Expansion Capacity Assessment
For RCS Project

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1. Introduction

UT5 required the Independent Expert (IE) to assess the capacity of each system in the Central Queensland Coal Network (CQCN) through the Annual Assessment Capacity (ACAR) process, and to review that assessment at least annually.

If the IE identifies a capacity shortfall when compared with the aggregate of committed capacity, an Existing Capacity Deficit (ECD) exists. In this case, Aurizon Network (AN) is required to rectify the ECD by implementing one or more Transitional Arrangements (TA). TAs can be capital improvements (expansion projects), or operating changes aimed at increasing network capacity. TAs are to be proposed by AN and either approved unanimously by affected access holders or, in the absence of unanimous approval, are recommended by the IE and approved by the Queensland Competition Authority (QCA). Before the implementation of any capital improvement (expansion project), the IE must approve the prudency and efficiency of the project prior to construction.

Further, within six months of the commissioning of an expansion project, the IE must conduct an expansion capacity assessment. This document sets out the IE's assessment of the remote-controlled signalling (RCS) project implemented in the Newlands system between March 2023 and July 2024 and commissioned in July 2024.

2. Expansion Capacity Assessment

The expansion capacity assessment requires the IE to consider whether the completed expansion is, in all material respects, the same as the expansion that was originally agreed upon, and to determine the capacity change resulting from the expansion.

The capacity change is calculated using consistent system operating parameters as follows:

(i) the Deliverable Network Capacity (DNC), including the implemented expansion, with the most recent ACAR as the baseline; compared with
(ii) the DNC of the system in the absence of the expansion.

If the calculation determines that the DNC created by the expansion is less than the capacity deficit that the expansion was intended to address, an Expansion Capacity Deficit exists. In this case, the IE's expansion capacity assessment must:

(i) quantify the ECD;
(ii) identify any specific causes of the expansion capacity deficit;
(iii) if applicable; specify the access holders affected;
(iv) provide, in reasonable detail, solutions that could efficiently address the expansion capacity deficit.

3. Background of RCS expansion project

In single-line systems or branch lines, the single-line infrastructure requires loaded and empty trains to pass or "cross" each other at passing loops, an operation which requires one or both trains to stop or "dwell". The extent and duration of these train dwells (and consequently, the impact on capacity) is highly influenced by the signalling system in place.

Most of the CQCN operates on the newer RCS system, in which signals (coloured lights) and turnouts (which allow trains to change tracks) are managed by train controllers in a centralised control room. This allows for relatively smooth crossing operations with minimal dwelling time.

A few remaining sections still operate on the older Direct Train Control (DTC) signalling system, in which a train's access to track sections is governed by train controllers assigning trains to track sections through radio instructions to the train crew. In this process, a system of verbal exchange of numerical codes is used to avoid errors that could result in two trains occupying the same track section. The DTC process requires significantly longer periods for trains to cross compared to RCS, thus lengthening journey times and reducing track capacity.

The RCS project involved upgrading the section of the Newlands system from Sonoma Junction South to Newlands Junction from DTC to RCS signalling, to increase the capacity of the Newlands-GAPE systems.

3.1. Goonyella to Abbot Point Expansion (GAPE) project

Prior to 2012, the Goonyella and Newlands systems of the CQCN were isolated from each other, preventing coal producers in the central Bowen Basin served by the Goonyella system from exporting coal from the terminal at Abbot Point, located north of Bowen.

In approximately 2007, a project was conceived to expand the Abbot Point terminal from 21 mtpa to 50 mtpa and to connect the Goonyella and Newlands rail systems. This would allow a wider range of coal producers to export via Abbot Point.

The rail component of this plan became known as the Goonyella to Abbot Point Expansion (GAPE) project. The project was comprised of three main components:

- Construction of approximately 100km of new rail track to connect the Goonyella system at North Goonyella Junction to the Newlands system at Newlands Junction (referred to as the "Northern Missing Link").
- Expansion of track capacity in the existing Newlands system, through:
    - the addition of passing loops,
    - upgrading the track weight capacity to accommodate 26.5 tonne axle loads, consistent with the Goonyella system characteristics,
    - electrification, and
    - upgrading of the sections of DTC signalling to complete the implementation of RCS signalling throughout the entire Newlands system.
- Minor modifications within the Goonyella system, primarily the addition of a "western angle" at Wotonga Junction near Moranbah to allow trains from Blair Athol to travel to North Goonyella Junction and then on to Abbot Point.

Prior to the GAPE project, the Newlands system operated on a mixture of newer RCS, and older DTC signals. Specifically, the track sections from Sonoma Junction south to Newlands junction operated on DTC signalling. Given the impact of DTC signalling on capacity, the original scope of the GAPE project included upgrading the complete Newlands system to RCS signalling.

Following the completion of the original design concept, however, the impact of the 2008 global financial crisis led to coal producers working with QR National Network (QRNN), the government owned predecessor of AN, to significantly reduce the cost and therefore scope of the GAPE project. The planned train length was reduced to 82 wagons (retaining the Newlands system standard), electrification was removed and DTC signalling was retained between Sonoma Junction and North Goonyella Junction.

Despite these changes, QRNN determined that the project could still deliver the 50 mtpa required to match the expansion of port capacity at Abbot Point, and the project obtained sufficient contractual

commitment from coal producers to proceed to construction. The Goonyella to Abbot Point Expansion was officially opened on 19 December 2011, with the first train successfully connecting the Goonyella and Newlands systems.

In mid-2012 QRNN proposed a change in train operations in the Newlands system from "run when ready" to scheduled operations in order to better align with the Goonyella system. QRNN advised however that the use of scheduled operations would reduce capacity and proposed to GAPE users a scope change to upgrade the signals from DTC to RCS from Collinsville to Leichardt Range in order to reduce crossing times, improve Below Rail Transit Time (BRTT), and recover capacity. At that time however, demand for use of the GAPE system was low and users approved the proposal but elected to defer the installation of RCS until demand reached a higher level (approximately 40 mtpa, based on QRNN's assessment of Newlands-GAPE capacity without RCS).

3.2. ICAR Capacity Determination and Aurizon's Network response to addressing Existing Capacity Deficit

With the advent of UT5 in 2019, the IE produced the Initial Capacity Assessment Report (ICAR) in October 2021, providing the first independent assessment of capacity in the Newlands and GAPE systems. This report assessed capacity at 33 mtpa against 50 mtpa of contracted volume. This shortfall represented an ECD and a corresponding obligation for AN to rectify the deficit via TAs.

The 2021 System Operating Parameters, published by CNCC on 27 October 2021 contained the key assumptions and model inputs contributing to the capacity modelling results that form the basis of the capacity assessment. For the Newlands and GAPE systems, these included train path separation of 60 minutes and DTC crossing times of 51 minutes.

On 14 March 2022, AN provided its *Detailed Response to the Initial Capacity Assessment Report* (Detailed Response), outlining its recommendations on TAs to address the ECD in the Newlands and GAPE systems (and other CQCN systems). In the Newlands and GAPE systems, AN suggested a three-stage approach to address the capacity deficit. Immediate implementation of the RCS project, deferred since 2012, was proposed as a part of Stage 1 to improve crossing times in the section of track from Sonoma Junction to Newlands Junction.

At that time, AN estimated study costs for the project (concept design, pre-feasibility design and feasibility design) of $1.36 million, while the RCS project capital cost was estimated at $16.22m (+/-50%) based on upgrades to the following signals[1]:

Location from	Meterage	Location to	Meterage
Collinsville CE20	78.282 km	Sonoma Junction SA14	84.600 km
Sonoma Spur and Balloon SA14	84.600	SA26	3.500km
Sonoma Junction SA14	84.600 km	Birralee BI16/18	93.894km
Birralee BI16/18	93.894km	Cockool CL16/18	113.517km
Cockool CL16/18	113.517km	Havilah HH16/18	131.216km
Havilah HH16/18	131.216km	Newlands NS21	146.055km

[1] Aurizon Network's Detailed Response to the Initial Capacity Assessment Report 14 March 2022 (Appendix 1)

Further, the following benefits of the RCS project were identified by AN in their Detailed Response[1]:

- The primary benefit of RCS signalling is the reduction in crossing times between McNaughton Junction and Newlands Junction.
- Analysis indicates that installing RCS has the potential to reduce the turnaround time of the system by up to 4 hrs per cycle. This increase in velocity means that trains can cycle quicker and achieve more throughput.
- With this project, pathing in the Newlands System can be reduced from a 60-minute dispatch to 36-minute dispatch.
- There are also additional safety benefits with RCS, with a simplification in safe working systems.

Based on modelling undertaken by the IE, AN's Detailed Response included a capacity benefit of the RCS project of 773 train paths or 5.2 mtpa.

In the same document AN provided commentary on alternative transitional arrangements considered by AN. In this section of the document entitled "Alternative Transitional Arrangements Not Recommended" (sic), AN rejected the possibility of reducing DTC crossing times, saying:

> "Consideration has been given to whether DTC crossing activities can be undertaken quicker, to reduce crossing times. Risk assessments have previously been undertaken to determine whether simultaneous crossing activities can occur. Aurizon Network considers this is not in line with our Safeworking System, and as such, recommend RCS as a more safe and efficient alternative."

3.3. IE's assessment of RCS Efficiency and Effectiveness (June 2022)

Following the publication of the Detailed Response, the IE undertook an assessment of AN's proposed TAs to determine which most efficiently and effectively address the ECD, the results of which were provided to the QCA on 17 June 2022.

The IE engaged with AN on the expected study, capital and operating costs and considered other factors such as industry feedback, risk and timing of the project implementation.

The capacity benefit of the project was assessed using the ICAR capacity model as the baseline. The model was modified based on AN's advice to reduce crossing times at the signals proposed to be converted from DTC to RCS from 51 minutes to 29 minutes and to reduce Newlands and GAPE system pathing from 60 minutes to 36 minutes. The IE estimated the corresponding capacity benefit of the project at approximately 5.6 mtpa.

As a result of this review, the IE recommended (and the QCA subsequently approved) that the RCS project progress for immediate implementation, effectively endorsing further work by AN in preparation for a final decision on the project's Prudency and Efficiency by the IE prior to construction.

3.4. IE's assessment of RCS Prudency and Efficiency (January 2023)

By January 2023, work on the RCS project was sufficiently advanced for AN to seek the required endorsement from the IE that the project was prudent and efficient and could proceed to full execution.

Working with the support of external rail consultants, the IE examined updated information from AN regarding the scope, cost and potential benefits of the project.

The capacity benefit of the project was re-assessed using the ACAR 2022 capacity model as the baseline, again reducing DTC crossing times from 51 to 29 minutes and to reducing pathing from 60 minutes to 36 minutes. At this time the IE estimated the corresponding capacity benefit of the project at 804 train paths (approximately 5.4 mtpa).

The capital cost estimate provided by AN at this stage was $18.1 million, however advice from the IE's external consultant indicated that the contingency of $0.9m (5%) included in the estimate was too low. As a result, the IE considered a more conservative level of contingency of $2.6 million (15%), bring the total cost estimate to $19.8 million.

Advice from the IE's external signalling experts suggested that the proposed RCS implementation was consistent with good industry practice. Even with the higher contingency allowance, based on the anticipated benefits, the IE determined the project met the prudent and efficient standard. This was communicated to AN and the QCA on 31 January 2023.

3.5. Change to RCS project assumptions (October 2023)

In October 2023, AN staff advised the IE that operational readiness consultation within AN had revealed changes to two key assumptions underpinning the assessment of the capacity benefit of the RCS project:

1. DTC crossing times; and
2. Train pathing.

At this time, AN informed the IE that current DTC crossing times were between 25-30 minutes, a significant reduction on the 51 minutes contained in AN's 2019 system operating parameters document and the IE's resulting 2021 SOP and 2022 SOP documents supporting the ICAR and ACAR22 capacity assessments. The implication was that more than half of the anticipated benefit of the reduction in DTC crossing times had already been delivered by operational improvements. (Note: as of October 2023, the IE did not have access to detailed records of train movements, which might have revealed this discrepancy. Access to this data has since been established, and the IE now receives detailed information of this nature monthly).

AN also informed the IE that its planning and scheduling practices were unable to deliver the anticipated reduction in train pathing/train dispatch separation from 60 minutes to 36 minutes, and that 60-minute pathing would need to be retained after the implementation of RCS. This was due to AN's inability to sustain 36-minute train separation given that the longest headway on the system, between Almoola and Birralee, was approximately 52 minutes.

Modelling undertaken by the IE following this notification suggested that, as a result of these two changes, the majority of the benefit expected from the RCS project would not eventuate.

Following further discussions with AN, a compromised position on train scheduling was identified to allow train pathing to reduce from 60 minutes to 45 minutes. This change was possible because the shorter hauls to and from the Collinsville mine and the Sonoma/Drake mines do not use the entirety of the Almoola-Birralee section. With a sufficient proportion of shorter hauls within the demand mix, the 52-minute headway issue can be managed, enabling 45-minute train separation.

4. Commissioning of RCS signalling (July 2024)

Following the approval of the project as Prudent and Efficient in January 2023, AN was able to commence full implementation of the project.

Initial site works occurred in March 2023, with project completion and commissioning expected in March 2024. In December 2023, AN advised stakeholders that challenges with the completion of the cabling contractor's scope had absorbed all the schedule contingency ahead of the late 2023/early 2024 wet season.

AN considered a range of potential responses and, in consultation with stakeholders, elected to schedule an additional system shutdown in early July 2024 to complete the project. Despite some further challenges with wet weather, AN was able to complete the installation and commissioning of the system, with the new RCS signalling commencing operations on July 5, 2024.

5. Expansion Capacity Assessment

5.1. Crossing Time Reduction and Cycle Time Benefits

The IE has examined train dwell times allocated by AN to "Crossing Activities" (in both empty and loaded directions) for the passing loops at Birralee, Cockool and Havilah (which were upgraded from DTC) for the 24 months prior to the implementation of RCS, as well as for the five months following RCS implementation (July to November 2024)[2].

Average scheduled dwell times at these locations decreased from 28 minutes to 19 minutes, while actual dwell times decreased from 15 minutes to 10 minutes. This implies an actual benefit of 15 minutes per train journey.

Comparing overall cycle time impacts is challenging due to the change in the mix of volumes from the various mines served by Newlands and GAPE systems. To mitigate this effect, the IE has separated mines into short and long hauls (see table 1 below).

This analysis suggests an improvement in scheduled cycle times of between 1.0 and 1.7 hours, while the actual reduction ranges between 0.6 and 1.6 hours. Notably, longer cycle destinations appear to have experienced larger improvements.

Table 1: Newlands & GAPE Cycle Time Results pre and post RCS

	Scheduled Cycle Time			Actual Cycle Time		
	Pre-RCS	Post-RCS	Change	Pre-RCS	Post-RCS	Change
"Short" Cycles[3]	14.9	13.9	-1.0	15.5	14.9	-0.6
"Long" Cycles[4]	26.9	25.2	-1.7	27.8	26.2	-1.6

These cycle time reductions exceed the simple reduction in crossing times at the three passing loops converted from DTC to RCS, suggesting that broader benefits of RCS on traffic flow across Newlands and GAPE systems are being realised. However, these reductions are less than the modelled cycle time reductions of 1.3 hours for "Short" cycles and 2.1 hours for "Long" cycles.

5.2. Capacity Change

5.2.1. Modelled Capacity

Following the commissioning of RCS, in December 2024 the IE completed additional modelling using the most recent ACAR24 as the baseline. Consistent with the expansion capacity assessment requirements of UT5, the following four scenarios were considered:

[2] CNCC Reporting Data (as provided by AN) – 7 December 2024
[3] Short cycles are defined as Collinsville, Sonoma/Drake, Newlands and Byerwen Mines
[4] Long cycles are Carmichael and other mines (note Carmichael cycle time includes time on CRN private infrastructure)

(i) the DNC of the system without RCS, with the original DTC crossing time of 51 minutes and 60-minute pathing;

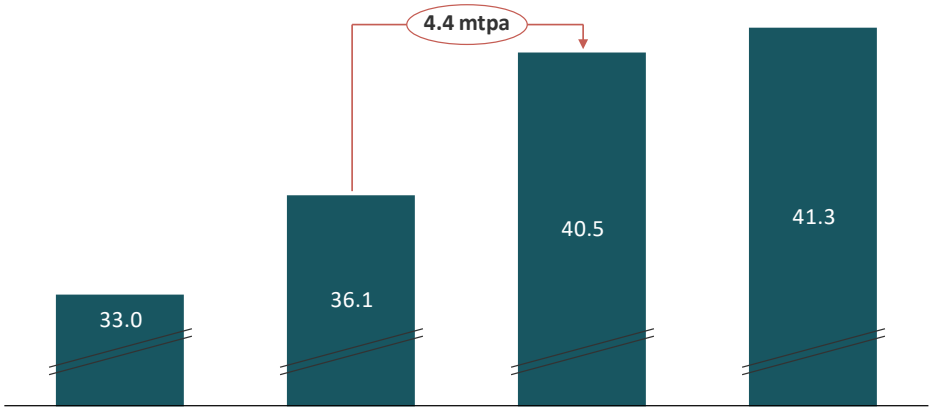
(ii) the DNC of the system without RCS, with updated DTC crossing time of 25-30 minutes and 60-minute pathing (the baseline for assessing the capacity change of RCS);

(iii) the DNC of the system with RCS, no DTC crossings and 45-minute pathing (the actual outcome of the RCS implementation); and

(iv) the DNC of the system with RCS, no DTC crossings and 36-minute pathing (the original expected capacity benefit case).

The IE modelling suggests that the capacity change (benefit) from the implementation of RCS is 4.4 mtpa. This is determined by comparing the capacity outcomes of scenario ii) and iii). This compares the results of the pathing reduction using the updated DTC crossing time of 25-30 minutes as the base case on the basis that the benefit from the reduction in crossing time was able to be delivered through operational changes and without the RCS implementation.

Expansion Capacity Assessment: RCS Project – model outcomes (mtpa)



	(i) ACAR24 60 mins pathing DTC Times 51 mins (19 consists)	(ii) ACAR24 60 mins pathing DTC Times 25-30 mins (19 consists)	(iii) ACAR24 45 mins pathing RCS (19 consists)	(iv) ACAR24 36 mins pathing RCS (19 consists)
Cycle Time (hours)	31.2	27.2	24.3	24.2
Train Paths	4,956	5,423	6,080	6,211
Average Payload	6,659	6,657	6,661	6,649

The capacity change of 4.4 mtpa is less than the 5.4 mtpa capacity benefit expected from the RCS project implementation as determined through the IE's prudency and efficiency assessment in January 2023.

However, on an absolute basis the aggregate Newlands and GAPE system capacity determined by scenario iii) (40.5 mtpa) exceeds previously expected result of 37.9 mtpa, even without the RCS project realising the expected benefit of 36-minute pathing.

In considering the potential driver of the increased capacity benefit from RCS, the IE notes that in ACAR24 a substantial uplift in capacity was experienced in the Goonyella system. This improvement appears to assist the journey of GAPE trains, providing an additional capacity benefit (0.5 mtpa) to the Newlands and GAPE system even in the absence of RCS. The introduction of RCS appears to magnify this benefit, with a further ~1.0 mtpa additional benefit of RCS above earlier estimates. (A full chronology of the various capacity assessments of RCS is available in Appendix 1).

5.2.2. Actual Throughput in the Newlands and GAPE Systems

Although the sample is somewhat limited, and potentially subject to demand constraints, average monthly traffic levels since July 2024 have been approximately 10% higher than the 24 months prior to the RCS implementation, with throughput at an annualized rate of ~5,750 trains (or 38.2 mtpa using ACAR24 average payloads).

Peak output since the implementation of RCS occurred in November 2024, for which throughput of 501 trains represented an annualized rate of 40.5 mtpa, which represents the highest achieved throughput in the Newlands and GAPE systems history. This exceeded the previous high of 39.5 mtpa achieved in May 2023, suggesting that further upside potential exists subject to sufficient demand.

6. Expansion Capacity Deficit

6.1. Assessment Outcomes

UT5 requires that the IE consider whether "the completed expansion was in all material respects the same as agreed".

The IE considers that the proposed construction scope of the RCS expansion (the upgrading of various signal locations from DTC to RCS) was completed to the agreed requirement.

The IE further considers, however, that the completed expansion was not in all respects the same as agreed because the project was unable to deliver the anticipated operational change from the reduction in train pathing from 60 minutes to 36 minutes, which would have delivered additional train paths to customers.

As outlined in section 5.2.1, the IE estimates that the RCS project has delivered an additional 4.4 mtpa of capacity to the Newlands and GAPE systems.

6.2. Expansion Capacity Deficit

The capacity benefit of the RCS expansion was determined by the IE during the prudency and efficiency assessment process. At that time, the capacity benefit assessed was 5.4 mtpa. Based on the expansion capacity assessment's capacity change of 4.4 mtpa, the IE has determined that an expansion capacity deficit, as defined by UT5, of 1.0 mtpa would result.

The existence of an expansion capacity deficit is complicated, however, by the nature of the two causes of the shortfall in expected capacity:

- The inability to achieve 36-minute train pathing; and
- Incorrect baseline assumptions for the time required to conduct train crossings under DTC signalling.

As outlined in section 3.5, AN was unable to implement 36-minute train pathing following the RCS implementation and instead the RCS expansion was commissioned with 45-minute pathing. This resulted in network paths being reduced from the proposed 40 to 32 train paths per day.

As also discussed in section 3.5, the IE's assessment of the capacity benefits expected from the RCS project was undertaken with incorrect information regarding the current train crossing times under the DTC signalling.

Had the correct information been available from AN at the time of the IE's prudency and efficiency assessment, the expected capacity benefit would have been reduced by approximately 1.7 mtpa, from

5.4 mtpa to approximately 3.7 mtpa (this is shown in the Appendix table, with accompany note 7). Against this revised benefit, the capacity change of the RCS project expansion capacity assessment would not result in an expansion capacity deficit.

The IE has considered what impact a revised benefit assessment at the prudency and efficiency stage would have had on the IE's decision to approve the implementation of the RCS project. At that time, RCS was the most tangible and well-developed project with the potential for a material improvement in capacity in the Newlands and GAPE systems. As a result, the IE has concluded that even with a reduced capacity benefit of 3.5 to 4 mtpa, the project would have been approved as prudent and efficient.

Given that the modelled benefits of RCS have increased in successive ACAR assessments, it appears that despite the failure to achieve 36-minute train pathing, the RCS project has improved network capacity by more than 4 mtpa.

Based on this, the IE has concluded that, for all practical purposes, the RCS project has met the level of capacity benefit expected, and that no expansion capacity deficit exists.

The IE notes that despite the implementation of RCS, an existing capacity deficit remains in the Newlands and GAPE systems, and the IE continues to work with AN on additional TAs to remedy this situation.

7. Definitions

Acronym	Full Form
QCA	Queensland Competition Authority
IE	Independent Expert
RCS	Remote Control Signalling
DNC	Deliverable Network Capacity
ACAR	Annual Capacity Assessment Report
GAPE	Goonyella to Abbot Point Expansion
ICAR	Initial Capacity Assessment Report
DTC	Direct Train Control
TA	Transitional Arrangements

Appendix 1 - Chronology of RCS Capacity Benefit Estimates

(All figures mtpa)	AN's Initial Response to ICAR	AN's Detailed Response to ICAR	IE's Efficiency & Effectiveness Assessment	IE's Prudency & Efficiency Assessment	AN's Change to assumptions	IE's Expansion Capacity Assessment
Date	**November 2021**	**March 2022**	**June 2022**	**January 2023**	**October 2023**	**December 2023**
Basis	AN	ICAR	ICAR	ACAR22	ACAR23	ACAR24
Financial Year	FY23	FY23	FY24	FY25	FY25	FY25
Baseline Capacity (DTC 51 mins, 60 min pathing)		32.7	32.9[5]	32.5	32.2	33.0
Revised baseline (DTC 25-30 mins, 60 min pathing)				*34.2*[7]	34.7	36.1
RCS (60 min pathing)					36.6	
RCS (48/45 min pathing)[6]					38.7	40.5
RCS (36 min pathing)		37.8	38.7	37.9	40.1	41.3
RCS Benefit						
Original DTC times, 36 minute pathing	5.8	5.2	5.6	5.4	7.9	
Revised DTC times, 36 minute pathing				*3.7*[7]	5.4	
Original DTC times, 45 minute pathing					6.5	7.5
Revised DTC times, 45 minute pathing					4.0	4.4

[5] Baseline includes the BCM TA (#NG2)
[6] October 2023 modelling used a hypothetical 48 minute pathing, later revised to 45 minutes
[7] Estimated – change in DTC crossing times not available until October 2023