast to support the heavier rail. This is examined further in the relevant sections on sleepers and ballast.

374. The details of the rail calculations are shown in the attached ERA model. The ERA has applied a 25 per cent margin for contractor's preliminaries and a 9.5 per cent margin for contractor's profit.

Track – Turnouts

375. A railway turnout (or switch) is a mechanical installation that allows a train to move from one track to another at a railway junction or where a spur or siding branches off a main line.

376. Manual turnouts are activated by levers, while the automatic turnouts are activated by electric, pneumatic or hydraulic switches.

377. Modern turnouts use motorized switches, remotely controlled, which are often integrated with automated systems under computer control.

Arc Infrastructure Statement

378. Arc proposed a construction replacement cost for turnouts of $455.5 million, comprising 2.3 per cent of its construction replacement cost for all assets.

379. To replicate the level of service provided by the existing turnouts on the network at least cost, Arc has based the MEA for turnouts on the following assumptions:[153]

- Any existing non-standard turnouts have been replaced with standard turnouts. Standard turnouts are 'off-the-shelf' configurations, with defined crossing angle, switch geometry, rail weight and crossing assembly, laid on straight mainline track with no customised geometry. These are most cost efficient to install and to maintain as spare parts can be easily sourced.
- All turnouts have been replaced with 60 kg per metre rail weight turnouts because this is the industry standard and therefore the least cost asset. Based on variability that Arc experiences in practice, turn outs costs were estimated based on rail gauge.
- All sleepers in the turnouts are assumed to be concrete.
- Where no specific turnout data is available, these have been assumed to be 1:10 standard turnout with 60 kg/m rail on concrete sleepers, as the most efficient and least cost configuration that would be used today.

380. The MEA turnouts assets and the construction replacement cost is shown Table 2.10 on a network group basis.

[153] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 43.

Table 2.10: Arc turnout MEA construction cost

Network Group	Number of Turnouts	Construct and Install Rate ($ million each)	Construction Replacement Cost ($m)
Metro	89	0.07	**44.8**
EGR	224	0.06	**95.8**
Midwest	58	0.05	**18.5**
EBL	66	0.06	**27.6**
LBL	39	0.04	**11.3**
SWM	115	0.04	**32.9**
Collie	19	0.05	**6.2**
MR	76	0.04	**23.5**
Central	95	0.05	**30.6**
GSR	86	0.05	**27.0**
Lakes	39	0.05	**13.2**
CBH Sidings	187	0.05	**60.6**
Sidings & Other	68	0.05	**23.9**
Non-Operational	119	0.05	**39.7**
Total	**1,280**		**455.5**

Source: GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 44.

Comments in submissions

CBH

381. CBH advised 60 kg turnouts is not an industry minimum and that the minimum is generally 47 kg to 60 kg depending on the closest weight to the mainline upon which they are installed.[154]

382. CBH advised Arc's base rate is reasonable except for 1:12 DG turnouts with concrete bearers which should be $474,400 per turnout.[155]

RP Infrastructure advice

383. RPI advised that the MEA proposed by Arc for turnouts is reasonable, and reflects the current installation of turnouts on the network.[156]

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154 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 24-25.

155 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 24.

156 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 20.

384. RPI advised that the rate provided by Arc is reasonable, in comparison with current costs for supply and installation of turnouts. RPI has recommended that Arc's construction replacement cost for turnouts of $455.5 million be accepted.

ERA Considerations

385. The ERA estimates a construction replacement cost for turnouts of $701.4 million. This is 54 per cent greater than Arc's proposed $455.5 million.

386. In its report, Arc has provided that there are 1,280 turnouts on its network.[157] The ERA has examined Arc's model and has established that these turnouts are located on 1,118 separate track sections. Arc has calculated the cost based on the assumption that there is one turnout per track section, thereby limiting the total number of turnouts to 1,118. There are 148 track sections with two or more turnouts. Therefore, the ERA has corrected the number of turnouts, which increases the turnout construction replacement cost compared to Arc.

387. It is unclear to the ERA how Arc applied contractor indirect costs, as these appear to amount to only 7.8 per cent overall. Arc appears to have applied the contractor's profit margin of 9.5 per cent only, and has not applied the margin to most of the dual gauge turnouts. The ERA has applied all contractor on-costs to turnout installation consistently with the application of contractor's on-costs for other asset classes. This correction to the application of contractor on-costs increases the turnout construction replacement cost compared to Arc.

388. The ERA notes CBH's suggested cost for 1:12 turnouts. With respect to CBH's submission that 60 kg rail is in excess of what is required for turnouts, RPI advised that standard turnout installed are 60 kg turnouts, regardless of track loading.

389. The inclusion of the correct number of turnouts and the correct contractor's margins has resulted in the ERA increasing turnout costs from that proposed by Arc.

[157] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 44.

Signalling and communications/control systems

390. Signalling and communication/control assets play a crucial role in the operation of a rail network by:

- controlling train movements to minimise safety risks – to prevent accidents and protect network users
- managing traffic movements to achieve planned capacity, minimising congestion and enabling efficient movement of trains.

391. Signalling and communication/control systems include assets on trains and across the network, managed and operated at control centres.

392. Control centre buildings are costed separately as part of the buildings asset class.

Arc Infrastructure Statement

393. Arc proposed a construction replacement cost for signalling and communications/control systems of $4,309 million, comprising 22 per cent of its construction replacement cost for all assets.

394. The service standard provided by the existing signalling and communications/control infrastructure is dependent on the control systems deployed across the network. There are two signalling and communications systems in use by Arc on the existing network. These are:[158]

- Train Order Working; and
- Centralised Train Control.

395. Arc provided two alternatives for signalling and communications. Arc indicated that the first alternative (alternative A – replacement of system like-for-like) was the option to be included in their statement, and the option to be assessed by the ERA.

396. The construction replacement cost submitted by Arc as a component of its DORC determinations is the construction replacement cost for alternative A.

397. The Arc report describes the existing application of signalling and communication/control assets on the Arc network. This forms the basis of the modern equivalent asset for signalling and communications assets (replacement like-for-like).

398. Arc has specified modern equivalent assets for the signalling and communication/control infrastructure based on the existing asset inventory provided by Arc's assessment of current levels of service.

399. Arc takes this to mean that the replacement should assume the same control systems as currently exist, but using modern equipment and materials, and that underground cabling would be fibre optic, rather than the current mixture of copper and fibre optic.[159]

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158 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 46.

159 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 48.

Description of Arc's communication system

400. The service standard provided by the existing infrastructure is dependent on the control systems in use by Arc on the existing network. The control systems currently in use are:

- Train order working – where a train is given authority to move along a limited track section (usually between two passing loops). This is typically communicated verbally by portable telephone between the train driver and the train controller, meaning there is no need for train detection systems.
- Centralised train control – the train operates from lineside signals, which are controlled from a train control centre. If train detection systems are employed then the system is referred to as rail vehicle detection.

401. Train order working systems are primarily used in low traffic or geographically remote parts of the network. Arc operates this system on the Esperance to Hampton line, West Kalgoorlie to Leonora, Avon Yard to Albany and associated branch lines.[160]

402. The utilisation of centralised train control and train order working systems across the network is described in Table 4-25 of the Arc report, and Arc has proposed that this be adopted as the modern equivalent asset for signalling and communications.

403. Arc currently operates centralised train control systems with rail vehicle detection from Perth to Bunbury Port and from Perth to Kalgoorlie. Arc also used rail vehicle detection between Brunswick East to Collie. Arc's centralised train control systems generally use Microlok computer-based interlockings, with rail vehicle detection being provided by track circuits.[161]

404. Rail Vehicle detection on the Perth to Kalgoorlie route currently uses legacy copper wires and not fibre optics.

405. Signalling and communications infrastructure are often proprietary products, supplied and installed by specialist contractors. Arc's procurement model assumes that the specialist contractor for the signalling and communications assets would be engaged and managed by the principal (Tier 1) contractor. The replacement cost includes the principal contractor's costs for the procurement and management of these works, as well as adjustments for location.[162]

406. Signalling and communications/control asset data by track section is provided by Arc in its model and is shown in the following categories:[163]

- Fibre optic communications network
- Signalling and control system assets
- Control centre signal assets

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160 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 46.

161 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 46.

162 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 48.

163 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 48.

- Communications assets
- Radio Masts.

Fibre optic network

407. Arc assumes that a fibre optic cable would be installed along sections of the network that currently operate centralised train control because this most closely replicates the service offered by the existing infrastructure.[164]

408. Table 4-26 in Arc's report shows the length of fibre optic cabling within each signal and network group and the direct replacement costs by network group. The supply and install rates vary by network group because of the location factor that reflects the remoteness of each group Signalling and control system assets.[165]

Signalling and control system assets

409. Signalling and control system assets are the physical signals, boom gates and interlockings, track side equipment, and all other track circuits that comprise the signalling installations on the network. The assets comprising signalling and control systems assets are detailed on page 50 of Arc's report.

Control centre signal assets

410. There are two control centres on Arc's network which contain signals assets. These control centres are located at Midland and Avon. The cost for these assets has been distributed across the network where signalling assets exist. This is because the signals within this asset group service the whole network. Table 4-29 in Arc's report details the construction replacement cost for control centre signals assets, by network group.[166]

Communications assets

411. Communications assets include equipment rooms, radio base stations (radio masts are identified separately), and associated signalling huts and cabins (not the actual two centralised control centre buildings). The quantities of each modern equivalent communications asset are summarised in Table 4-30, by network group. This also presents the direct unit cost rate (unfactored by location) for each item.[167]

Radio masts

412. Arc has identified radio masts separately to other signalling and communications assets. This is because radio masts may provide coverage over more than the route section in which they are located. To address this, Arc has considered that all radio masts provide coverage to all route sections to which they are proximate to. Arc has established this using two methods:[168]

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164 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 49.

165 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 49.

166 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 51.

167 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 52.

168 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 54.

- Where the named location of the radio mast matched the name of a route section, or part of the name of a route section, Arc has assumed it provides coverage over all associated route sections. For example, the radio mast at Amery was assumed to provide a service to the following route sections:
  - Amery to Burakin
  - Amery to Mukinbudin
  - Goomalling to Amery.

  In these situations, Arc has assumed the radio mast provides a service to each route section in proportion to the total combined length of all route sections that it serves (in kilometres).

- Where the named location of the radio mast did not match the name of a route section, Arc assigned it to the route section it is closest to by visual inspection of its location. The cost of that radio mast was then allocated to that route section.

413. As well as recognising that a radio mast may provide a service to more than one route, Arc also recognised that a route may receive a service from more than one radio mast. This was achieved by summing the total proportions of all radio masts that served each route.[169]

414. Arc used this approach to allocate the 114 radio masts across the Arc network to each network group as shown in Table 4-32 of the Arc report. Arc has noted that the average location factors for each network group will differ from those in the other assessments because of the geographical spread of the assets within each network group.[170]

Comments in submissions

CBH

415. CBH submitted that Arc should remove all proposed asset specific mark-ups from signalling and communication/control system assets, including specialist contractor preliminaries (35 per cent) and specialist contractor overheads and profits (20 per cent) (see unit costs indirect cost).[171]

416. CBH considers that fibre optic cable installation has not been applied appropriately in the Arc model. Fibre optic cable has been priced for the entire Kalgoorlie to Esperance line (380 km), even though only 16 km of the line between Kalgoorlie and Hampton is operated under centralised train control, with the remainder operated under train order working. CBH submitted that this 364 km section should be removed from the costing.[172]

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169 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 54.

170 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 54.

171 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 14.

172 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 27.

417. It considers that Arc's average fibre optic supply, test and commission and installation rate of $504/m (excluding indirect costs) is significantly higher than the cost provided by CBH's Tier 1 construction contractor ($99/m).[173]

418. CBH is of the view that Arc should provide the rationale or justification for the quantities and unit rates for communications assets for each network group and that these should relate to replacement of the communication assets/buildings themselves. In addition, Arc should provide additional detail on the build scope for each communication asset so that they can be assessed. [174]

419. ERA should validate all the proposed radio mast asset costs to ensure that they reflect appropriate quantities/specifications and the lowest cost to replace.[175]

420. CBH estimates that Arc's 2025 signalling and communications costs are on average four times the escalated 2014 values. CBH submits that this is partly due to excessive margins (62 per cent to direct costs reflecting multiplicative margins for specialist signalling contractor preliminaries (35 per cent) and overheads and profit (20 per cent). A further 49.5 per cent margin was then applied to the total signalling and communications replacements costs (principal contractor risk allowance 5 per cent, preliminaries 30 per cent and overheads and profits 9.5 per cent. A further 22 per cent margin is then applied for railway owner's project costs.[176]

RP Infrastructure advice

421. RPI assessed signalling asset costs across the following key areas:

- Fibre Optic cabling
- Signalling
- Communications
- Radio Masts.

422. These are treated as works that would be performed by specialist signalling and communications subcontractors. RPI indicated that, while these costs will be unique to the specific locations, track layout, and other rail corridor requirements, indicative benchmarked unit rates have been calculated from other signalling and communications projects being proposed or constructed across both urban and freight routes in Australia.

423. RPI has applied these typical rates to the track length or route length quantities as appropriate as shown by the asset counts.

- Fibre optic cabling has been costed for those route lengths as advised in the Arc cost build up.

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173 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 28.

174 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 29.

175 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 29.

176 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, pp. 26-27.

- Signalling systems have been split into communications based train control and train order working systems based on the information and track lengths provided by Arc.
- Communications systems have been calculated based on the route lengths as used in Arc's costing.
- Radio Masts have been calculated based on typical mast spacings along the route lengths as used in Arc's costing.
- Uplifts for locality adjustment, and main contractor's overheads and margin have then been added onto the resulting costs, noting that the main contractor's overheads will be required given that they must manage, maintain, coordinate, and integrate the works being undertaken by the specialist subcontractors.

424. RPI used the quantum of assets as proposed by the Arc submission, as a basis for its costing.

425. RPI arrived at a construction replacement cost of $4.2 billion for signalling and control assets.

ERA Considerations

426. The ERA estimates a construction replacement cost for signalling of $2,146 million. This compares to a cost of $4,309 million proposed by Arc.

427. Across all components of signalling costs, the ERA has accepted RPI's advice that the contractor preliminaries should be reduced to a 10 per cent uplift for the primary contractor given the specialist contractor also has a contractor preliminary of 35 per cent.

428. CBH made comments in its submission about the quantum of signalling contractors on-costs, which are compounded. The ERA accepts that signalling installation is a specialist contracting field, and that dedicated contractors are employed by the principal contractor for this work. The ERA considers that compounding of contractors on-costs is appropriate in these circumstances.

429. The ERA does not agree with CBH's contention that the entire Esperance branch line is specified as having centralised train control signalling in Arc's MEA modern equivalent asset. Centralised train control is specified as far as Hampton only.

430. CBH submitted that Arc should provide the rationale or justification for the quantities and unit rates for communications assets and should provide additional detail on the build scope for each communication asset. The ERA notes that Arc's modern equivalent asset reflects the current asset count on the ground. RPI has costed these on the basis of the modern equivalent asset, not in the context of the current build scope for each asset.

431. The ERA has conducted a bottom-up analysis of the signalling and communication assets by each of the four categories provided by Arc. The analysis has confirmed $2,146 million of signalling assets, and is detailed below.

Fibre Optic Network

432. The ERA estimates a construction replacement cost for fibre optic cabling of $1,067 million. This is 32 per cent lower than Arc's proposed cost of $1,565 million.

433. The ERA has examined the length of fibre optic cabling proposed by Arc of 1,428.5 km in its model and has identified that this is the length of cabling required for communication based train control signalling (Alternative B), not for the centralised train control which was nominated by Arc. The length of cabling required for centralised train control is identified in Arc's model as being 1,215.75 km.

434. As Arc nominated Alternative A as the basis for the MEA, and as the ERA is assessing Alternative A, the ERA has made its cost estimates on the basis of 1,215.75 km of fibre optic cable.

435. The ERA has accepted Arc's proposed direct cost rate for fibre optic cabling, adjusting the primary contractor preliminaries from 30 per cent to 10 per cent.

436. The adjustments to fibre optic length and to contractor preliminaries accounts for the difference between Arc and ERA in fibre optic network cost.

Signalling and Control Systems Assets

437. The ERA estimates a construction replacement cost for signalling and control systems of $822.8 million. This is 15.4 per cent lower than the Arc proposed cost of $972.7 million.

438. There are 25 asset types included in the signalling and control systems.[177]

439. Arc has included two control centres which were labelled as equipment rooms. The ERA has excluded both of these from the signalling asset base to ensure control centres are not double counted. Submissions are invited on the correct manner of inclusion of these assets.

440. The costing for all signalling and control system assets have been built up using the rate provided by Arc, while adjusting the primary contractor preliminaries from 30 per cent to 10 per cent.

441. The adjusted contractor preliminaries and minor adjustments to asset classification account for the differences between Arc and ERA costings of signalling and control systems assets.

Control Centre Signal Assets

442. The ERA estimates a construction replacement cost for control centre signal assets of $97.7 million. This is 32 per cent lower than the Arc proposed cost of 143.8 million.

443. The ERA accepted the inclusion of signalling assets from both active control centres.

[177] GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 50.

444. Arc applied the location cost factor to the control centre signal assets after allocating the cost for each route section. The ERA agrees with CBH that this is not the correct application of location cost factor s it should account for the cost of supplying materials on location. That is, the location cost factor must be applied to the location of construction of the control centre and not applied to the service the control centre provides at different parts of the network. The ERA has applied a location cost factor of 1.1 to the Avon Control Centre (on the Toodyay to Avon West route section) and a location cost factor of 1.0 to the Midland Control Centre (on the Midland to Woodbridge South route section). It is unclear from Arc's model which route section the Midland control centre is located. The ERA distributed the construction replacement cost of control centres after location factor is applied.

445. Arc allocated the control centre assets costs to route sections based on the spread of asset costs from fibre optic communication network, signalling and control system assets, communication assets and radio masts. Arc stated in its report that the costs for the control centre signal assets are distributed where signalling assets exist. The ERA has allocated control centre signal assets to the distribution of signalling and control system assets only as this is seen to best align with the purpose of control centre signal assets. This impacts only the allocation of costs to route sections, and not the overall construction replacement cost. The ERA intends to investigate this further for its final decision.

446. The ERA agrees with the direct costs of the control centre signal assets proposed by Arc. Across all components of signalling costs, the ERA has accepted RPI's advice that the contractor preliminaries should be reduced to a 10 per cent uplift for the primary contractor given the specialist contractor also has a contractor preliminary of 35 per cent. The application of location adjustment factor to the location of the control centres and adjusting the primary contractor preliminaries to 10 per cent from 30 per cent account for the difference between the Arc and ERA costings of control centre signal assets.

Communications Assets

447. The ERA estimates a construction replacement cost for communications assets of $40.7 million. This is 15 per cent lower than the Arc proposed cost of $48 million.

448. The ERA accepts the direct costs, unit quantity and location of all communication assets.

449. The ERA seeks further clarification on the distinction between equipment rooms in the signalling and control assets and the communication assets.

450. The adjustment of primary contractor preliminaries to 10 per cent from 30 per cent account for the difference between Arc and ERA costing of communications assets.

Radio Masts

451. The ERA estimates a construction replacement cost for radio masts of $118.1 million. This is 22 per cent lower than the Arc proposed cost of 151.8 million.

452. CBH submitted that the ERA should validate all the proposed radio mast asset costs to ensure that they reflect appropriate quantities/specifications and the lowest cost to replace.

453. Arc stated in its report that there are 114 radio masts across the network. The ERA has adopted a construction replacement cost for 78 radio masts across the network. This reduction in assessment of radio mast numbers is due to consideration of (1) the minimum number of radio masts required on the network and (2) the existence of radio masts no longer in operation.

454. Arc outlines an MEA in its model for radio masts at a minimum 50 km intervals across the network. Arc calculated the minimum radio mast interval across network groups and not across individual route sections. Arc did not explain why additional masts are required if the network is able to operate on current capacity without the additional radio masts. The ERA has not added additional radio masts on this basis.

455. Arc includes seven radio masts in its inventory which are not in use or have been removed from the network. These are the Buracoppin, Cookernup, Darrine, Kalgoorlie Radio, Mundijong, Norseman, Pinjarra and Salmon Gums radio masts. These have been marked in Arc's model as either to be removed or to be replaced and have no next scheduled inspection date. The ERA has removed these from its assessment.

456. There are four radio masts which have been nominated as not belonging to Arc, marked as belonging to Telstra, Philips mast and two belonging to Vodafone. The cost of these masts have been included by the ERA as they are required for the operation of the network.

457. The remaining 78 radio masts have been allocated to route sections and had their location factor applied before allocation across the network. Where a radio mast is allocated against multiple route sections, the ERA has allocated the radio mast to the largest route section. This does not impact the total cost or allocation of the cost of radio masts.

458. The ERA has allocated radio mast costs on a route kilometre basis across the network, spreading the cost of radio masts evenly across the 5,269.64 km of the network. The ERA invites further submissions on the appropriate method of allocating radio masts.

Buildings

459. Buildings are signalling control centres, depots and maintenance facilities. Centralised control centres and depot/maintenance facilities provide services over the entire network, despite being located in discreet locations.

Arc Infrastructure Statement

460. Arc proposed a construction replacement cost for buildings of $162.2 million, comprising less than 1 per cent of its construction replacement cost for all assets.

461. Costs in this category comprises (1) control centres and (2) maintenance depots. Arc's statement included direct costs for buildings as follows:

- Control centres $24.7 million
- Depots $13.8 million
- Maintenance Facilities $123.7 million.

462. There are only two active control centres, and the costs for these are allocated on a route kilometre basis, only to those routes where signalling is included.

463. The construction replacement cost for buildings by network group is shown in Table 4-38 of Arc's report. Arc has submitted that the replacement cost has been based on unit rates benchmarked against relevant recent projects, for example:[178]

- Centralised control centre - benchmarked against PTA's Public Transport Operations Control Centre, adjusted to account for differences in scope of works and escalation between the date of tender and the valuation date.
- Maintenance facilities - benchmarked against numerous PTA depots, including (but not limited to) Bellevue Depot, Claisebrook Depot, Nowergup Depot and Welshpool Depot, adjusted to account for differences in scope of works and escalation between the date of Tender and the valuation date.
- Depots - benchmarked against PTA and other depots based on building and external area and facilities.

464. Arc's submitted that its costs for buildings are comparable to recent costs incurred by the PTA for similar facilities.

Comments in submissions

CBH

465. CBH submitted that there was no information on buildings in previous ERA 2009 and 2014 determinations and Arc's statement provided no explanation as to why buildings were not included in the earlier determinations.[179]

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178 GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, p. 61.

179 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 29.

466. CBH submitted that the ERA should validate building and plant, tools and equipment costs and quantities to ensure they are appropriate.[180]

467. CBH submitted that Arc should make clear what train control centre assets are included in signals control centre assets so that they can be reviewed. [181]

KML

468. KML submitted that section 1.1 of Arc's statement states depots and other facilities are excluded from replacement costs, however, Arc has included 60.4 m^2 of depots without providing further explanations.[182]

RP Infrastructure advice

469. RPI advised that in the absence of detailed information the rates for control centres and depots and maintenance facilities seem reasonable and recommended that the proposed direct costs for buildings be accepted as reasonable.[183]

ERA Considerations

470. The ERA estimates a construction replacement cost for buildings of $144.7 million. This compares to a cost of $162.2 million proposed by Arc.

471. The ERA has accepted RPI's recommendation that the direct costs for buildings proposed by Arc are reasonable.

472. The ERA, in accepting the direct job cost proposed by Arc, has modified the figure by adopting the 25 per cent contractor preliminaries as recommended by RPI over the 30 per cent proposed by Arc. This contractor cost change accounts for the difference between Arc's proposed construction replacement cost and the ERA's assessment of construction replacement cost.

473. In relation to KML's assertion that Arc has indicated that depots and maintenance facilities are excluded, the ERA sees that KML has cited a part of Arc's statement which refers to rollingstock maintenance depots and above-rail depot facilities. Above-rail facilities are not assessed as below-rail costs.

474. CBH raised concern about the lack of building information in past determinations. For this determination, the ERA has confirmed the existence of the facilities referred to by Arc by satellite imagery.

475. The ERA agrees with Arc that control centre costs should be allocated to route sections in proportion to the incidence of signalling costs, consistent with accepted industry and regulatory approach, and that depot costs be allocated evenly on a route length basis across the network.

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180 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 30.

181 CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 28.

182 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 21.

183 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 20.

476. Consistent with the Arc proposal, the ERA has included the following three buildings in its assessment. The ERA considers that these are not above-rail assets.

- Kenwick welding facility
- Kewdale training facility
- Hampton rail siding

477. Arc stated in its report that it would size each maintenance facility at each of the ten identified location to the average size of maintenance facilities across the network. Arc did not do this in its model, but applied the average to the Pinjarra facility only, preserving the actual size (and associated cost) of all other maintenance facilities.

478. The ERA has averaged the direct costs for maintenance facilities across all locations.

Associated Track Structures – Level Crossings

480. A level crossing is required where a railway track intersects with a road or path at the same elevation, requiring vehicles or pedestrians to cross the railway tracks.

481. There are two types of level crossings:

- Active crossings – use warning systems that activates as a train approaches, such as boom gates, audible warning systems, lit signs and flashing lights.
- Passive crossings – use signs only to inform vehicles or pedestrians that they are approaching a railway line.

482. Arc does not own any vehicle level crossings, as these are owned by Main Roads. Arc owns and maintains active and passive pedestrian crossings.

Arc Infrastructure Statement

483. Arc proposed a construction replacement cost for level crossings of $33.6 million, comprising 0.2 per cent of its construction replacement cost for all assets.

484. There are 227 pedestrian level crossings, including 7 situated on non-operational lines.[184]

485. There is no data on the condition or installation dates for level crossings in Arc's report.

Comments in submissions

KML

486. KML submitted that there is inadequate data to assess Arc's costing of level crossings.[185]

RP Infrastructure advice

487. RPI advised a cost of $39.3 million for the 227 pedestrian level crossings.[186]

488. RPI advised:[187]

> *Based on our current Level Crossing Cost Data compiled from recent projects across Australia the unit rate for a new level crossing has been increased to better reflect the expected construction cost of an average public level crossing. This is an average cost noting that some will be passive and others will be active crossings, but it is assumed that all crossings require a sealed surface, fencing and either passive signage or active flashing lights or barriers.*

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184 Data provided by Main Roads WA through email correspondence.

185 Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 33.

186 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 21.

187 RP Infrastructure, *Initial Report (Review of Arc Infrastructure's Sections 47J and 47K submissions) FINAL,* 23 October 2025, p. 19.

ERA Considerations

489. The ERA estimates a construction replacement cost for level crossings of $34.2 million. This compares to a cost of $35.6 million proposed by Arc.

490. The ERA understands that there are 227 pedestrian crossings on the network with seven of those being on non-operational lines.[188] The ERA has excluded non-operational crossings.

491. The ERA understands the maintenance for the assets is carried out by the State Government. On this basis, it may be claimed that Arc does not have ownership of pedestrian crossings. The ERA considers that maintenance costs are included in operating costs as outlined in the Costing Principles. Paying for maintenance does not change ownership of an asset.

492. Where the ERA has received information outlining the State Government having contributed to the construction of the existing pedestrian rail crossings, these contributions are included as capital contributions.

493. On the basis of the costing provided by RPI, the ERA considers Arc's submitted construction replacement cost for level crossings is reasonable.

494. The ERA, in accepting the construction cost proposed by Arc, has modified the figure by adopting the 25 per cent contractor preliminaries over the 30 per cent proposed by Arc. This difference accounts for the disparity between Arc's proposed construction replacement cost and the ERA's assessment of construction replacement cost.

[188] Data provided by Main Roads WA through email correspondence.

Miscellaneous

495. Costs for this asset category include:

- plant and equipment
- walkways
- signage.

496. These are costs which do not fit neatly into any other asset category. Costs for these asset classes are typically allocated across the network to route sections on a route-kilometre basis.

Arc Infrastructure Statement

497. Arc proposed a construction replacement cost for miscellaneous of $139.9 million, comprising 1.3 per cent of its construction replacement cost for all assets.

498. Arc's statement included direct costs for miscellaneous assets detailed in Table 2.11.

Table 2.11: Arc's Proposed Miscellaneous Assets

Asset Type	Construction Replacement Cost ($ million)
Plant and equipment	61.8
Walkways	70.1
Signage	8.1
Total	**263.6**

Source: GHD Advisory, *Applicable Railway Infrastructure DORC Final Report – Arc Infrastructure Pty Ltd*, 06 June 2025, pp. 61, 68.

Comments in submissions

Aurizon

499. Aurizon submitted that Arc has undertaken a high-level desktop assessment, with little reference to actual age or condition. Aurizon noted that no evidence is provided as to whether access walkways are installed.[189]

CBH

500. CBH submitted that the ERA should also validate the specifications underpinning Arc's walkway quantities and costs, and if not reasonable, adopt the specifications approved in the ERA's 2014 Determination.[190]

[189] Aurizon, *Arc Infrastructure Proposed Depreciated Optimised Replacement Cost Submission to ERA*, 11 August 2025, p. 25.

[190] CBH Group, *CBH submission on Arc Infrastructure's statement of the depreciated optimised replacement cost and statement of the depreciation schedule published on 16 June 2025,* 11 August 2025, p. 31.

KML

501. KML submitted that Arc failed to specify the exact location or functional basis of walkways. According to current railway layout, personal access can be achieved through the formation shoulder, eliminating the need for additional dedicated structures. Even under special circumstances, walkways are only applicable to support train inspections, making them non-essential network facilities.[191]

RP Infrastructure advice

502. RPI has recommended a construction replacement cost for these items as submitted by Arc, totalling $139.9 million.

ERA Considerations

503. The ERA estimates a construction replacement cost for miscellaneous of $136.9 million. This compares to a cost of Arc's $139.9 million.

504. The inclusion of plant and equipment, walkways and signage are valid assets to include.

505. We have adjusted Arc's cost by adopting the 25 per cent contractor preliminaries over the 30 per cent proposed by Arc. This difference accounts for the disparity between Arc's proposed construction replacement cost and the ERA's assessment of construction replacement cost.

506. The comments in submissions from Aurizon, CBH and KML relate to the specification and age of walkway assets, in addition to comments on the extent to which walkways are installed on the network.

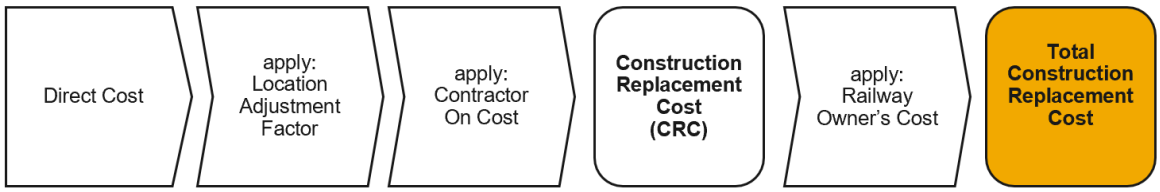
507. The ERA considers that the Arc model provides an adequate MEA for walkways, which reflects the installation of walkway assets across the network.

508. The cost of walkways constitutes more than half of the total costs of miscellaneous assets. There were no comments in submissions relating to the other elements of the miscellaneous asset class, namely plant and equipment, and signage.

509. The ERA has allocated the plant and equipment component of miscellaneous assets only to those routes which are operational.

[191] Karara Mining Limited, *KML's Submission Regarding Arc's DORC Report*, 11 August 2025, p. 22.

Total construction replacement cost



510. Total construction replacement cost, for each route, is equal to the construction replacement cost identified for the route uplifted by railway owner's costs.

Arc Infrastructure Statement

511. Arc did not provide a measure of total construction replacement cost for route sections in its statement. Arc applied railway owner's costs after optimisation of the construction replacement cost.

ERA Considerations

512. The ERA's total construction replacement costs, by route section, is detailed separately in the ERA's *DORC valuation model.*

513. The ERA's assessment of total construction replacement costs by asset class is shown below in Table 2.12. Total construction replacement cost by asset class is aggregated across all route sections. Note these figures include the 19.3 per cent railway owners cost uplift.

Table 2.12: Total construction replacement cost by asset class ($ million)

Asset class	Sub-assets	ERA
Right of Way	Clearing & grubbing, Cuttings/embankments, Formation, Access roads	1,898
Civil Structures	Bridges, Tunnels, Culverts	751
Track	Ballast, Sleepers, Rail, Turnouts	12,913
Signals and Communications	Fibre Optic, Signalling and Control Systems, Control Centre Assets, Communication, Radio Masts	2,560
Buildings	Buildings (Control Centres, Maintenance Facilities and Other Buildings)	173
Associated Track Structures	Pedestrian Level Crossings	41
Miscellaneous	Control Centres, Depots, Maintenance facilities, Plant and Equipment, Walkways, Signage	163
Total all assets		**18,500**

514. The ERA estimates the aggregate of total construction replacement costs across all routes as $18,500 million.

515. The largest contributor to the ERA's total construction replacement cost is track at $12,913 million. This constitutes approximately 70 per cent of the total construction replacement cost. Excluding railway owner's costs gives a total of $10,824 million, which compares with a track construction replacement cost provided by Arc of $12,103 million (excluding railway owner costs). The main drivers of the ERA's reduction are in lower costs for the asset classes of track and signals and communications.

516. Signals and control assets are the second largest asset category of the ERA's total construction replacement cost at $2,560 million or 13.8 per cent. Excluding railway owner's costs gives a total of $2,146 million, which compares with Arc's proposed $4,309 million and represents approximately 50 per cent reductions. The ERA has conducted a bottom up analysis of signalling assets and has removed parts of that proposed by Arc and adjusted unit rates.

Appendix 1 List of Tables

Appendix 2 List of Figures