



EM80 Report

Scheduling and Maintenance Review

Prepared for KiwiRail

Prepared by Beca Limited

18 May 2023



make
everyday
better.

Contents

Executive Summary	1
1 Introduction.....	3
1.1 Background.....	3
1.2 Scope of the review	3
2 Methodology	4
2.1 Interviews.....	4
2.2 Document and Information Reviewed	4
2.3 Scope Exclusions	4
2.4 Inherent Limitations	4
3 Findings.....	5
3.1 Timeline of Key Events	5
3.2 Maintenance and Scheduling Systems	7
3.3 Accountabilities in Engineering Standards	8
3.4 Risk Mitigation Measures.....	9
3.5 Resilience in the intervening period before the EM80 is replaced	11
3.6 Wider lessons	12
4 Identified Causal Factors and Key Recommendations.....	1

Appendices

Appendix A: Documents Reviewed

Revision History

Revision N°	Prepared By	Description	Date
1.0	Section 9(2)(a) - Privacy	First Draft	10/5/2023
2.0		Interval Review – Draft	11/5/2023
3.0		Client Review	12/05/2023
4.0		Final	17/5/2023

Document Acceptance

Action	Name	Signed	Date
Prepared by	Section 9(2)(a) - Privacy		17 th May 2023
Reviewed by			18 th May 2023
Approved by			18 th May 2023
on behalf of	Beca Limited		

© Beca 2023 (unless Beca has expressly agreed otherwise with the Client in writing).
This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.
This report should be read in full, having regard to all stated assumptions, limitations and disclaimers. No part of this report shall be taken out of context and, to the maximum extent permitted by law, no responsibility is accepted by Beca for the use of any part of this report in any context, or for any purpose, other than that stated herein.

Executive Summary

The following report summarises investigations into the timeline of events and causal factors associated with the scheduling and maintenance of the Track Evaluation Car (EM80) that impacted the Wellington Metro (WLG) network in early May. Interviews were completed with 14 people and relevant information reviewed to identify recommendations to prevent the risk of future reoccurrence and update the escalation process.

From the timeline of communications, it is evident that there was awareness of the delayed compliance inspection for Wellington Metro from 6 March 2023, including varying meetings and emails communicating the importance of completing inspections before 30 April. However, the consequence that a blanket speed restriction would be needed for not completing inspections by 30 April was first indicated as a possible implication on 18 April, before being confirmed on 20 April 2023. As it was the updated EM80 programme on 20 April planning inspections on Wellington Metro to be done on 22 May, that meant the blanket speed restriction would be needed. The blanket speed restriction was then communicated upwards from Thursday 20 April, before being escalated to KiwiRail Executive on Wednesday 26 April.

From the timeline of events, the following causal factors have been identified:

- Currently the EM80 Technician plans the inspection routes of EM80, emailing out programme updates as required and as any changes occur. Emailing updates requires people on the distribution list to read, check and confirm they understand the implications of the running schedule. If there are conflicts in the EM80 programme or other competing track access priorities, then that must be worked through between National Services (Plant Team), Infrastructure Services (Track Maintenance Team), and Engineering (Technical Advice and Compliance Team). However, the Track Standard that sets the inspection frequency does not identify who has the authority to overrule any competing EM80 programme priorities (i.e., that compliance activities take precedence and therefore must be completed on time).
- The Track Geometry Track Standard allows for a four-month compliance frequency between inspections, with no approval or escalation required if the additional 4-week tolerance period is needed or when planned in to be used. Approval is only needed through the code exemption process if track inspections are not completed by the required compliance date. Any delays or schedule changes during the tolerance period therefore creates risks that the track inspection may not be completed on time.
- Since mid-December 2022 the EM80 has had to have regular repairs and maintenance. The repairs, maintenance, and also storm track damage disrupting recalibration, impacted availability through January and February. Changes to the programme in March also delayed the wheels being lathed to remove “guttering”, which on 4 February was booked to be done in Wellington on 19-21 April. On 14 April a report was completed placing a speed restriction on the EM80 reducing it to a top speed of 50km/hr (from 60km/hr), stating that the wheels needed to be lathed, and that it was booked in to be completed in Auckland 2-4 May.
- The EM80 Technician and other supporting team members, plan, operate, and maintain the EM80. Training has been prioritised from key EM80 suppliers to increase rostering capability, however no overarching training and competency model exists for the roles and responsibilities associated with the EM80. Limited rostering options, increasing training needs, public holidays, and staff unavailability (annual leave etc) then impacted the EM80 availability through March and April.

From the timeline of events and causal factors identified, the following areas, issues, and recommendations to prevent the risk of future reoccurrence and to update the escalation process are:

- Planning and Scheduling of Work – to reduce changes, increase visibility, and centralise coordination:
 - A dedicated planner is needed to coordinate EM80 network inspections, planned maintenance intervals, and report progress monthly; and
 - Compliance end dates should be added to the EM80 programme and National Integrated Plan, so all recipients are aware of time critically (e.g., “**Wellington Metro compliance inspection – code compliance ends xx/xx/xxxx**”).
- EM80 Maintenance Planning – to improve reliability and increase availability:
 - All required maintenance activities need to be reviewed, including confirming appropriate intervals for pre-emptive servicing;
 - Ensure all long lead parts, critical spares, and inventory matched to reoccurring faults are available for the servicing intervals, or unplanned maintenance; and
 - Ensure that all service intervals are planned in around the Wellington and Auckland Metro compliance inspections, with the annual service planned in January every year.
- EM80 Training and Competency Model – to increase rostering capability:
 - Confirmation of what roles are needed for planning (e.g., dedicated planner), operating (e.g., number of competent operators required) and maintaining (e.g., number of competent fitters and service technicians needed); and
 - Roles and responsibilities associated with EM80 should also be updated in the Track Standard – Track Geometry, for planning, operating, and maintaining, so they align to the Training and Competency Model.
- Track Standard Update – to create regular inspection periods, control the use of the 4-week tolerance period, and create an escalation path when a tolerance period is approved for use:
 - Wellington and Auckland Metro compliance inspections should be done in March, July and November, rather than a frequency of every 4 months.
 - The use of the 4-week tolerance period should be controlled, requiring approval from the Professional Head – Track (i.e., like the current code exemption process);
 - When the EM80 is approved by Professional Head – Track to complete a compliance inspection within a tolerance period, this is immediately notified to Senior Management and KiwiRail Executive, as completing compliance inspections in this tolerance period creates a business risk; and
 - The Track Standard must also confirm who is responsible and has the authority to overrule any competing EM80 programme priorities, and therefore ensure that compliance activities take precedence.
- Plant Risk Management Review – given the impact of the EM80 incident on Wellington Metro it is timely to review and update the Plant Risk Register:
 - To ensure threats and opportunities associated with all on track machines in the Wellington and Auckland Metros are collectively understood, and appropriate mitigating actions are in place.

Specific recommendations are summarised and included in Section 4.0 Identified Causal Factors and Key Recommendations.

1 Introduction

1.1 Background

Monitoring of track quality at set inspection frequencies is a compliance requirement stipulated in the Track Geometry Track Standard. The Track Evaluation Car (EM80) is an important tool that allows KiwiRail to monitor track quality at regular intervals. Where “*Track quality is the roughness of the track as indicated by the track geometry parameters either in isolation or combined. High quality track means track is generally smooth and provides a good ride for the passenger and lower rates of wear for the track and rail vehicles, thereby maximising the life cycle of each.*” (Track Standard: T-ST-AM-5120 Track Geometry).

The EM80 is therefore a compliance tool for maintaining the safety and efficiency of railway tracks. It is used to inspect railway tracks and identify defects, trends in defect locations, or track anomalies that require maintenance intervention or immediate repair. As such, inspections must be completed within certain timeframes to be compliant to KiwiRail Codes and Standards. If compliance timeframes cannot be achieved, a “code exemption” is then needed which is reviewed and approved by the Professional Head – Track (Track Standard: T-ST-AM5101 Track Audit and Compliance).

1.2 Scope of the review

The scope of this review was targeted into identifying causal factors associated with the scheduling and maintenance of the EM80, in particular:

- 1) A timeline of decisions taken or failed to be taken between 15 March 2023 to 26 April 2023 regarding the scheduling of Wellington track evaluations including when the matter was escalated to the Senior Executive Team (*the date range during the review was updated to include from 1 December 2022*);
- 2) A review of maintenance and scheduling systems, contingency and maintenance periods in relation to compliance periods with relevant linkages to responsible Business Units;
- 3) Whether accountabilities are clear under KiwiRail’s Engineering Principles & Standards;
- 4) Confirmation that the single-issue fault is identified in KiwiRail’s risk register and that appropriate risk mitigation measures are identified;
- 5) The EM80 is the only Track Evaluation Car in New Zealand. KiwiRail has approached the market to purchase a new Track Evaluation Car with automatic track inspection system functionality, but the contract is not expected to be entered into until late 2023 and the new equipment will then need to be manufactured and shipped to New Zealand. Accordingly, the terms of reference for this review includes recommendations to ensure resilience in the intervening period; and
- 6) Wider lessons that may be applied across other Business Units.

2 Methodology

2.1 Interviews

Given the urgency of the review and the quick turn-around for findings and recommendations, interviews with 14 people were held on May 3rd, 4th, 5th and 8th (via Microsoft Teams and in person), with additional documents provided and requested to assist, including reports, registers, plans, and Track Standards.

2.2 Document and Information Reviewed

Through the interview process, several documents and a variety of information was requested and provided. Those documents identified as most relevant to the scope of this review are listed in Appendix A and referenced throughout the report.

2.3 Scope Exclusions

KiwiRail is currently undertaking a substantial workstream through its Engineering & Asset Management Teams, to develop a maintenance and renewal strategy, strategic asset management plans and asset class strategies, to improve overall asset management systems, processes, and strategies, hence these areas were excluded from the scope of the review.

Given the timeframes to complete, interviews were ~1 hour long each, and questions were focused predominantly on the scope and what supporting information was available. As such no additional analysis or detailed investigations were possible.

2.4 Inherent Limitations

In carrying out our review, we have undertaken tests of selected controls as appropriate. Occasions may arise where the nature of the controls, the lack of controls or circumstances of the independent review require us to undertake alternative review procedures. The decision to test, or not to test controls, is made by us solely at our discretion. Because of the inherent limitations in any system of internal control, errors, fraud or irregularities may occur and may not be detected.

Our independent review fieldwork was completed on 8 May 2023. Our findings are expressed as at that date. We have no responsibility to update this report for events or circumstances occurring after that date.

3 Findings

3.1 Timeline of Key Events

During the initial interviews the timeline was extended back to include from 1 December 2022 to 26 April 2023, as the Wellington Metro was last inspected in early December. From December 2022 there were also then a series of events that occurred and help identify the causal factors impacting work scheduling and EM80 availability. The timeline of events and associated communications are shown in Figure 1 with a chronological summary provided in Table 1.

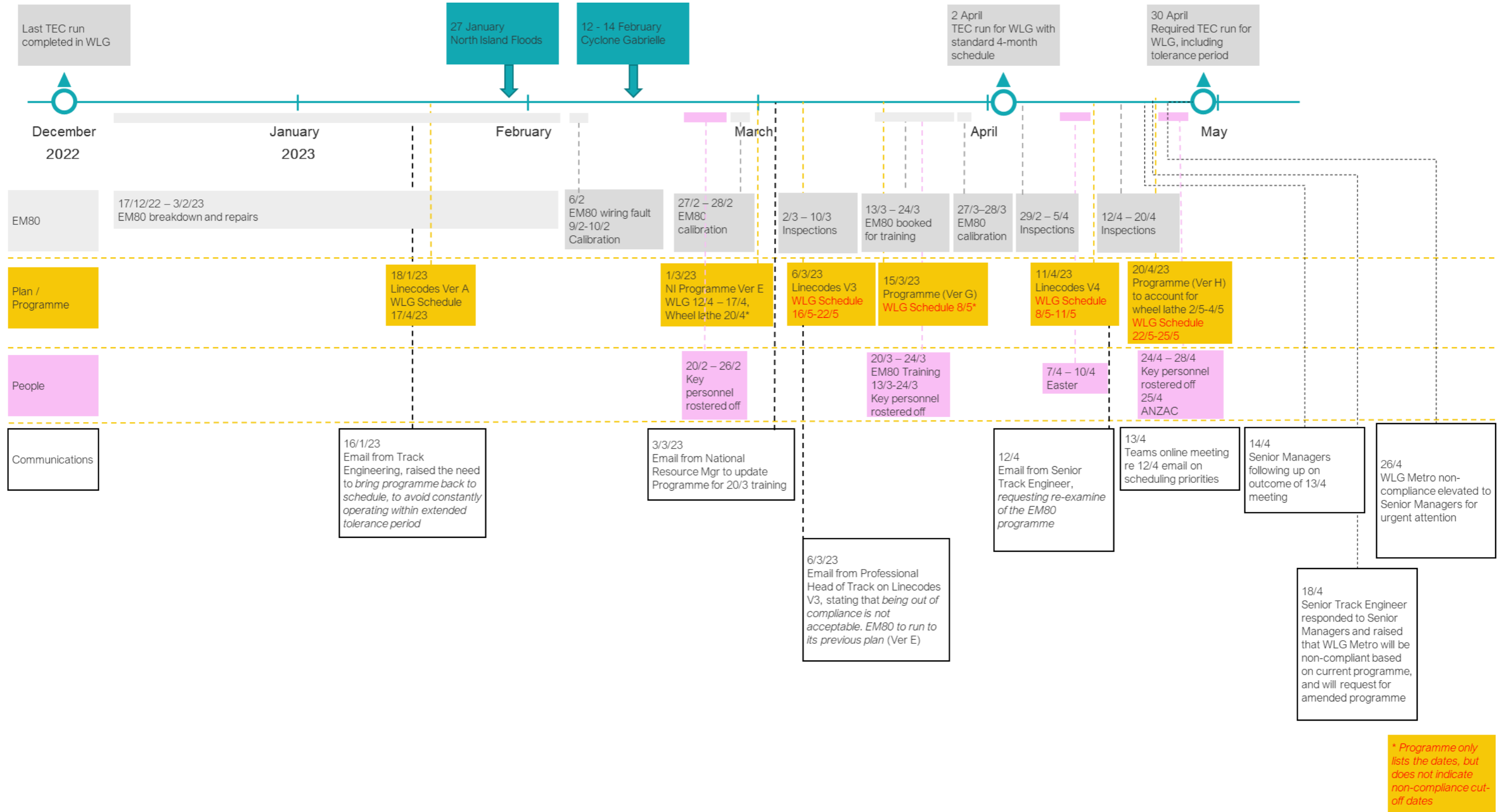


Figure 1: Key Events, Planning and Communications between 1 December 2022 and 26 April 2023

Table 1. Chronological summary of key events.

Date	Key Event	Event Significance
Dec 2022 – Early Feb 2023	EM80 breakdown	EM80 is unavailable, as repairs and maintenance needed
4 February 2023	“Calenda23 proposed to April v1”, wheels planned in to be lathed in Wellington	Wheels planned to be lathed 19-21 April in Wellington after inspections completed
Mid-February 2023	Cyclone Gabrielle	Track damage and calibration required to be done further away
6 March 2023	“Linecodes V3” revised to account for training on 20-24 March	EM80 training organised to improve rostering capability. Programme indicated WLG inspections to fall outside compliance period for the first time (WLG inspection to be completed by 22 May). Potentially, some communications may not have been received by distribution recipients.
6 March 2023	Professional Head of Track responding to the “Linecodes V3”	Engineering comment that being out of compliance is not acceptable, and the EM80 needs to complete its inspections to the previous plan.
15 March 2023	‘Revised Programme (Ver G)’	Revised programme, with WLG inspection now to be completed earlier on 8 May (but still outside of compliance period)
13 March – 24 March 2023	EM80 unavailable for the week leading up to training on 20-24 March. EM80 required to be calibrated following training (27-28 March).	Training and need for re-calibration impacted EM80 availability
11 April 2023 – 13 April 2023	Issue of “Linecodes V4”, which prompted further communications between Engineering and National Resource team. Teams online meeting held 13 April between Senior Track Engineer, National Resource Manager and National Manager Infrastructure Operations.	Linecodes suggest WLG inspections to be carried out on 8 May – 11 May. Correspondences between Engineering and National Resource teams on the programme. Programme confirmed as under review and to be updated next week.
14 April 2023	Senior Managers enquiring on 13 April meeting outcome	Senior Managers (GM Engineering and Technical Director) make enquiries with Senior Track Engineer on 13 April meeting outcome.
14 April 2023	EM80 now booked in for wheel lathe in Auckland	Speed restriction placed on EM80, limiting it to 50km/hr (from 60km/hr), and change in wheel lathe time and location to Auckland 2-4 May
18 April 2023	Senior Track Engineer response to Senior Managers and followed up with National Resource team.	First documentation to Senior Managers on the risk of WLG inspections non-compliance and potential consequences. The email noted that while “a <i>blanket</i>

		<i>temporary speed reduction of 40 (Class 1**) or 60 (Class 1) may be excessively harsh, there needs to be a defined course of action in terms of mitigations for excessive late running (beyond tolerance periods) of the TEC [EM80]</i> ".
20 April 2023	"Programme (Ver H)" to account for wheel lathe	Programme for WLG inspections pushed back further to 22 - 25 May, to account for wheel lathe from 2 - 4 May.
25 April 2023	ANZAC day	Note ANZAC day fell on a Tuesday this year, where this meant some personnel away on Monday 24 th April.
26 April 2023	Elevated to Senior Managers and KiwiRail Executive	Engineering elevates to the Professional Head of Track and Senior Managers who escalate to KiwiRail Executive, including urgency for discussion, as latest programme (Ver H) now having WLG inspections up to 25 days outside the programme tolerance period. Communication noted that in addition to extra track inspections, a reduction in line speed as <i>"additional mitigation is applied for unknown track defects. We will need to make a call on a code exemption for Wgtn Metro this week, with whatever mitigations deemed necessary"</i> .

3.2 Maintenance and Scheduling Systems

Currently, the EM80 Technician completes the:

- Planning of EM80 inspections on the network (e.g., EM80 North Island Programme, Calenda2023);
- Calibration testing and analysis, to ensure it is operating within required measurement specifications;
- Compliance reporting to the required inspection frequencies (e.g., Linecodes 2023);
- Uploading of the track inspection data recorded by the EM80 into Maximo; and
- Coordination of EM80 repairs and maintenance.

Coordination of track inspections with other business units is predominantly via email, through set distribution email lists. The information received by the people in the business units, is then assessed (e.g., Linecode compliance reporting), or used to coordinate activities within known worksites (e.g. EM80 programme is checked to ensure no clashes with other planned works). The Track Geometry Track Standard however makes no mention of EM80 operations and maintenance requirements, just that an annual programme is needed.

We recommend that roles and responsibilities associated with the EM80 around its planning, operation, and maintenance are updated in the Track Geometry Track Standard (see specific recommendations in Section 3.3). To improve planning, we would also recommend moving away from email notifications, bringing in a dedicated planner who leads and coordinates directly with the centralised National Integrated Plan, and producing compliance reports stored in a central register that people can access (rather than search for via their emails). As EM80 planning and reporting is compliance information which is best stored in central directories, or captured centrally via specialised software (e.g., P6 for the National Integrated Plan). We would also recommend that all

required maintenance activities and intervals need to be fully reviewed to ensure timely pre-emptive maintenance and servicing is integrated in the planning process and is completed over the next three years (see specific recommendations in Section 3.4).

3.3 Accountabilities in Engineering Standards

T-ST-AM-5120 Track Geometry Track Standard “covers the track geometry monitoring of the track infrastructure” and “the quality of track geometry”, which are recorded by the EM80 which “provides an indication of track quality under load” (i.e., similar to a train). The Track Geometry Track Standard in Section 6.2 provides clear guidelines on the frequency of recording by route as shown in Table 2 below.

Table 2. TEC inspection frequency (reproduced from Track Geometry Track Standard, Table 6.1)

Line Class	Description	Run Frequency	Tolerance
Class A	Metro Auckland and Wellington Metro	Once every four months	Four weeks

Section 10 then includes “Responsibilities for Managing Track Geometry Recording and Outputs” as shown in Table 3 below.

Table 3. Roles and responsibilities (selected rows reproduced from Track Geometry Track Standard, Table 10.1)

Responsibility	When	Action Required	Review comments
Professional Head of Track	Every three years	Review TEC run frequencies in light of business plan changes and risk. Advise National Planning Resource Service Manager of the required recording frequencies.	No change in frequencies since 2017. National Planning Resource Service Manager role no longer exists.
National Planning Resource Service Manager	Annually	Prepare detailed programme as per required frequency for each route and run the TEC to this programme.	National Planning Resource Service Manager role no longer exists, tasks being completed by EM80 Technician.
National Planning Resource Service Manager	As required	Undertake calibration of the TEC and report validation findings to Professional Head of Track.	National Planning Resource Service Manager role no longer exists, tasks being completed by EM80 Technician.

We recommend the Track Geometry Track Standard is fully reviewed and Table 10.1 is updated with the required EM80 roles and responsibilities, including planning, operation, and maintenance. As currently the majority of tasks associated with the EM80 are being completed predominantly by the EM80 Technician.

Additionally:

- The EM80 should inspect the Auckland and Wellington Metro's in fixed timeframes (e.g., March, July and November) every year, as this creates clearer repetitive inspection frequencies on the network, rather than a return frequency;
- The use of the tolerance period should be restricted and controlled, requiring approval from the Professional Head – Track, as is required when a code exemption is required. As the required inspection frequency is 4 months, so all inspections should be completed in this frequency, and then by exception and approval the Professional Head – Track, the tolerance period may be used if needed;
- If the EM80 is then approved to complete the inspection in the tolerance period by the Professional Head - Track, this must be immediately escalated to Senior and Executive Management. As operating the EM80 in the tolerance period creates risk to KiwiRail operations, as you only need a combination of unplanned repairs and maintenance, Covid/sickness/crew unavailability, storms/weather events, and/or track access issues/restrictions, and it is possible the required completion date could be missed (i.e. requiring a code exemption, which can therefore include blanket speed restriction); and
- A dedicated planning resource for the EM80, and possibly other associated plant (e.g., Non-Destructive Testing (NDT) inspections) should sit in National Planning. This dedicated resource would coordinate the “detailed programme” for the EM80 and integrate directly into the National Integrated Plan. As changes in the EM80 programme need to be minimised, coordination with other planned activities prioritised, and the importance of the EM80 inspections communicated (e.g., **“Wellington Metro compliance inspection - code compliance ends xx/xx/xxxx”**). Centralised reporting of planned vs actual would also then be possible, and broader monthly reporting to Senior Managers and the KiwiRail Executive.

3.4 Risk Mitigation Measures

The Enterprise Risk Management Policy states that risk management is *“a formal process whereby those risks which threaten the achievement of Strategic, Project and Operational objectives are identified, evaluated, & cost-effectively treated”*. Ownership of risks includes Divisional/Business Unit Leadership Teams which *“are responsible for ensuring that risks within each of their areas of operations have been identified and quantified, with appropriate risk mitigation strategies developed to manage, minimise or remove the risk identified.”*

As the EM80 is managed by National Services (Plant Team), their Risk Register was reviewed which identifies 34 items in total, including three EM80 risks, see Table 4.

Table 4. Relevant information extracted from the NLP Plant and Equipment Risk Register.

No.	Risk Statement	Existing Controls	Proposed New Controls	Review Comments
1.05	<i>EM80 fails and is unable to complete test programme</i>	<i>Experienced staff who are capable of repairing existing machine. Regular maintenance and maintaining suppliers. Ability to operate at a lower speed across the Network to mitigate the lack of recording data. Increase mainline inspection"</i>	<i>Identify what other technology is available to undertake a track recording and have a plan for bringing in machine from abroad. Test frequency has increased in some areas which means the test requirements have increased. New Technology being investigated and will be brought in line when replacement introduced.</i>	Sourcing machinery from overseas has been reported as difficult, as similar narrow-gauge plant is in high demand, and not readily available. EM80 maintenance was completed in January and is planned in May and August, with future costs identified in the Plant and Equipment Asset Management Plan. However, given the age of the EM80 and the requirement to be available for a further 3 years potentially, the maintenance required needs further review. Automated track inspection technology is continuing to evolve, and possible options are under review and being considered.
1.09	<i>Unable to complete EM80 test programme.</i>	<i>Training occurred to use internal staff to replace operator if they are away (succession planning). No other reason why we would not be able to complete.</i>	<i>Training underway to get staff exposure to operation machine - Training Partially Complete.</i>	Training is being coordinated and prioritised, using EM80 suppliers (e.g., Pacific Real Time and Plasser). However, a wider training plan, linking required competencies and the regular assessment of them, is needed that links back to the Track Geometry Track Standard roles and responsibilities.
1.18	<i>The EM80 is [over] 30 yrs old and will come to a point where the substructure will come to life end or need major refurbishment.</i>	<i>Interim inspections by Plasser on the superstructure of the car, over and above the rail operating code checks which are undertaken. i.e. 155 checks undertaken by plant manager and A, B & C Inspections undertaken by freight mechanical.</i>	<i>Plasser do not inspect. Machine will be replaced in due course. Measure partially effective as age will continue to be a factor.</i>	Procurement of replacement vehicle now well progressed, expected to land in NZ in ~2 years. Risk of delays possible within the procurement process and need to be factored into the ongoing maintenance of the EM80.

We recommend the Plant Risk Register is fully reviewed and updated against the Auckland and Wellington Metro Networks. As currently, there is a significant amount of capital work occurring across these networks, that creates potential risk on inspections and plant requirements, hence all mitigating actions should be reviewed and updated accordingly.

Additionally:

- The EM80 could need to be available for a further 3 years so the maintenance activities needed should be reviewed to confirm the appropriate internals for all pre-emptive servicing and all required spares for urgent repairs are available. Any long lead items should be identified, together with known inventory matched to reoccurring faults. All planned service inspections and maintenance on the EM80 must be planned in and around the Auckland and Wellington track inspections, with the annual service planned in January each year.
- An overarching training and competency model is needed for the EM80, so those roles associated with planning, operating and maintaining are clearly defined, together with well-defined training and competences, so rostering capability is increased. As there are a variety of documents available for the EM80, so these need to be amalgamated in one training and competency model (including on the job training). As the EM80 completes track inspections across the country, increased rostering capability is also needed across the country over the next three years.

3.5 Resilience in the intervening period before the EM80 is replaced

As identified in Sections 3.2 - 3.4 above, it may take up to 3 years before the replacement EM80 is in the country and running at capacity across the network. Hence, as per the recommendations identified, targeted action over the next three years is needed around the following areas:

- National Integrated Planning, to maximise utilisation, minimise changes, and increase reporting;
- Updating relevant Track Standards, to clearly define roles and responsibilities associated with planning, operating and maintaining;
- Updated review of all plant risks associated with inspection and maintenance of the Wellington and Auckland Metro networks, to ensure all appropriate mitigations are identified, and actions prioritised;
- Review of all required EM80 maintenance and service intervals, to ensure they are planned around inspections and appropriate spares are on hand; and
- A training and competency model, to increase national rostering capability and maximise EM80 utilisation (including on the job training).

3.6 Wider lessons

Through the targeted interviews there was limited opportunity to go into broader questioning on wider possible lessons, however post interviews we have identified the following questions/possible lessons for consideration:

- Is there an opportunity to digitise and complete a 3D model of EM80, effectively a digital twin. So all maintenance history, service requirements, and planned works are centralised in an online model? Would digitising the EM80 make it easier to also share virtually on how the machine operates and key maintenance requirements? Would there also be wider benefits in regards to online shared learning, online training videos and modules, and therefore reducing the need to travel for training and reducing disruption to the EM80 inspection programme?
- Should all on track machinery have a similar training and competency model, and are there elements from other on track machinery documents that could apply to the EM80 (and vice versa)? As possibly this may increase the cross operability of all operators across all on track machinery.
- Should the team who plans and operates the EM80 and NDT report through the Engineering Team, given the importance of compliance to mitigate business risks? As that would create more direct relationships and quicker escalation paths of any critical issues.
- Once the new Track Evaluation Car is operational, could the EM80 still be used on some freight only lines around the country? As it may take longer to complete the metro areas in three years' time with increasing utilisation of the metro networks, thus using the EM80 only on freight lines could add in additional network inspection capacity?
- We understand that only certain Interislander Ferries can transport on track machinery between the islands, and that the ferries also have set maintenance periods where they are unavailable. The ferry maintenance periods therefore also need to be included in the National Integrated Plan, as they can impact plans to complete inspections in the South Island and/or return to the North Island.
- Are there opportunities to increase risk management awareness across the organisation? As potentially, if people have greater awareness of consequences, then escalation of issues will also be quicker.

4 Identified Causal Factors and Key Recommendations

From the interviews completed and information provided, Table 5 provides a summary causal factors and recommendations.

Table 5. Summary of causal factors and key recommendations.

Areas	Identified Causal Factors	Key Recommendations
Planning and Scheduling of Work	1) Currently the EM80 Technician plans the inspection routes of EM80, emailing out programme updates as required and as changes occur. Emailing updates requires people on the distribution list to read, check and confirm they understand the implications and understand all consequences.	1) The EM80 planning should be included and centralised into the National Integrated Plan by a dedicated resource. As the National Integrated Plan coordinates and communicates critical network operations, in specialised planning software. EM80 programmes must also clearly state compliance end dates. As business-critical information is best stored in central directories (e.g., Compliance Reports), or captured centrally via specialised software (e.g., P6 for the National Integrated Plan).
EM80 Maintenance Planning	2) The age of the EM80 increases the need for timely repairs and maintenance. Repairs and maintenance were required in January impacting availability. Storms and other faults requiring maintenance, which then required calibration testing, further reduced availability in February March and April.	2) All EM80 maintenance activities required need to be reviewed, including the appropriate internals for pre-emptive servicing and all critical spares for urgent repairs. Any long lead items should be identified, together with known inventory matched to reoccurring faults. All planned service inspections and maintenance on the EM80 must then be planned in and around the Auckland and Wellington Metro inspections, with annual servicing planned in January each year.
EM80 Training and Competency Model	3) The EM80 Technical Officer is currently completing most of roles associated with the EM80. Training is being provided by key suppliers to increase rostering capability, however no overarching training and competency model exists for the EM80, for planning, operating, and maintaining.	3) An overarching training and competency model is needed for the EM80, so those roles associated with planning, operating and maintaining, are clearly defined and documented. As there are a variety of documents available for the EM80, along with knowledge of what is needed, when and why, so this needs to be amalgamated into one training and competency model. Having a training and competency model enables increased rostering capability, with operators then also available across the country.

Track Standard Update	<p>4) The frequency and tolerance period in the Track Geometry Track Standard effectively allows for the four-month frequency, with no approval or escalation required if the additional 4-week tolerance period is planned in to be used.</p> <p>5) Roles and responsibilities associated with planning, operating and maintaining the EM80, are not fully documented. The EM80 Technical Officer is currently completing most of them.</p>	<p>4) The inspection frequency for Wellington and Auckland Metros should be set as March, July and November, with no tolerance automatic period available. If the 4-week tolerance period is needed, then it should be applied for, reviewed and approved by the Professional Head – Track, before the EM80 is planned in.</p> <p>5) Roles and responsibilities associated with planning, operating and maintaining the EM80 must be reviewed and updated in the Track Geometry Track Standard. The Track Standard must also confirm who is responsible and has the authority to overrule any competing EM80 programme priorities, and therefore ensure that compliance activities take precedence and are completed on time.</p>
Plant Risk Management Review	<p>6) The current Plant Risk Register identifies three risks associated with the EM80. Work has been progressing against the three risks, however it is timely all plant risks are reviewed.</p>	<p>6) A review of plant risks associated with the EM80 and other on track machinery needs to be completed, to ensure appropriate mitigating actions are in place, and regular reviews of mitigating actions are occurring.</p>

Appendix A: Documents Reviewed

Type	Document	Relevancy
Track Standard	Track Audit and Compliance (T-ST-AM-5101) – Dated 1/12/2018	Outlines the process for periodic reporting by KiwiRail to demonstrate compliance, including the process for Code Exemptions.
Track Standard	Track Geometry (T-ST-AM-5120) – Dated 3/03/2017	Outlines how track quality is measured, and the process for monitoring, including EM80 frequency and roles and responsibilities.
EM80 Planning	EM80 North Island Programmes: <ul style="list-style-type: none"> Version E, Dated 1/3/23 Version G, Dated 16/3/23 Version H, Dated 20/4/23 	A detailed inspection programme, including: <ul style="list-style-type: none"> Dates Route identity Start Point End Point Kilometrage Extent TOL Time Depart Arrive
EM80 Planning	Calenda23: <ul style="list-style-type: none"> Proposed to April v1 – Dated 4/2/23 Proposed v2 - Dated 6/3/2023 Proposed v4 – Dated 11/4/2023 	A summary lookahead calendar of what is planned for the EM80 by each day for each month. V1 had wheel lathe booked in Wellington after inspections V4 included: <ul style="list-style-type: none"> What had been completed in March, and up to April 10th (Easter Monday) What was planned for the rest of April, May, and June)
Compliance Reporting	Linecodes 2023: <ul style="list-style-type: none"> A Last Saved 18/1/2023 X3 Last Saved 6/3/2023 X4 Last Saved 11/4/2023 	A register of all the lines and inspections that the EM80 completes, including: <ul style="list-style-type: none"> “Last run done” – date it was last inspected “Last Date to be run by next” – date to be completed by within the set compliance frequency “Last Date to be run by next” – absolute tolerance period date to be completed by, before code exemption will be needed “Next run date” – actual planned inspection date

Compliance Reporting	Loco 442D Non-comply Vehicle Authority Dated 14/4/2023	Speed reduced to maximum of 50km/hr from 60km/hr. Booked into Auckland wheel lathe at Westfield from 2-4 May.
Policy	Enterprise Risk Management Policy Date 1/3/2022	<i>“KiwiRail is committed to providing customers with a quality service and conducting its business in a safe, healthy and environmentally responsible manner. To protect our employees, the environment, our assets, earnings, markets and reputations we will manage risk as an essential component of operational excellence”.</i>
Risk Register	NLP Plant and Equipment Risk Register – Last Saved 2/5/2023	<i>“The Register provides an indication of the current status of operational risks and enabling the Managers to monitor and effectively manage these activities”</i>
Asset Management Plan	Plant and Equipment Asset Management Plan – Dated 10/10/2022	<i>“This Asset Management Plan (AM Plan) sets out how KiwiRail intends to manage its Plant and Equipment assets. This plan defines the actions required to provide an agreed level of service in the most cost-effective manner while outlining associated risks”</i>
EM80 Operating	Rail Operating Procedures Section 10.4 Running Rights/Restrictions: Track Evaluation Car (3/12/2020)	Provides rail personnel with the running rights and marshalling restrictions for the Track Evaluation Car
EM80 Operating	EM80 Instructions for Loco Engineers (10/2/21)	Operating guidance note
EM80 Operation and Service	EM80 Operating and Service Manual (1/4/2014)	Specific information regarding operations and maintenance of the EM80.

Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client, including the information listed above, and has not sought independently to verify the information provided