QUEENSLAND COMPETITION AUTHORITY: QUEENSLAND RAIL WEST MORETON SYSTEM

Reference number 2020027

27/01/2020

UPDATE TO WEST MORETON SYSTEM COST AND INVESTMENT FORECASTS





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1. INTRODUCTION

1.1 Background

The West Moreton System is part of the Queensland Rail network. It has a length of 321km and extends between the townships of Rosewood to the East and Columboola in the West.



Figure 1. West Moreton System

The System is a regulated asset and Access Undertaking 1 (AU1) currently applies. A new access undertaking will commence in 2020 for a five year term. This undertaking will be prepared in draft form as Draft Access Undertaking 2 (DAU2). This review of capital, maintenance and operations cost is an element of the consultation process to assist progressing DAU2 into the final Access Undertaking 2 (AU2).

In August 2018 Queensland Rail submitted DAU2 to the QCA.

SYSTRA Scott Lister (SYSTRA) subsequently completed a 'Review of Proposed Maintenance, Capital and Operations Expenditure Report' (the 2019 Report), providing an assessment of the reasonableness and efficiency of the maintenance, capital, and operations cost estimate within the Queensland Rail DAU2.

In April 2019, following submissions from interested parties, the Queensland Competition Authority (QCA) released its Draft Decision on DAU2.

Submissions on the Draft Decision were received in July 2019, further collaborative submissions in September 2019 and a further submission received from Queensland Rail in November 2019.

1.2 Objective

The purpose of this supplement is to review and update the assessments within the 2019 Report considering stakeholder feedback within the July, September and November 2019 submissions, including :

- Revised cost estimates from Queensland Rail based on a 2.1 million net tonnes per year of thermal coal (mtpa) scenario.
- Additional coal paths through the Brisbane Metropolitan network.

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2. SUMMARY OF PREVIOUS SYSTRA ASSESSMENT

2.1 General

SYSTRA analysed Queensland Rail's proposed maintenance and capital program against the current asset condition in the context of Queensland Rail's Civil Engineering Track Standards (CETS), Civil Engineering Structural Standards (CESS), approaches by other rail agencies, and good asset management and engineering practice.

SYSTRA assessed the Queensland Rail submission for maintenance and capital funding for the West Moreton System primarily for a base case 9.1 mtpa scenario with an indicative review of other scenarios:

- A low tonnage scenario of 2.1 mtpa
- A high tonnage scenario of 9.1 mtpa with ARTC Inland Rail (Inland Rail) commissioned in 2024/2025.

2.2 Maintenance Expenditure

SYSTRA assessed Queensland Rail's method for projecting costs to higher and lower tonnages from a base case of a 6.25 mtpa scenario could be enhanced. SYSTRA recommended a reduction in resurfacing and track lowering works, with part of this budget reallocated to rebuilding formations.

2.3 Capital Expenditure

SYSTRA assessed a number of capital works may be deferred until certainty of Inland Rail and New Acland coal production is established. SYSTRA assessed that complete renewal of a number of timber bridges is unnecessary under certain scenarios.

SYSTRA recommended Queensland Rail develop a medium term formation rebuild strategy. The SYSTRA analysis has not included quantification of the impact on reducing the cost of capital type works in terms of cost per unit of production due to longer and less restrictive track access. Longer and less restrictive access reduces the impact of mobilisation, demobilisation and expensive equipment fixed costs; consequently lowering unit production costs.

2.4 Operating Costs

SYSTRA determined the budget allocation for operation costs, less train control costs, as a percentage of direct costs is approximately 10%. SYSTRA assessed this as reasonable and applied this percentage across all scenarios.

3. SUMMARY OF STAKEHOLDER ASSESSMENTS

3.1 General

3.1.1 Forecast Coal Tonnage

Queensland Rail included two scenario forecasts in their August 2018 DAU submission that:

- 2.1 mtpa would be transported on the system, all produced by the Yancoal mine.
- 9.1 mtpa if the planned New Acland mine stage 3 (NAS3) progresses prior to AU2, 2.1mtpa from the Yancoal mine and 7mtpa from NAS3.

Since that submission:

- On 2 September 2019, New Hope Coal announced it would be making 150 of its 300 workers redundant at the New Acland Stage 2 mine, having yet to receive any indication from the State Government about the future of the NAS3¹.
- On 10 September 2019, the Queensland Court of Appeal ruled in favour of New Acland Coal Pty Ltd against an appeal by the Oakey Coal Action Alliance Inc. New Hope has advised the Australian Stock Exchange that it remains committed to delivering the NAS3 project in a timely manner². However, "the timeframe for resolution and the outcome of this process is unknown"³.
- New Hope Coal has advised that if the NAS3 does proceed the NAS3 coal production forecast has reduced from 7mtpa to 5mtpa due to operating conditions associated with the approval of NAS3 and infrastructure limitations with train loading and the capacity of the coal preparation plant. However, the likelihood of New Hope having its approvals in time to transition to NAS3 at the commencement of the DAU2 period appears low.⁴
- Yancoal has received approval to expand production from 2.8 mtpa run-of-mine (ROM) to 3.5 mtpa ROM and would give Yancoal the ability to increase tonnes available for railing and shipment to 2.6 mtpa. However, at this stage Yancoal has not contracted additional train paths to move these tonnes (nor made an access application to do so) and Queensland Rail has been given no indication that this would occur before the commencement of the DAU2 period.
- In November 2019 Queensland Rail proposed the Reference Tariff be based on a 2.1mtpa scenario and provided updated forecasts based on this scenario.

3.1.2 Additional Coal Traffic Paths Through the Metropolitan Network

In July 2019 Queensland Rail provided advice that, "full utilisation of the 113 train paths available on the metropolitan Brisbane network, including those not preserved under TIA, did not present a challenge to passenger train operations. This outcome has since been used as a core traffic baseline in any new investigations involving passenger train services."⁵

⁵ Queensland Rail's Response to the QCA's Draft Decision on Queensland Rail's Draft Access Undertaking 2 (DAU2), 11 July 2019, Attachment 1: 87 Train Path 'Constraint' Letter.

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¹ Response to industry comments on the QCA's Draft Decision on Queensland Rail's Draft Access Undertaking 2, Queensland Rail, 27 September 2019, page 10.

² Response to industry comments on the QCA's Draft Decision on Queensland Rail's Draft Access Undertaking 2, Queensland Rail, 27 September 2019, page 10.

³ Response to industry comments on the QCA's Draft Decision on Queensland Rail's Draft Access Undertaking 2, Queensland Rail, 27 September 2019, page 10.

⁴ DAU2 West Moreton System low volume coal reference tariff, Queensland Rail, 22 November 2019, page 5.

3.1.3 **ARTC Inland Rail project**

On 29 November 2019 the Australian and Queensland Governments signed a Bilateral Agreement to deliver Inland Rail. "Deputy Prime Minister and Minister for Infrastructure, Transport and Regional Development Michael McCormack said the Bilateral Agreement would ensure Queensland's future growth is supported by a robust freight rail network capable of servicing the long-term liveability and productivity of Queensland's regions, towns and cities." 6

3.2 **Maintenance Expenditure**

Queensland Rail has given some consideration to the SYSTRA Report, but advised its forecasts are based on the assumption the 2.1 mtpa scenario will be the short term outlook rather than the medium to longer term assumed in the Report.⁷

3.2.1 Structure - Timber bridge maintenance

Queensland Rail has generally accepted SYSTRA's recommendation that timber bridge maintenance should be increased for a 2.1 mtpa scenario. The reduction in capital expenditure for the DAU2 period is \$ 15.119 m; the delay of this capital works will lead to an increase the timber structure maintenance budget for DAU2 of \$ 1.729 m.

3.2.2 **Resurfacing and track formation rebuild**

Queensland Rail has:

- Advised overall it is supportive of the Report and accepts in principle SYSTRA's recommendation there be some trade-off between resurfacing and formation build. The Report recommended a 209km annual reduction of resurfacing from 432.425km per annum to approximately 223km per annum. The recommendation was premised on SYSTRA's recommendation of a formation rebuild strategy. The concept of the strategy being to rebuild the formation in the first three years of the DAU2 term at locations that have historically required three or more resurfacings.
- Stated SYSTRA's formation rebuild strategy would not result in a 209km annual reduction in resurfacing as outlined in the Report. Rather, the potential reduction is 53 km per annum. Queensland Rail estimates that the DAU2 resurfacing costs for 2.1 mtpa is for J2C for R2J, total ; rather than the and in the SYSTRA.
- Commented that they support some rebuilding of formation to provide a long term lower resurfacing costs as suggested by SYSTRA noting that SYSTRA provided the formation repair versus resurfacing trade off as an example strategy only, not a recommended outcome. Noting, "SYSTRA acknowledges the complexity of this challenge; particularly over the expansive black soils and the nature of development of some of these failure sites. SYSTRA also acknowledges that other methods exist to address these issues such as lime stabilisation, geocells or slotted aggregate filled trench drains perpendicular to the formation."89

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⁶ <u>https://inlandrail.artc.com.au/mediareleases/news_feed/ministerial-release</u>

⁷ Queensland Rail's Response to the QCA's Draft Decision on Queensland Rail's Draft Access Undertaking 2 (DAU2), 11 July 2019, p.14.

⁸ Queensland Rail's Response to the QCA's Draft Decision on Queensland Rail's Draft Access Undertaking 2 (DAU2), 11 July 2019, p.7.

⁹Other potential solutions for the expansive clays areas, used in the North West of Western Australia, include "waterproofing" the full corridor width in the region of the problem with impervious clay. This blanket ensures no water gets in and no water gets out, thereby rendering the expansive clay neutral. This solution is less disruptive to traffic, can be actioned all day and can be performed with minimum labour.

 Noted that no justification has been provided for the complete removal of the \$9.5M in track lowering costs. Queensland Rail believes that this is required and should remain included in the reference tariff works¹⁰.

3.2.3 Grinding

Queensland Rail has generally accepted SYSTRA's recommendation that grinding should be reduced for a 2.1 mtpa scenario. SYSTRA's grinding calculation is based on Table 5.5 from the CETS for a 20 tonne axle load system; that is 40 mgt for tangent track, 20 mgt for curves less than 2,500m radius and 10 mgt for curves less than 1,000 m radius.

3.2.4 ARTC Inland Rail project

Queensland Rail has:

- Noted the proposed construction of Inland Rail, revised the scope of the proposed timber bridge replacement in the Rosewood to Jondaryan corridor and deferred six signalling/telecommunications projects. As described below (section 3.3.4).
- Advised it assumes it will need to provide reliable access to the network at least in the medium to longer term, with no certainty about the timeframe for the development of Inland Rail. Queensland Rail also notes that even with Inland Rail, customers will have a choice of whether to use the Queensland Rail network or the Inland Rail network.

3.3 Capital Expenditure

3.3.1 General

As with forecast maintenance expenditure, Queensland Rail has:

- Considered the SYSTRA assessment, where appropriate to develop its revised low tonne capital expenditure, but has not considered the temporary mothballing of some dual track sections and strategically applied speed restrictions as suggested.¹¹
- Advised, whereas the Report assessed the original 2.1mtpa estimate as a medium to long term scenario, Queensland Rail's view is this is a temporary situation and that either an existing coal producer or a new producer would require tonnages to increase back towards 9.1 mtpa. Therefore its approach is to maintain the reliability of the network to a level sufficient to accommodate New Hope railings with NAS3. Queensland Rail considers it is prudent to undertake capital expenditure (such as timber bridge replacement) even if volumes are lower, which also minimises the potential impact on future available capacity. This avoids the need to undertake additional 'catch-up' capital expenditure when tonnages are closer to maximum capacity, also causing delays. If Queensland Rail developed a lower tonnage scenario on the basis of volumes on the West Moreton System being low indefinitely similar to SYSTRA, this would require Queensland Rail to reconsider its asset management strategy.¹²

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¹⁰ SYSTRA notes that although Queensland Rail are using the "ballast undercutting" coding in SAP for this track lowering activity it is not ballast undercutting. The activity is the removal of surplus ballast below track that has had a number of resurfacing activities, each with its own ballast top up, and consequently the track rails are now too high; in some cases up to 600 mm too high. The CETS has a maximum limit of ballast depth of 600 mm so this track must be either rebuilt or lowered.

¹¹ DAU2 West Moreton System low volume coal reference tariff, Queensland Rail, 22 November 2019, p. 11.

¹² DAU2 West Moreton System low volume coal reference tariff, Queensland Rail, 22 November 2019, page. 11.

- Nevertheless, provided a revised capital expenditure forecast.¹³
- Including \$ 22.016 million for the Toowoomba Range Slope Stabilisation (TRSS) project which
 has commenced but will not be commissioned during the AU1 period. The TRSS project was
 not included as part of the original DAU2 submission, however, during 2018-19, Queensland
 Rail consulted with industry on the TRSS and sought and was given pre-approval by the QCA
 for the project for prudency of standard and scope.
- Commented it is not in their financial interests to be performing unnecessary capital expenditure on the West Moreton System. Queensland Rail does however, have a responsibility as the accredited Rail Infrastructure Manager to ensure that it is performing the maintenance and capital expenditure necessary to ensure that rail infrastructure in use is safe and reliable, and meets the requirements of Queensland Rail's Safety Management System.¹⁴

3.3.2 Civil - Structure

Queensland Rail has generally accepted SYSTRA's recommendation that timber bridge maintenance should be increased for a 2.1 mtpa scenario with a corresponding reduction in timber bridge capital expenditure.

The scope of timber bridge replacement in the Rosewood to Jondaryan corridor has been revised, noting the proposed construction of Inland Rail. The revised 2.1 mtpa capital expenditure forecast has been reduced to the proposed construction of DAU2 period, the proposed lower than the original DAU2 submission of the proposed construction. This capital works will lead to an increase in requiring an commensurate increase in the maintenance budget for DAU2 of \$ 1.729 m.

3.3.3 Track

Queensland Rail has not accepted SYSTRA recommendations to reduce the Queensland Rail submission by 50% reflecting the amount of rail that is scheduled to be replaced in dual track areas and value engineering of other proposed rail replacement areas.

3.3.4 Signalling, Telecommunication

Queensland Rail partially accepted SYSTRA recommendations to reduce the Queensland Rail submission by 50% reflecting value engineering of this capital work.

Six signalling/telecommunications projects with a collective value of \$ 13.89 million have been deferred to a future period given the potential for duplication by Inland Rail and while volumes on the West Moreton System are low.

3.3.5 Telecommunications

Queensland Rail has not accepted SYSTRA recommendations to reduce the Queensland Rail submission by 50% reflecting the amount of rail that is scheduled to be replaced in dual track areas and value engineering of other proposed rail replacement areas.

¹³ DAU2 West Moreton System low volume coal reference tariff, Queensland Rail, 22 November 2019, Attachment 1.

¹⁴ DAU2 West Moreton System low volume coal reference tariff, Queensland Rail, 22 November 2019, page. 11, p.12.

3.4 Operating Expenditure

In its original DAU2 submission, Queensland Rail proposed operating expenditure of \$ 48.717 million (\$2020-21) for the DAU2 period - \$9.73 million per annum under both the 2.1 mtpa and 9.1 mtpa scenario considering that its operation expenditure is unchanged for the 2 tonnage scenarios. Following SYSTRA's assessment of Operating expenditure, Queensland Rail has partially accepted SYSTRA's recommendation for operating expenditure.

3.4.1 Train operations management

Following SYSTRA's assessment of Operating expenditure, with the suggestion that network planning resources can be reduced for the 2.1 mtpa scenario, Queensland Rail considers that SYSTRA train operations management estimate of \$17.360 million over the DAU2 period for the 2.1 mtpa ceiling reference tariff would be applicable for lower tonnage scenarios.

3.4.2 Other operating expenditure 2.1 mtpa

Queensland Rail's original 2.1 mtpa DAU2 operating cost estimates applied the same methodology used for the AU1 cost estimates, with the cost build up based on Queensland Rail's actual costs for 2016-17 as reported in the Below Rail Financial Statements.

After review of Queensland Rail's costs, SYSTRA recommended a 9.25 percentage for other operating expenditure, based on an unreferenced Evans & Peck study completed in 2009 (with an extract of a table reproduced), but no other information included.11. With the limited information provided, Queensland Rail is not in a to position to assess whether the application of the Evans and Peak Study makes a like-for-like comparison to the operating expenses included in the Queensland Rail submission.

Queensland Rail considers the application of the 9.25% underestimates the true costs of providing the service and is inconsistent with the methodology approved by the QCA for Aurizon Network's UT5, where the equivalent corporate overheads percentage is 37.6% of total costs.

Queensland Rail also notes that while it has applied the SYSTRA recommendation for the purpose of estimating the 2.1 mtpa ceiling reference tariff, it does not consider that this methodology adequately compensates for the efficient operating costs of providing coal services on the West Moreton System and Queensland Rail will seek to have the QCA's methodology for estimating operating expenditure be reviewed for the next undertaking.¹⁵

¹⁵ DAU2 West Moreton System low volume coal reference tariff, Queensland Rail, 22 November 2019, page. 19

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4. SYSTRA UPDATED ASSESSMENT

4.1 Context

SYSTRA acknowledges that the context the West Moreton System operates in has become better defined since SYSTRA's previous review of Queensland Rail's proposed maintenance, capital and operating costs. The two major elements of this better definition are:

- The forecast mine tonnages in the five-year horizon are likely to be closer to 2.1 mtpa in the short term, five-year horizon. Queensland Rail anticipate increased tonnages after this.
- The signing of a bi-lateral inter-government agreement for the Inland Rail project on 29 November 2019.

SYSTRA proposes that reasonable planning scenarios are:

- Short Term (less than five years, this undertaking period) the West Moreton System should be maintained to a capacity of 2.1 mtpa cost effectively without compromising the ability of the system to expend to carry greater tonnages.
- Medium Term (three to ten years) The West Moreton System should be prepared to carry greater tonnages. The operation of a rail system for low tonnages is very difficult to make economically viable and SYSTRA assume that most stakeholders will be working towards increasing tonnages.
- Long Term (Inland Rail is operational) The coal from the South West Queensland coal mines is central to the Inland Rail business case¹⁶; SYSTRA assume that on the commissioning of Inland Rail coal traffic will exit the West Moreton system at approximately Gowrie, slightly west of Toowoomba, on to the Inland Rail alignment¹⁷ through to Brisbane and the element of the West Moreton system east of Gowrie will become redundant.

¹⁷ It should be noted switching of traffic on to Inland Rail will be a complicated project requiring stakeholder negotiation, amendment of agreements, careful consideration of dual gauge track, signalling arrangements and capital works staging. This is balanced by the opportunities to minimise capital expenditure through this approach.

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¹⁶ Inland Rail, Melbourne to Brisbane Inland Rail, Attachment A: ARTC Inland Rail Business Case, Figure 7.3 on page 130 shows 25 % of Inland Rail's traffic as a percentage of net tonne kilometres is West Moreton coal.

SYSTRA assess that the short-term scenario of low net tonnages of 2.1 mtpa may be in place for an extended period and that this justifies further consideration of adjusting current asset management and rail operations to take advantage of the low traffic density to minimise supply chain costs. Actions that SYSTRA assess Queensland Rail could apply during DAU 2 are:

- lowering system speeds to reduce the dynamic load on the formation and consequently reduce the requirement for bridge maintenance, resurfacing and formation rebuilds
- mothballing sections of duplicated track to reduce maintenance costs
- deferring capital expenditure
- rationalising some operational resources with the wider Queensland Rail network

The table below puts the revised, November 2019 estimate, into perspective. This report will only address items where a remaining significant point of difference remains.

 Table 1: Summary of Queensland Rail and SYSTRA¹⁸ estimates and points of difference (\$ m 2021)
 after Queensland Rail's revised submission

DESCRIPTION	ORIGINAL DAU2 SUBMISSIOM QUEENSLAND RAIL	INITIAL SYSTRA	INITIAL DIFFERENCE	REVISED QUEENSLAND RAIL	DIFFERENCE POST REVISED QUEENSLAND RAIL
TOTAL	317.109	233.04	83.686	281.093	48.053
Maintenance	101.882	87.431	14.451	102.409	14.978
Capital ¹⁹	166.51	110.114	56.013	137.504	27.390
Operations	48.717	35.495	13.222	41.180 ²⁰	5.685

Table 1 shows that the revised Queensland Rail submission has reduced the points of difference between Queensland Rail and SYSTRA from \$ 83.686 m to \$ 48.847 m. Queensland Rail has critically revised two aspects of the August 2018 submission in regard to minimising cost during the low tonnage period; capital works on bridges and train control.

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¹⁸ This table includes the allowance of \$ 22.016 m for the slope stabilisation in both Queensland Rail and SYSTRA calculations. The original Queensland Rail submission and the 2019 SYSTRA report did not include this allowance. This is applied throughout this report for consistency.

¹⁹ Includes the \$ 22.016 m for slope stabilization.

²⁰ This Operations figure also includes an overhead allowance for TRSS project not included in the initial DAU submission.

4.2 Maintenance Expenditure

4.2.1 General

After the November 2019 Queensland Rail review the remaining points of difference included two items totalling \$ 14.978 m. These items in order of value are:

- Track repair
- Track lowering -



The table below shows the detailed initial and remaining points of difference between SYSTRA and Queensland Rail after Queensland Rail's revised estimate and SYSTRA's consideration of this estimate. After considering Queensland Rail's November 2019 submission SYSTRA has remaining points of difference in two areas; track repair and track lowering.

Table 2: Queensland Rail and SYSTRA estimates and points of difference for maintenanceexpenditure (\$ m 2021) after review

ITEM	DESCRIPTION	REVISED QUEENSLAND RAIL	INITIAL SYSTRA	DIFFERENCE	REVISED SYSTRA JANUARY 2020	DIFFERENCE AFTER SYSTRA REVIEW
1	Maintenance	102.410	87.432	14.978	85.281	17.129
2	Track repair					
3	Resurfacing					
4	Structures					
5	Track side systems					
6	Track lowering					
7	Track inspections					
8	Planning & technical support					
9	Rail grinding					
10	Other track					
11	Facilities other					

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ITEM	DESCRIPTION	REVISED QUEENSLAND RAIL	INITIAL SYSTRA	DIFFERENCE	REVISED SYSTRA JANUARY 2020	DIFFERENCE AFTER SYSTRA REVIEW
12	Impact of lowering speed	0	N/A	0	- 2.028	2.028
13	Impact of mothballing Rosewood to Helidon	0	N/A	0	- 3.123	3.123

Table 2 shows SYSTRA agrees some allowance for track lowering is required. SYSTRA maintains its position that the asset management strategy should minimise track lowering and that the overall maintenance figure at \$ 102.41 m is not consistent with assessments based on review of fixed/variable percentages and benchmarks with other rail systems. SYSTRA also assesses that under a prolonged 2.1 mtpa scenario, Queensland Rail will need to slow the system speed down and mothball duplicated track. These strategies are explained further below.

SYSTRA suggest these two checks support the initial SYSTRA assessment of \$ 87.432 m with an additional allowance of the support of ballast lowering for rail safety reasons.

SYSTRA suggest that to minimise maintenance cost under a low 2.1 mtpa scenario the operating model for West Moreton must be reviewed. Under this low tonnage scenario Queensland Rail has the opportunity to reduce maintenance costs through slowing trains down, mothballing track and achieving better unit rates by having access to longer track possession windows.

4.2.2 Track repair

Queensland Rail has not accepted SYSTRA's recommendation for a reduction in the track repair allowance in the general maintenance budget for a 2.1 mtpa scenario. In the November 2019 submission Queensland Rail provided an alternative method of interpolating a maintenance cost for a 2.1 mtpa scenario. The data available and the different nature of the systems used in the Queensland Rail and SYSTRA methods makes it difficult to assess which method has more merit. A remaining point of difference of \$ 9.830 m exists over the DAU 2 period. SYSTRA will reassess this based on a review of total maintenance costs.

Aside from interpolating historical results there are two other ways to arrive at an estimate of a track maintenance estimate for 2.1 mtpa. These are:

- Based on the fixed and variable split of maintenance costs
- Benchmarking the cost per track kilometre with other systems.

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Fixed²¹ and Variable Maintenance Split

In the August 2018 submission Queensland Rail²² provided three approaches to the fixed versus variable proportions for maintenance to fixed costs on the West Moreton system. These three approaches were:

- GHD 62 % fixed and 38 % variable
- Queensland Rail DAU2 9.1 mtpa 57 % fixed and 43% variable
- Queensland Rail QCA 6.25 mtpa scenario 54.4 % fixed and 45.6 % variable.

The analysis of the West Moreton System is complicated by the fact that the tonnages on the Jondaryan to Columboola (J2C) segment, 210.354 km long, will remain at 2.1 mtpa whereas tonnages on the Rosewood to Jondaryan (R2J) segment, 157.061 km long, drop from 6.25 mtpa to 2.1 mtpa. This change can be allowed for by basing the assessment on using the product of tonnes transported and kilometres travelled; that is million tonne km.

Prior to the reduction of the R2J section to 2.1 mtpa the system was moving:

- On J2C 2.1 mtpa on 210.354 km 442 million tonne km per annum
 - On R2J 6.25 mtpa on 104.705 km -
 - 654 million tonne km per annum

- 1,096 million tonne km.

With a total system achievement

After R2J reduces to 2.1 mtpa:

- On J2C 2.1 mtpa on 210.354 km 442 million tonne km per annum
- On R2J 2.1 mtpa on 104.705 km
 - With a total system achievement
- 220 million tonne km per ann
- 220 million tonne km per annum
- 662 million tonne km.

The variable maintenance costs in the system should reduce as a ratio of 662 to 1,096, or 60.4 %, when the tonnages on R2J drop from 6.25 mtpa to 2.1 mtpa.

Basing our analysis on a figure of \$ 115 m in maintenance cost for AU1 for 6.25 mtpa and assuming 45.6 %²³ of the \$ 115 m is variable gives a variable cost for 6.25 mtpa of \$ 52.4 m and a reduction in variable cost to 60.4 % of this to \$ \$ 31.7 m under the 2.1 mtpa R2J scenario.

This \$ 31.7 m in variable costs needs to be adjusted by the various fixed/variable ratios to arrive at an estimate of total maintenance cost.

Table 3 below applies the range of fixed/variable costs to this revised variable cost figure.

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²¹ Fixed costs refer to activities such as planning resources, inspections, facilities, planning and technical support, elements of below rail asset management, vehicles, plant supervisory staff and system wide maintenance support. The fixed costs will reduce with tonnages but not as directly as the variable costs.

²² Queensland Rail's Draft access Undertaking 2 (DAU 2)Explanatory Document August 2018, p32.

²³ Queensland Rail quote this figure as being applied by QCA to the DAU1 on p32 of the original August 2018 submission.

ITEM	MODEL	2.1 MTPA (VARIABLE \$ 31.7 M)	6.25 MTPA²⁴ (VARIABLE \$ 52.4 M)
1	GHD (62% fixed/38% variable)	\$ 83.3 M (Variable \$ 31.7 M) (Fixed \$ 51.6 M)	
2	Queensland Rail DAU2 (57% fixed/43% variable)	\$ 73.6 M (Variable \$ 31.7 M) (Fixed \$ 41.9 M)	\$ 115.0 M (Variable \$ 52.4 M)
3	QCA 6.25 mtpa (54.6% fixed/45.6 % variable)	\$ 69.4 M (Variable \$ 31.7 M) (Fixed \$ 37.7 M)	(Fixed \$62.6 M)
4	Actual Queensland Rail Submission 2.1 mtpa (69 % Fixed/31 % Variable)	\$ 102.4 M (Variable \$ 31.7 M) (Fixed \$ 70.5 M)	

 Table 3: Total DAU2 maintenance cost under various fixed/variable scenarios (\$ m)

There are a number of conclusions from comparing these scenarios:

- No quoted fixed/variable % scenario supports Queensland Rail's proposed maintenance cost of \$102.4 m for a net tonnage of 2.1 million.
- A maintenance cost of \$ 102.4 m would require a fixed cost to variable cost ratio of approximately 69 % and 31 %.

This analysis, on the basis of a 62% fixed and 38 % variable scenario as recommended by GHD in Queensland Rail's initial submission, supports SYSTRA's original \$ 87.432 m as a reasonable maintenance allowance.

This analysis is based on 2018/2019 AUD and should be indexed two years to obtain 2020/2021 AUD at a rate of 2.5 %. This results in a maintenance allowance for DAU 2 of approximately \$ 91 m.

²⁴ Applying 54.4 % Fixed/45.6 % Variable

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Benchmarking annual cost per track kilometre

The Queensland Rail maintenance submission of \$ 102.410 m equates to approximately **\$ 56,746** per track kilometre²⁵ per annum. This figure is significantly higher when benchmarked with other low tonnage systems such as ARTC and WestNet. A possible reason for this relatively high cost is the poor condition of the formation, track system and legacy timber bridges. A more level playing field is to benchmark with other systems excluding resurfacing costs, track lowering and timber bridge maintenance; noting that formation repairs are grouped under capital expenditure.

Excluding allowances for resurfacing, bridges and track lowering, as the West Moreton system has particular challenges in these areas, adjusts the annual maintenance costs to approximately *\$ 37,671* per track kilometre.

The SYSTRA estimate of \$87.432 m equates to maintenance costs of approximately **\$47,593** per track kilometre; and after excluding the resurfacing, bridge and track lowering allowances gives annual maintenance cost of approximately **\$32,320** per track kilometre. Applying semi-permanent speed restrictions by reducing speed by 20 km/hr creates a 10 % reduction in maintenance cost resulting in annual maintenance cost of **\$29,088** per track kilometre.

Table 4 below shows these rates compared with rates quoted in a number of reports for other systems.

This table illustrates that the proposed Queensland Rail West Moreton maintenance allowance is consistent²⁶ with Moura²⁷ and Newlands²⁸but high relative to the WestNet Rail systems. It should be noted that both these systems were moving approximately 10 million tonne of coal per annum in 2007. This indicates that Queensland Rail is currently maintaining West Moreton to transport approximately 10 mtpa and needs to review maintenance to be more suitable, and cheaper, for a 2.1 mtpa operation.

SYSTRA assesses that the benchmarking with other rail systems supports SYSTRA's initial assessment of \$ 87.432 m for maintenance with a track component of \$ 37.958 m and that a benchmark maintenance cost per kilometre of \$ 29,088 per year should be targeted with semi-permanent speed restrictions imposed.

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²⁵ Based on 367.415 track km from the Queensland Rail West Moreton System Information Pack. The actual route kilometres are 315.094 km.

²⁶ It should be noted that both Moura and Newlands quoted rates are from 2007 pre the sale of the coal systems in the 2009 IPO.

²⁷ The Moura System was first built with a connection to the Callide Mine in the 1950's with a connection to the Moura mine in the 1960's.

²⁸ The first element of the Newlands System was constructed in the 1920's with a rail link to Collinsville.

Table 4: Range of track maintenance costs (2019/2020 AUD \$/track kilometre²⁹)

SYSTEM	RATE	REFERENCE	COMMENTS
Victoria	\$ 6,744	<i>PwC, Review of WestNet Rail's Floor and Ceiling Costs for certain rail lines, 2007</i>	Grain
WestNet Rail	\$ 13,110	PwC, 2007	Worsley to Premier
Victoria	\$ 14,565	PwC, 2007	Non Freight Regional
ARTC	\$ 19,354	PwC, 2007	Network wide
WestNet Rail	\$ 23,245	PwC, 2007	Kwinana to Worsley
WestNet Rail	\$ 24,795	PwC, 2007	Forrestfield to Kalgoorlie
SYSTRA West Moreton Estimate	\$ 29,088	This report	With Speed Restrictions Excludes resurfacing, bridges and track lowering.
North Coast Line	\$ 30,007	ARTC, An assessment of ARTC Maintenance Cost Relative to Efficient Industry Practice, 2007	
SYSTRA West Moreton Estimate	\$ 32,320	This report	Current situation. Excludes resurfacing, bridges and track lowering.
Queensland Rail West Moreton Estimate	\$ 37,671	November 2019 Submission	Excludes resurfacing, bridges and track lowering.
Moura System	\$ 38,712	ARTC, 2007	
Newlands System	\$ 40,431	PwC, 2007	

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²⁹ Allowing a 32 % increase due to CPI between 2006 and 2019.

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4.2.3 Track lowering

SYSTRA's rationale for removing this allowance was that the areas requiring track lowering would be areas that are also subject to multiple resurfacing operations per year and consequently early targets for track rebuilds. SYSTRA accept that under the 2.1 mtpa scenario there will be some requirement for interim track lowering prior to a formation rebuild situation for safety reasons.

In order to derive a reasonable amount to allow for track lowering SYSTRA will apply the following assumptions:

- Queensland Rail will adopt a strategy of targeting high frequency resurfacing sites for track renewal based on SYSTRA's suggested approach with approximately 6.336 km in Year 1 and approximately 4.474 km in Year 2.
- Approximately half of Year 2 sites will require ballast lowering.
- An estimate based on an allowance of \$ 1 m/km as an initial estimate for this type of operation, noting that this operation has mobilisation and demobilisation costs.

SYSTRA suggest an allowance of approximately 3 km of track lowering is reasonable to conduct track lowering for safety reasons with the intent of phasing this operation out by replacement with track reconstruction or formation rebuild. This work has an indicative budget of **COMP**. This addition brings the DAU 2 maintenance allowance in total to approximately \$ 91 m which is consistent with the fixed/variable cost and benchmarking analyses.

4.2.4 Impact of lowering speed and mothballing track

Figure 2 below from p70 of *Modern Railway Track* by Esveld (2014) shows the cost impact of speed, axle load and track quality³⁰ on maintenance cost. It is clear that cost savings in maintenance can be achieved by strategically using speed restrictions.

SYSTRA recommends that Queensland Rail take advantage of the low tonnage scenario by lowering the maximum speed on the system and imposing semi-permanent in areas where top and line exceedances are expected to occur; before the exceedances occur.

Although every rail system is in unique, the relationship between dynamic load and speed is common and the relationship between increased maintenance cost and increased dynamic load is also common. Based on the speed/cost relationship in Figure 2, a reduction in speed from 80 km/hr to 60 km/hr³¹ would lead to approximately a 10 % saving in maintenance cost for an average quality track; the saving would be greater for a poorer quality track; potentially of the order of 20 %.

³¹ The unit on the horizontal axis is in m/s; however SYSTRA believe this could actually be km/hr. For example: 60 m/s equates to 216 km/hr and 120 m/s equates to 432 km/hr. Notwithstanding this, the proportional relationship of maintenance cost to speed is consistent and clear.

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³⁰ The BMS system uses accelerometers and measurements of track geometry to derive a measure of track quality. In this system a σ of 3 mm signifies a poorer track with worse track geometry and greater accelerations; conversely a σ of 1 mm signifies a high quality track.



Figure 2: Relationship between maintenance cost, track quality, speed and axle load (Esveld, 2014)

SYSTRA assess that in the event the 2.1 mtpa scenario will continue for the foreseeable future where possible lengths of duplicated track one track could be mothballed. Figure 3 is an extract of the schematics from Queensland Rail's West Moreton Information Pack. This extract shows the duplicated track between Rosewood and Helidon.

These schematics show that there are three lengths of track potentially suitable for mothballing:

٠	Rosewood to Grandchester	- 56.051 to 68.560	- 12.509 km
٠	Laidley to Gatton	- 76.185 to 95.990	- 19.805 km
•	Gatton to Helidon	- 96.996 to 113.969	- 16.975 km.

Mothballing the second track in these locations would remove a maintenance requirement of 49.289 km of track and 30 bridges.

The system under the 2.1 mtpa scenario would be taking a range of three to five trains a day in each direction. This includes all traffic; not only coal traffic. Therefore these trains could be six hours apart or three hours if the loaded and unloaded trains are staggered. At 40 km/hr these trains would be approximately a minimum of 60 to 100 km apart. Reconfiguring the track between Rosewood and Helidon to single track with passing loops at Grandchester and Gatton would likely not impact operations even at low speeds of 40 or 60 km/hr.

Lowering the speed should reduce maintenance costs by \$ 1.014 m per year and the combined effect of no longer maintaining 49 km and the lower maintenance cost for the remaining track should save an additional \$ 2.028 m per year in maintenance cost; giving a total annual saving of \$ 3.123 m. In addition, these changes reduce the maintenance costs to \$ 29, 088/km (not including resurfacing, bridges and track lowering).

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Figure 3: Track schematic between Rosewood and Helidon

SYSTRA understand that changes in operations such as this will take time and have incorporated the impact of these changes <u>only</u> in to the last two years of the DAU period. SYSTRA also understand that there is potential for increased tonnages that could lead to a reassessment of this strategy.

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4.2.5 Impact of ad hoc tonnages

The maintenance cost at 2.1 mtpa is largely driven by fixed maintenance costs required to ensure safe operation of the railroad. These costs require a base investment in operations, train control, maintenance teams, plant and infrastructure. At low tonnages of 2.1 mtpa there is likely to be spare capacity with these resources; consequently the addition of ad hoc tonnages of 1 to 2 mtpa over short periods is unlikely to lead to increased maintenance costs. Two examples of this are track maintenance teams and train control.

Due to the length and geography of the track it may be determined for fatigue management reasons, in accordance with the Rail Safety National Law, that two maintenance depots are required. Under a longer term 2.1 mtpa scenario these depots may not be fully tasked, but are still required to ensure safe operation. Under a prolonged 2.1 mtpa scenario Queensland Rail may wish to rationalise to a single depot with a full team and smaller satellite depots capable of inspections and minor maintenance only.

In the train control scenario a minimum setup is required to operate a 24 hour/7 days a week operation; even if it is for only three to five trains each way per day, as is the case for the 2.1 mtpa scenario. This minimum setup would be able to absorb additional ad hoc traffic. A longer term option if the 2.1 mtpa scenario is to continue is to incorporate the West Moreton train control operation into the Mayne Yard train control centre leading to efficiencies and reduced cost.

4.3 Capital Expenditure

4.3.1 General

The table below shows the detailed initial and remaining points of difference between SYSTRA and Queensland Rail for estimated capital works.

Queensland Rail commented that it is not in their financial interests to be performing unnecessary capital expenditure on the West Moreton System.³² Queensland Rail does, however, have a responsibility as the accredited Rail Infrastructure Manager to ensure that it is performing the maintenance and capital expenditure necessary to ensure that rail infrastructure in use is safe and reliable, and meets the requirements of Queensland Rail's Safety Management System

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³² DAU2 West Moreton System low volume coal reference tariff, Queensland Rail, 22 November 2019, p.12..

Table 5: Queensland Rail and SYSTRA estimates and points of difference for capital expenditure (in\$ m 2021) after review

ITEM	DESCRIPTION	REVISED QUEENSLAND RAIL	INITIAL SYSTRA	REVISED DIFFERENCE	REVISED SYSTRA	DIFFERENCE AFTER SYSTRA REVIEW
	Capital	137.684	110.294	27.390	122.742	<u>14.942</u>
1	Civil	48.631	44.015	4.616	44.015	4.616
2	Track	43.908	32.866	11.042	38.716	5.192
3	Signals & Telecoms	23.129	11.397	11.732	17.995	5.134
4	Slope stabilisation	22.016	22.016	0	22.016	0

From Table 5, it can be seen that Queensland Rail has undertaken a critical review of capital works with a view to deferring works because of the low tonnages in the immediate future and the potential future impact of Inland Rail.

\$22.016 million has been included for the Toowoomba Range Slope Stabilisation (TRSS) project which has commenced but will not be commissioned during the AU1 period. The TRSS project was not included as part of the original DAU2 submission, however during 2018-19, Queensland Rail consulted with industry on the TRSS and sought and was given pre-approval by the QCA for the project for prudency of standard and scope.

After review SYSTRA concurs with Queensland rail in regard to level crossing reconditioning, transitions and concrete sleepers for tight curves on the Toowoomba Range. SYSTRA suggests with the reduction in tonnage the following should be value engineered to reduce capital cost:

• Track	- Re-sleepering and re-railing	- \$ 5.192 m.
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• Signals - Level crossing upgrades

- \$ 5.134 m. - \$ 4.616 m.

Civil - Culvert repairs

4.3.2 Track

A detailed breakup of the status of the estimate of track capital works is shown in the table below.

able 6: Detailed capital assessment for track works (\$ million 2020/2021) after Queensland Rail and SYSTRA's review

ITEM	DESCRIPTION	REVISED QUEENSLAN D RAIL	INITIAL SYSTRA	INITIAL DIFFERENCE	REVISED SYSTRA	REVISED DIFFERENCE
	TRACK SUBTOTAL	43.908	32.866	11.042	38.716	5.192
1	Track reconditioning					
2	Re-sleepering					
3	Re-railing					
4	Level crossing reconditioning					
5	Greasers					
6	Level crossing transitions					
7	Concrete sleepers on curves					

SYSTRA maintains that the re-sleepering and re-railing scope should be reviewed and value engineered under the context of an operational model with:

- Lower tonnages.
- Slower train speeds.
- Potentially some lengths of duplicated track temporarily mothballed.

SYSTRA accepts that the level crossing reconditioning and transitions are required because of the critical safety aspect of these assets. SYSTRA accepts that the concrete sleepers on the curves of the Toowoomba Range are required as failure to install these could lead to expensive and disruptive rerailing activities on the Toowoomba Range.

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4.3.3 Signals and telecommunications

SYSTRA maintains that the upgrading of level crossings scope should be reviewed and value engineered under the context of an operational model with lower tonnages, slower train speeds and potentially some lengths of duplicated track temporarily mothballed.

Queensland Rail have assessed that the following signals and telecommunications capital works are required in the 2.1 mtpa scenario. This is detailed in Table 7 below.

Table	7:	Detailed	capital	assessment	for	signalling	and	telecommunications	works	(\$	million
2020/	202	21) after C) Lueensla	nd Rail and S	YST	RA's review	,				



SYSTRA accepts that deferral of some capital works will place increasing reliance on signalling, telecommunications and monitoring systems to ensure rail safety and that the following are required:

- Minor signalling renewal
- Remote monitoring systems
- Digital telemetry works
- Miscellaneous telecommunications works.

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³³ Includes location case removal, trailable facing points and weather stations.

³⁴ Includes Nera microwave refresh and telecommunications rectifiers.

4.3.4 Civil

The remaining point of difference between SYSTRA and Queensland Rail is that Queensland Rail has assessed that the full estimate of culvert replacement works, valued at approximately **second second**, are required in the 2.1 mtpa scenario to maintain track reliability. SYSTRA's original assessment allowed half of this amount with a view to value engineering/deferring some of these works.

A detailed breakup of the status of the estimate of civil capital works is shown in the table below.





SYSTRA acknowledges how important effective drainage is to rail infrastructure integrity and consequently safety. The allowance of **submitted by** Queensland Rail is the same as the estimate required for the 9.1 mtpa scenario. SYSTRA assess that this figure should be critically reviewed on a case by case basis and value engineered through:

- Expedient type engineering methods such as propping culverts
- Imposing semi-permanent speed restrictions
- Maximising longer track possessions to minimise unit costs
- Restricting traffic to good weather.

SYSTRA acknowledge that imposing operational restrictions due to asset condition is not a preferred option to managing the rail system. However given the pressure on all elements of the supply chain to reduce cost to maintain the economics of the West Moreton system under low tonnages reducing maintenance costs through operational constraints should be actively considered. SYSTRA maintains its position that in regard to culvert replacement value engineering, scope minimisation and operational controls are recommended.

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4.4 Train Control and Operations Expenditure

Table 9 below shows the detailed initial and remaining points of difference between SYSTRA and Queensland Rail for estimated operational costs. Queensland Rail and SYSTRA have a remaining point of difference of \$ 5.685.

Table 9: Queensland Rail and SYSTRA estimates and points of difference for other operation
expenditure (in \$ m 2021) after review

ITEM	ITEM DESCRIPTION		REVISED QUEENSLAND RAIL INITIAL SYSTRA		REVISED SYSTRA	REVISED DIFFERENCE	
	TOTAL OPERATIONS	41.180	35.495	5.685	36.171	5.009	
1	Train control	17.360	17.360	0	17.360	0	
2	Other operational costs & Corporate Overhead ³⁵	23.820	18.135	5.685	18.811	5.009	

Queensland Rail states that the 2016-2017 year will be used as the model for estimating the DAU2 overheads and operating expenditure and detail these costs³⁶. SYSTRA agrees that the annual allowances for Other Expenses, \$ 2.328 m, and Corporate Overheads, \$ 1.325 m, as listed in this table appear reasonable for the 6.25 mtpa scenario. SYSTRA's initial assessment was that other operational costs should be approximately 9.25 % of direct costs; based on direct costs of \$ 203.367 m Other Operational Costs for the DAU 2 period allowance is \$ 18.811 m.

The Economic Regulatory Authority of WA quotes a figure of \$ 14,400/track³⁷ km for operating and overhead costs for ARTC in 2007 and \$ 15,090/track km for WestNet Rail for 2009. Adjusting for CPI for both these figures gives \$ 19,249 for ARTC and \$ 19,026 per track kilometre for WestNet in 2020 AUD. Applying the equivalent allowances to West Moreton for the DAU 2 period gives \$ 35.322 m using the ARTC benchmark and \$ 34.914 m using the WestNet Rail benchmark³⁸. This benchmarking indicates that the SYSTRA train control and operating cost assessment of \$ 36.171 m is reasonable.

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³⁵ The SYSTRA calculated operational costs do not include the TRSS project. TRSS is currently under construction, during AU1, and it appears will be well progressed before the start of AU2 with a quoted completion date, on the Queensland Rail website, of late 2020.

³⁶ Table 18 on page 36 of the August 2018 Queensland Rail submission.

³⁷ Economic Regulation Authority, WestNet Rail's Floor and Ceiling Costs Review, Final Determination on the Proposed 2009-2010 Floor and Ceiling Costs, Table 11, p34

³⁸ These benchmark estimates reduce to \$ 33.436 m and \$ 33.049 m if 49 km of track is mothballed in Years 4 and 5 of the DAU reducing track kilometres from 367 km to 318 km.

5. SUMMARY OF REVISED POSITION

A summary of SYSTRA's revised position is in the table below.

Table 10: Summary of Queensland Rail and SYSTRA estimates and points of difference formaintenance expenditure (\$ million 2021)

ITEM	DESCRIPTION	REVISED QUEENSLAND RAIL	INITIAL SYSTRA	DIFFERENCE POST QUEENSLAND RAIL REVIEW	REVISED SYSTRA	REMIANING DIFFERENCE
1	TOTAL	281.094	233.041	48.053	244.194	37.080
2	Maintenance	102.410	87.432	<mark>14.978</mark>	85.281	17.129
3	Agreed elements					
4	Track repair					
5	Resurfacing					
6	Track lowering					
7	Impact of lowering speed	0	N/A	0	-2.028	2.028
8	Impact of mothballing Rosewood to Helidon	0	N/A	0	-3.123	3.123
9	Capital	137.684	110.294	27.390	122.742	14.942
10	Civil	48.631	44.015	4.616	44.015	4.616
11	Track	43.908	32.866	11.042	38.716	5.192
12	Signals & Telecom	23.129	11.397	11.732	17.995	5.134
13	Slope stabilisation	22.016	22.016	0	22.016	0
14	Operations	41.180	35.495	5.685	36.171	5.009
15	Train Control	17.360	17.360	0	17.360	0
16	Other Operational costs	23.820	18.135	5.685	18.811	5.009

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SYSTRA acknowledges that the 2.1 mtpa scenario places a challenge on Queensland Rail has a challenge to minimise capital, maintenance and operating costs on the West Moreton System. SYSTRA has recommended the actions in this report as mechanisms to assist reducing these costs.

SYSTRA also acknowledges that an optimum approach to the right capital, maintenance and operations balance for a safe railway will require a monitoring program and possible adjustment. In the 2019 SYSTRA Report a method of using annual reviews of the distribution curves of the "10 m Twist" track condition index was proposed. Tracking the pattern of the distribution curves of this index will provide insight into whether the track geometry is being maintained in a safe manner or additional capital and maintenance effort may be required.

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