AUCKLAND RAIL NETWORK HIGH LEVEL INFRASTRUCTURE REVIEW

Interim Findings and Assurance Report

Auckland Transport
An Auckland Council Organisation

KiwiRail

transdev
the mobility company

WSP | OPUS

DISCLAIMER

The conclusions of this interim findings and assurance report are based on our professional judgement. These conclusions have been made following a review of asset condition and performance data provided, performing six site visits to various locations on the network, cab ride inspections (electrified network only) and as a result of discussions with relevant personnel from KiwiRail, AT and Transdev. We have not carried out a full and complete audit of the condition of KiwiRail infrastructure within the Auckland Transport Metro Network. The findings of this report, including any commentary on KiwiRail Codes & Standards, apply only to the operations and maintenance of the Auckland Metro Network and are not reflective of the national network.

This draft report is **CONFIDENTIAL** and shall not be disclosed to anyone unless required to do so by law.

EXECUTIVE SUMMARY
INDEPENDENT ASSURANCE STATEMENT

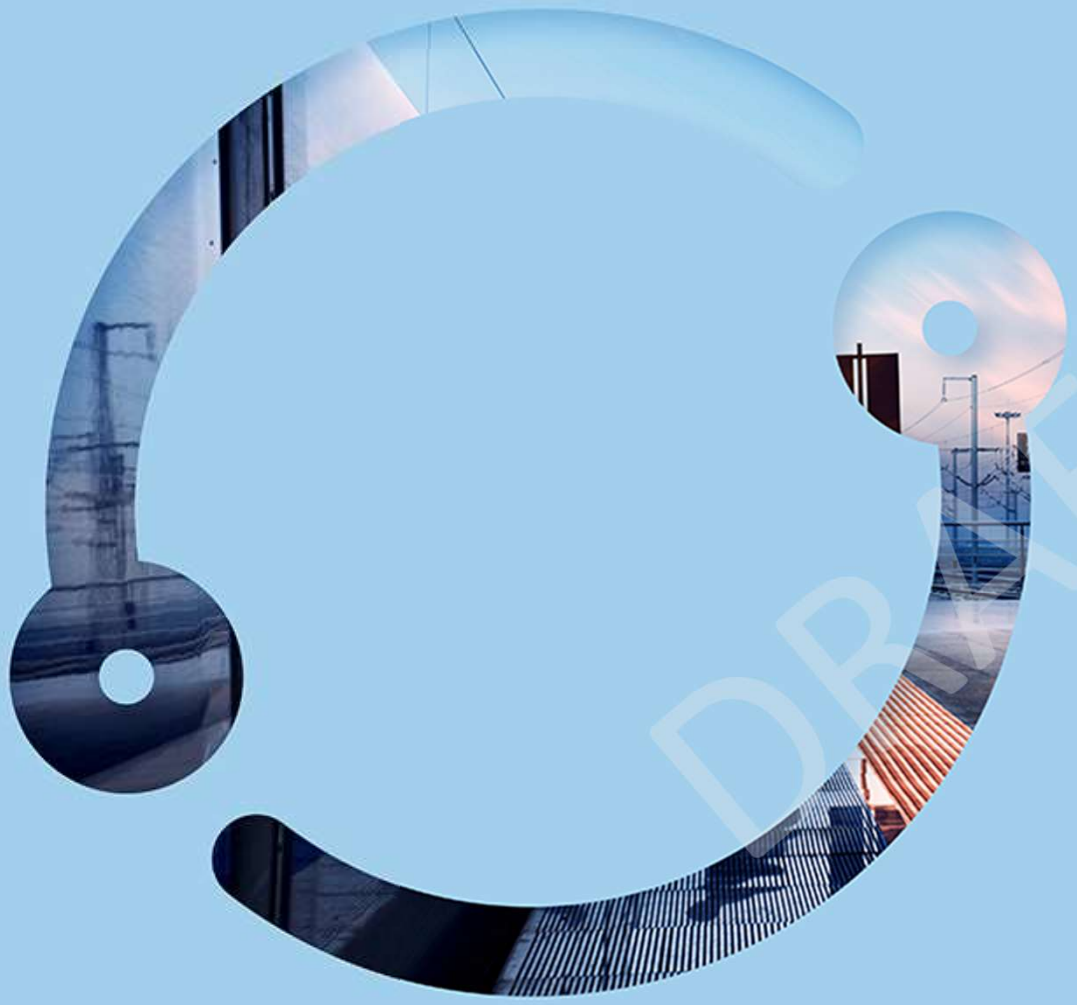
WSP-Opus' independent, professional assessment of the condition of the Auckland Metro network infrastructure, in particular the track asset, is that it is likely that sizeable sections of the track geometry and components are not within code requirements (i.e. C1 or C2 as defined by KiwiRail standards). However, we consider that the condition of assets deemed not within code is generally understood by KiwiRail and is being addressed via a process of inspection, monitoring and other mitigations from which a programme of maintenance and renewal is being produced and executed.

Whilst KiwiRail has experienced and competent track maintenance personnel, the efficiency of the work undertaken is compromised by the lack of track access time and resources. This has the result of programmed work not being finished within the track time allocated and the deferment of some works.

From evidence gathered, the effectiveness of KiwiRail's maintenance strategy is arguably sufficient for the existing network operations. However, given the scale of the maintenance task ahead and the limited availability of track time and skilled resource, we believe that there is a high risk of network deterioration to below an acceptable condition that warrants further intervention now.

In our view, it is clear that the existing asset condition, resourcing and maintenance strategies will not be sufficient for the reliable and, ultimately, safe operation of planned future rail services in the Auckland area.

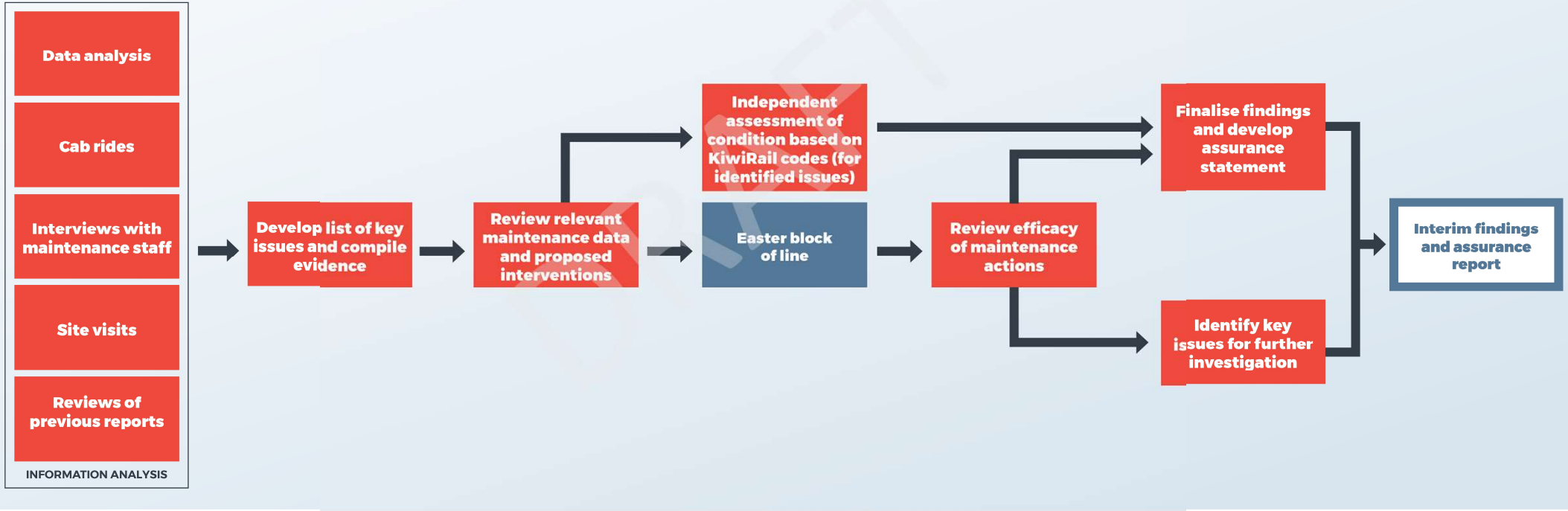
The next phase of this review will focus on collaborative development of a programme of forward works and recommendations for change.



Auckland Rail Network High Level Infrastructure Review

Overview of Assurance Process

INTERIM FINDINGS AND ASSURANCE PROCESS



SUMMARY OF INFORMATION SOURCES

Data capture

Initial data related to codes and standards together with maintenance processes and work orders have been received from KiwiRail. We have also received Asset Management Plans, work programmes and budget data. In addition, we have received Temporary Speed Restriction (TSR) and Rail Time Loss (RTL) data in order to determine trends in TSR numbers and have received details of M125 (track Inspection), M134 (Pre-Works Scoping Document) and M155 (Fault) reports

Cab Rides

We have been on three escorted Cab rides of the network (including return trips from Britomart to Swanson, Onehunga and Manukau) and have discussed the perceived condition of the track from a driver's viewpoint.

Interviews and discussions

Stakeholder meetings have been ongoing with KiwiRail, AT and Transdev.

Site Visits

We have attended site visits, escorted by KiwiRail, both before and after works have been undertaken, to electrified sites at Westfield, Otahuhu, Avondale, Wiri, Homai, Quay Park/Strand, and a night visit to Britomart/Quay Park. We have also visited the non-electrified section between Papakura and Pukekohe

Reports

Reports received from KiwiRail include SGS Welding Reports, Asset Management Plans for 2012 to 2019, weekly heat 40 reports, Autech Grinding Reports, CAPEX report for 2020 to 2025.

SUMMARY OF MAIN ISSUES

- Rolling Contact Fatigue (RCF) appears be a recent phenomenon on the Auckland network since the introduction of the EMU services. This poses a risk to the rail integrity for which an effective grinding regime is required. KiwiRail have produced an RCF register which details crack lengths and recommendations for testing, grinding or rail replacement for which priorities for intervention are required. RCF testing frequencies and mitigations are being reviewed with the KiwiRail Professional Head for Track prior to production of a programme for RCF maintenance. This may include changes to the method of testing to be carried out to ensure that more accurate RCF data is collected. Action is urgently required to accelerate the monitoring and assessment of RCF and to institute a rolling programme of RCF mitigation by grinding and/or rail replacement.

- Visual assessment of the alignment appears to show cyclic top faults which is indicative of a possible formation issue potentially exacerbated by track defects and/or dipped welds. We have also noted ponding next to the track in a number of locations demonstrating that, in some sections, drainage systems appear to be ineffectual.

- Welding competence varies in this specific field with some welding done well but other showing poor weld construction resulting in poorly aligned and finished welds during site visits. We are planning a conversation with the Professional Head for Track to understand more about what is being done.

- There is a lack of quality data relating to track alignment and rail profiles. There have been some issues with the EM80 rail measurement car resulting in data corruption. We have received data from 2016-2018 which is being assessed to determine any concerning trends. KiwiRail have plans to introduce new technology that can help automate the visual inspection process through the use of image recognition software and laser scanning to enable inspectors to focus on specific issues. In addition, a detailed assessment of rail profiles over the whole network is required.

- Due to network access constraints and maintenance resource availability for maintenance, there are a number of temporary fixes on the network resulting in an increase in TSRs.

- KiwiRail is only just coping with maintenance of the network with poor timeliness of interventions due to lack of resources, competency deficiencies and reduced track access time. However, KiwiRail's understanding of the network condition, evidenced by up-to-date records is notable and will be further improved by KiwiRail's proposed asset management process and data collection systems.

- **Whilst the current maintenance strategy is arguably sufficient for the existing network operations, it is less than that which would be expected for the safe and reliable operation of Auckland Transport's future metro services.**

INITIAL FINDINGS

We have reviewed the track condition and the follow summarises our initial findings:

Rolling Contact Fatigue

There are a number of locations where rails are suffering from Rolling Contact Fatigue (RCF) resulting in Gauge Corner Cracking (GCC) and shelling of rail material.

Poor track geometry due to Formation and Drainage issues

In a number of locations, deterioration of the track bed, ballast and support components (sleepers and fastenings) has resulted in track geometry misalignments, cyclic top faults and twist faults.

Poor track welds

There are a number of track welds which have been poorly formed because the set-up of the rails during welding or the final grinding has been incorrect due to lack of competency of welding teams.

Susceptibility for track buckles

There appear to have been a number of track buckles due to an insufficient stressing regime or exacerbated by voiding under the track or deficiency of ballast in ballast shoulders and cribs.

Loose fastenings

In some areas there are lengths of track with loose fastenings within poor condition wooden-sleepered tracks. In addition, in some track sections the Pandrol fastenings are loose resulting in an insufficient toe load.

Rail Defects

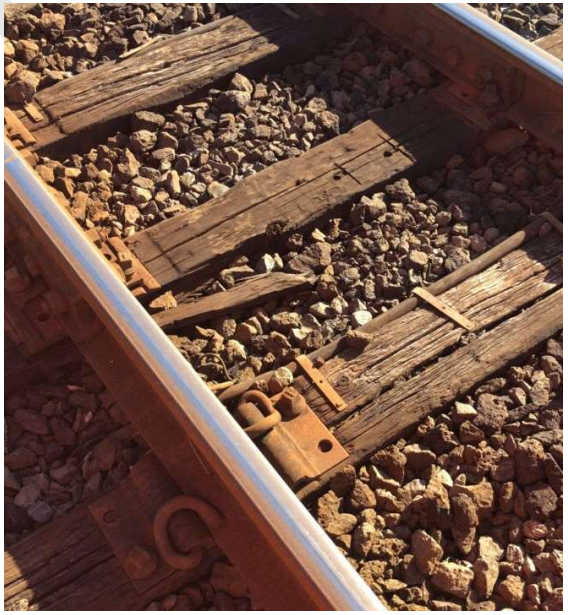
A number of rail defects have been observed during the site visits. These include defects due to heavy point loads or sudden change in head plane level under traffic (head shattering or excessive wear), mushrooming of the rail head and lipping causing gauge issues and switch blade wear

Level Crossing condition

There are a number of level crossings where the surface has been covered in tarmacadam making it difficult to assess the condition of the underlying track components.

Volume of life-expired assets

There is a large volume of 91lb rail and a large number of Peruvian Decayed Sleepers on the network which are being removed under an accelerated programme



OTHER FINDINGS

Track maintenance competence
We consider that the resources available for track maintenance and their competencies are insufficient to maintain the 92 route kilometres of AT track. This leads to a reliance on corrective maintenance instead of proactive maintenance. With a doubling in the number of vehicles running on the network in the past 5 years, and future increases proposed, the maintenance resources required will need to be increased accordingly, trained to an acceptable competency and additional plant and equipment will be required.

Track Inspection Regime
There is a large reliance on cab inspections. The relevant inspection code allows cab inspections to replace foot patrols. There is a need to increase the number and frequency of on-site inspections and do some "themed" inspections (for example, for earthworks, structures, drainage, ballast, formation, level crossings and turnouts).

Joints and CWR
In many cases there are former joints that have been welded but the rail ends have not been cut before welding. Therefore there are numerous bolt holes with welds between. These bolt holes have not been “cold bolt expanded” to increase their strength and minimise the risk of star-cracking.

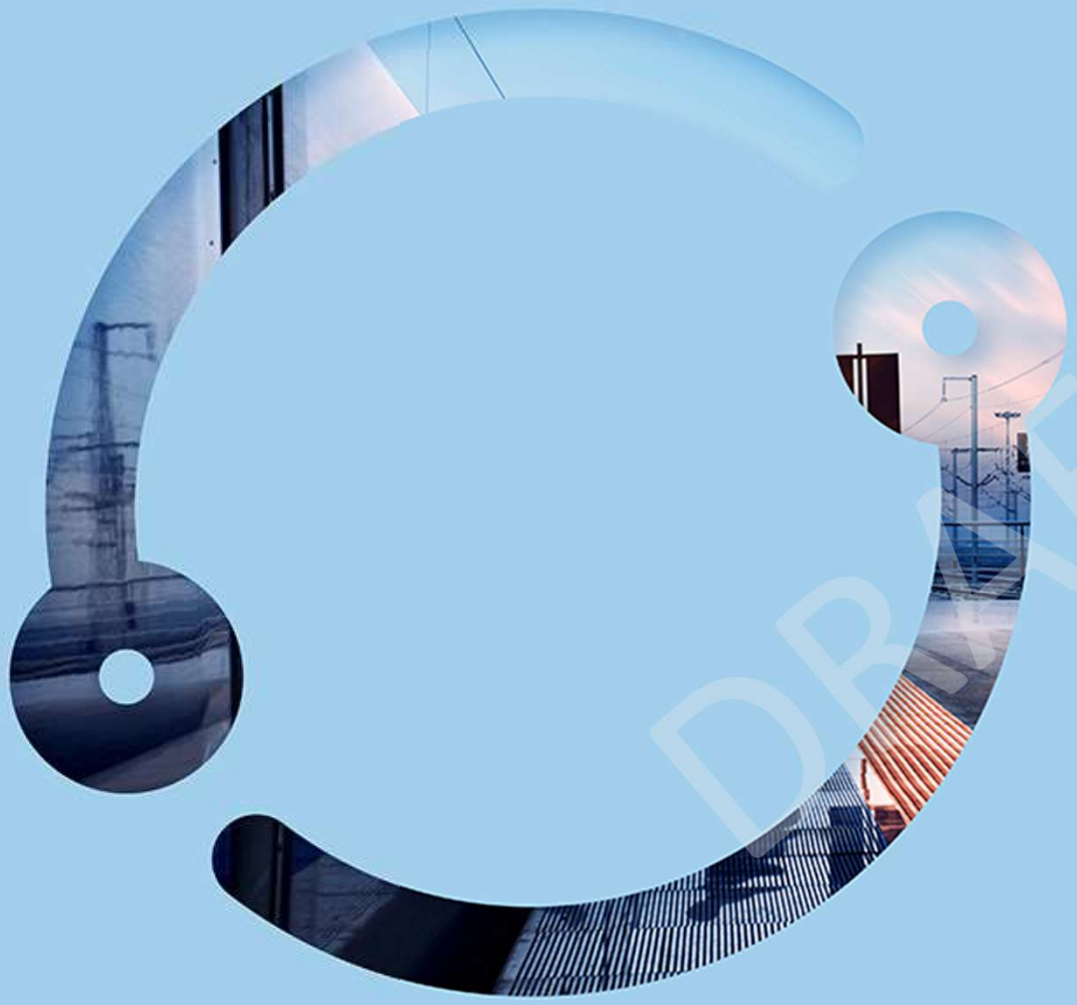
Alignment Monitoring/OHLE masts
OHLE masts have been equipped with datum plates to indicate offsets to the nearest running rail, rail level and cant. In many places, however, the details have not been etched onto the plate. We have been told that this is because the etching can punch through the thin plate. This suggests that an alternative plate may be necessary.

Signalling and operations
ETCS speed enforcement on approach to stations (where signals for level crossings are at the end of the platform) results in slow running through those platforms.

Wheel-Rail interface issues
There are issues with the wheel and rail profile interface which are being assessed through the wheel-rail interface group.

Rail Defect Testing
Rail defects are tested using Ultrasonic Testing equipment. This does not determine the depth of RCF throughout the continuous rail head and Eddy Current testing is the preferred method.

Level Crossing Surfacing
There are several level crossings which are surfaced using tarmacadam which hides the track materials and makes it difficult to inspect and maintain the track asset. The tarmacadam should be replaced with removeable units.



Auckland Rail Network High Level Infrastructure Review

Review of KiwiRail inspection, assessment and maintenance processes

We have talked to KR and received the following data to satisfy ourselves what was being done about the issues found:

- Code Standards – T200/T003/T100. These include track gauge, track construction and maintenance standards and railhead profiles
- KiwiRail Design, Inspection and Maintenance Standards – these have enabled us to assess whether or not the track asset alignment and components are “in-code” based on a condition coding system from which inspection staff enter the relevant Priority Action onto the M125/6 form which will also be entered into the Maximo asset database .
- EM80 traces from 2016 to 2018 – these will enable us to review trends in condition to determine whether or not the track asset is deteriorating and what mitigation measures are in place to maintain the track in a safe condition
- M155 faults, closed and open – these have enabled us to produce a trend analysis to determine whether or not faults have been increasing
- List of NDT ultrasonic faults
- Rail and sleeper types and data per kilometre
- Rolling Contact Fatigue Register and inspection plans have been provided and are being addressed by KiwiRail
- Asset Management Plan - sections for Track & Ballast, Signalling, Structures, Telecommunications, Electrical Assets and Traction (OHLE)
- List of Temporary Speed Restrictions and Rail Time Loss data - enabling us to produce and assess trend analysis
- Track Access Windows data – this helps us to understand the limited access time for track inspection and maintenance, especially in light of the increase in train numbers since the introduction of the Auckland Transport Metro fleet EMUs
- Maintenance organisation chart – we have discussed maintenance gang numbers and competencies in order to assess future requirements
- Weekly heat reports – these have a bearing on the number of TSRs on the system which has a direct bearing on AT operations
- Turnout installation dates – based on life expectancy of track assets these are useful in determining maintenance and renewal requirements
- Welding and Grinding Reports – produced to determine the future requirements for grinding and removal of Rolling Contact Fatigue defects
- Easter 2019 Task Orders and programme of works – we have received details of the Easter 2019 works plan and have carried out preliminary inspections of sections of the work undertaken in order to assist in the assurance assessment

ASSESSMENT OF CONDITION

- Track inspections are undertaken in accordance with Standard No. T-ST-IN-5109 Track Inspection
- Assessment of condition is based on Standard no. T-ST-IN-5108 Permanent Way Asset Condition Assessment Guide in which a range of conditions is given in the following table:

C1	Asset meets code requirements
C2	Asset meets code requirements but some deterioration noted
C3	Asset requires planned intervention to meet code requirements
C4	Asset requires urgent intervention to meet code requirements
C5	Asset does not meet code requirements and requires immediate intervention

- Track inspections are undertaken in accordance with Standard No. T-ST-IN-5109 Track Inspection and inspection staff enter the Priority Action onto the M125 form which will also be entered into the Maximo asset database. The following priorities are shown in the following table:

P1	Maximo P3	Repair within 48 hours
P2	Maximo P6	Repair within seven days
P3	Maximo P10	Repair within four weeks
P4	Maximo P16	Repair within 26 weeks
P5	Maximo P17	Repair within 52 weeks

All priorities within Maximo are from P1 (ASAP) to P27 (within 10 years)

ASSESSMENT OF CONDITION AND WORK PRIORITISATION

- Using T-ST-IN-5108 Permanent Way Asset Condition Assessment Guide the field engineer provides an initial assessment of the track asset condition, from C1 to C5

- Inspection is undertaken and Form M125 is produced which includes the assessed priority for the works to be undertaken (based on Maximo P1 to P27)

- This is then input into the Maximo system from which Work Order Details are produced which includes the following:
    - work site details,
    - programme/scheduling information,
    - detailed description of the work to be carried out,
    - materials required, planned labour resource (KiwiRail and contractor),
    - together with tools and equipment required
    - Estimated labour and materials costs

- The data within Maximo is used in Juno Viewer to visualise the occurrence of faults geographically. This is used to group maintenance in certain areas and create work packages. Juno Viewer also has the capability to undertake trend analysis/degradation modelling. Although primarily designed for road/pavement asset management KiwiRail are looking at using this to assess railway assets

ASSESSMENT OF CONDITION

- The Work Order also includes form M134 which is the Pre-Works Scoping Document which describes the location, site observations, dilapidation survey, condition assessment code, scope of works, materials and enabling works. The Condition column describes the assessed condition code (C rating from 1 to 5) .

KiwiRail

M134 - Pre-Works Scoping Document

1. LOCATION							
WO Number	1760600		Job Type	Resleeper-Face-T/O-1:9-Composite-T/O. 1570A			
Asset No.	2200776		Asset Description	T/O 1570A, Southdown, NAL 0+475			
From km	0	From m	475	To km	0	To m	475
Datum Reference Point		From km	0	From m	475	P.O.S. T/O 1570A	

2. SITE OBSERVATIONS - DILAPIDATION SURVEY			
CORRIDOR LOG	Type	Condition	Corridor Log Comments
Rail	50kg	1	S0(12) C1
Sleepers	PDS	4	PDS sleepers in very poor condition. PDS bar codes 50159 - 50157
Fastenings	P	1	Pandrol(12)
Turnout(s)	CRSBG	1	CRSBG 1:9 turnout.
Ballast	OK	OK	
Other features	N/A	N/A	

- T-ST-IN-5108 Permanent Way Asset Condition Assessment Guide includes photographs relating to the different condition codes.

- It is only within Condition Codes C1 and C2 where the asset is deemed to be “in-code” (i.e. ”meets the code”). Therefore, it is deemed acceptable that assets can be out of code provided that specific mitigation measures are in hand to bring the asset back to Condition Codes 1 or 2.

- The following slides show the process from inspection, condition assessment and production of Work Orders for various different track defect scenarios.
- after which there are a number of photographs showing our independent assessment of the condition of some sections of track before and after work has been undertaken. This is based on the photographs in T-ST-IN-5108 and gives an indication of the effectiveness of typical maintenance work undertaken

Examples of Work Order process

Removal of Faulty Weld on UM NIMT

Faulty weld @ 637.600km UM – 3645750

Has this been reported and when?

Initially reported on 26/03/2016, SR324176 (P16)

Is it in code – which code?

Based on Permanent Way Asset Condition Assessment Guide (Track Standard : T-ST-IN-5108) and Rail Management (Track Standard: T-ST-AM-5330), Running surface defect, is condition level 3 for class A Line so it require planned intervention to meet code requirement.

The rail has been tested ultrasonically, no defect has been found.

How it reported and what is the process for renewal?

It was reported by Track Inspector on his reporting document M125 and was entered into the system under service request SR324176and follow up SWO # 3645750 was created to carry out the work.

When is the work due to be done?

The work has been planned (SWO# 3645p750) to install closure rail to remove faulty weld by mid-May, 2019.

Where are the documents and task orders?

Refer attached

Mitigation

Tested 3 monthly by the ultrasonic testing program.

Checked during detailed visual inspection.

KiwiRail

Work Order Details - CM **Status: RTP** **Discipline: TRACK**

3645750 **M125 - Remove faulty weld on UM NIMT 637.60km, right rail**

Asset: 1000000 - NIMT MainL, Wellington - Auckland **Gang:** **Area:** Auckland Metro

Work Site		Scheduling Information		
Start	End		Start Date	Finish Date
637 Km + 600m NIMT	637 Km + 600m NIMT	Target		12/05/19
		Scheduled		
		Actual		

Work Information

Priority: 16 **JP Num:** **Field Engineer:** Raghbir Singh

Parent WO: **PM Num:** **Safety Plan:**

Long Description

- Replace with 6.3m closure

Related Service Requests

SR	Description	Start m	End m	Status
NIMT MainL, Wellington - Auckland				
SR324176	M125 - Remove faulty weld on UM, right rail	637.600	637.600	NEW

Attribute Data

Attribute ID	Description	Value	Unit ID
WHICHRAIL	Which rail	RIGHT	

Work Notes

Work Signoff

Mark with a cross each task that has **not** been completed

Examples of Work Order process

Resleeper with Concrete sleepers NIMT

Re-sleeper @ 639.000km (approx.) UM – 2207151

Has this been reported and when?

Reported on 28/6/2016

Is it in code – which code?

Based on Permanent Way Asset Condition Assessment Guide (Track Standard: T-ST-IN-5108) and Rail Management (Track Standard: T-ST-AM-5330), Timber sleeper condition, is condition level 3.

How it reported and what is the process for renewal?

It was reported by Field Asset Engineer during Annual Engineering Inspection and was entered into the system under SWO#2207151.

When is the work due to be done?

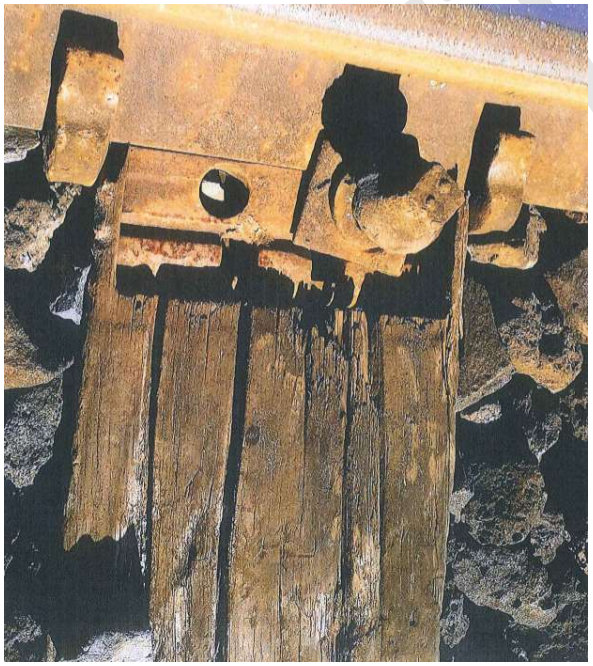
Face re-sleeper FY24, Priorities being reviewed to bring job into FY20.

Where are the documents and task orders?

Refer to attached

Mitigation

Inspected regularly (weekly).



Work Order Details - CAP **Status: LOCKED** **Discipline: TRACK**

2207151 Resleeper-Face-Concrete-700mm

Asset: 1000000 - NIMT MainL, Wellington - Auckland **Gang:** **Area:** Auckland Metro

Work Site	
Start	End
637 Km + 340m NIMT	639 Km + 820m NIMT

Scheduling Information	Start Date	Finish Date
Target		
Scheduled		
Actual		

Work Information

Priority: 21 **JP Num:** JP92782 **Field Engineer:**

Parent WO: **PM Num:** **Safety Plan:**

Long Description

270 cut in 10 - 20mm 637.340 - 638km, 166 cut in 10 - 20mm split ctr DK 638 - 639km, 301 cut in 10 - 15mm 639 - 640km & 203 DKd 640 - 640.683km DM 28/6/16 P4

Attribute Data

Attribute ID	Description	Value	Unit ID
PDSBARCOD	PDS Barcode		
PDSBARCOD	PDS Barcode		
PDSBARCOD	PDS Barcode		
PDSBARCOD	PDS Barcode		
PDSBARCOD	PDS Barcode		
PDSQUANT	Number of PD sleepers replaced		
PDSQUANT	Number of PD sleepers replaced		
PDSQUANT	Number of PD sleepers replaced		
PDSQUANT	Number of PD sleepers replaced		
PDSQUANT	Number of PD sleepers replaced		

Planned Labour

Task ID	Trade	Quantity	Hours	Rate	Cost
	TRCT3M	1	0.00	$0.00	$0.00
	TRCT2M	1	0.00	$0.00	$0.00
	TRCT1M	1	0.00	$0.00	$0.00
	LABSTA	1	0.00	$0.00	$0.00
	PROT1M	1	0.00	$0.00	$0.00
	COMMS1	1	0.00	$0.00	$0.00
	SIG1M	1	0.00	$0.00	$0.00
	WKND	1	0.00	$0.00	$0.00
	4480	1	0.00	$0.00	$0.00
	SAL2	1	0.00	$0.00	$0.00
	TRK2M	3	0.00	$0.00	$0.00
	TRK3M	1	0.00	$0.00	$0.00
			Total Planned Labour		$0.00

Examples of Work Order process

Replace T/0 19A NIMT

Turnout 19A @ 628.400km (approx.) UM – 1759548

Has this been reported and when?

Reported on 13/6/2016

Is it in code – which code?

Based on Permanent Way Asset Condition Assessment Guide (Track Standard : T-ST-IN-5108) and Rail Management (Track Standard: T-ST-AM-5330), Switch point wear, is condition level 4.

How it reported and what is the process for renewal?

It was reported by Field Asset Engineer during Annual Engineering Inspection and was entered into the system under SWO#1759548.

When is the work due to be done?

Turnout to be replaced in FY20.

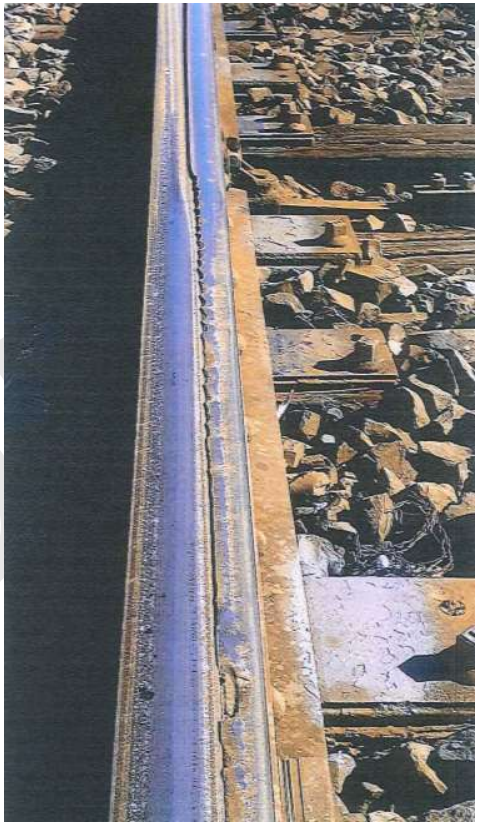
Interim maintenance intervention scheduled by end of June, 2019.

Where are the documents and task orders?

Refer to attached

Mitigation

Inspected regularly.



KiwiRail

Work Order Details - CAP **Status: LOCKED** **Discipline: TRACK**

1759548 T/O Replacement-New-LH-1:12-Concrete-T/O 19A

Asset: 2200966 - T/O 19A, Pukekohe, NIMT 628+413 **Gang:**

Area: Auckland Metro

Location: 9000568 - Pukekohe (PUK)

Asset Location	Scheduling Information		
Location		Start Date	Finish Date
628 Km + 413m NIMT	Target		
628 Km + 413m NIMT	Scheduled		
	Actual		

Work Information

Priority: 20 **JP Num:** JP50361 **Field Engineer:**

Parent WO: **PM Num:** **Safety Plan:**

Long Description

T/O 19A 91lb (73) TPR/HW; 23 x bored cut 5-10mm, worn frog Fit kg 1 in 12 LH kg 2019 (to Pukekohe loop, 4 Peruvians, 1080, 15 cant @ frog) TID19715. 1084, 16 cant @ frog, 25 x bored, curve road used for DMUs only and odd crossing DM 13/6/16

Attribute Data

Attribute ID	Description	Value	Unit ID
TURNOUT_IE	Turnout Number	19A	

Planned Labour

Task ID	Trade	Quantity	Hours	Rate	Cost
	TRK5	3	0.00	$0.00	$0.00
	4480	1	0.00	$0.00	$0.00
	PROT3	1	0.00	$0.00	$0.00
	SIG4M	1	0.00	$0.00	$0.00
	TRK4	2	0.00	$0.00	$0.00
	TRCT3	1	0.00	$0.00	$0.00
			Total Planned Labour		$0.00

Planned Materials

Task ID	Material Num	Description	Store	Quantity	Unit Cost	Cost
	1082519	Glued Insulated Joint S.C. 6 hole 7.4m	I111	2	$2,391.04	$4,782.08
	1103553	SLEEPER 1:12 CONCRETE L/H T/OUT MARTINUS	W20A	1	$18,949.19	$18,949.19
	1081558	THERMIT, ONE SHOT WELD KIT, 50KG H.H.	I111	18	$93.35	$1,680.30
	1081564	THERMIT,ONE SHOT CRUCIBLE	I111	18	$19.81	$356.58
	1102994	TURNOUT, 50kg,1:12, Left Hand, Martinus	W20A	1	$83,202.38	$83,202.38
	1103454	CTS2 MARTINUS CONFIGURATION KIT SW800CM	W20A	0	$9,794.18	$0.00

Examples of Work Order process

Remove mud spot NIMT

Rough top @ 662.769km DM – 3718409

Has this been reported and when?

Initially reported on 23/01/2017

Is it in code – which code?

Track Geometry (Track Standard: T-ST-AM-5120).

How it reported and what is the process for renewal?

It was reported by Track Inspector on his reporting document M125 and was entered into the system under service request SR434134 and follow up SWO # 3718409 was created to carry out the work.

When is the work due to be done?

The formation repair will be carried out in June, 2019.

Where are the documents and task orders?

Refer to attached

Mitigation

Inspected regularly (weekly).

KiwiRail

Work Order Details - AMREN **Status: CREATE** **Discipline: TRACK**

3718409 **M125 - NIMT DM, Mudspot forming 8 sleepers long at 662.769km**

Asset: 1000006 - NIMT MainR, Amokura - Auckland (604+394 to 681+838) **Gang:**

Area: Auckland Metro

Work Site		Scheduling Information		
Start	End		Start Date	Finish Date
662 Km + 769m NIMT	662 Km + 774m NIMT	Target		23/01/18
		Scheduled		
		Actual		

Work Information

Priority: 14 **JP Num:** **Field Engineer:**

Parent WO: **PM Num:** **Safety Plan:**

Long Description

PAR
mud spot has been reviewed and brought forward for repair into FY2019 during June BOL

Related Service Requests

SR	Description	Start m	End m	Status
	NIMT MainR, Amokura - Auckland (604+394 to 681+838)			
SR434134	M125 - NIMT DM, Mudspot forming 8 sleepers long at 662.769 km	662.769	662.774	NEW

Work Notes

Work Signoff

Mark with a cross each task that has **not** been completed

Person Responsible for Work _____ Date Completed _____

Signature _____

Examples of Work Order process

Remove mud spot NIMT

Rough top @ 629.530km UM – 4132489

Has this been reported and when?

Reported on 27/03/2019

Is it in code – which code?

Track Geometry (Track Standard: T-ST-AM-5120).

How it reported and what is the process for renewal?

It was reported by Track Inspector on his reporting document M125 and was entered into the system under service request SR617337 and follow up SWO # 4132489 was created to carry out the work.

When is the work due to be done?

The tamper has been organised and planned to go in the section by end of next shift, commencing early June, 2019.

Where are the documents and task orders?

Attached

Mitigation

Inspected regularly (weekly).

KiwiRail

Work Order Details - CM **Status: RTP** **Discipline: TRACK**

4132489 **M125:- Lift and Pack track over 10m @ NIMT 629.530km, DM**

Asset: 1000006 - NIMT MainR, Amokura - Auckland (604+394 to 681+838) **Gang:**

Area: Auckland Metro

Work Site		Scheduling Information		
Start	End		Start Date	Finish Date
629 Km + 530m NIMT	629 Km + 540m NIMT	Target		6/04/19
		Scheduled		
		Actual		

Work Information

Priority: 7 **JP Num:** **Field Engineer:** Raghbir Singh

Parent WO: **PM Num:** **Safety Plan:**

Long Description

- Lift and Pack

Related Service Requests

SR	Description	Start m	End m	Status
	NIMT MainR, Amokura - Auckland (604+394 to 681+838)			
SR617337	M125:- Lift and Pack track over 10m @ NIMT 629.530km, DM - Lift and Pack	629.530	629.540	NEW

Work Notes

Work Signoff

Mark with a cross each task that has **not** been completed

Person Responsible for Work _____ Date Completed _____

Signature _____

Assurance of Track Asset Condition

Correction of surface rail defect

The following photographs show our independent assessment of the condition of some sections of track before and after work has been undertaken. This is based on the photographs in T-ST-IN-5108 and gives an indication of the effectiveness of typical maintenance work undertaken

Before

Assessed Condition Code 4

After

Assessed Condition Code 1

Assurance of Track Asset Condition

Typical Switch Rail welding

Before

Assessed Condition Code 4

After

Assessed Condition Code 1

Assurance of Track Asset Condition

Typical Frog Rail head repair

Before

Assessed Condition Code 5

After

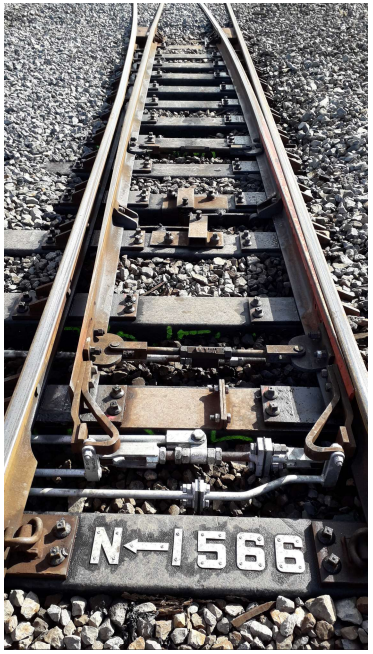
Assessed Condition Code 1

Assurance of Track Asset Condition

Replacement of Peruvian Decayed Sleepers with Composite Sleepers – Westfield Turnout no. 1566

Before

Assessed Condition Code 5



After

Assessed Condition Code 1

Assurance of Track Asset Condition

Rerailing at Pukekohe to remove squats and RCF sections

Before

Assessed Condition Code 4

After

Assessed Condition Code 1

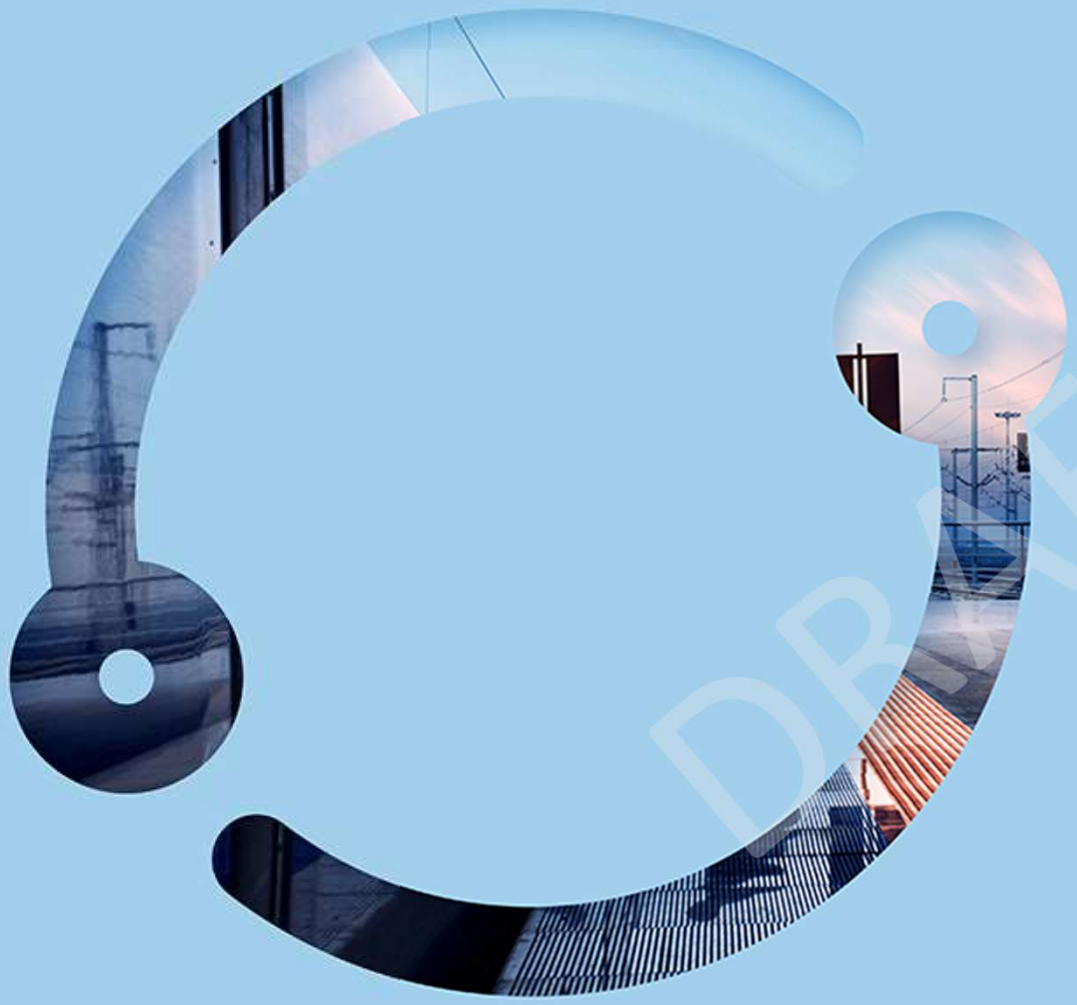
SUMMARY

- During our site visits we noted 19 separate issues relating predominantly to track condition

- All these items had previously been identified by KiwiRail and all had been programmed in Maximo with some due to be completed during the Easter 2019 Block Of Line. Other works have been programmed for future maintenance

- There were some quality issues regarding welding and inability to complete all jobs

- After review of the work undertaken at Easter 2019 we are more comfortable with the efficacy of KiwiRail's maintenance regime. However, it is clear that there are programming issues leading to the inability to complete maintenance on time. Furthermore, assets with poor condition code (i.e. C4 and C5) are remaining in situ beyond a comfortable timeframe increasing the risk to the network.



Auckland Rail Network High Level Infrastructure Review

Conclusions and Next Steps

CONCLUSIONS

- The increase in passenger and freight traffic over the network over the last 5 years has resulted in additional strain on the infrastructure, particularly the track structure. This is exacerbated by the difficulty in gaining access for track maintenance due to the increase in traffic.
- Resource numbers are at a low level for the maintenance requirements of the network. Experience and competence of personnel needs to be addressed to ensure a competent, well trained, multi-tasking workforce with some specialized teams for tasks such as welding and stressing.
- The combination of increased traffic, difficult access and low competent resource numbers means that KiwiRail are only just coping to maintain the network with arguable timeliness and quality
- Further increase in traffic volumes as a result of the introduction of the City Rail Link and based on the forecast increase in patronage numbers will increase the risk of disruption to traffic caused by deterioration of the track asset condition
- After discussions with KiwiRail relating to inspection and maintenance regimes and proposals to improve monitoring methods and asset data retrieval, and from assessment of track work undertaken during the Easter 2019 Block Of Line we are more comfortable that KiwiRail are seeking to maintain the railway to meet the existing code requirements. Where the track is not within Condition Codes 1 or 2, KiwiRail are actively prioritising the programming of maintenance work to improve the track to meet the code
- An accelerated programme of maintenance intervention is recommended, with particular emphasis on the monitoring, assessment and removal of defects caused by Rolling Contact Fatigue in order to manage risks to the level required for the AT Metro network

NEXT STEPS

- Further data gathering and interrogation
- Verification through additional site visits
- Ongoing discussion with KiwiRail, AT, Transdev, CAF and other key interested parties
- Discussion with KiwiRail Professional Heads to review ongoing improvements to codes, standards and maintenance practices
- Codes and Standards, Asset and Maintenance review, including approaches, practices and benchmarking against international best practice
- Review of predicted traffic volumes and impact on the network
- Develop Key Performance Indicators (KPIs) and Level of Service assumptions
- Preparation of a costed programme of infrastructure investment
- Recommendations for programme of change

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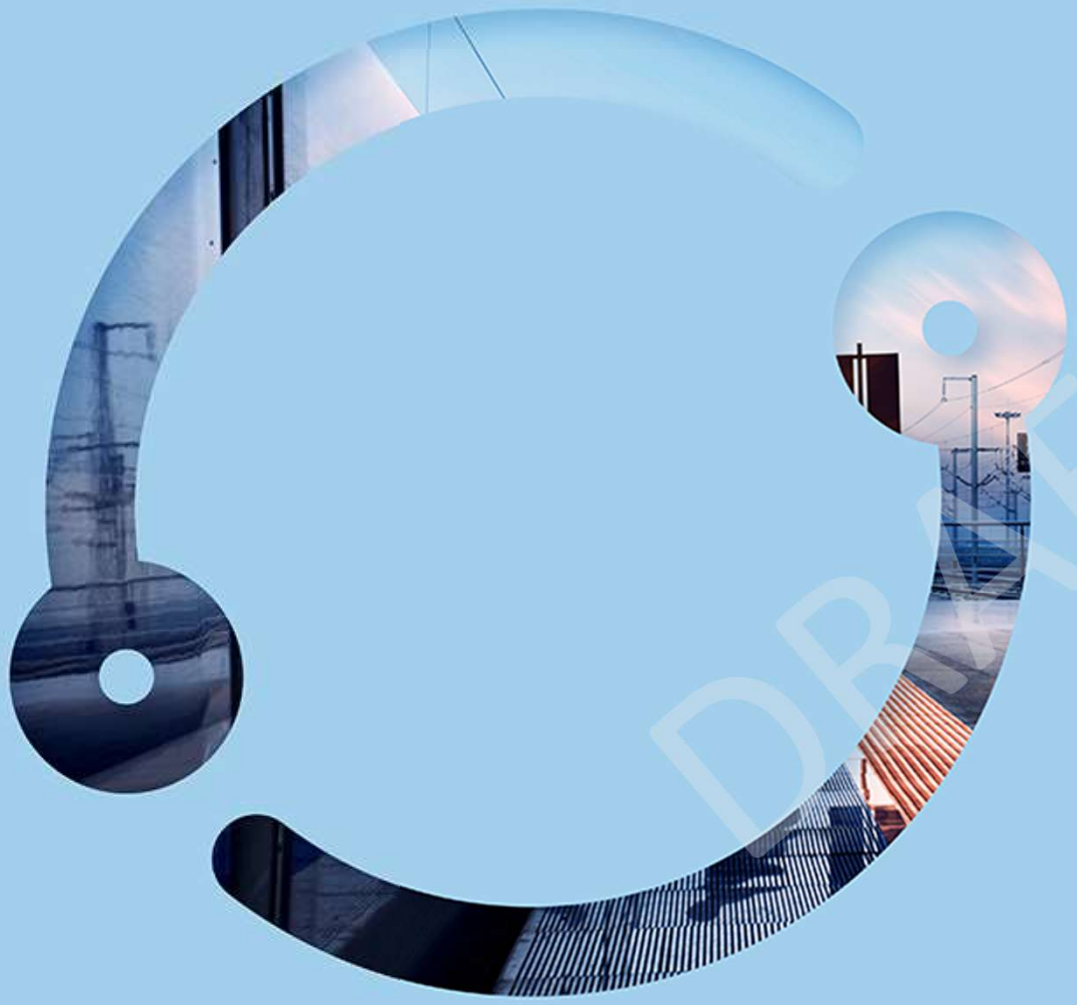


Auckland Rail Network High Level Infrastructure Review

Appendix A1
Comparison with Condition Assessed in 2014

COMPARISON WITH 2014 CONDITION

Operations
There has been an increase in the number of trains from a total of 400 per day in 2014 to a total of 700 per day in 2019.

Rolling Contact Fatigue
Rolling Contact Fatigue was not noted as an issue in 2014 and appears to have emanated since 2014 with several sites showing evidence of Gauge Corner Cracking caused by RCF.

Formation and Drainage
Formation issues are still occurring resulting in cyclic top and poor alignment. Cyclic top was not apparent in the initial assessment in 2014 and appears to have emanated since the increase in the number of services since 2014

Sleepers
The number of Peruvian Decayed Sleepers and Treated Pinus Radiata sleepers has decreased, especially within turnouts, with many sleepers being replaced with composite sleepers which is a great improvement. The rolling programme for PDS and TPR replacement is ongoing

Rail
The amount of 91lb rail has reduced but there are still sections where 91lb rail is in-situ, which is over 50 years old (installed 1968). There are still many lengths of track where the jointed track has been welded into CWR and the bolt holes are remaining

Turnouts
Many turnouts and their components (especially sleepers) have been replaced which is an improvement

COMPARISON WITH 2014 CONDITION

Level Crossings

Many level crossings still have tarmacadam surfacing. This makes it difficult to inspect the track components under the crossing. There are still issues with water from road run-off entering the tracks

Track Access

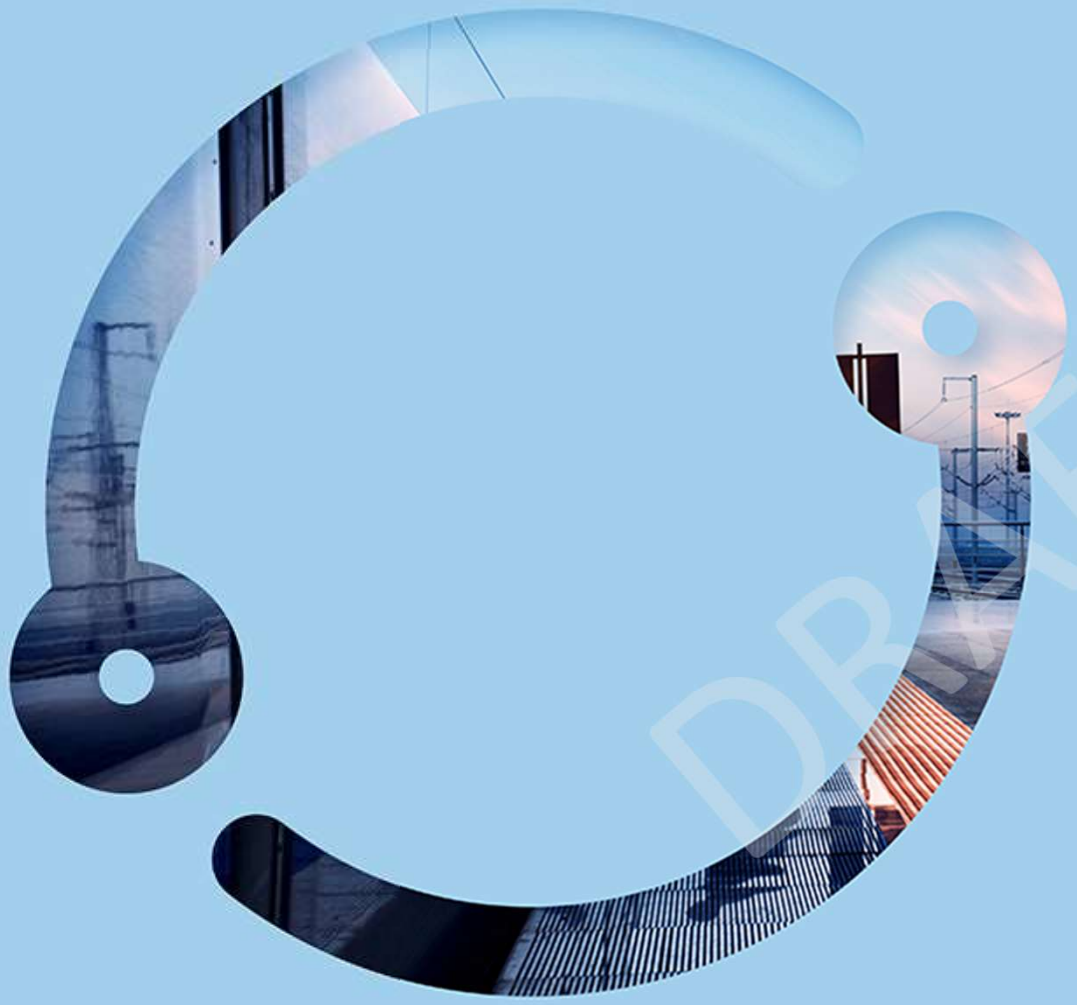
Track access is more difficult since the increase in services

Inspections

More detailed on-site inspections are required. Changes to standards for inspection are in the process of being rolled out.

Defective track welds

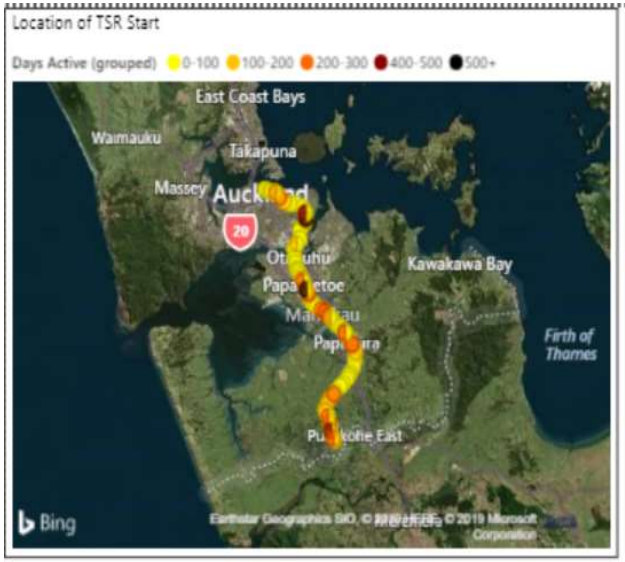
Defective welds did not appear to be an issue in 2014. Now, there are a number of track welds which are defective either because they have been formed from joints where the rail ends were dipped or because the set-up of the rails during welding has been incorrect due to lack of competency of welding teams.

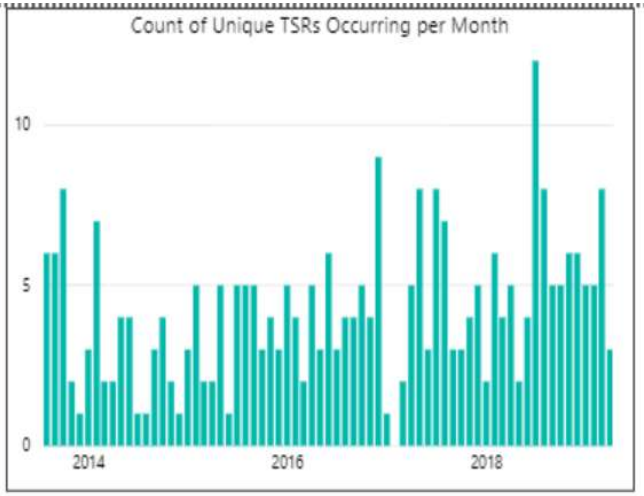


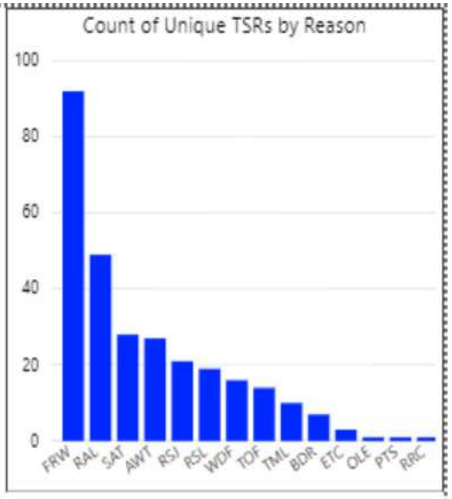
Auckland Rail Network High Level Infrastructure Review

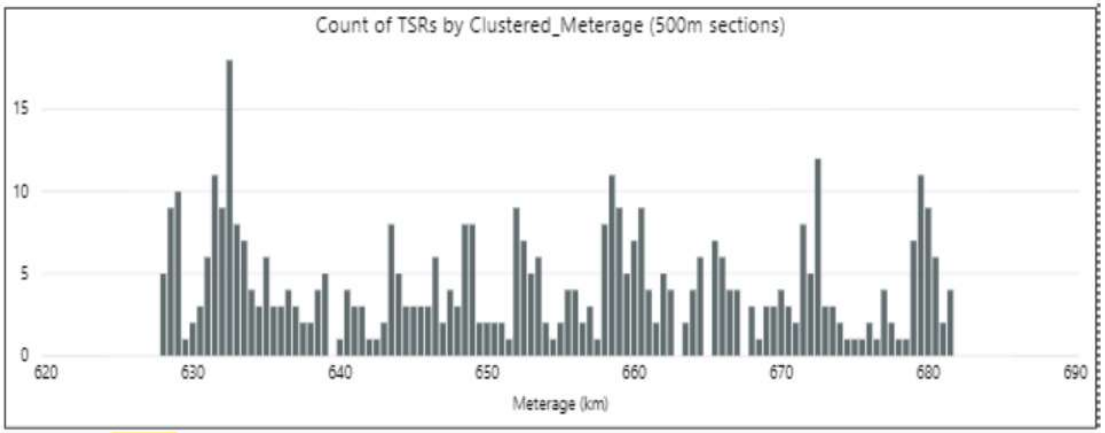
Appendix A2
Analysis of Temporary Speed Restrictions

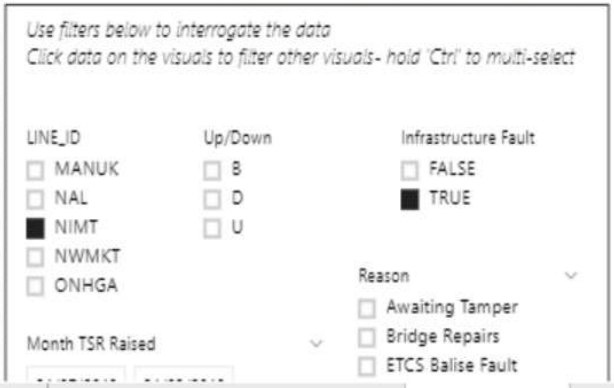
ANALYSIS OF TSRs











Basic Heatmap of TSR Locatons | TSR Faults | 155 Faults

TSR CODES

FRW – Formation Repair Work
RAL – Rail Repairs/Rerailing
SAT – Settlement After Tamper
AWT – Awaiting Tamper
RSJ – Joint Repair
RSL – Resleepering
WDF – Warning Device Fault
TOF – Turnout Fault
TML – Track Misalignment
BDR – Bridge Repairs
ETC – ETCS Balise Fault
OLE – OLE Fault
PTS – Points Fault
RRC – Rusty Rail Conditions

ANALYSIS OF TSRs (NIMT)

Unique TSRs occurring per month

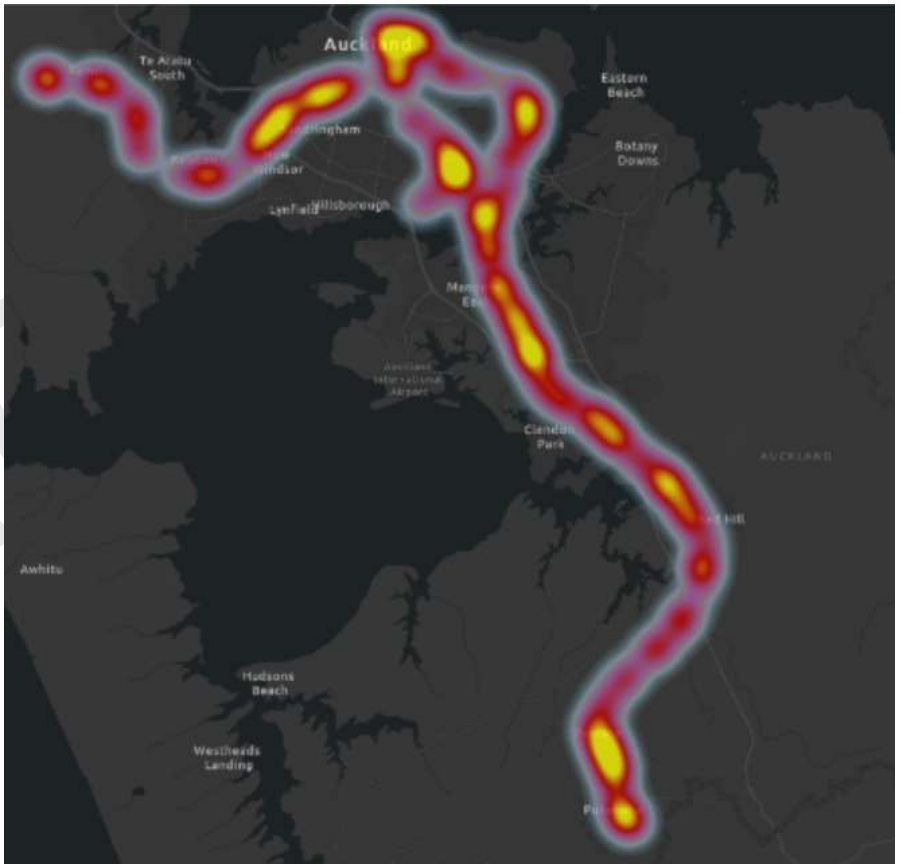
The green histogram shows the number of TSRs per month from 2014 to 2018 based on Maximo data provided by KiwiRail. This appears to show a gradual increase since 2014 when the electric EMU service commenced.

TSRs By reason

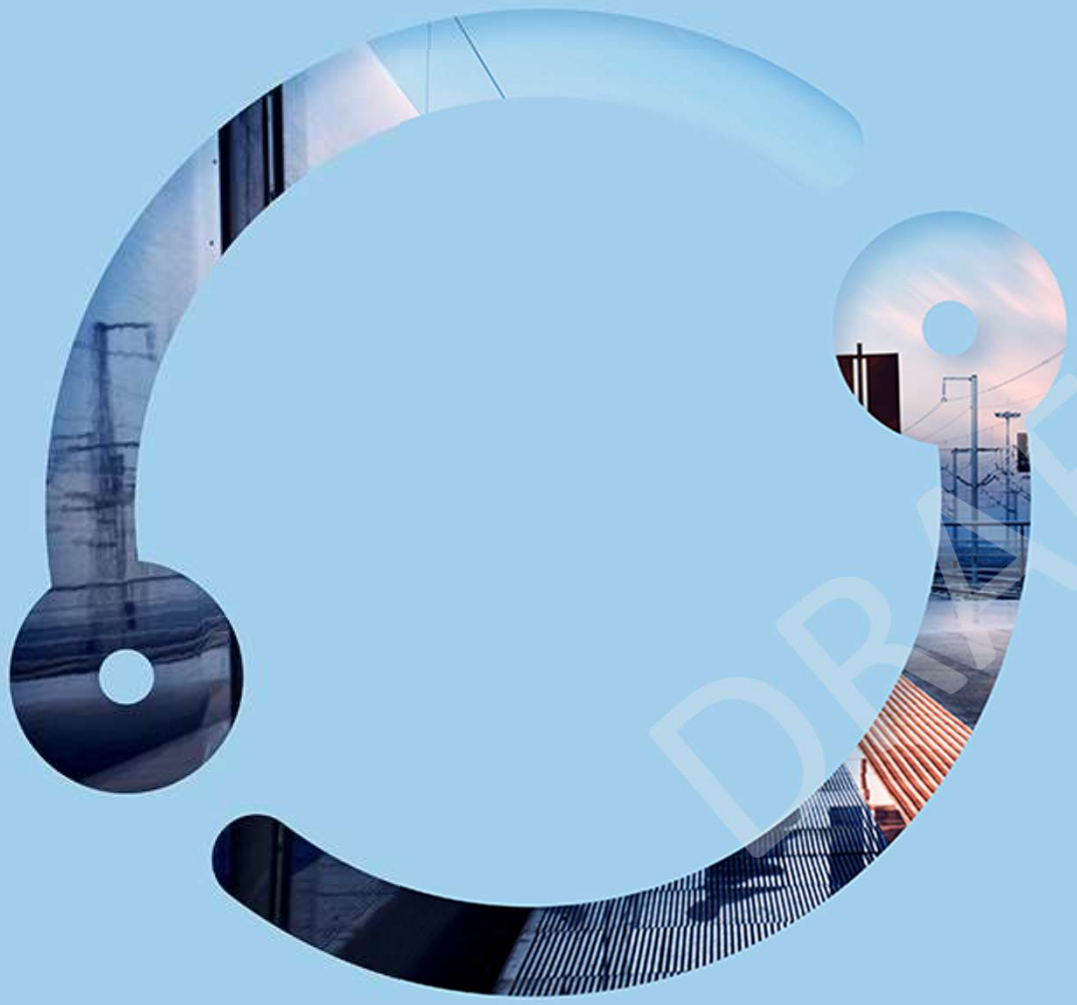
The blue histogram shows the numbers of TSRs based on the reason they have been imposed. The largest number of TSRs relate to formation condition and rail repair work required. The second largest number of TSRs are due to rail repairs.

TSRs by kilometreage

The grey histogram shows the number of TSRs for the running kilometreage of the NIMT. This indicates that the number of TSRs are evenly spread throughout the NIMT.



Heat map showing the location of faults that resulted in track speed restrictions (TSR)

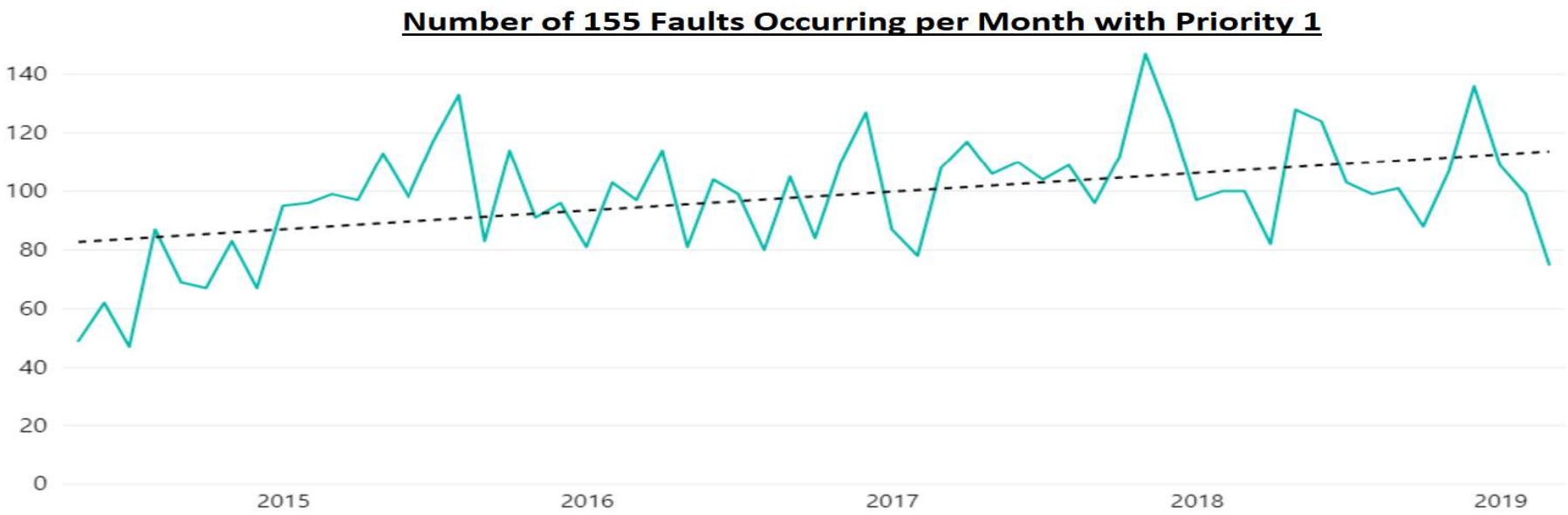


Auckland Rail Network High Level Infrastructure Review

Appendix A3

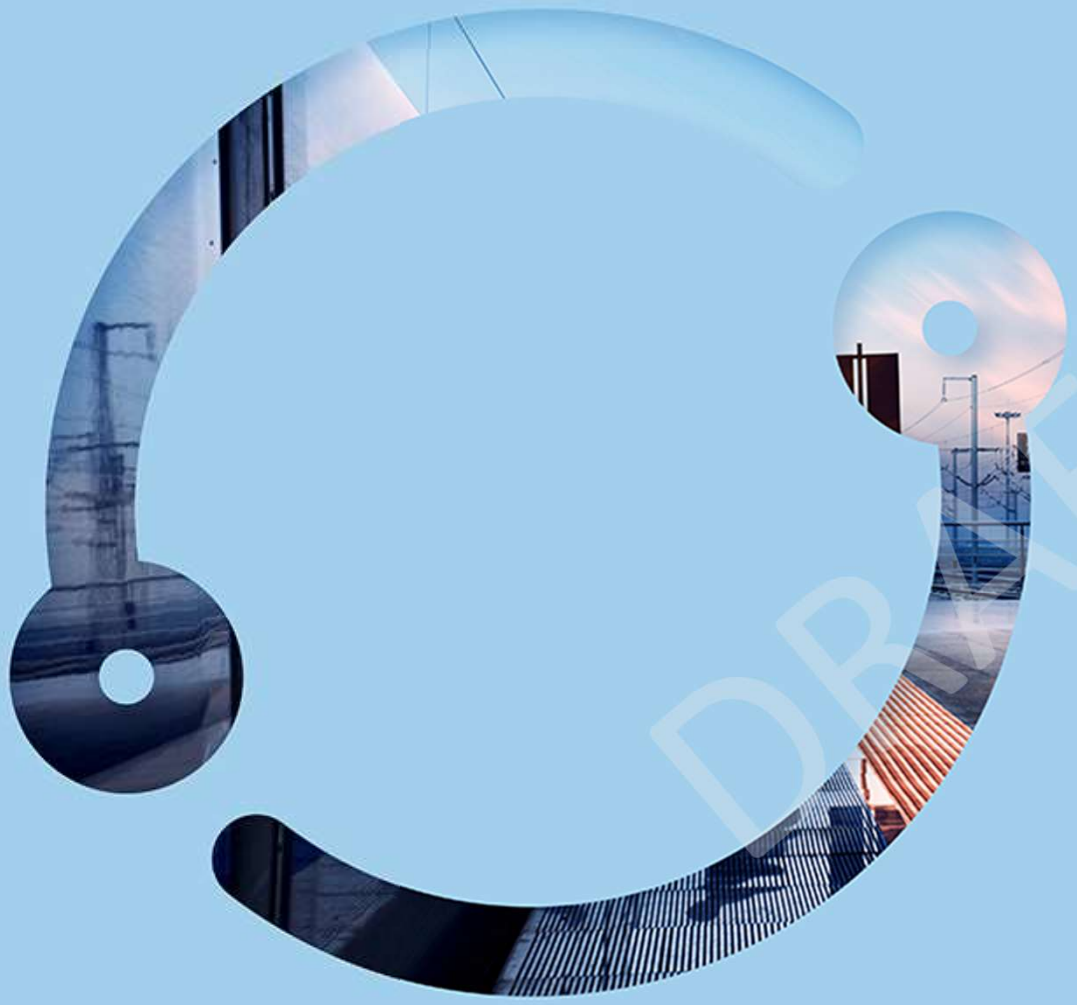
Analysis of M155 Faults

ANALYSIS OF 155 FAULTS



Priority 1 faults

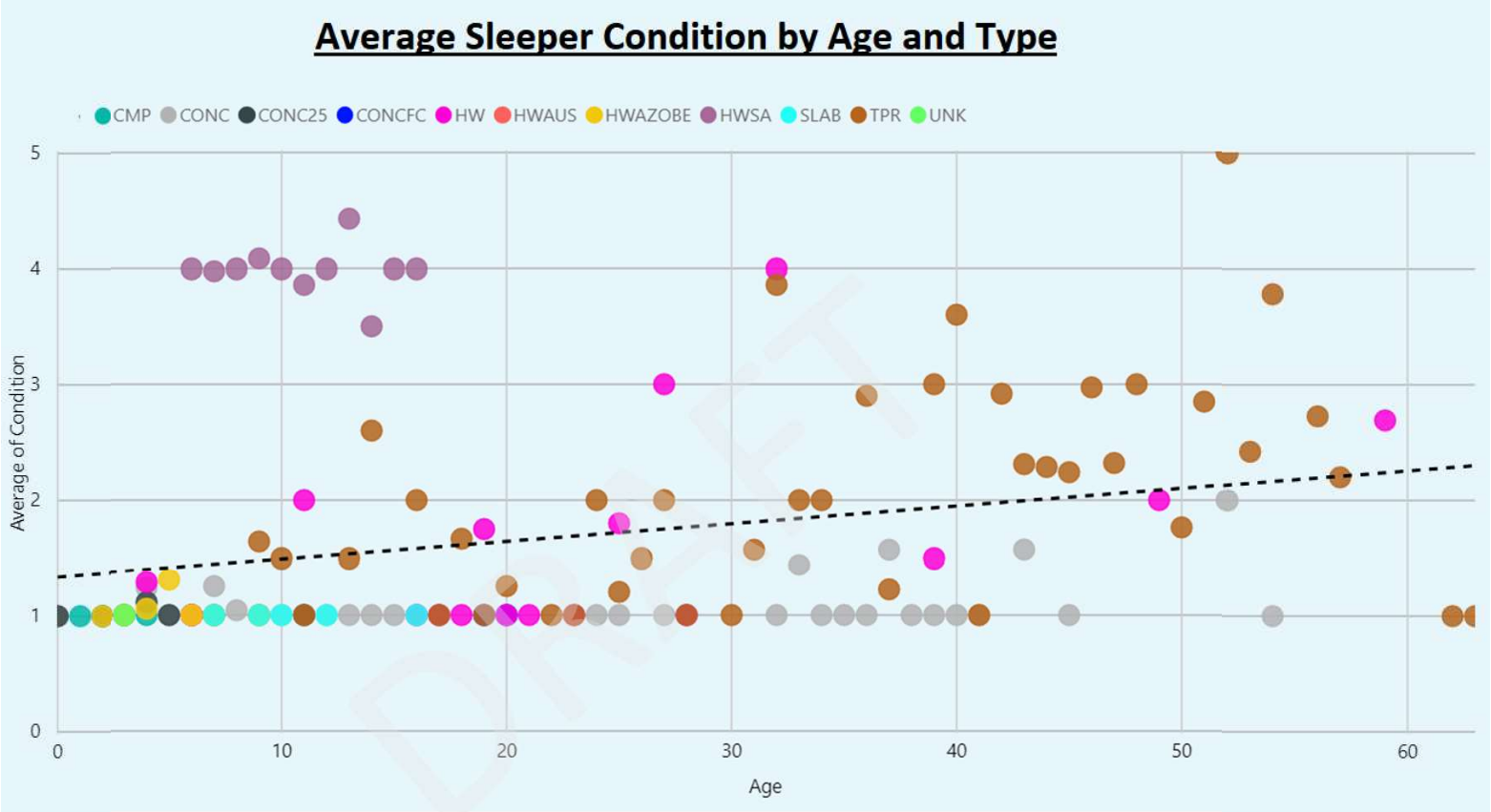
These faults are the highest priority and must be inspected within 1 hour of being raised. This data shows a gradual increase in the number of faults raised since the EMU service began. During 2015 the rate of increase was steep with an approximate doubling of faults over the year. From 2016 the rate of increase in the number of faults has reduced and is rising at a less steep rate. Further analysis is required to determine the main reasons for the M155 faults and how they may be mitigated.



Auckland Rail Network High Level Infrastructure Review

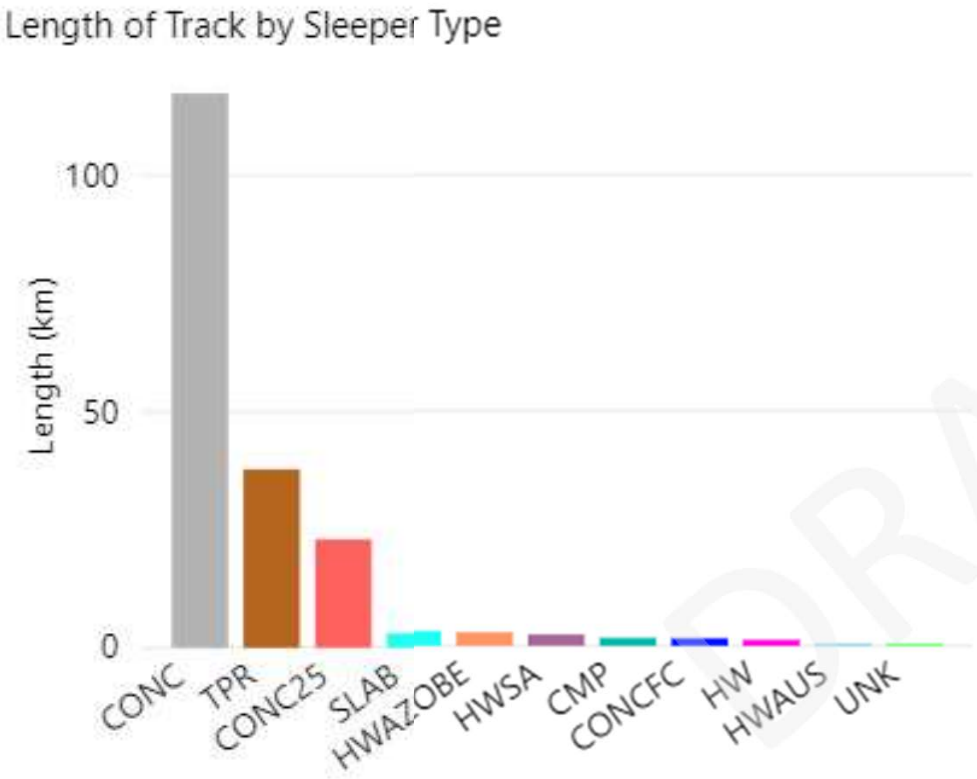
Appendix A4
Analysis of Sleeper Age and Condition

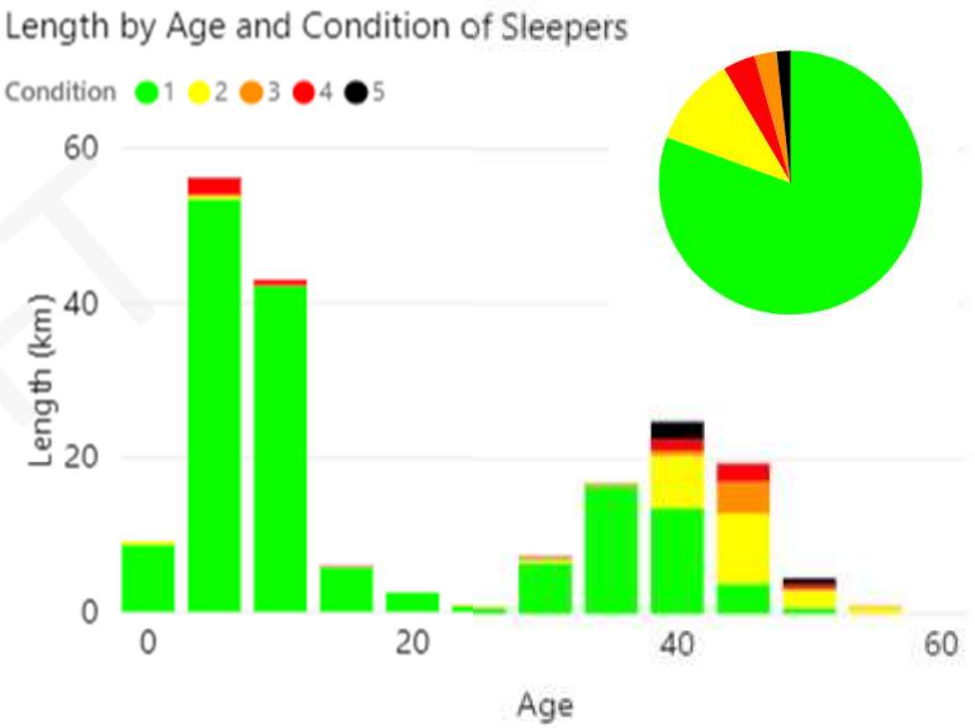
ANALYSIS OF SLEEPER CONDITION BY AGE AND TYPE



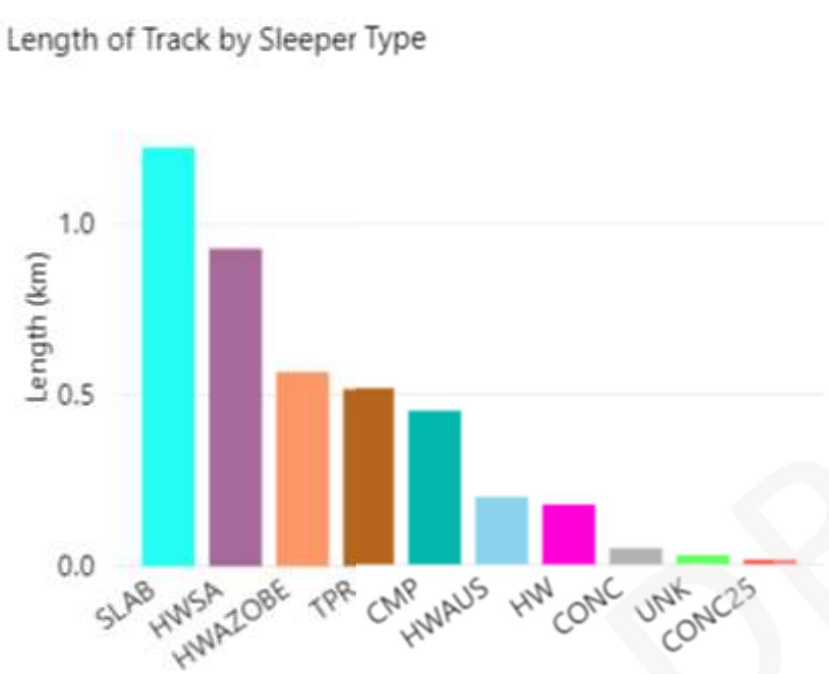
Condition is graded 1 to 5 (1 being best), HWSA sleepers around condition 4 with an age between 5 and 15 years are Hardwood South American Sleepers (Peruvian Decayed Sleepers). A programme of replacement is in place to remove all of the HWSA sleepers.

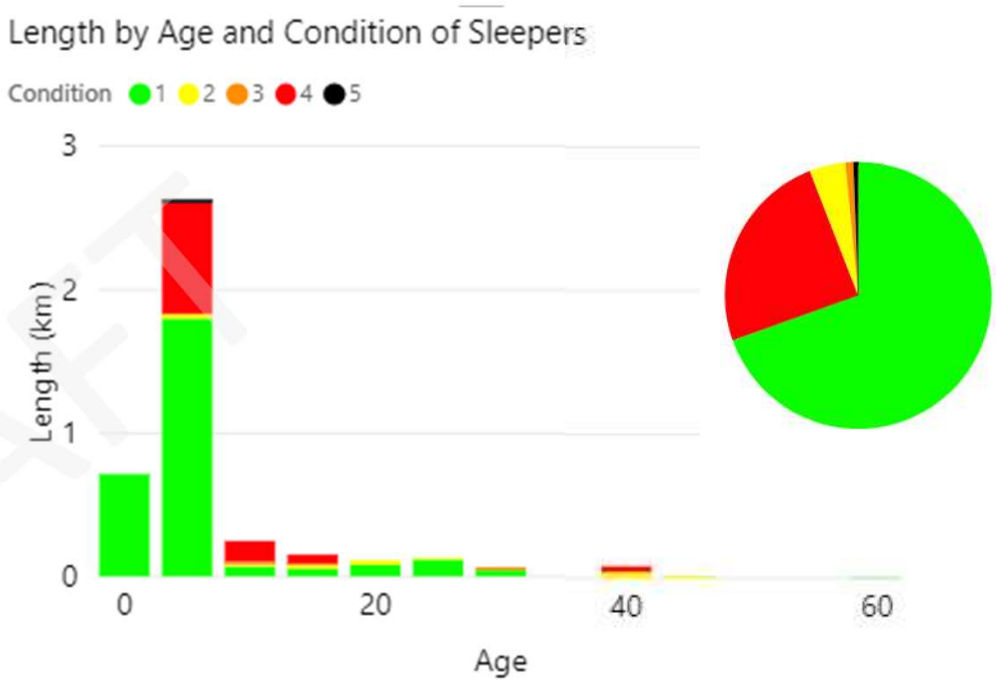
ANALYSIS OF SLEEPERS IN THE AT NETWORK

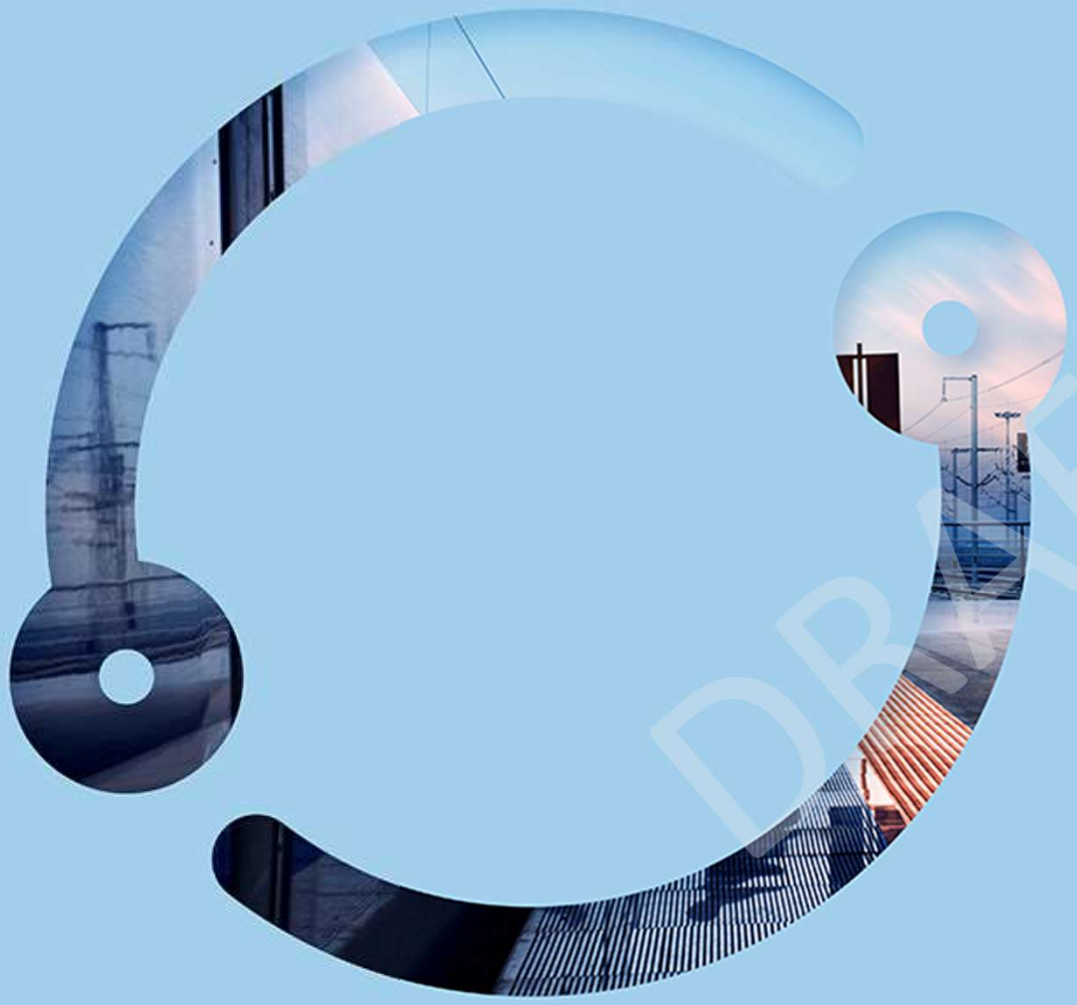




ANALYSIS OF SLEEPERS IN TURNOUTS







Auckland Rail Network High Level Infrastructure Review

Appendix A5
Typical Sites Assessment and Work Order Summary

PHOTOGRAPHS OF TRACK CONDITION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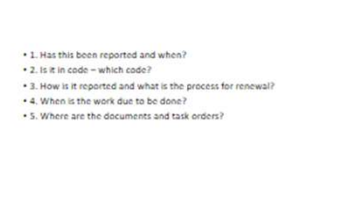

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SUMMARY OF ASSESSED WORK ORDERS

Site No.	Location	Chainage (km)	Feature	When Reported	Condition Code	How Reported	Work Order No.	When Maintenance Work is Due	Mitigations
1	UM	637.6	Running Surface Defect at Weld	26-Mar-16	3	By Track Inspector - M125	3645750	May-19	Ultrasonic testing and detailed visual inspection
2	UM	634.4	Rail RCF	28-Jun-16	Not given	By Field Asset Engineer during Annual Engineering Inspection	1762515	Rerailed Easter BOL 2019	N/A
3	DM	630.1	Rail RCF	10-May-18	Not given	By Field Asset Engineer during Annual Engineering Inspection	3695833	Rerailed Easter BOL 2020	N/A
4	DM	639.2	Rough Top	1-Feb-19	Not given	By Track Inspector - M125	3451882	May-19	Weekly inspection
5	UM	634.4	Rail RCF	28-Jun-16	Not given	By Field Asset Engineer during Annual Engineering Inspection	1762515	Rerailed Easter BOL 2019	N/A
6	UM	629.53	Rough Top	27-Mar-19	Not given	By Track Inspector - M125	4132489	Jun-19	Weekly inspection
7	UM	639	Poor Sleepers	28-Jun-16	3	By Field Asset Engineer during Annual Engineering Inspection	2207151	FY20	Weekly inspection
8	UM	628.4	Turnout 19A	13-Jun-16	4	By Field Asset Engineer during Annual Engineering Inspection	1759548	Interim maintenance June 2019, Turnout replacement FY20	Regular Inspections
9	DM	650.95	Poor top through level crossing	20-Aug-18	3	By Track Inspector - M125	577533	FY21	Regular Inspections
10	DM	662.769	Rough Top	23-Jan-17	Not given	By Track Inspector - M125	3718409	Jun-19	Weekly inspection
11	DM	655.8	Poor Top at Benkler Joint	19-Oct-18	Not given	EM80 Top fault	Not given	Jun-19	40 TRS
12	Homai	655.69	Rail RCF	14-Mar-19	Not given	By Track Inspector - M125	Not given	Jul-19	Ultrasonic testing every 3 months
13	DM	654.56	Mud Spot	18-Dec-17	4	By Track Inspector - M125	3718395	May-19	Weekly inspection
14	DM	653.85	Defective Rail Head	24-Aug-18	3	By Track Inspector - M125	584513	May-19	Weekly inspection
15	DM	652.92	Rough Top	24-Aug-18	Not given	By Track Inspector - M125	584664	May-19	Weekly inspection
16	Westfield	Turnout No. 1566	Poor PDS sleepers	27-Mar-15	Not given	By Field Asset Engineer during Annual Engineering Inspection	1760601	Resleepered Easter BOL 2019	N/A
17	UM	663.6	Rough Top	28-Nov-18	Not given	By Track Inspector - M125	3451882	May-19	Weekly inspection
18	Papakura	Turnout No. 2275B	Poor PDS sleepers	5-Jul-16	Not given	By Field Asset Engineer during Annual Engineering Inspection	1759639	Resleepered Easter BOL 2019	N/A
19	DM	641.6	Corrugation	4-Jul-16	4	By Field Asset Engineer during Annual Engineering Inspection	2358275	Jul-20	Ultrasonic testing every 3 months