## Agenda

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Share</td>
<td>Ryan Bell</td>
</tr>
<tr>
<td>FY2016 Network Performance</td>
<td>Jason Livingston</td>
</tr>
<tr>
<td>Maintenance cost trends: UT3 to UT5</td>
<td>Michael Bray</td>
</tr>
<tr>
<td>Overview of Maintenance Cost Report for FY2016</td>
<td>Rob Cumberbatch</td>
</tr>
<tr>
<td>FY2018 Maintenance and Capital Plan</td>
<td>Jason Livingston</td>
</tr>
<tr>
<td>Next Steps</td>
<td>Michael Bray</td>
</tr>
</tbody>
</table>
Standard Work Practice Review – Scheduled Patrol Inspections

**Legacy Inspection Regime**
- Hi-rail patrol inspection every 96 hours (min. frequency)
- All on track within the Danger Zone

**Current Inspection Regime**
- Hi-rail patrol inspection every 192 hours (min. frequency)
- Retained 96 hours on NCL and timber & steel track

**Risk Assessed**
- All Stakeholders engaged, principally Infrastructure Maintenance
- Reviewed all defects identified via Hi-rail Inspections
- No defects identified that would ordinarily manifest themselves within a 192 hour window
- Change Management Plan developed and Endorsed by the ORR

**Benefits**
- Removing (SFAIRP) personnel from the Danger Zone
- Freeing up train paths, enabling additional services and flexibility
FY16 Network Performance
FY2016 Network Performance Highlights

- Continued to have a Lost Time Frequency Rate of 0
- Improvement in performance plan from 89% to 92%
- Reduction in derailments from 29 to 23

- Completed 123 kms (linear) of ballast undercutting (based on 300mm standard depth);
- 133km delivered on a volumetric equivalent

**Below Rail Cancellations**

<table>
<thead>
<tr>
<th>Location</th>
<th>2014/15</th>
<th>2015/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackwater</td>
<td>243</td>
<td>82</td>
</tr>
<tr>
<td>Goonyella</td>
<td>169</td>
<td>178</td>
</tr>
<tr>
<td>Moura</td>
<td>44</td>
<td>21</td>
</tr>
<tr>
<td>Newlands</td>
<td>53</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>509</td>
<td>304</td>
</tr>
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</table>

**Below Rail Delays**

<table>
<thead>
<tr>
<th>Location</th>
<th>2014/15</th>
<th>2015/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackwater</td>
<td>6.9%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Goonyella</td>
<td>5.5%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Moura</td>
<td>5.2%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Newlands</td>
<td>6.7%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Total</td>
<td>10.5%</td>
<td>10.3%</td>
</tr>
</tbody>
</table>

**Performance to Plan**

<table>
<thead>
<tr>
<th>Location</th>
<th>2014/15</th>
<th>2015/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackwater</td>
<td>86%</td>
<td>91%</td>
</tr>
<tr>
<td>Goonyella</td>
<td>86%</td>
<td>91%</td>
</tr>
<tr>
<td>Moura</td>
<td>86%</td>
<td>91%</td>
</tr>
<tr>
<td>Newlands</td>
<td>95%</td>
<td>96%</td>
</tr>
<tr>
<td>Total</td>
<td>89%</td>
<td>92%</td>
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</tbody>
</table>
CQCN Performance Indicators - OTCI

The OTCI reports on the quality of Aurizon Network’s track by individual Coal System. The lower the indicator, the better the track quality. As an index, the OTCI is used as an indicator of abnormality only as it cannot reflect all variations within a coal system.
CQCN Performance Indicators - BRTT

Below Rail Transit Time: Section Run Times, Below Rail Delays, Train Crossing, Force Majeure and Delays due to Operational Constraints. % calculated by dividing the BRTT by the relevant nominated section running times (in the direction of travel) as specified in the Train Service Entitlement.
Maintenance trends: UT3 to UT5
CQCN continues to deliver record volume throughput

Annual volume forecasts for UT5 are on average:

- 45% higher than UT2
- 31% higher than UT3
- 3% higher than UT4
While reliability, volumes and size (track km) have increased, Aurizon Network’s costs have remained relatively stable.
MAR per NT driven by major network expansions and major weather events
Cost trends UT3 to UT5: Mechanised maintenance
Ballast Undercutting

UT4 scope performance to date:

- Aurizon Network is delivering UT4 scope
- UT5 scope to be refined through regulatory process once GPR analysis is completed

### Costs ($m)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Allowance - Real FY2015</td>
<td>53.0</td>
<td>58.0</td>
<td>58.8</td>
<td>60.4</td>
<td>61.3</td>
<td>61.3</td>
<td>64.9</td>
<td>64.9</td>
</tr>
<tr>
<td>Allowance – Nominal</td>
<td>54.6</td>
<td>61.6</td>
<td>64.5</td>
<td>69.6</td>
<td>64.5</td>
<td>65.7</td>
<td>70.8</td>
<td>72.1</td>
</tr>
<tr>
<td>Actual Cost</td>
<td>54.6</td>
<td>61.7</td>
<td>73.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference to allowance</td>
<td>(0.0)</td>
<td>(0.1)</td>
<td>(9.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>

### Mainline (km) and Turnouts (#)

<table>
<thead>
<tr>
<th></th>
<th>FY14 to FY16 Approved</th>
<th>FY14 to FY16 Delivered</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainline (km)</td>
<td>380</td>
<td>403</td>
<td>23</td>
</tr>
<tr>
<td>Turnouts (#)</td>
<td>122</td>
<td>147</td>
<td>25</td>
</tr>
</tbody>
</table>
Resurfacing

UT4 scope performance to date:

- Cost uplift for UT5 linked to replacement of life expired equipment
- Long lead time items with useful life of ~15 years
- QCA will conduct detailed review of rationale of this investment

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<tbody>
<tr>
<td>Allowance - Real FY2015</td>
<td>19.5</td>
<td>19.0</td>
<td>18.2</td>
<td>20.1</td>
<td>23.3</td>
<td>23.8</td>
<td>24.2</td>
<td>24.3</td>
</tr>
<tr>
<td>Allowance – Nominal</td>
<td>20.1</td>
<td>20.3</td>
<td>20.0</td>
<td>23.3</td>
<td>24.5</td>
<td>25.5</td>
<td>26.4</td>
<td>27.0</td>
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<tr>
<td>Actual Cost</td>
<td>19.1</td>
<td>21.2</td>
<td>21.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference to allowance</td>
<td>1.0</td>
<td>(0.9)</td>
<td>(1.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Under / (Over)</td>
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</table>
**Rail Grinding**

- **UT4 scope performance to date:**
  - **Mainline (km)**
    - Approved: 10,188
    - Delivered: 10,101
    - Variance: (87)
  - **Turnouts (#)**
    - Approved: 2,025
    - Delivered: 1,948
    - Variance: (77)

- QCA didn’t publish rail grinding scope in the UT4 final decision.

- Scope performance reported above reflects NSAP scope based on a volume forecast which was ultimately higher than the UT4 final decision.

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowance - Real FY2015</td>
<td>13.6</td>
<td>13.7</td>
<td>12.8</td>
<td>12.3</td>
<td>17.9</td>
<td>17.8</td>
<td>17.7</td>
<td>17.6</td>
</tr>
<tr>
<td>Allowance – Nominal</td>
<td>14.1</td>
<td>14.6</td>
<td>14.0</td>
<td>14.2</td>
<td>18.8</td>
<td>19.1</td>
<td>19.3</td>
<td>19.6</td>
</tr>
<tr>
<td>Actual Cost</td>
<td>14.6</td>
<td>17.4</td>
<td>18.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference to allowance</td>
<td>(0.6)</td>
<td>(2.8)</td>
<td>(4.2)</td>
<td></td>
<td></td>
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<td>Under / (Over)</td>
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</table>
Despite higher volume throughput, costs are stable

- Unit costs of most non-mechanised activities are reducing in real terms
- Increase in “Structures” attributable to initiative which improve resilience against extreme weather events (e.g. culvert cleaning)
Blackwater System: UT4 to UT5

- Higher volume throughput has the effect of reducing fixed unit costs
Goonyella System: UT4 to UT5

- Uplift in FY2020 and FY2021 due to greater ballast undercutting scope and flat volumes. Scope to be refined through UT5 regulatory process
• Ballast undercutting increase in FY2016 the result of additional scope delivered while network was closed due to flooding
Newlands and GAPE System: UT4 to UT5

Newlands and GAPE - Real maintenance costs per GTK'000 (SFY2016)

- Ballast Undercutting
- General Track
- Signalling
- Resurfacing
- Rail Grinding
- Telecommunications
- Structures
- GTK

FY2014 (a) FY2015 (a) FY2016 (a) FY2017 FY2018 FY2019 FY2020 FY2021

- Ballast Undercutting: 0.16 0.17 0.21 0.23 0.12 0.12 0.14 0.14
- General Track: 0.15 0.22 0.31 0.31 0.14 0.29 0.29 0.29
- Signalling: 0.37 0.34 0.32 0.49 0.30 0.48 0.29 0.48
- Resurfacing: 0.34 0.32 0.42 0.57 0.50 0.49 0.49 0.49
- Rail Grinding: 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57
- Telecommunications: 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57
- Structures: 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26

Total Costs: 0.71 0.73 0.73 0.73 0.73 0.73 0.73 0.73

0.16 0.17 0.21 0.23 0.12 0.12 0.14 0.14
0.15 0.22 0.31 0.31 0.14 0.29 0.29 0.29
0.37 0.34 0.32 0.49 0.30 0.48 0.29 0.48
0.34 0.32 0.42 0.57 0.50 0.49 0.49 0.49
0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57
0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57
0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26

AURIZON
Driving efficient outcomes in UT5

Objectives for UT5:

• Promote safe and efficient utilisation of the CQCN
• Focus on continuous improvement (including work practices) and cost control, and
• Harnessing technology to improve our data capture and reporting capability

Experience to date:

• For most maintenance products, real unit costs have decreased or remained stable over an extended period of time
• Delivering maintenance scope, in conjunction with improvements in network performance and record volume throughput
• Condition based assessment – “the CQCN is in overall good condition”
FY16 Maintenance Cost Report
FY16 Network Maintenance Costs

• Record equalling tonnes of 226 million which exceed forecast by 8.3m

• The spend of $209m, was an overspend / under-recovery against the QCA approved allowance by $13m. As the allowance was approved in May of the Financial Year. We lost the opportunity to meet the cost challenge

  • Ballast undercutting program reflected a $9.4m under recovery of our costs following the QCA’s capping unit rates at $400k / km 11 month’s into the year. During the year we delivered an increased amount of scope via excavator undercutting. This activity is less cost efficient than the RM900 undercutting machine

  • General Track Maintenance, resurfacing and rail grinding activities under recovered by $3.6m. Which reflected changes in the assumptions around volumes and fixed and variable costs

NB: The last year of rail renewals being treated as Operational expenditure. From FY17, rail renewals will be treated as capital.
Total Under Recovery of costs vs the UT4 Allowance was $13m for FY16. $15m under recovery from our Mechanised maintenance, $3m adverse in General Track; offset $2m by labour savings in our Signalling and Telecommunications maintenance and $3m in Other

Preventative Mechanised Maintenance represents 53% of maintenance costs (Ballast Undercutting, Resurfacing, and Rail Grinding)

In FY16 AN delivered on or above the required scope for mechanised maintenance products

* Others include indirect costs (ROA, Return on Inventory for the allowance). Actuals include Maintenance specific support costs for Planning, Administration, and Logistics staff. In the Allowance, these costs were spread over the non-mechanised products
FY16 Maintenance Cost By System

**Goonyella** had the greatest ($) variance against allowance
- Ballast undercutting $8.3m
- General track, resurfacing and rail grinding works $2m

**Moura** had the greatest % variance against the allowance
- Whilst the system was shut for Flood rectification works, we took advantage of the track availability to deliver a larger amount of scope in ballast undercutting and resurfacing activities
Ballast Undercutting – **Target scope delivered, but at $9m under recovery**

**Mainline Undercutting**
- Plan scope: 133 linear km at standard depth of 300mm
- Actual scope completed: 134 linear equivalent km (volumetric)

**Turnouts**
- Delivered above QCA approved scope

**Cost**
- FY16 - $69m actual v $60m Allowance
- Due to production constraints of the RM900 Ballast Undercutting Machine (BCM), Aurizon Network additional scope was delivered by more use excavator undercutting. This is less cost efficient.
- Costs also rose from the increase in depreciation the new spoil wagons.
FY16 Rail Grinding – *Just under target scope delivered, but $4m under recovered*

Delivered 5% below the original DAU UT4 **mainline** scope. Delivery is based on the asset requirement assessed throughout the year.

Delivered to target of the original DAU UT4 **Turnout** scope.

**Cost**
- FY16 - $18m actual v $15m planned (UT4) – Under recovered our costs by $3m in FY16, and this will continue in FY17
- Costs are 75% fixed. The UT4 FD adjusted for a lower volume, but assumed 100% variable costs
- Aurizon Operations is Australia’s largest (market share) grinding company who charge us a comparable rate to recent open market tenders won in Australia.
FY16 Resurfacing – *More than target scope delivered, $2m under recovered*

Delivered 6% above the UT4 mainline scope based on the asset requirement assessed throughout the year.

Delivered 8% above the UT4 Turnout scope based on the asset requirement assessed throughout the year.

FY16 Resurfacing Costs By System

- **Cost**
  - FY16 - $22m actual v $20m planned (UT4) – Under recovered our costs by $2m in FY16, are working to deliver scope within the allowance in FY17
  - Arrival of new fleet has increased depreciation and maintenance, but with higher productivity and reliability
  - We continue to drive the most out of the machines, and access to the track is key
FY16 General Track - $3m under recovered, but delivering improved performance

Key Points:

Overall increase reflects growth in GTK’s over time.

- Specific Increases in this area have come about from:
  - Rail Repair costs
  - Maintenance Ballast
  - Rail Stress Management
  - Ballast Undercutting Other – emergency Mud-Holes corrections
  - Earthworks Non-Formation [Access Road & Points]

- Most of the costs in these activities have been preventative in nature, where we have inspected the asset, seen the early signs of defects, and corrected the defects in a planned manner.

- Turnout Maintenance costs have seen a reduction from UT3 to UT4 – driven by component renewals

- FY16 - Moura’s overspend is from Rail Stressing and Maintenance Ballast works
FY18 Maintenance & Capital Plan
Balanced Asset Management - Maintenance vs Capital

<table>
<thead>
<tr>
<th>Renewal CAPEX Investment</th>
<th>Maintenance Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aim of investment</strong> is to renew, replace, refurbish or extend assets to achieve the same functional design intent of the original asset.</td>
<td><strong>The level of renewal investment will allow maintenance cost to remain at the current level</strong></td>
</tr>
<tr>
<td>The current investment level is sufficient to offset the natural ageing and deterioration processes so that the average asset performance, system performance and risk levels remain relatively constant.</td>
<td>A reduction in renewal CAPEX will have an upward effect to maintenance cost and vice versa.</td>
</tr>
<tr>
<td>The current level of investment will be required in the medium term given forecast demand and tonnages and to maintain system performance.</td>
<td>The renewal program renews / replaces approximately 2% of the asset p/a therefore at the current investment levels maintenance hold the remaining 98% of assets in a subject year</td>
</tr>
<tr>
<td>Holding capital spend in an environment of increasing tonnages drives a constant efficiency challenge exacerbated by pressure on closure time of increased work requirements with increased tonnages.</td>
<td></td>
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<tr>
<td>Drive efficiencies in delivery as availability to the track is under pressure.</td>
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</tbody>
</table>

Balancing Renewal capital with ongoing maintenance requirements enables:
- Efficient costs
- Safe network
- Available network
- Customer engagement
- Stable cost and pricing outcomes
Condition & Criticality Based Asset Management

**Condition of Asset**
- Generic condition rating across all asset classes
- Condition derived from data systems – NAMS, remote monitoring systems, track recording data & engineering assessments

**Location Criticality**
Location criticality determined by:
- Tonnage over asset
- Impact of outage – including mean time of outage duration
- Impact on velocity

**Prioritised Asset Listing**
- Ability to create long term asset management plans
- Scope & timing of asset inspections & maintenance works is informed by risk & ranking of assets

**Supported by:**
- Master Data Systems (NAMS)
- Data Analytics (RAMSYs)
- Asset Management Plans

**Allows for:**
- Optimal investment planning for long run assets
- Asset condition trending to inform decision making

**VALUE**
Greater network reliability
Greater system availability
Better train planning
FY18 Capital Cost

Renewal capital:
- $177m against a RAB value of $6.2bn; equates to a rate of renewal of 2.9%

Transformation capital:
- $46.8m, including the completion of NAMS Tranche 2 and Project Pluto
The rate of degradation of rail infrastructure is impacted by tonnages, hence renewal requirements are correlated with throughput.

Electrical renewals and replacement capital are also required in Blackwater and Goonyella.

### FY18 Capital Scope

#### Blackwater
- $79.9m
  - 22.1km rail renewal
  - 44.7km track upgrade
  - 3 Turnout renewals
  - 15,000 sleepers renewed
  - 5 structures renewed
  - 70km of Overhead minor component renewal
  - Power resilience upgrades at 13 sites

#### Goonyella
- $94.4m
  - 23.1km rail renewal
  - 30.2km track upgrade
  - 8 Turnout renewals
  - 7,400 sleepers renewed
  - 5 structures renewed
  - Level crossing upgrades at 8 sites
  - 73 km of Overhead minor component renewal
  - Location Case upgrades at 16 sites

#### Moura
- $8.5m
  - 2.3km rail renewal
  - 4.9km track upgrade
  - 1,051 sleepers renewed
  - 188m of bridge rollouts
  - Data coms upgrades at 21 sites

#### Newlands
- $24.9m
  - 0.9km rail renewal
  - 2.1km track upgrade
  - 2 Turnout renewals
  - 1,896 sleepers renewed
  - 5 structures renewed
  - Data coms upgrades at 20 sites

#### System Wide
- $17.2m
  - Universal Train Control (UTC) system upgrades
  - Radio System renewal project
  - NAMS Tranche 2
  - Fix on fail renewal for turnouts, formation and rail
  - Fencing across the CQCN
  - Safety systems establishment for electronic track access
## Asset Renewal Performance

Annual renewal rates need to be sustainable and considered in context with the total asset value

<table>
<thead>
<tr>
<th>Program</th>
<th>FY16 Delivered Scope</th>
<th>FY16 Cost ($m)</th>
<th>Total amount of Asset</th>
<th>FY16 % of asset renewed</th>
<th>NSAP renewal rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail</td>
<td>110km / year</td>
<td>58.0</td>
<td>5,426km</td>
<td>2.0%</td>
<td>136km / year (40years)</td>
</tr>
<tr>
<td>Sleepers</td>
<td>58,372 sleepers</td>
<td>14.8</td>
<td>4.6m sleepers</td>
<td>1.3%</td>
<td>92,000 (50 years)</td>
</tr>
<tr>
<td>Turnouts – Full Replacement</td>
<td>5 / years</td>
<td>14.7</td>
<td>1,014</td>
<td>0.5%</td>
<td>40 / year (25 years)</td>
</tr>
<tr>
<td>Culverts</td>
<td>21 / year</td>
<td>17.2</td>
<td>3,809</td>
<td>0.5%</td>
<td>38 / year (100 years)</td>
</tr>
<tr>
<td>Bridges</td>
<td>1 / year</td>
<td></td>
<td>339</td>
<td>0.3%</td>
<td>3 / year (100 years)</td>
</tr>
</tbody>
</table>

### Notes:
- Assets are selected for renewal via the scope condition and criticality analysis. This analysis builds on the theoretical renewal rates in the NSAP model and considers actual asset condition and asset location criticality to the supply chains performance.
- NSAP life of assets is dependant on various pre conditions including axle loading of the track or structure, the construction methodology, size, material and alignment. The lives represented against assets in the table are the most predominant asset in the CQCN within that asset class.
- Turnouts are upgraded via major component upgrades prior to full replacement and therefore a lower renewal rate is applied.
- Rail costs include the Rail Renewal project as well as the Track upgrade project.
FY18 Maintenance Cost – All Products
### FY18 Mechanised production scope and costs

<table>
<thead>
<tr>
<th>Location</th>
<th>Total Cost</th>
<th>Undercutting Mainline:</th>
<th>Undercutting Turnouts:</th>
<th>Grinding Mainline:</th>
<th>Grinding Turnouts:</th>
<th>Resurfacing Mainline:</th>
<th>Resurfacing Turnouts:</th>
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</thead>
<tbody>
<tr>
<td><strong>Blackwater</strong></td>
<td>$47.0m</td>
<td>69km</td>
<td>20 locations</td>
<td>1,375km</td>
<td>194 locations</td>
<td>653 km</td>
<td>153 locations</td>
</tr>
<tr>
<td><strong>Goonyella</strong></td>
<td>$48.1m</td>
<td>57km</td>
<td>19 locations</td>
<td>2,122km</td>
<td>418 locations</td>
<td>797 km</td>
<td>155 locations</td>
</tr>
<tr>
<td><strong>Moura</strong></td>
<td>$2.8m</td>
<td>10km</td>
<td>2 locations</td>
<td>237km</td>
<td>29 locations</td>
<td>223 km</td>
<td>44 locations</td>
</tr>
<tr>
<td><strong>Newlands/GAPE</strong></td>
<td>$9.9m</td>
<td>4km</td>
<td>2 locations</td>
<td>405km</td>
<td>106 locations</td>
<td>195 km</td>
<td>23 locations</td>
</tr>
</tbody>
</table>

*Note: All distances are in kilometers.*
General Track Maintenance for FY18 ($m)

- UT5 proposal for General Track Maintenance is comprised of a number of activities.

- Reactive activities such as vegetation control are heavily dependent on external factors (i.e. amount of wet weather) and are scoped & costed on the basis of historical trends and observations.
Next steps
Next Steps

• **Comments and feedback**
  
  • We are committed to providing additional transparency about our asset management performance
  
  • Want to better understand what information is most relevant and useful to you
  
  • Welcome the opportunity to meet with you (individually if necessary) to address specific questions or areas of concern

• **Quarterly Maintenance Cost Report**
  
  • Template will shortly be distributed for consultation
  
  • Feedback due by 24 March

• **QCA’s review of UT5 proposal**
  
  • Aurizon Network recognises the critical role played by the QCA in assessing the efficiency of the scope and cost of the UT5 maintenance cost proposal
  
  • We are actively working with the QCA and its consultants to support its comprehensive review of all aspects of the UT5 proposal
Appendix
Asset and Maintenance Overview

Mechanised Maintenance accounts for 49%* of maintenance costs

Ballast Undercutting is preventative and goes to minimise defects in the track and formation to avoid speed restrictions, train delays and derailments

Rail Grinding and Resurfacing are preventative and extend the life of the asset and reduce defects requiring unplanned maintenance

Non-Mechanised Maintenance accounts for 45%* of maintenance costs - General Maintenance (20+ activities) makes up 22% of these costs

Split into preventative (mainly time based inspections) or planned / unplanned corrective works (e.g. rail repair)

Time based inspections are critical to understanding asset condition and finding faults prior to causing major system disruption

* remaining 6% of maintenance costs are attributed to inventory management, return on plant and inventory
Ballast Undercutting

What

Ballast is essential to the structural integrity of the track – absorbing forces from trains and providing drainage to ensure the track remains in correct alignment.

Why

Keeping ballast clean and with the right profile is integral to minimise track defects in the track and formation to avoid speed restrictions, train delays and avoid derailments.

How

Ballast Cleaning Machines (BCM) excavate fouled ballast and replace with cleaned or fresh ballast which is then profiled to restore the track to the correct height and depth.

When

Scope for Ballast is determined primarily by data obtained through Ground Penetrating Radar (GPR) runs that show the condition of the ballast and formation. This data is analysed by the Assets team to determine the maintenance scope to ensure the track meets minimum requirements under the SMS.
Resurfacing

What
Resurfacing involves ensures the ballast has the right profile and the track is correctly aligned.

Why
Prevents accelerated wear of track components caused by excessive forces from trains. Resurfacing is preventative and reduces the costs over the life of the assets and the need for unplanned maintenance tasks that disrupt train services.

How
Resurfacing is done by a number of machines - Tamping Machines, Ballast Regulators, Dynamic Track Stabilizers which tamp, shape and align the track.

When
Resurfacing is completed following any track disturbance works (such as rail replacement or ballast undercutting).
Resurfacing is also programmed to rectify issues identified by track recording cars or visual inspections.
Rail Grinding

What

Rail Grinding maintains the correct profile of rail and removes irregularities such as cracks and surface defects ensuring the desired interface between the rail and rollingstock wheels and prevents accelerated wear on rail.

Why

It is preventative and minimizes the number of rail defects which require unplanned maintenance. It also decreases the wear rates (and increases asset lives) of both the rail and rollingstock wheels.

How

Rail Grinding is done using high speed rail grinding machines which have a series of cylindrical grinding stones that rotate at the required angle to achieve the correct profile on the rail.

When

Scope for rail grinding is determined by the NSAP model and is based on forecast tonnage. This scope may be amended by the rail grinding team based on visual inspection.
Non-Mechanised Maintenance Activities

Non-Mechanised Maintenance cover activities relating to Civil (track, formation and structures), Control Systems (signaling control systems, wayside monitoring systems) and Electrical Systems that do not require track equipment.

Non-Mechanised activities are either periodic inspections or fault rectification works which are carried out without track equipment. The time based inspections and activities are critical to understanding asset condition and to find faults prior to them causing major system disruption.

Non-Mechanised Maintenance activities are done by staff located at 6 major depots across the CQCN.

The time based activities (e.g. track inspections and track recording) are set in accordance with Network’s Safety Management System (SMS).

Fault rectification works arise from visual inspections or incidents (e.g. vegetation control). Scope is set based on historical requirements but may vary year on year due to external factors (e.g. wet weather increases scope for vegetation control).
## Definitions of network performance measures

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR Cancellation Impact %</td>
<td>The number of trains cancelled to a below rail cause as a percentage of the weekly agreed orders.</td>
</tr>
<tr>
<td>Cycle Velocity</td>
<td>The total time taken for the service / total distance for that service.</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>The total time taken for the service from depart depot to arrive depot.</td>
</tr>
<tr>
<td>BR Delay Cycle Impact %</td>
<td>The total below rail caused delays minutes expressed as a percentage of the total cycle minutes for each service.</td>
</tr>
<tr>
<td>Performance to Plan</td>
<td>No. Services arrived at port / No. Services requested and planned (Weekly Agreed Orders)</td>
</tr>
</tbody>
</table>