

Engineering Train Movement not in accordance with published process

Stamford Brook

14th – 16th May 2021

HSE Info Exchange Reference Number: 138323

	Name	Title	Organisation
Author	Jyoti Palit	Incident Investigations Manager	TfL SHE
Checked by	James Wardell (Chair) and Panel members	Head of Programme - Change & Mod	TfL LU
Commissioned by	Andy Lord	Managing Director - LUL	TfL LU
Accepted by	DRACCT		

Version Number	Date
V3	01/03/2022

Contents

1.0	Executive Summary	3
2.0	Preface	4
3.0	Terms of Reference	4
4.0	Summary of Incident.....	6
5.0	Location of the Incident	7
6.0	Weather and Environmental Conditions.....	7
7.0	Pre-Incident Details	7
7.1	Possession Planning	7
7.2	Industrial Relations issues.....	8
7.3	Closure details.....	9
8.0	Intention of Entry/Exit Process	10
9.0	Incident Timeline	11
10.0	Immediate Actions Taken	11
11.0	Areas, Subjects and Assets Investigated	12
11.1	Signal A581 held at danger.....	12
11.2	Communications by Protection Staff to Test Train Drivers.....	13
11.3	Briefings to Drivers prior possession weekend	14
11.4	Possession Plan Documentation.....	14
11.5	Time Pressure.....	16
11.6	Communication of Incident	17
12.0	Similar Incidents	17
13.0	Root Cause Analysis	19
14.0	Conclusions.....	20
15.0	Observations	20
16.0	Recommendations.....	21
17.0	Appendices	27
17.1	Formal Investigation Panel Members	27
17.2	Persons Interviewed	28
17.3	Consultation.....	28
17.4	Documentation	28

1.0 Executive Summary

Transport for London (“TfL”) conducts Formal Investigations into the most serious incidents that occur across its transport network. These investigations are undertaken by trained investigators in accordance with approved procedures. The outcomes of these investigations allow TfL to understand the cause of any such incident and implement suitable action to prevent reoccurrence.

On the weekend of 14-16th May 2021 (referred to as week 7), Four Lines Modernisation Project (4LM) were carrying out a Communications Based Train Control (CBTC) test train operations possession, in the Signal Migration Area five (SMA5) area. Thales were the Principal Contractor responsible for Test Train Operations and TfL were responsible for the logistical planning, including planning and execution of the possession arrangements.

This possession was different to previous Test Train possession due to; (i) the possession not being taken around the test trains, as the SMA5 migration boundary needed to be tested, (ii) a mixture of S Stock Trains and Engineering Vehicles entering the possession. (iii) an overall more complex possession (in comparison to other possession).

Concerns were raised during the weekend around the entry and exit process being used by the Engineering Vehicles on the test weekend. These were not initially appreciated, until an S Stock Train travelled the same route and carried out a different process.

The final published process stated that after permission had been granted by the protection staff for a train to enter the possession, the train would pass the Possession Protection signal at Stamford Brook PN579 (being held at danger) and then continue on to Barons Court, using the legacy signalling system as the method of ensuring a safe distance was maintained between trains. The engineering vehicles did not follow this process. The S Stock train did.

Through initial investigations there have been found to be several issues around communications, errors in documentation, late submission of documents and issues around briefings.

An interim report was produced into the factors behind this event, to enable the investigation team to provide some immediate recommendations to ensure the upcoming possession weekends mitigated against this similar risk.

2.0 Preface

The purpose of the Formal Investigation is to determine the causes of the incident and to identify any measures necessary to prevent a reoccurrence. The investigation is not to establish blame or liability.

3.0 Terms of Reference

IRF Reference Number – I38291

Incident Location – Stamford Brook, Signal PNX579.

Date and Time – 12:35, May 16th, 2021

A formal investigation has been commissioned, following a high potential incident reported during a Four Lines Modernisation Project (4LM) Communications Based Train Control (CBTC) test train operations possession; in the Signal Migration Area five (SMA5) area.

Engineers Train 642 entered the possession via Stamford Brook and the correct train entry process had not been followed.

The train had cut out its tripcocks and proceeded directly from Stamford Brook, past the possession protection signal (PNX579) that was at danger (displaying a red aspect) and to Hammersmith Platform 4. At least one further legacy signal (A581) was passed at danger.

Signal A581 (between Stamford Brook and Ravenscourt Park) had been reported as failing to clear. It was established post the incident, but during the possession period, that the way that the pre-planned possession arrangements were implemented were the cause of signal A581 not clearing.

The potential consequence of this incident could have been a line speed collision of one train into the back of another whilst undertaking testing. There were no points in the track section effected by the incident, so there was not a derailment risk from, for example, the route not being set correctly.

The purpose of this investigation is to determine the causes of the incident and to identify any measures necessary to suitably minimise the risk of recurrence (not to establish blame or liability).

The investigation should:

- Establish the sequence of events that led to the incident.
- Identify why the incident occurred in terms of immediate cause, causal factors and root causes.
- Identify any actions already underway to address the root causes.
- Develop reasonably practicable recommendations to address the root causes.
- Consider previous or similar incidents.

The investigation should pay particular attention to:

- The planning for the testing activity, particularly in context of this being a non-routine activity and one for which normal possession plans may not be sufficient.
- Why the published train entry process was not followed and whether the staff involved fully understood the importance of it.
- Whether it is significant that the only train to enter the possession correctly (to be confirmed as part of the investigation) was an S Stock test train (rather than an Engineers Train).
- If the published train entry process was easy to understand, if it explained the relevant features of the activity, and was available to everyone who needed to see it.
- If the process of getting the possession plan reviewed and authorised resulted in a robust check of the processes, with adequate time for discussion and amendments.
- Whether the staff involved were sufficiently briefed and had adequate time and opportunity for this.
- If the novelty/complexity of the arrangements was a causal factor and significantly increased the risk of an incident occurring.
- If the late planning of this work, including late changes to the possession arrangements, was a causal factor or meant that an opportunity to prevent this incident was lost.
- Why there was a late change to the crewing arrangements of the Engineers Trains and whether this was relevant.
- If staff involved were familiar with test train operations and recognised the requirement for different arrangements to those, for example, in a track replacement possession.
- Whether the correct process was followed when trains exited the possession.
- Whether the rules for using legacy signalling within possessions are clearly defined.
- Whether the use of possessions and Rule Book 14 are fit for purpose for test train operations
- Why the decision to cut out the trip cock was made. Who made this decision and when (i.e. during planning or during the possession)?

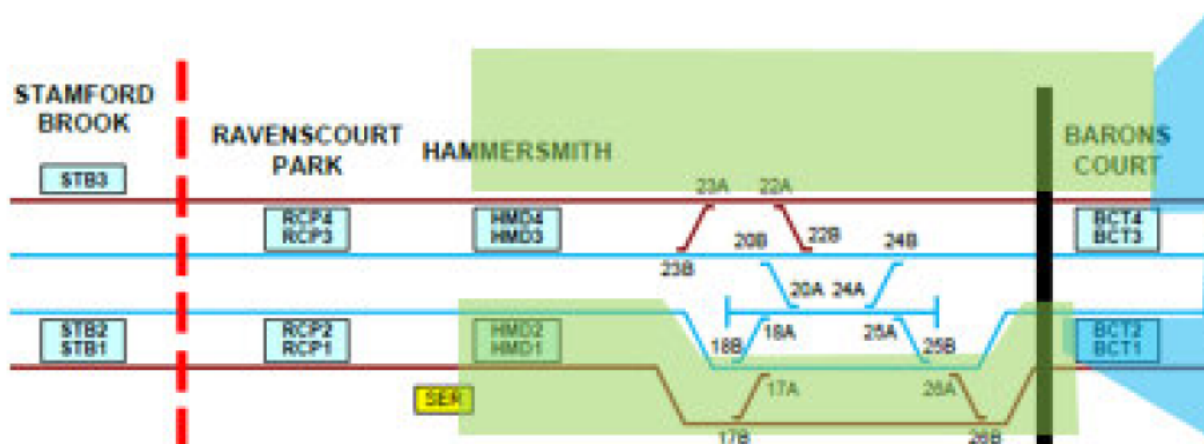
- The escalation route and the speed of which the incident was reported by responsible persons in MPD & LU to LU Directors & Major Projects Directors, including if the information flow from the possession was sufficient.
- If the language used in the initial incident report (EIRF 138391) reflected the severity of the incident and the facts under consideration.
- Were any human factors involved in the root cause, such as time pressure, workload, lack of rest, etc

4.0 Summary of Incident

Date	14 th to 16 th May 2021
Organisations involved and their business units /departments	4LM, Access, Transplant, Test Train Operators, LU Skills and Development, Service Control
Location	Between Stamford Brook and Hammersmith District Line
What Happened	Engineering Trains not following published process around legacy signalling
Consequences	Potential Near Miss
Incident Report Number	138323
Enforcement Authority Involved	None

5.0 Location of the Incident

The incident/s occurred between Stamford Brook and Hammersmith on the District Line Eastbound Local and between Hammersmith and Stamford Brook on District Line Westbound Local.



6.0 Weather and Environmental Conditions

Weather/Environmental conditions were not a factor in this incident.

7.0 Pre-Incident Details

7.1 Possession Planning

The planning for the possession weekend began 15 weeks prior to the planned possession date (T-15) – as per the usual planning process. The plans were “locked down” at the Final Planning meeting at T-9 (9 weeks prior to possession weekend), which was attended by key stakeholders. This gives the teams eight weeks for the plans to be produced, reviewed and make any corrections and sign offs.

There were several amendments through the revision process with the final version of the possession plan (no: PPLN-DIS-RVP.KOY.PYBtoHAS.BAS-10356) being sent out on the 6th of May 2021.

On 12th May, the Engineering in Charge (EIC) briefing was held. This was a detailed briefing attended by the possession staff, project team and others. Having reviewed the relevant documents and after interviews with personnel involved, it is apparent that this briefing didn’t go through the train entry/exit process in detail. The EIC presentation did refer to the process and directed everyone to review the entry/exit process in the possession plan and possession works guide.

On 13th May, a Week 7 Closure Walkthrough meeting was held by the project team to go over the plan. This meeting was attended by the key stakeholders and discussed the possession plan in place.

Once the possession plan was shared with operational staff, queries were raised around the accuracy of the possession plan – namely around incorrect signal number, incorrect details around the entry and exit process. (The original possession plan document was signed off by 14 people, but these errors weren't picked up).

These issues were raised to the attention of the 4LM project team and Access teams. They sought to correct the errors via a Possession Amendment Notice (PAN). The PAN is a document that is part of the possession's management process. It is intended to capture any minor changes that may occur post publication of the Possession Plan. The use of a PAN is not unusual, given the dynamic nature of a live railway system.

Final documentation was sent out via email on 13/14th May – the possession was being taken later that night. (The Thales 4LM SMA05 ML3/4 Week 07 System Test Programme was signed off on the 14th of May 2021). Anyone working that night would be off shift at this time so may not have seen the final documentation until booked on. Anyone working the next morning would only be 3 hours away from their minimum 12-hour rest period so wouldn't have time to review in full. Also due to Covid restriction no paperwork was to be 'handled' on trains.

7.2 Industrial Relations issues

During a 4LM CBTC Test Possession weekend, held 30th October to 2nd November 2020 (Week 31), concerns were raised by the Transplant Team regarding Test Train Operators (who are part of the Fleet organisation) operating engineering vehicles outside of the possession between Barons Court and Ealing Broadway.

The concerns raised were that the Test Train Operators (TTOs) didn't have the correct qualifications to be driving engineering vehicles outside of the possession worksite test area. Any manoeuvres outside of this area should have been carried out by Engineering Train Operators (ETOs).

With the aim of addressing these issues the 4LM Project Team held a meeting with all the key stakeholders (Transplant, TTOs, Project Team and LUSD Trainers). There was also further

complication around Covid measures to consider, as a maximum of two operatives in the cab of an engineering vehicle is permitted.

The outcome of the meeting was that the LUSD Trainers (who are qualified to drive Engineering Vehicles) agreed to help all parties by being the second competent person in the Test Engineering Vehicle alongside the TTO. Although a high-level agreement was reached, it wasn't fully detailed out to cover all the different sections of the possession, so different parties left that discussion with a different understanding of the agreement. This consequently led to confusion on site.

The Possession protection signal was at Stamford Brook but the Possession itself then starts after the sub-gap at Ravenscourt Park, and the next board is the worksite limits. This also may have added to the misunderstanding of where the TTO's could or could not take the train over from.

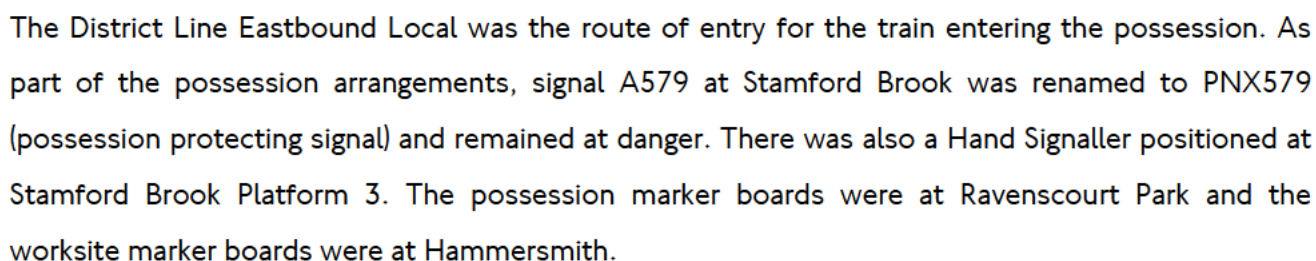
Since the publication of the interim report, all parties feel these issues have now been resolved. All are aware of their roles. The process has been agreed and operatives are briefed prior to the closure commencing and also reiterated on the exit process.

7.3 [Closure details](#)

A weekend closure was in place to for 4LM CBTC to test train operations within the SMA5 area and to test the boundary. Thales were Principal Contractor with the Thales Lead tester giving instructions on the movement of trains. TfL were responsible for planning and running of the possession arrangements.

District/Circle – Embankment & Edgware Road (Exclusive) to Kensington Olympia/Wimbledon/Richmond/Ealing Broadway (Inclusive) – COT Friday 14th to COT Saturday 15th May 2021

District/Circle and H&C – Embankment & Baker Street (Exclusive) to Kensington Olympia/Wimbledon/Richmond/Ealing Broadway and Hammersmith (H&C) (Inclusive) – COT Saturday 15th to prior to SOT Monday 17th May 2021



The intention was to use the legacy signalling system to provide a safe separation of trains between Stamford Brook and Hammersmith. [REDACTED]

This part of the process was undertaken correctly by all the trains entering the possession. The next part of the process is where the difference arose between the EVs and S-Stock. Before the EV's entered the possession the drivers cut out their tripcocks and proceeded directly to Hammersmith Platform 4, without the knowledge that the amended process stated more clearly to follow the legacy signalling system, stopping at any signals held at danger (hence no need to cut out the tripcock) and requesting permission before proceeding.

9.0 Incident Timeline

The below timeline has been put together from reports, emails, Connect and POM Radio recordings and tracker net

Date/Time	
28 th Jan	Planning for Possession starts (initial Planning meeting T-15)
11 th Mar	Final Possession Plan Lockdown meeting held
6 th May	Final Possession Plan published
12/13 th May	Briefings held with various teams
13 th May	Concerns raised around errors in Possession Plan entry/exit process, signal number and timings within the possession plan
13/14 th May 16:00	Amended PAN and other documentation emailed out (the mailing list didn't include everyone who needed to receive this including key operatives involved in the movement of trains)
15 th May 02:41	Possession taken
15 th May 08:00 (approx.)	Change from possession plan briefed to POM made by LU Closure Manager to route trains to Hammersmith and not to Barons Court as written in the plan. (plan was incorrect).
15 th May 11:00	Engineers Train 643 enters possession at Stamford Brook after permission received from Hand Signaller
15 th May 19:20	Engineers Train 642 enters possession at Stamford Brook after permission received from Hand Signaller
16 th May 12:35	Engineers Train 642 enters possession at Stamford Brook after permission received from Hand Signaller
16 th May 16:20	S8 Stock Test Train 711 enters possession at Stamford Brook after permission received from Hand Signaller
16 th May 16:30 (approx.)	Lead tester received reports of a signal failure A581
16 th May 18:00	An observer raised a concern after seeing the S8 stock entering the possession and adhering to legacy signal, they realised the Engineering Vehicles had not done the same.

10.0 Immediate Actions Taken

As the occurrence of the incident was picked up almost towards the end of the closure, there were no immediate actions in relation to the incident.

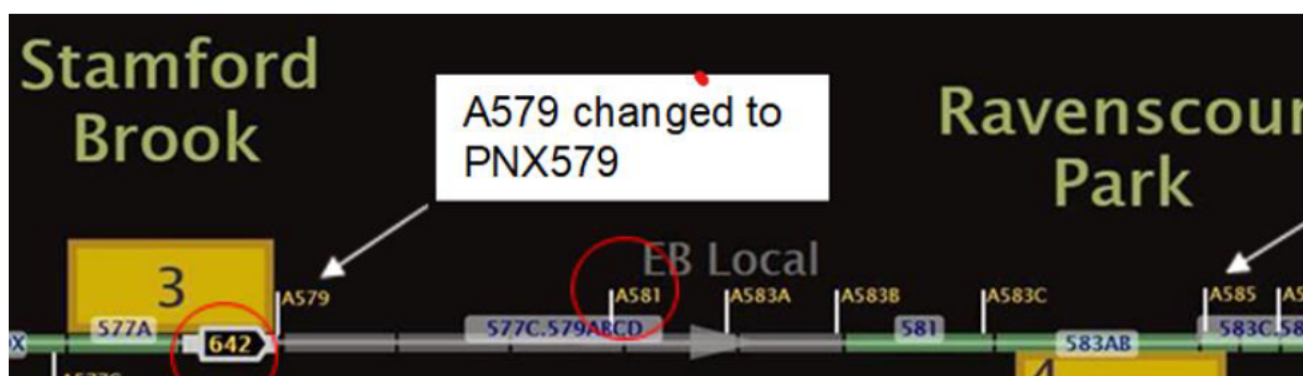
Following a post incident review, the 4LM project team have introduced a new peer review process which takes place two weeks prior to any closure or a specific workstream with complexity. The peer review will be a joint effort between Thales & LUL team, and other key stakeholders as appropriate such as Construction & Engineering. Due to the complexity of Test & Commissioning closures, the key stakeholders identified to attend the peer review will be able to challenge plans more constructively. Recommendation 06

The Transplant team have ensured more members of their management team are included on the mailing list of key documentation to ensure a wider group of people receive and share the information as required.

11.0 Areas, Subjects and Assets Investigated

11.1 Signal A581 held at danger

Over the connect radio recordings it can be heard that the team are trying to find out the cause of signal A581 failing. This signal being held at danger was picked up by the S Stock TTO when, after they passed the PNx, the next signal they came across was at danger.



Later during the possession window it was discovered, that this wasn't a signal failure. A581 was held at danger due to the method of possession arrangement used.

During the possession planning process it was decided that signal A579 should be held at danger to protect the possession; this information is then passed to the signalling department to arrange. This is common practise for possessions, however there are two methods of holding a signal at danger, (explained very simply here), [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

11.2 [Communications by Protection Staff to Test Train Drivers](#)

Listening to communication recordings over the connect radio system, overall the observation is that the communications were clear.

The PAN made it clear that the train operators were to follow all legacy signalling from Stamford Brook to Barons Court with these signals under the control of the District Line Controller. Engineers Train operators are very familiar with operating engineers trains in engineering possessions where most colour light signals are ignored, due to track circuits being dropped because they are constantly disturbed due to the nature of track renewal work, with the engineers train operators receiving their instructions and authority to move from the Protection staff. So the instruction to follow legacy signalling in a possession would have been unusual for them.

The last communication prior to the trains entering the possession were between the Hand Signaller and the EV Driver. The driver was informed that they were clear to proceed to Hammersmith. (We cannot verify this as the conversation between the Handsignaller and the Driver isn't recorded as it was face to face, this assumption is drawn from the message given to the Handsignaller from the POM over the recorded line).

Rule Book 14 section 8 states that *"the safe system of work (SSoW) must, as a minimum cover "how communications will be maintained between persons controlling the movement of an engineer's train and/or rail mounted mechanised vehicles and work groups that might be affected by any move"*

The SSoW put together by the project team does cover rules around communication from LU Rule Book 1 and the communication interfaces the Train SPC has, at a high level.

This final communication prior to entering a possession is probably our last opportunity to ensure all involved are 100% clear on the expectation once the train passes the PNx signal. To make this final part of the process more robust it is recommended that the individual giving the final communication, whether that be the (POM/Hand Signaller/Train SPC) along with the destination also include information regarding whether legacy signalling system is to be followed or not, information

on whether the tripcocks should be Cut-Out or not and information on the speed they are expected to travel at. **Recommendation 02.**

There was some discussion around the use of flags within the possession. After having reviewed the rules around this, the correct flags were used by the hand signaller.

11.3 Briefings to Drivers prior possession weekend

The Possession Amendment Notice (PAN), which contained corrected detail around the entry/exit process, was not received by the LUSD trainers or the Engineering Train Operators. The updated PAN included clarification around the entry process (not to pass any signals showing a red signal inside the possession limits).

In construction possessions, Engineering Vehicle operators are instructed to cut out the front and rear trip and follow instructions provided by POM. In this case, the instruction provided gave the driver permission that they are clear to go to Hammersmith Platform 4. So this instruction and not having seen the updated PAN led to the driver not stopping at the red signals.

To try to prevent reoccurrence, the FIR recommends that a specific briefing is delivered by a project team member to Drivers (TTO's/ETO's/LUSD), Train SPC, POM and other key people involved in safe movement of trains around the possession, on the plan for the weekend including what system is being followed to ensure safe separation of trains. To ensure that they have received the briefing and understand the arrangements. **Recommendation 03a**

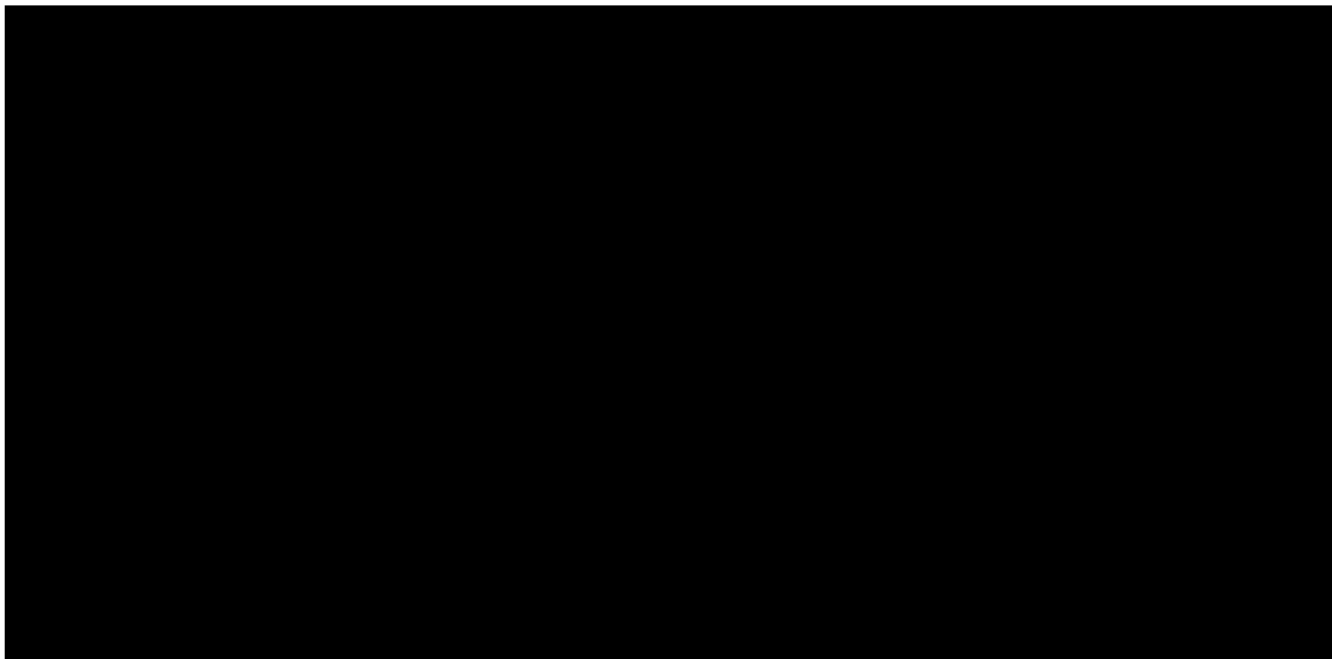
Ensure that the document agreeing who is driving which train and when is absolutely clear and shared at least a week in advance of the closure. Detailing certain sections, as appropriate i.e. from depot to possession limit to worksite limit. **Recommendation 03b**

11.4 Possession Plan Documentation

As mentioned previously, the planning process starts 15 weeks prior to possession weekend and the final meeting is held 9 weeks before. After which the review and sign off process commence. This document is then signed by a number of key discipline signatories. Post this, several key errors were picked up within the document.

The Access team have worked closely with the track team to drive down the number of changes post T-9. Track possessions and project Possessions are very different, but it may be beneficial to drive a similar review within projects possessions.

The Possession planning timescales document contains a roadmap for a successful possession closure.



We recommend a review of the process is carried out to include:

- a) review the signatories on the possession plan. Are the right people in the meetings? Do we need to bring certain roles/teams into the process earlier to avoid late changes? How do ensure attendance from all key disciplines at these meetings?
- b) Review the Possession Plan process from a projects point of view. How can we ensure that projects are able to follow the plan laid out above? Define what is considered a minor change and allowable, and what is considered a major change and may need escalation. At what point are no more changes allowed?
- c) PAN documentation are considered a key part of the possession plan process. Introduce more robustness around the delivery of the PAN documentation, a confirmation of acceptance and a defined latest possible time to send out a PAN. Recommendation 04a, 04b and 04c.

Since the interim report, improvements have been made in the overall process. Attendance and review by signatories seems to have improved. The PAN now doesn't go out any later than 12pm on the Thursday prior to a possession weekend. The team are a lot stricter around "last minute favours" and requests for deadline extensions. The definition of what minor changes can be done are now agreed, anything more significant will be escalated to senior team.

Improvements have been noticed by the Access team in the timeliness of 4LM document submission, but there remains room for improvement.

A SMA5 Test possession weekend took place in September 2021 from which two near miss eIRFs were raised. These eIRFs were investigated by the Operations Delivery Manager in the Access team. In both near misses everything was stopped safe before an incident occurred. All staff that were on duty took part in the debrief and discussions around the incident. It was reassuring for the FIR to see the detailed response from all parties involved and the proposed resolutions for moving forward. Well done to all involved in this good practice.

During the height of Covid, train briefings had moved onto Microsoft Teams (online video meetings), which can sometimes make it difficult to assess who is engaging and how much. Due to the current improvement in the Covid situation, remote working is getting less, so Train briefings going forward will be in person. This in turn will help ensure greater engagement.

11.5 Time Pressure

Late changes to the documentation create issues for everyone.

Thales as the principal contractor, in their attempt to deliver to the possession date calendar, supply late changes to software/documentation too close to the possession date. This causes pressure on all teams involved. The issue of late delivery of software/documentation has been an ongoing theme within the Project, with eIRFs being raised in the past on this exact issue. This is also one of the factors raised in another recent 4LM FIR (05-2021 – Monument – Near Miss).

4LM is a complicated programme with many interfaces to consider including various technical and operational elements. Any delay in one area has knock on impacts on the next area of delivery, and with limited opportunities for testing and commissioning closures, there is a lot of pressure on the

team to maintain the schedule, even when it significantly reduces the time required to carry out key processes. Unfortunately, this has become the norm rather than by exception.

The FIR acknowledges there is also a commercial pressure involved with significant cost of the programme and closure weekend, which leads to further pressure to maintain tighter and tighter deadlines. The view that timescales are unrealistic but are still pursued won't come as a surprise to any of the teams involved, this has been an ongoing issue.

The responsibility for these issues need to be taken on and addressed jointly by TfL and Thales. Recommendation 05.

11.6 Communication of Incident

The initial incident occurred on the 15th of May. The team were not aware that an incident had occurred, due to changes in usual process, late changes to PAN and difference between possession type and the way EV were intended to behave in this particular possession. The issues were picked up the following day around 1pm when the S-Stocks started to enter the area and were leaving the tripcocks in place and obeying the signalling system.

This was then escalated up the hierarchy with an email on the eIRF being shared with Directors/Senior Team later that evening.

The sharing of initial information around this with the senior team was done swiftly, with more detail being added as more information was gathered. We feel this was done appropriately and as swiftly as possible by the team.

12.0 Similar Incidents

The following FIRs have some similarities in terms of business area, but the causes of these are different to this incident, so not directly relevant.

FIR 09/2013 – Highgate – TBTC Switchover: Six trains operating on the Northern Line Edgware Branch switched and locked (latched) into an inhibited mode of Transmission Based Train Control (TBTC) operation, causing them to Emergency Brake to a halt. This Immediate Cause of the incident

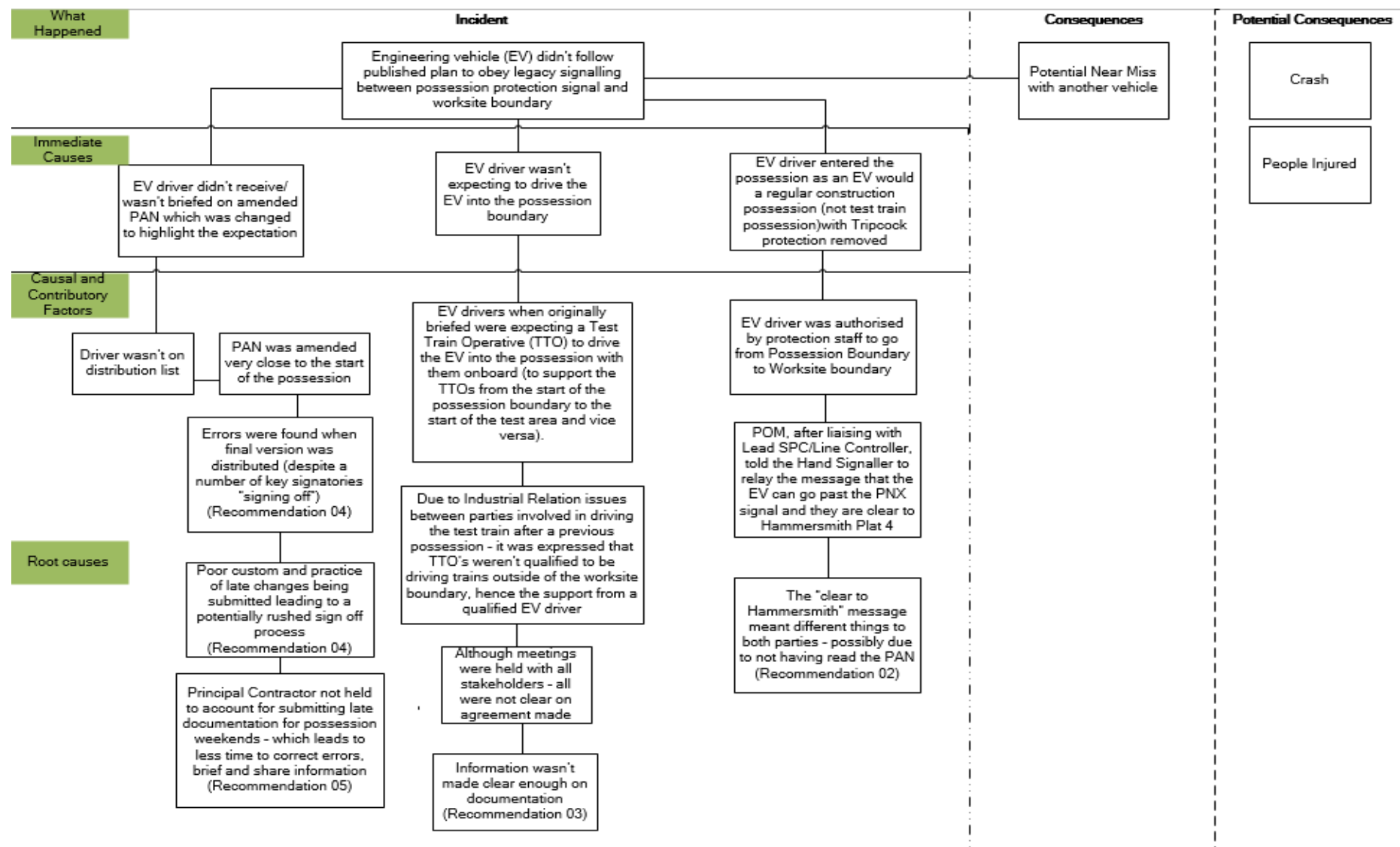
was found to be that the software, was changed from the Reliability Objective Groups 2 (ROG2) reliability software, to the Testing Software during Traffic Hours.

FIR 10/2013 – Hampstead – Test Train: two test trains were instructed to depart the test area prior to the Incompatible Train Movements Procedure area (ITMP) being fully handed back from the test team to the Service Control team. The trains were stopped and the ITMP fully lifted before the train were correctly authorised to depart. The trains remained under tripcock protection throughout.

FIR 05/2021 – Monument – Signalling Near Miss: two near misses following the implementation of the new CBTC system in SMA3 on 6th March 2021. Although the causes for this incident were not similar, there is a lot of shared learning between these two FIRs especially around Time Pressure issues and submission of late documentation.

Documentation from previous closures have also been reviewed where similar errors in the possession planning have be picked up last minute, causing late changes to plans, amendments and in some cases curtailing of train movements. These have been dealt with at a local level.

13.0 Root Cause Analysis



14.0 Conclusions

This incident was foreseeable. There have been numerous occasions when late delivery of documentation by Thales has led to squeezed deadlines in an attempt to stick with the programme dates, despite not leaving sufficient time for review and assurance checks.

Programmes and Projects will always have occasions when the team will need to “pull something out of the bag” to meet a tight deadline. This is acceptable on the odd occasion but not if it becomes the norm. Also, as these projects have multiple interfaces it is not just the immediate project team that is affected, but various parts of the business, and the coordination of all the different elements without sufficient time will inevitably lead to issues.

The team have learnt from this incident. This has been demonstrated by the processes put into place by the team post the incident and that most of the interim recommendations been completed. It is great to see this response. The aim of the recommendations is to ensure this is embedded for longevity to prevent reoccurrence, as individuals may eventually move roles take the memory of the incident with them.

Close working between the Access and Project Team led to “favours” around deadline submission dates and the type of changes allowed. This incident has brought back into focus the need and the importance of these deadlines and sticking with them.

The amount of paperwork involved in putting together a possession weekend is a lot but is necessary – pulling out the key information around train movements will help ensure that the intended plan and the safety around these elements are clear to all.

15.0 Observations

As an overarching improvement, it is recommended to review the pathway process to ensure that it meets the needs for a Test and Commissioning project – including appropriate check points along the way such as the new Peer Review process. This should take place with representatives from all areas involved through the process including the Project Team, Access, Safety and Operational Teams. Recommendation 07

To create greater awareness and increase understanding around possessions and their management, and to try and retain some knowledge from around the business it was considered that creating eLearning modules around possessions and their management, setting up possession arrangement, logistical arrangements, different types of possessions, would be useful to the business.

Recommendation 08

16.0 Recommendations

Recommendation 01	
Purpose	To ensure that site team are aware if any signals will be held at danger due to planned possession arrangements.
Action	<p>When a planned possession arrangement, causes certain signals to be held at danger in addition to the PNx signal, this should be made clear within the possession plan, so all teams involved are aware (including the Access Team, Project Team, Lead Tester and others on site).</p> <p>Technical Officer removing the fuse must provide a summary back to the access team of which signal will be held at danger and if there are any other signals impacted, for their awareness.</p> <p>This detail needs to be documented in the possession plan.</p>
Action Owner	Darren Pearce - Operations Delivery Manager – LU Access Team
Action Target Date	COMPLETE
Validation	Evidence of new process and a possession plan containing the above detail
Validator	Matt Hancox – Head of Logistics & Manufacturing – LU APCD

Recommendation 02	
Purpose	This final communication prior to entering a possession is probably our last opportunity to ensure all involved are 100% clear on the expectation once the train passes the PNx signal. To make this final part of the process more robust it is recommended that the individual giving the final communication, whether that be the (POM/Hand Signaller/Train SPC) along with the destination, also include information regarding whether legacy signalling system is to be followed or not, information on whether the Tripcocks should be Cut-Out or not and information on the speed they are expected to travel at.
Action	Update communication guidelines to include destination, following legacy signalling system or not, status of Tripcock and expected speed of travel
Action Owner	Darren Pearce - Operations Delivery Manager – LU Access Team
Action Target Date	Complete
Validation	<p>Example of scripts written jointly between 4LM/Access/Line Ops to provide to the staff who will be instructing the drivers capturing above mentioned elements.</p> <p>Confirmation of inclusion of this step into possession planning process.</p>
Validator	Matt Hancox – Head of Logistics & Manufacturing – LU APCD

Recommendation 03	
Purpose	A factor in this incident is related to the delivery of briefings to key people. Need to ensure going forward that they are captured and engaged with.
Action	<p>3a) To try to prevent reoccurrence we recommend that a specific briefing is delivered by a project team member to Drivers (TTO's/ETO's/LUSD), Train SPC, POM and other key people involved in safe movement of trains in/around the possession, including what system is being followed to ensure safe separation of trains. To confirm a process has been put in place, for projects across MPD, that they have received the briefing and understand the arrangements.</p> <p>3b) Ensure that the document detailing who is driving which train and when is shared at least a week in advance of the closure. Detailing certain sections if needed i.e. from depot to possession protection signal to possession limit to worksite limit, for projects across MPD.</p>
Action Owner	Andy Eastham – Senior Project Manager – 4LM
Action Target Date	3 months
Validation	Evidence that this has been completed for Projects involving possessions across MPD
Validator	Kirsty Drury - Programme Delivery Manager – 4LM

Recommendation 04	
Purpose	To review the possession planning process from a projects point of view to help enable it to be more robust.
Action	<p>We recommend a review of the process is carried out to include:</p> <ul style="list-style-type: none"> a) review the signatories on the possession plan. Are the right people in the meetings? Do we need to bring certain roles/teams into the process earlier to avoid late changes? How do ensure attendance from all key disciplines at these meetings? b) Review the Possession Plan process from a projects point of view. How can we ensure that projects are able to follow the plan laid out above? Define what is considered a minor change and allowable, and what is considered a major change and may need escalation. At what point are no more changes allowed? c) PAN documentation are considered a key part of the possession plan process. Introduce more robustness around the delivery of the PAN documentation, a confirmation of exceptance and a defined latest possible time to send out a PAN.
Action Owner	Darren Pearce - Operations Delivery Manager – LU Access Team
Action Target Date	4 months
Validation	Evidence of a, b and c
Validator	Matt Hancox – Head of Logistics & Manufacturing – LU APCD

Recommendation 05	
Purpose	Reduce Time pressure on all teams involved by more timely delivery of documentation and/or software.
Action	<ul style="list-style-type: none"> a) Review the documentation submission process for Thales to ensure that documentation/software is in place at least 10 days before the possession weekend takes place. And an immediate escalation process if this fails to happen. (potentially consider a phased approach with the last document a minimum of ten days in advance, i.e. any documents relevant to briefings to be submitted as early as possible) b) Thales to provide TfL a full scope of intention at a much earlier phase (to enable TfL to secure resources/vehicles, understand the possession limits and any nuances). Thales to provide a baseline and agree a process of change control where appropriate. c) TfL and Thales to work together to review the current program plan. Period of time between weekend closures/possession/testing needs to be reviewed to assess if it puts unreasonable pressure on the team based on the amount of time required to get all elements in place for a possession and how this will be managed going forward.
Action Owner	Chris Hobden - Project Director – 4LM
Action Target Date	<ul style="list-style-type: none"> a) 6 months b) 6 months c) 6 months
Validation	<ul style="list-style-type: none"> a) Need to evidence a significant improvement in turnaround time – to show that there is a change from Thales b) Evidence of process c) Roadmap - (would like evidence of how this has improved and will be a sustainable way of proceeding)
Validator	James Terry – Head of SHE BP - Construction & Projects

Recommendation 06	
Purpose	The 4LM project team have introduced a new peer review process which takes place two weeks prior to any closure or a specific workstream with complexity. The peer review is a joint effort between Thales & LUL team, and other key stakeholders as appropriate such as Construction & Engineering. Due to the complexity of Test & Commissioning closures, the key stakeholders identified to attend the peer review will be able to challenge plans more constructively.
Action	Update the 'Gate Strategy' Pathway Product template (PD0221), section 1.4 Other Planned Reviews – to reference the need for Peer Reviews and the Stage that they will take place.
Action Owner	Nick Prangley - Senior Process & Guidance Manager, PMO
Action Target Date	6 months
Validation	Updated Gate Strategy template launched in Pathway
Validator	Kirsty Drury - Programme Delivery Manager – 4LM

Recommendation 07	
Purpose	Does the current pathway process enable and support teams appropriately for testing and commissioning projects
Action	A review to take place of Pathway Processes in relation to Testing and Commissioning Project works.
Action Owner	Lead – Andy Gordon – PEL Change and Sustainability - Engineering Supported by – Kirsty Drury - Programme Delivery Manager – 4LM Nick Prangley - Senior Process & Guidance Manager, PMO
Action Target Date	31 st December 2022
Validation	Summary of the review with recommendations. Project plan of how the recommendations will be implemented.
Validator	Mark Grey - Senior SHE Management System Manager

Recommendation 08	
Purpose	To create greater awareness and increase understanding around possessions and their management
Action	Create eLearning modules around possessions and their management, setting up possession arrangement, logistical arrangements, different types of possessions. Full content to be determined by SMEs.
Action Owner	Lead – Darren Pearce - Operations Delivery Manager – LU Access Team Supported by: Sean Allison - Senior Programme Manager - Access Tom Carter - Access Capability Manager - Access Andy Gordon – PEL Change and Sustainability - Engineering Sebastian Homewood - Training & Competence Manager - SHE
Action Target Date	6 months
Validation	Launch of eLearning
Validator	Matt Hancox – Head of Logistics & Manufacturing – LU APCD

17.0 Appendices

17.1 Formal Investigation Panel Members

Name	Title	Organisation
James Wardell	<i>FIR Chair/ Head of Accessibility</i>	TfL
Jyoti Palit	<i>Lead Investigator/ SHE Incident Investigations Manager</i>	TfL
Andy Eastham	<i>Senior Project Manager 4LM</i>	TfL
Ricky Taylor	<i>Operational Readiness, Lead Asset Delivery Manager 4LM</i>	TfL
Tony Hayes	<i>Test Train Operations Manager</i>	TfL
Gareth Desmond	<i>Transplant Operations Delivery Manager</i>	TfL
Glenn Miller	<i>Skills Development Business Partner</i>	TfL
Tim O'Sullivan	<i>Access Operations Manager</i>	TfL
Kiran Kalia	<i>Senior Engineering Leader Rail Vehicles</i>	TfL
Gemma Thomas	<i>SHE Business Partner 4LM</i>	TfL
Peter Bickers	<i>ASLEF Rep</i>	TfL
Michael Jones	<i>RMT rep</i>	TfL

17.2 Persons Interviewed

Title	Organisation
Operational Delivery Manager	Head of Operational - 4LM
Possession Master	Access
PWT (Protecting Workers on the Track)	Access
Trainer/EV Driver	London Underground Skills Development
Senior Construction Manager	4LM
Project Manager	4LM
Business Partner Fleet Maintenance	London Underground Skills Development
Vehicle Test Engineer	Technical Services (Train Test)
Operational Task Manager (ATC)	Head of Operational - 4LM
4LM Head of Field Deployment (URS)	Thales

17.3 Consultation

Title	Organisation
4LM Head of Field Deployment (URS)	Thales
Signalling Asset Engineer (Testing and Commissioning)	TfL - Signals - Works

17.4 Documentation

Title	Reference	Revision
Preliminary investigation report	By Kirsty Drury, 4LM Programme Delivery Manager	V1
eIRF 138323/138305/138291	Electronic Incident Report Forms	
P2 possession plan	PPLN-DIS-RVP.KOY.PYBto HAS.BAS-10356	F01
P2 possession plan	PPLN-DIS-EAB-10363	F01
Possession amendment notice (PAN)	Closure week no: 07	Issue date: 13/05/2021
Wk7 SMA5 CBTC system Testing Test Train Crew Crib Sheet		V2
Possession Works Guide – Week 07	PWG-Wk7-DIS-RVP_KOY_PYBto HAS_BAS-10356-14_05_21 (2)	F01
CBTC System Testing 16th May 2021 - Test Train staff briefing	4LM-PSEC0056-SSL-BRF-00345	
S-Stock System Testing 15 th & 16th May 2021 - Test Train staff briefing	4LM-PSEC0056-SSL-BRF-00346	
Resource Roster Week 07		vD
WK07 Timeline		
Attendance Sheet EIC briefing and Wk7 Closure Walkthrough		
Week 31 District Northern Line Issues Log		
Possession Planning Timescales		2 nd Nov 2019

NEPA and Engineering Notices for the weekend		
Documents on Passing a train into a possession and using the signalling system to stop trains		
Relevant Rule Books and PWT-TH Information Booklet		
4LM SMA05 ML3/4 Week 07 System Test Programme	67279869-440 (Thales Document)	3.0
4LM Week 19 Day shift briefing sheet	Thales Doc	
TIC Briefing – VCC Testing	Thales Doc	

17.5 Abbreviations and Glossary

4LM	Four Lines Modernisation Project
CBTC	Communications Based Train Control
SMA5	Signal Migration Area five
EIC	Engineering in Charge
PAN	Possession Amendment Notice
TTO	Test Train Operators
ETO	Engineering Train Operators
LUSD	London Underground Skills and Development
EV	Engineering Vehicles
POM	Possession Master
SSoW	Safe System of Work