# JUGL REGIONAL LINX

TRACK CAPABILITY ASSESSMENT

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**CRN CM 004** 



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# **Document Control**

Function	Position	Name	Date
Approver	A&E Manager	Lucio Favotto	24.01.2022

Revision	Issue Date	Revision Description
1.0	12.11.2021	UGLRL Operational Standards Template applied
2.0	29.11.2021	First approved and issued UGLRL version
3.0	24.01.2022	Issued for publish to internet and webpage

## Summary of changes from previous version

Section	Summary of change
All	This document is based on the previous rail infrastructure maintainer (RIM). Full revision history is available on request from UGLRL







# Chapter 1 Introduction

# C1-1 Purpose

The purpose of this document is to describe what factors and inputs need to be considered when assessing the capability of track to allow an increase in the permitted track loading and / or speeds of rolling stock on the CRN. This document is intended for use by the UGLRL CRN Engineering Services team only. Any changes to permitted track loading and / or speed is based on an assessment of the configuration and condition of the infrastructure by the Principal Track & Civil Engineer in conjunction with the Principal Rolling Stock Engineer, stakeholders and subject matter experts.

The document sets out the process for considering new or changed proposals for the operation of existing and / or new rolling stock on the CRN with respect to track loading and / or allowable speed.

The document has been developed in response to requests to UGLRL CRN for increased axle loads and speeds for heavier freight locomotives and wagons on the CRN.

As the asset steward of the CRN, UGLRL applies asset management principles to optimise customer use of the network, balanced with sustainable asset management practices.

#### C1-2 Purpose

This process applies to permissible rolling stock, track loading and / or speed on all operational tracks (existing or proposed) of the CRN network. Typically, this includes a review of the following parameters

- Track configuration and condition
- Rolling stock kinematic profile (transit space)
- Rolling stock axle loading and tonnages
- Structures configuration and condition (including load rating)
- Level crossing safety
- · Vertical and horizontal alignment, permissible speeds
- High consequence locations

Other considerations may include:

- Internal rolling stock characteristics and condition, including speed restrictions when loaded, acceleration and braking capacity
- · Locomotive tractive effort and dynamic braking
- Signalling systems

The assessment process is risk based, objective and defensible. The process is required for all changes in rolling stock operations and should also consider corridor traffic density.

The assessment process aims to balance risk with potential increases in maintenance resources considering the operational benefits realised by CRN network customers.

The assessment process is mainly focussed on the operation of freight locomotives and wagons on class 2, 3, 3G and 5 operational tracks (existing or proposed) of the CRN. Typically, these track classes have undergone a configuration change through maintenance and upgrading or due to having a good historical based condition. These factors provide an opportunity for increased operation above the allowable limits set by CRN CS 200. In many cases, sections of track or entire corridors are configured above or between nominal classes.



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Class 1 mainline tracks would follow the same assessment process, however operations are not expected to change significantly from the existing engineering standards and TOC manual.

The use of historical track classifications to describe configuration is intended to be progressively revised or phased out of the civil standards due to the inconsistencies between corridors of the same class.

Operation over turnouts is considered in the process. The assessment requires verification that mainline turnouts have a loading capacity at least equivalent to open mainline track on the relevant line.

Operation within sidings is considered in the process. The assessment requires verification that sidings can accommodate the changed loading conditions at slow speed.

Conditions on rolling stock operation are managed through the TOC manual and do not form part of this assessment process.

The process can also be used for the assessment of tracks for a reduction in capability if required.

## C1-3 Application

This process can be applied to all change proposals as well as a review of existing permitted loadings and / or speed if needed.

#### C1-4 References

CRN CS 200 - Track System

CRN CS 210 – Track Geometry and Stability

TOC – Train Operating Conditions Manual

CRN PLN ASM - 001 - Asset Management Plan







# Chapter 2 Existing Track Standards

The permissible rolling stock track loading limits and allowable speeds on the CRN are set by the Train Operating Conditions (TOC) Manual and Track Standard CRN CS 200 Track System. Table 1 of CRN CS 200 is provided below.

Track Class	Max Axle	Max Train Operating Speed			Nominal	
	Load (Tonnes)	H.S Passenger (km/h)	Passenger (km/h)	Freight (km/h)	Maximum MGT/year	
Main line						
1	25	160	115	80	10	
2	21	120	100	80	6	
3 / 3G	19	-	-	70	5	
5	19	-	-	40	1	
Siding						
1	25	25	25	25	6	
2	21	25	25	25	6	
3	19			25	5	

CRN CS 200 also notes: 'The maximum speeds shown in Table 1 are assumed for the purposes of design / configuration. The definitive speed and axle load conditions for all rolling stock (which may be higher than the nominal maximum axle load or speed shown in Table 1) are detailed in CRN RM 001 Train Operating Conditions Manual (TOC Manual) or the Working Timetable.'

The TOC Manual specifies permissible locomotives on the CRN by classifying the locomotives with an 'S' category rating from S1 to S13 (generally heavy to light respectively) and then specifies in the TOC Section Pages for each line of the CRN whether each category of locomotive is permitted to operate and the maximum allowable speed. The locomotives of every operator seeking access to the CRN are rated with the 'S' category system.

The TOC Manual also specifies permissible wagons on the CRN by classifying the vehicle type from A - F and then specifies in the TOC Section Pages for each line of the CRN whether each type of wagon is permitted to operate and the maximum allowable speed.

## C2-1 Track Classes

The track class system has been adopted from previous rail maintainers and has its origins from a period when all sleepers were timber and each track class could be defined by many parameters including rail size, ballast type and depth.

Significant changes to this system have occurred with the introduction of steel sleepers to all tracks, re-railing of several Class 5 lines with cascaded 53 kg/m rail, and extensive application of CWR. The transformation of these track classes is ongoing with further steel sleeper insertion and selective re-railing and upgrading of lines. The extent of this work is necessarily constrained by budgets and the availability of second-hand heavier rail. It is not envisaged that new timber sleepers will be inserted except at special locations where track depth is restricted or at residual joints. Ultimately lines will be 100% steel sleepers as remaining timber sleepers become life expired.

The insertion of steel sleepers to Class 2, 3 and 5 lines does not, by itself, improve the track capability of the line but rather retains the line in a tied condition as timber sleepers deteriorate. However, where steel resleepering is carried out in conjunction with ballast and rail improvement, there is a potential for increased track loading capacity on the line.





## C2-2 Track Condition

Because of the progressive change of steel sleepers and variability of rail and ballast conditions a range of conditions exists across Class 2, 3, 3G and 5 tracks. This range of conditions needs to be considered in determining permissible loading and / or speed of rolling stock.

Track condition may range from poor to good condition and represents some of the key factors in determining the allowable speed of rolling stock. Poor condition generally represents the condition and configuration of lines where minimal upgrading has been undertaken, though parts of some lines may be in a better condition and some in a lesser condition. Good condition generally represents an ultimate condition of track within its class on completion of steel sleepers with full ballast profile, CWR and removal of any adverse track defects.

Note: Lines with lower condition may have reduced operation.

To provide guidance on condition, CRN CS 210 Tables 12 & 13 are provided below for Track Condition Index (TCI) of various line classes. As part of the assessment process the TCI's are reviewed along the length of track. The historical TCI's provide an oversight of the performance of track over time and can be used as part of the monitoring of performance post approval of a change to operations.

Ideally the reviewer would be looking for locations where good condition occur as well as focussing on poor locations that may require additional controls post approval.

Indices – Construction and renewal					
	Тор	Twist	Gauge	Line	Total
All classes					
Tangent Track and curves ≥ 800 radius	8	7	5	8	28
Curved Track >240m but < 800m radius	8	8	5	9	30
Turnouts	Not appli	cable			
Indices - Maintenance (following resurfacing)					
Class 1					
Tangent Track and curves ≥ 800 radius	12	11	9	11	43
Curved Track >240m but < 800m radius	12	11	11	13	47
Class 2, 3 Welded and 3G					
Tangent Track and curves ≥ 800 radius	13	12	10	12	47
Curved Track >240m but < 800m radius	13	13	12	14	52
Class 3					
Tangent Track and curves ≥ 800 radius	15	13	10	13	51
Curved Track >240m but < 800m radius	15	14	14	15	58
Class 5					
Tangent Track and curves ≥ 800 radius	15	13	10	14	52
Curved Track >240m but < 800m radius	15	15	15	17	62
Turnouts (all Classes)	Not applicable				





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Track Class	T.C.I. Target		
1	45		
2, 3 Welded 3G	48		
3 Loose	54		
5	57		







# Chapter 3 Track Capability Assessment

This chapter provides guidance when carrying out a track capability assessment. The flow chart provided below outlines the various input details required when carrying out an assessment. The complexity of the assessment is subject to the change required, length of track being assessed and the associated risk.









## C3-1 Assessment Considerations

Assessment considerations outlined in the flow chart in Chapter 3 are not provided in a priority order and are not limited to the list provided. These represent the key elements to be considered when assessing track capability.

#### C3-1.1 Consultation

Subject to the complexity of the assessment, consultation may include relevant stakeholders as follows

- UGLRL Routine Maintenance Team(s) to provide local knowledge and maintainer of assets post assessment approval
- UGLRL Operation, Engineering and Asset Team(s)
- Rolling Stock Operator(s)
- TfNSW / CRC

The consultation process typically identifies issues that may not be accounted for in the relevant asset management systems and usually detail specific localised issues with track condition and configuration.

The consultation process usually requires data sets to be collected and validated in the field if found to be missing in the asset systems.

A final consultation review with the maintenance team should be undertaken before any TOC waivers are issued to ensure all requirements have been considered.

#### **C3-1.2 Investigation Reports**

A track capability assessment may utilise additional input from existing or proposed engineering reports and studies as needed. An engineering study may include a review of

- Track Structure Capacity
  - Sleeper to Ballast pressure based on ballast depth and condition
  - Sleeper type (including plating)
  - Type of fastenings used
  - Subgrade pressure
- Rail Fatigue
  - Rail deflection
  - Rail stress
  - Wheel to rail force at different speeds
- Bridge and Culvert load ratings
- • Sleeper fatigue life
- Impact on future maintenance
  - Rail defects.
  - Maintainability of track geometry.
- Level crossing passive sighting and active timing for increase speeds
- Align analysis with aspirational line capability targets

Where an engineering study is not available a first principles approach may be needed with supporting track analysis software to confirm track structure capacity is sufficient.



## C3-3.1 Track Configuration and Condition

A review of the track configuration includes

- rail size (sufficient capacity)
- jointed / welded (JWR / CWR / Loose)
- fastening type (resilient / non-resilient)
- sleeper type and spacing
- ballast depth, quality and effectiveness
- drainage, formation and surrounding ground conditions

Condition review includes

- condition indices (below / at / above recommended)
- defects review rail condition, TSR's
- localised issues curve pull in

When reviewing condition related issues, the risks and impacts must be considered on the potential to accelerate degradation and increase maintenance which may require some adjustment to existing programs. Conversely the assessment should not be taken as an opportunity to trigger unnecessary asset condition upgrades.

## C3-1.4 Siding Configuration and Condition

All assessments of the mainline should consider the impacts of adjoining sidings. Slow speed sidings with smaller rail sizes may be required to be upgraded or restricted from operation for heavier rolling stock. This is managed through the TOC manual. Condition will be reviewed via the defect database and inspection reports.

#### **C3-1.5 Turnout Configuration and Condition**

All mainline and siding turnouts need to be confirmed as meeting the minimum requirements for rail size appropriate to the change being undertaken. Condition will be reviewed via the defect database and inspection reports.

#### C3-1.6 Level Crossing Configuration, Condition and Sighting Assessment

The population of level crossings across the CRN provides some variables that should be considered as follows,

- · Passive crossings require a sighting assessment where speeds are proposed to increase
- Active crossings require a check of timing design for strike point activation
- 'Dirt' crossings may not have adequate track support for increased loads which may require future upgrades
- Level crossings are typically 'fixed' assets that over time tend to suffer poor geometry defects which can generate local condition issues. Load increases may accelerate those types of defects

#### C3-1.7 Structures Configuration, Condition and Load Rating

Where the assessment includes the increase on loading,

- All underbridges must have known design loading information or a load rating report carried out before any load increases can be approved
- All culverts need to be reviewed considering current defects and condition including depth below top of rail







 Any structures with temporary supports or propping are to be reviewed for remaining capacity and restrictions

#### C3-1.8 Tonnage and Rolling Stock Data

A key aspect of the track capability assessment is the current and proposed tonnage combined with the change to the rolling stock type to be used. The complexity of the review will change if the rolling stock proposed changes significantly i.e. partially loaded container wagons replaced by fully loaded coal wagons.

As many CRN branch lines carry low to moderate annual tonnages and in some instances seasonal tonnages the expected life of the assets differs significantly compared to more heavier traffic lines. The track capability assessment must also consider how the track will be operated in the future. In some instances, an increase in axle loads may not see a subsequent increase in annual tonnage. This also must be considered in future maintenance plan requirements.

Examples below are typical tonnage data for a corridor over a 5-year period.



#### C3-1.9 Transit Space

Subject to capability proposal, the allowable transit space may need to be reviewed. The diagram below is an extract from CRN CS 215 showing a typical review required for the operation of S4 locos with narrow square outlines.



**Rolling Stock Outlines** 







#### C3-1.10 AMP / AWP

Track assessments may be triggered to align with AMP / AWP or other funding source deliverables. As part of the configuration review above a review of the past, present and future projects is needed to ensure that all required deliverables have been undertaken.

#### C3-1.11 Technical Maintenance Plan (TMP)

A review of the existing TMP for adequacy needs to be considered for potential increases in frequency of inspections. Increased inspections may be required as a temporary control while additional data is obtained to monitor the performance of the change.

#### C3-1.12 Specific Localised Issues

As discussed above specific local issues may include

- General condition of line over time
- Weather events, heat, rain, cold, flood and drainage
- Historical issues such as dipped welds or high rates of rail defects
- Curves with history of pull in

#### **C3-1.13 Site Inspections**

Most assessments can be undertaken as a desktop exercise, however elements may need to be validated in the field to confirm the available data. Inspections by engineering teams may provide an alternate perspective on the condition of the asset.

#### C3-2 Implementation of Proposed Assessment

Implementation of any approved track capability assessments shall be managed through the TOC waiver process which will include any restrictions or controls as part of the approval.

Typical restrictions or controls may include

- Approval of a trial period of 6-12months which will trigger a review of performance. Note: some
  operators may not be able to fully utilise the trial period due to available rolling stock resources
  so this will need to be assessed and potentially extended
- Incremental steps of both load and speed with an intent to attain the future proposed line capability. Additional incremental steps will occur after a performance review
- Additional inspections to gather condition based data (i.e. track recording data)
- Monitoring of at risk assets that may have an existing condition issue
- Additional maintenance or AWP projects that need to be carried out in parallel

#### C3-3 Performance monitoring and review

The long term risks associated with an assessment approval may not be realised for many years due to the low tonnages and usages of some lines. It is intended that each approval will be monitored as part of the TOC waiver conditions. Nearing the end of the TOC waiver period the performance of the track will be reviewed including the actual take up by the operators. This review process is outlined in the flow chart below.









