

11/26 Link Incident: Audit Overview and Agency Response

Citizen Oversight Panel

3/2/22



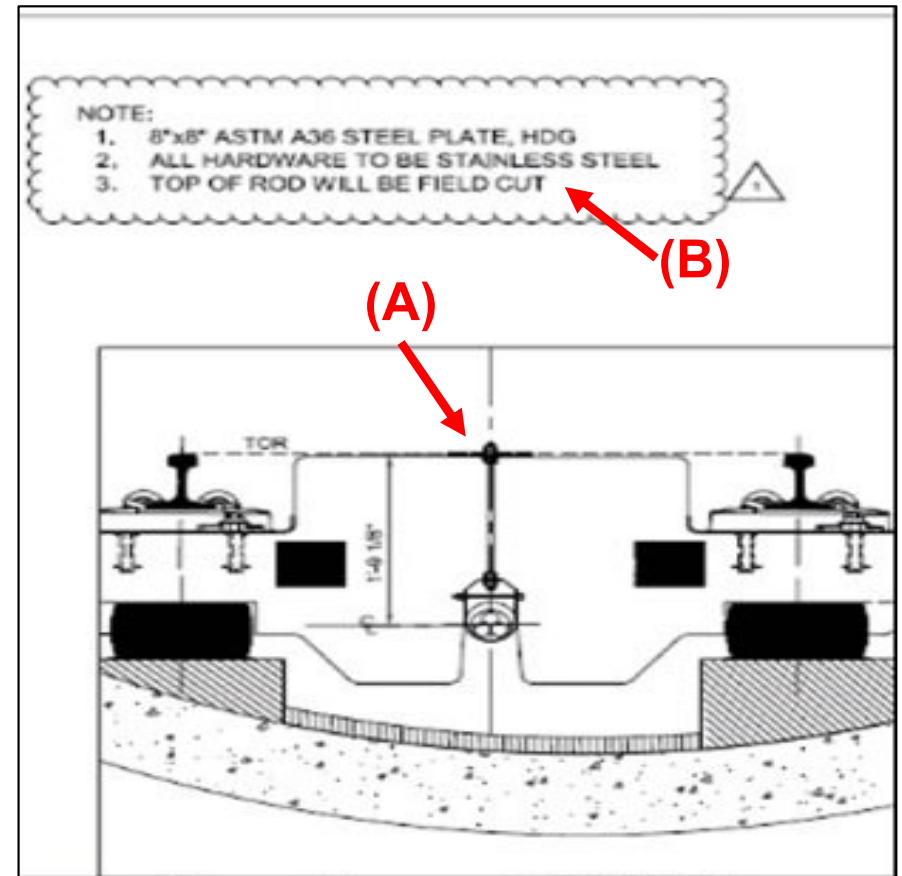
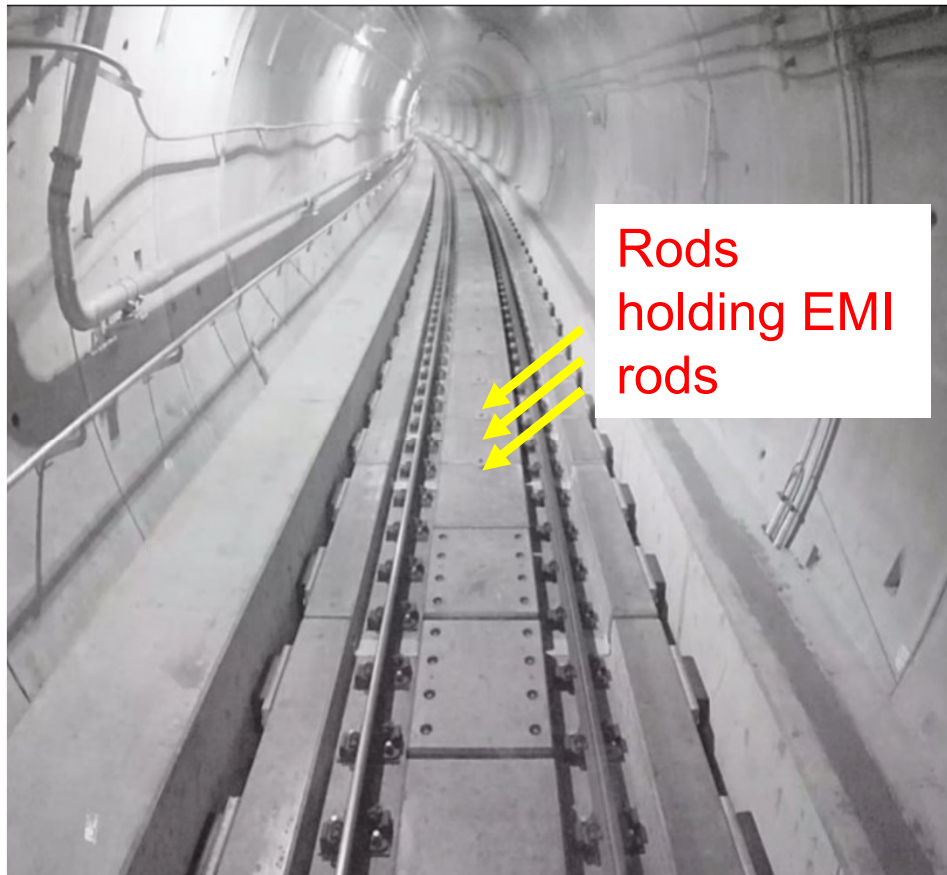
Audit findings categories

1. Causes of train damage and stoppage.
2. Effectiveness of communications.

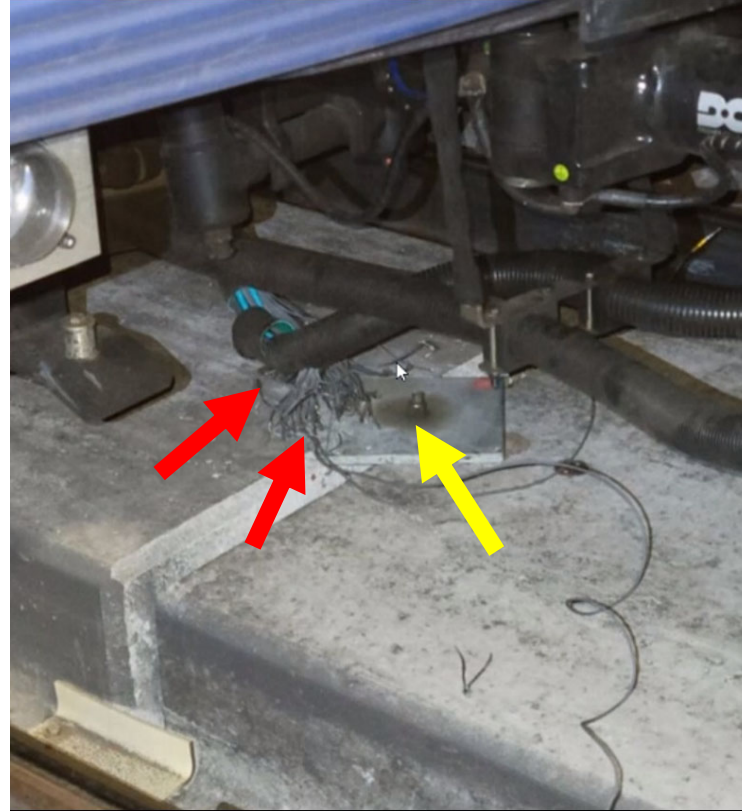
Summary of what damaged the train

1. Series 2 train vehicle struck a protruding EMI rod between the rails which severed cables beneath the vehicle.
2. Pre-revenue testing processes had not fully considered clearance differences between Series 1 and Series 2 vehicles under all possible operating conditions.
3. Previous rod strikes and non-disabling vehicle damage were being reported by maintenance staff but were not properly escalated.

Electromagnetic interference (EMI) rods

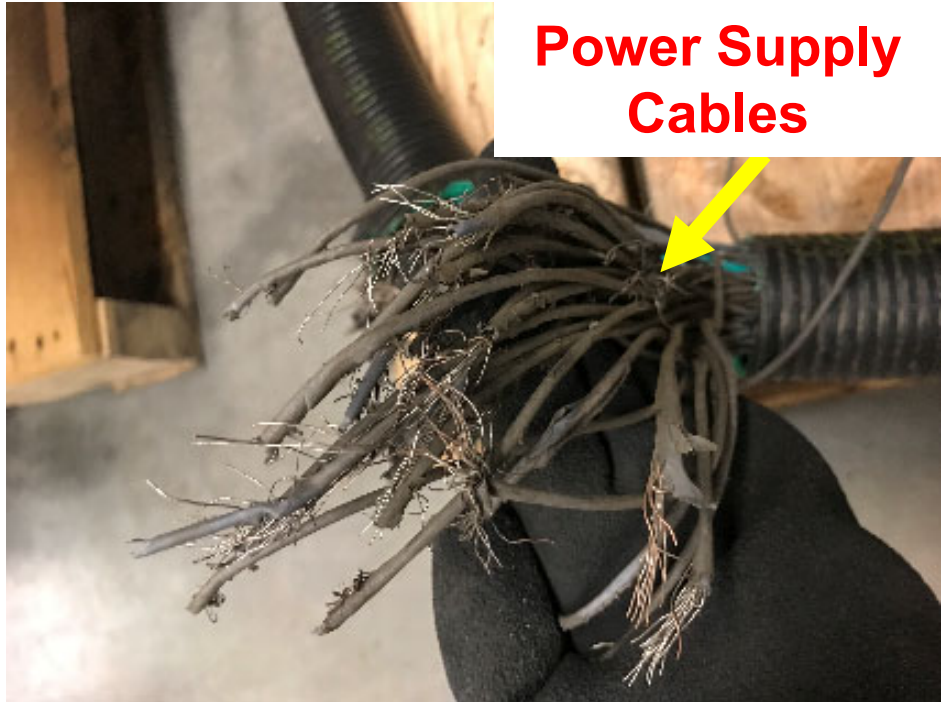
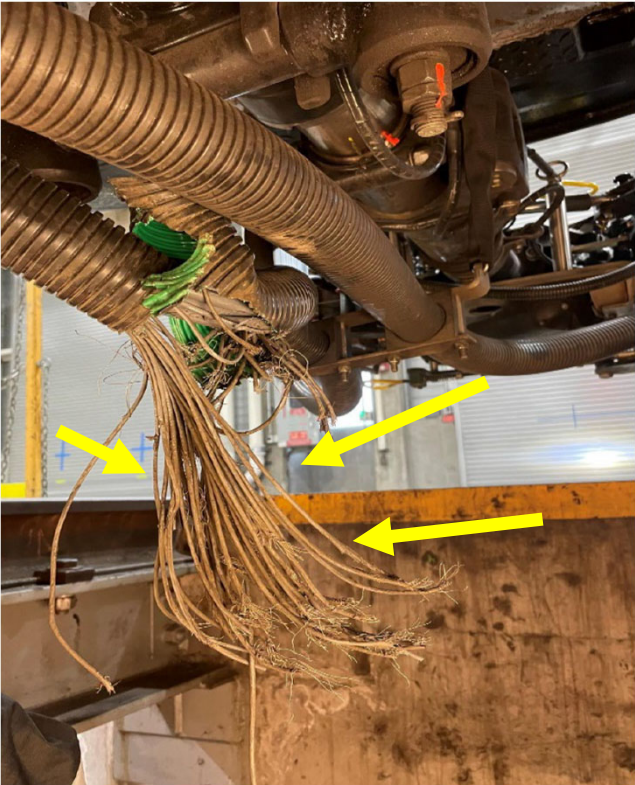


Previously damaged EMI rod (left) and damaged vehicle (right)



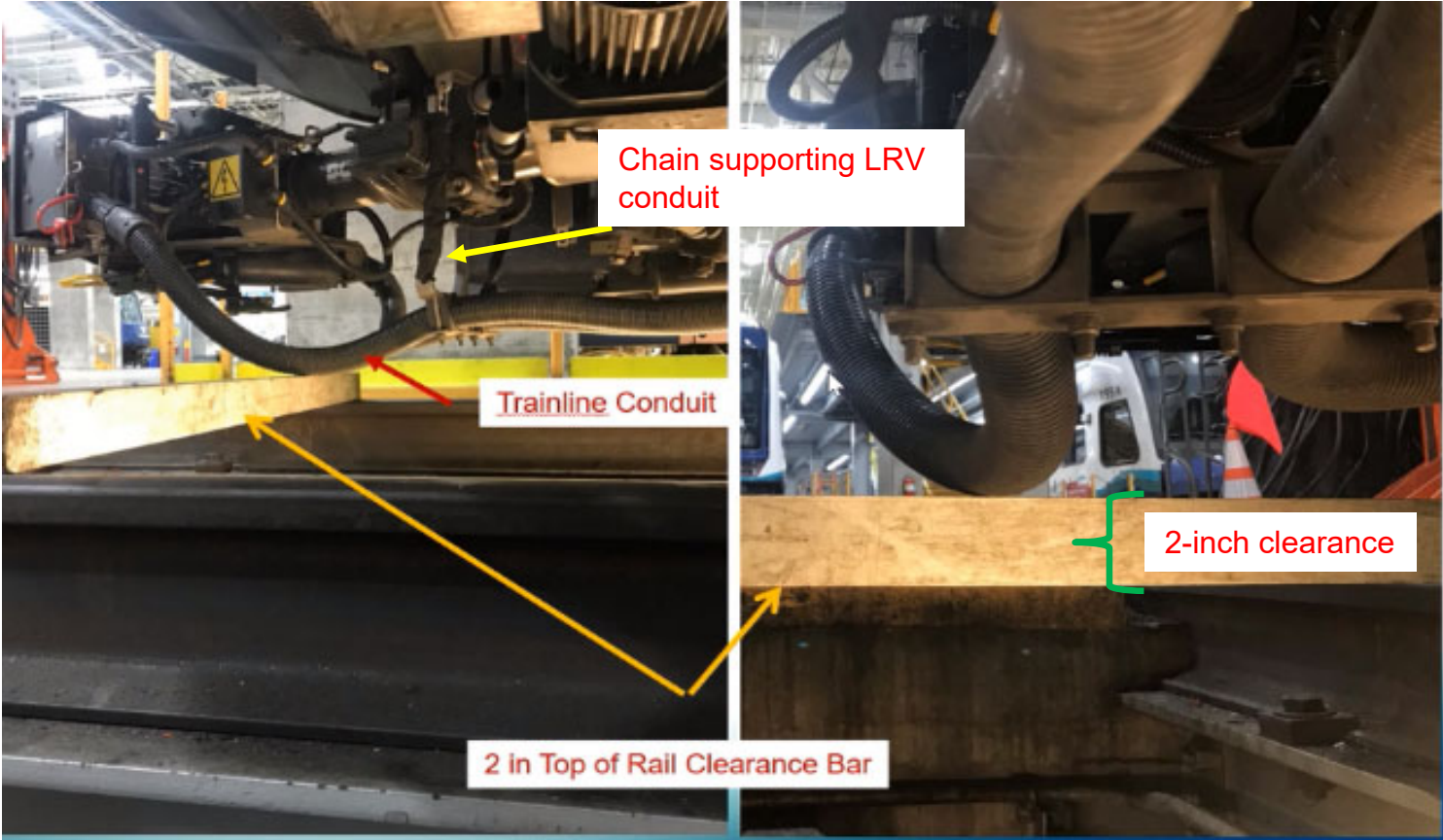
Damage caused by EMI rod

Conduit damage to light rail vehicle

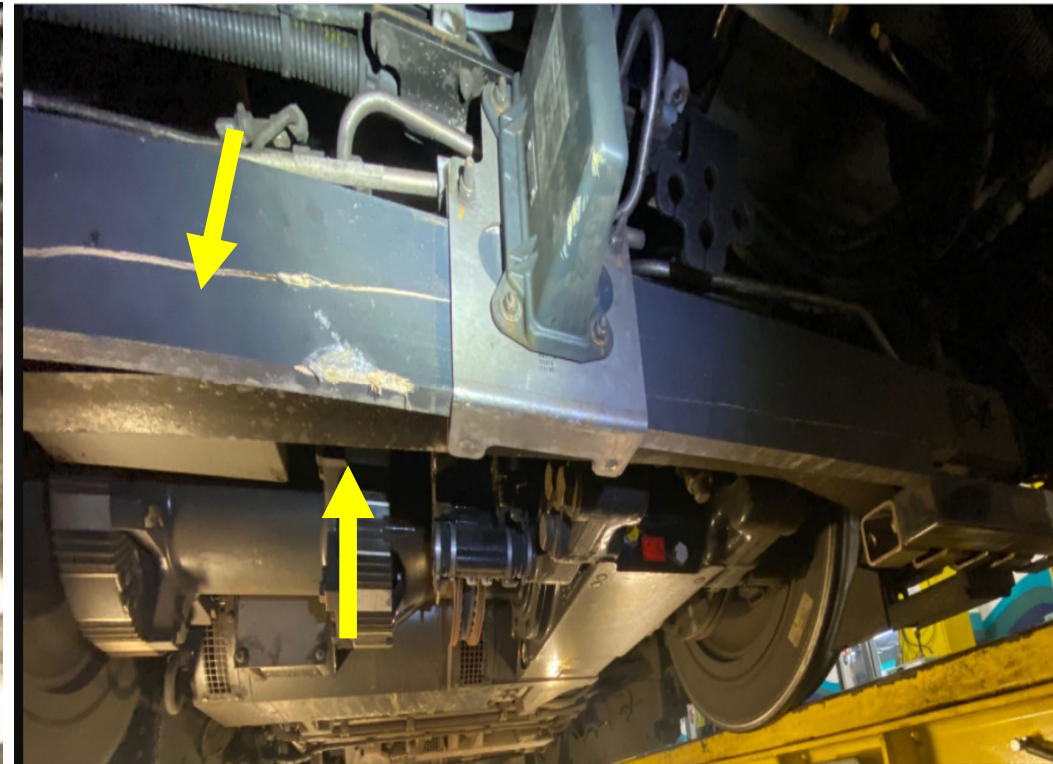
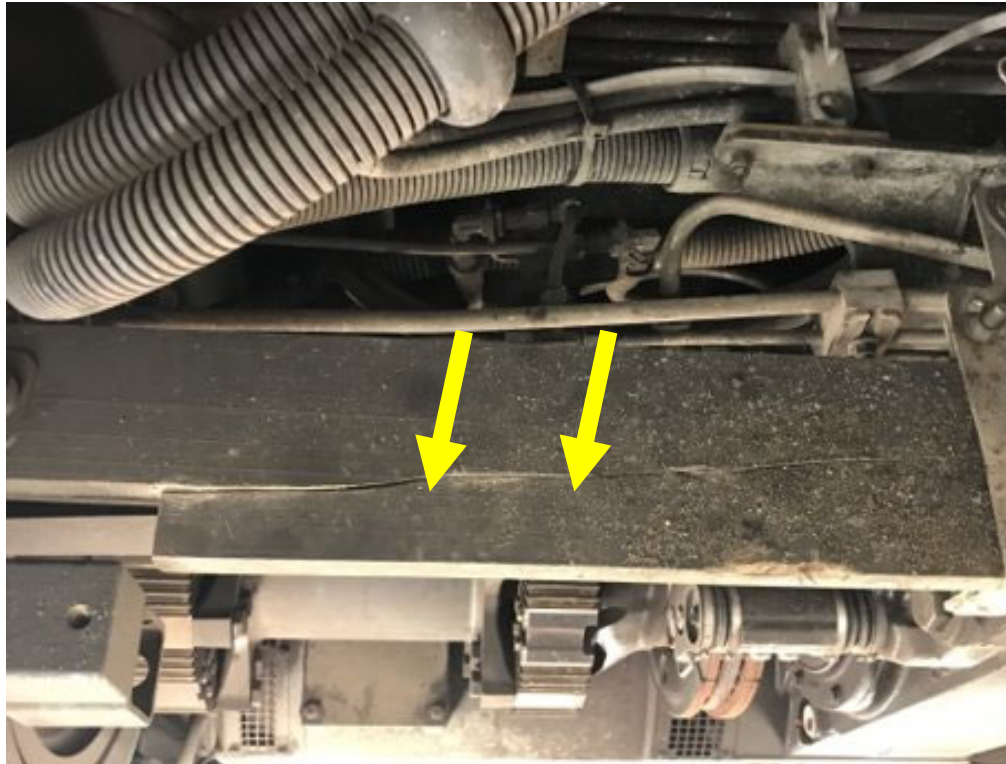


Post-incident vehicle clearance checks

Configuration differences



Damage occurring prior to incident



Damage occurring prior to incident (cont.)

- Audit team reviewed 2,800 work orders, finding 16 relating to EMI rods or related damage.
 - 5 work orders for damage to Series 1 vehicles.
 - 3 work orders for damage to Series 2 vehicles.
 - 8 work orders for rods.
- King County Metro was looking into the issue and notified Sound Transit Engineering.
- King County Metro Safety, Sound Transit Operations, and Sound Transit Safety were not notified, as established by procedures.

Communications breakdowns

- Passengers on the affected train did not receive prompt communications about the incident and impact to service.
- Duty officer communications information didn't reach the right channels, preventing prompt staff and passenger communications (rider alerts).
- Some functions (tunnel cameras, station PA systems) inoperable on night of event.

Agency Response to Incident and Audit

Key improvement areas

- ***Strengthen operations procedures***
 - Emphasis on clarity around Sound Transit's overarching accountability for service.
 - All Sound Transit and King County Metro operations staff must be fully aware of their respective roles and responsibilities. We must work to eliminate any ambiguity or confusion.
- ***Improve agency emergency communication processes***

Agency Response to Incident and Audit

- ***Action plan to address the findings***
 - Initial overview of action plan and responses presented today
- ***Establish Executive Oversight Team with King County Metro and begin quarterly reporting on findings action on incident action plan***
- ***Improve communications processes and procedures***

Why are we here?

- Review internal audit findings
- Review agency response
- Describe key areas for improvement

Internal Audit Overview

1 Line service and background

- Sound Transit owns 1 Line service and is responsible for rider information, security, and incident communication.
- King County Metro is under contract for operations, maintenance, safety, and incident/emergency response.
- Responsibility for emergency actions divided between the two agencies.
- Incident occurred Nov. 26, on a section of track that had opened eight weeks prior on Oct. 2.



Slide 16

CMO

Forgot to ask if it is true that ST is responsible for posting emergency signage. Or do we provide the signage (in some cases) to KCM for them to post in the trains. IF mixed responsibility (i.e. ST posts in tunnel but KCM posts in trains) then I would suggest change word "post" to "provide"

Cummings, Mary, 2022-01-26T15:29:42.855

JPO 0

It's one of those areas that isn't well defined. I'll change it to provide.

Johnson, Patrick, 2022-01-26T15:41:52.765

Why was the Audit Division involved?

- Broad investigation requested by CEO Rogoff.
- To inform improvements in communications, operating practices, safety and security.
- To identify gaps and prevent similar incidents.

Incident Overview

Incident overview

8:19pm – Full train leaves UW Station for U District Station

- Day after Thanksgiving, immediately following Apple Cup.
- 46% more trains in service for event (13 regular, 6 special).
- Crush-loaded trains immediately after the game.



Incident overview (cont.)

8:20pm (+1 minute) – 1,000 feet north of UW Station, the train loses power and comes to an abrupt stop



Slide 20

WHO

Are the yellow arrows showing the place the train stopped, or the object it hit?

Wright, Heather, 2022-01-24T21:44:51.908

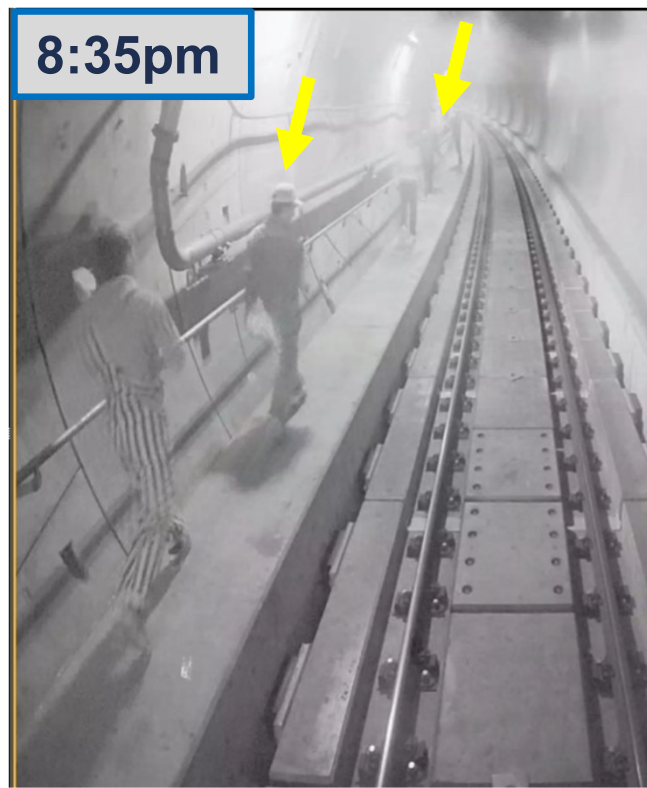
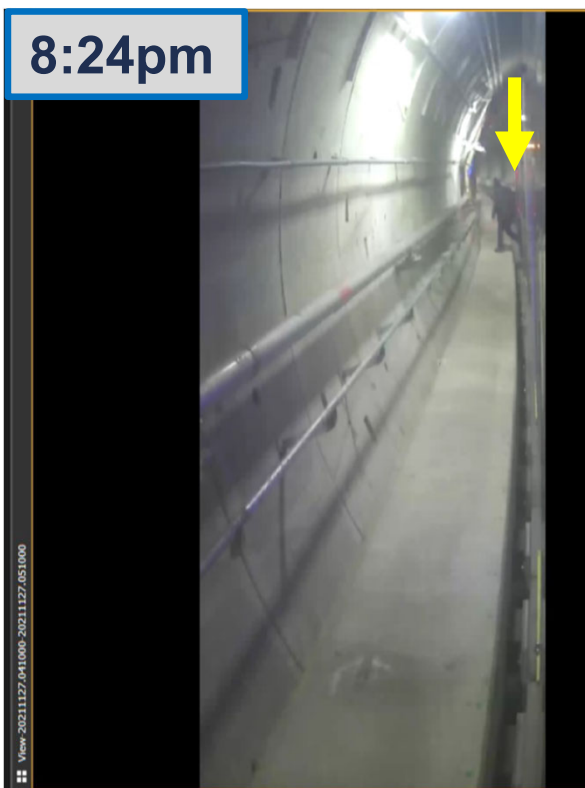
JPO 0

Yep! I've added a text box for that

Johnson, Patrick, 2022-01-25T03:56:48.524

Incident overview (cont.)

8:24 (+4 mins): passengers begin self-evacuating the train



Incident overview

Event Timeline

8:32pm (+12 mins)

- Operator makes first announcement to passengers.
- King County Metro Link Control Center (LCC) implements a full system stop, requiring all trains to hold in position.
- The LCC dispatches a rescue train.

8:36pm (+16 mins)

- LCC clears rescue train to proceed slowly southbound from U District Station to the nearest cross passage.
- King County Metro Rail Supervisors walk the tunnel to assist getting passengers off the disabled train.

Slide 22

WHO

Does the audience know what the LCC is?

Wright, Heather, 2022-01-24T21:45:35.221

JPO 0

They don't but it is referred to in the talking points and will be noted in the report

Johnson, Patrick, 2022-01-25T04:14:24.396

Incident overview (cont.)

Event Timeline

- ***8:41pm (+21 mins)***
 - ST Operations duty officer sends "Command Post" message.
- ***8:46pm (+26 mins)***
 - King County Metro Rail Supervisors begin loading passengers onto the rescue train.
 - The rescue train's departure is then delayed.
- ***9:15pm (+55 mins)***
 - All remaining passengers from the disabled train are aboard the rescue train and it proceeds to U District Station.
- ***9:19pm (+59 mins)***
 - Trains continue shuttling some passengers to/from the platforms using single tracking.

Slide 23

WHO

is it important to know what pantographs are?

Wright, Heather, 2022-01-24T21:47:17.439

WHO 0

Made the 3rd bullet more passive voice so it doesn't sound like we're blaming the passengers.

Wright, Heather, 2022-01-24T21:49:47.845

CM1

Slide a bit wordy. Suggest that last bullet with 3 subs be removed and become verbal talk points related to the key bulleted event of moving passengers via rescue train.

Cummings, Mary, 2022-01-26T16:55:58.274

JP1 0

Understood and corrected

Johnson, Patrick, 2022-01-26T20:03:29.726

Incident overview (cont.)

Event Timeline

- ***9:19pm (+59 minutes)***
 - Bus bridge communications issues.
- ***9:35pm (+1 hour, 15 mins)***
 - Three calls to ST Communications Duty Officer go unanswered.
- ***9:53pm (+1 hour, 33 mins)***
 - Sound Transit CEO Peter Rogoff notified.
- ***9:57pm (+1 hour, 37 mins)***
 - Communications hears of the incident from external media outlet.

Incident overview (cont.)

Event Timeline

- ***10:00pm (+1 hour, 40 mins)***
 - Passenger Experience staff hears of the incident and sends first “Rider Alert” message two minutes later.
- ***10:20pm (+2 hours)***
 - WSDOT and FTA reporting deadline passes, without reporting.
- ***10:58pm (+2 hours, 38 mins)***
 - King County Metro tows disabled train back to the Operations and Maintenance Facility (OMF).
 - Single tracking ends and normal 1 Line service resumes.
- ***11:57pm (+3 hours, 37 mins)***
 - Communications sends out a blog post about the event.

Summary of Findings

Preventing track clearance issues

Slide 27

HJ0

Change text to reflect Patrick's sectionalization.

Higuera, Juan, 2022-02-03T21:36:52.849

Issue: track clearance

Errors leading up to 11/26

PK3

- Checkpoints in design, construction and testing for Northgate Link Extension should have ensured proper clearance on the new alignment.
- Checkpoints in testing and acceptance for the Series 2 vehicles should have ensured proper clearance at the highest passenger load limits.
- Checkpoints in the Activation process should have ensured the rods be cut to complete Safety Certification
- Once in Operations, known incidents of protruding EMI rods should have been escalated via Safety Incident Reporting ^Tpl. PG4

Slide 28

SS0

The trains are tested at AW2 levels during pre-rev service. Loads during the Apple CUP was over AW3.

Shetty, Suraj, 2022-01-27T01:29:01.363

HJ0 0

is this a commitment that we can make under future actions? i.e. test at AW3 for future fleet - HTLE and ST3 LRVs.

Higuera, Juan, 2022-01-29T00:23:24.863

HJ1

Bullets 3 and 4 seem to be covered in bullets 1 and 2, can we merge or move to speaking points.

Higuera, Juan, 2022-01-29T00:22:26.784

SS2

I redid this slide with the thinking that I keep it more general and speak to the "crush load" clearance test, the issues - log process during activation and the need to take care of the bolts as soon as we found it.

Shetty, Suraj, 2022-01-29T01:40:59.631

PK3

The design 'and construction' verification.

Clearance tests did occur but they measured the fully loaded train criteria (2") on an unloaded vehicle. We should have tested the unloaded vehicle and measured the unloaded criteria of 3" clearance.

I also think it is important to note what did go well. In this case, the train disabled and performed as designed. Given the severity of the situation (severed cables), the vehicle shut down to prevent an electrical fire. The PA system was working in all cars as well but it was not easy to know that for the operator given the screen was black. At 12 minutes, the operator attempted the PA and it worked.

Suggest:

The design and construction verification process should have tested vehicle and track clearance criteria below the vehicle at various loading conditions.

For 3rd bullet, we are not sure if SOP's include an escalation process. Suggest remove 'procedures' and replace with 'finding'

Pihlstrom, Kerry, 2022-01-31T01:48:34.133

PG4

This isn't very understandable. Could/should we say "October maintenance orders regarding protruding bolts should have been escalated and expedited."

Patrick, Geoff, 2022-02-03T22:17:52.499

Issue: track clearance

Actions since 11/26:

- Field cut all protruding rods per approved design.
- Raised the trainline cables on Series 2 vehicles.
- Adjusted vehicle clearance requirements in our design verification testing.
- Applied these requirements to East Link testing.
- Refined special event procedures to ensure adequate staffing and passenger communications

Slide 29

SS0

The coupling design is not related to the issue with the train cable severing, but rather, the cable was lowered to compensate for a coupler issue and now that we have shortened it again, the coupler design needs to be looked at, because the lengthening of the chain was supposed to help that problem.

Shetty, Suraj, 2022-01-27T01:31:27.269

HJ1

Does the clearance envelope resolution include the under car? since that's where the issue originated.

Higuera, Juan, 2022-01-29T00:24:52.098

PK2

1st Bullet: Bolts do not meet design criteria. The nut of the bolt is above the top of rail but by a minor amount. There is a factor of safety built in to the 2" vehicle criteria of a fully loaded train. the nut of the bolt will use some of this 2". It is more accurate to state that all bolts have been field cut per approved design.

All Siemen's vehicles have been measured to verify unloaded clearance of 3" measurements are met.

2nd Bullet: I do not know what is meant by Train to track clearance specification increased. I don't believe this to be true. Recommend remove.

Suggest state:

- Bolts cut and vehicle cables raised to ensure vehicle clearance criteria met.

- Adjusted clearance verification procedures prior to revenue service to ensure track and vehicle clearance criteria is met (applied to East Link). This applies to both vehicles and track.

Pihlstrom, Kerry, 2022-01-31T01:59:38.958

Issue: track clearance

Additional next steps:

- Improve quality assurance processes prior to live power testing on the new alignment.
- Improve verification processes prior to testing and operations (design, construction, safety certification).
- Review high-risk and non-standard design elements throughout the operating system.

Slide 30

SS0

The coupling design is not related to the issue with the train cable severing, but rather, the cable was lowered to compensate for a coupler issue and now that we have shortened it again, the coupler design needs to be looked at, because the lengthening of the chain was supposed to help that problem.

Shetty, Suraj, 2022-01-27T01:31:27.269

HJ1

Does the clearance envelope resolution include the under car? since that's where the issue originated.

Higuera, Juan, 2022-01-29T00:24:52.098

PK1 0

The issue originated with the bolt not being field cut which hit the vehicle in other locations and not just the cable.

Yes, the clearance test has been updated for the vehicle and track (two separate tests).

Another additional next step is to process a design deviation for the portions of the bolt that remain above the top of rail. (not sure if this too in the weeds for this audience)

Pihlstrom, Kerry, 2022-01-31T02:01:04.176

PK2

Rather than "ensure" quality assurance. Suggest change to "improve".

Pihlstrom, Kerry, 2022-01-31T15:49:10.694

Effective communications

Issue: onboard communications

HJ1

What should have happened during incident?

SS0

- Prompt communication to passengers of the mechanical problem and instructing them to remain onboard for rescue train.
- Passenger communication should have occurred simultaneously with attempts to troubleshoot or restart the disabled train.

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SS0

My comments

Shetty, Suraj, 2022-01-27T01:38:23.830

HJ1

Propose Comms on Train on header.

Higuera, Juan, 2022-02-03T21:40:43.114

Issue: onboard communications

Actions since 11/26:

HJO

- Revised protocols and training for train operator communications with passengers of disabled trains.
- Reinforced existing protocols for expedited staff dispatch and prompt staging of rescue trains.

Slide 33

HJ0

Are these actions already taken, if so how? or are these future actions?

Higuera, Juan, 2022-01-29T00:29:17.945

Issue: onboard communications

Additional next steps:

- Review and reinforce protocols for no train deployment, if intercom system is disabled.
- Analyze potential technical solutions to show the operator whether intercom is working, independent of main panel.
- Add train signage promoting rider alerts (website and text/email subscriptions).

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SS0

We have to work out a technical solution too, to give feedback to the operator that the PA systems are working

Shetty, Suraj, 2022-01-27T01:44:51.735

HJ0 0

added as third bullet

Higuera, Juan, 2022-01-29T00:32:27.510

PK1

I am not sure what is meant by 2nd bullet "explore technical solution to allow PA system functioning feedback". If this falls on engineering, please clarify.

Pihlstrom, Kerry, 2022-01-31T02:04:30.238

PK1 0

Suggest we also consider what we do in scenarios with a fully loaded car without AC. People could get claustrophobic. We should look at protocols for failed HVAC

Pihlstrom, Kerry, 2022-01-31T15:52:01.791

PK1 1

We are also working on adjusting a current train order that does not allow another train in an area if people are outside the vehicle in tunnel. Systems provided data to Operations to re-evaluate the need for this train order. The train order is in place due to concerns of rail voltage.

Pihlstrom, Kerry, 2022-01-31T15:54:09.216

Issue: station and system communications

What should have happened?

AR1

- Prompt communication of system stoppage on all station platforms, including notification of alternate bus bridge.
- Ensured that staff was trained and prepared to use individual station intercoms.
- Issued sufficiently detailed rider alerts (email, SMS, Twitter) within minutes of the start of the incident.
- Contingency plans in place for staff absences in Link Control Center during evenings, weekends and holidays.

Slide 35

HJ0 made tweaks to the language as to the what should have happened?
Higuera, Juan, 2022-01-29T00:44:23.175

AR1 should we indicate that the rider alerts would provide information to all riders and not specific to the passengers on the train.
Arnold, Russ, 2022-01-31T20:18:56.967

HJ2 Covers system as a whole.
Higuera, Juan, 2022-02-03T21:41:18.457

Issue: station and system communications

Actions since 11/26:

ARO

- Ensured that LCC staff have working remote access station intercoms and conducting extra testing prior to large events to ensure they are working as expected.
- Trained staff to use on-site intercom.
- Clarified bus bridge implementation protocols.
- Temporary dedicated staffing commitments at LCC during high-ridership events.

Slide 36

ARO

Has KCM agreed to this i.e. having CITRIS staff work all events? My understanding is they have always said no in the past.

Arnold, Russ, 2022-02-01T17:51:52.582

Issue: station and system communications

Additional next steps:

- Co-locate Sound Transit passenger communications staff and King County Metro Rail staff in a new Link Control Center (begins 2023).
- New Passenger Information Management System (PIMS) and increased control center staffing will enable more rapid intercom and electronic signage communications.

Slide 37

ARO

we will also be able to make announcements into the individual cars...so we want to telegraph that here as well?

Arnold, Russ, 2022-01-31T20:17:51.779

Ongoing Safety Oversight

Additional next steps:

- Safety Department tracking each corrective action and finding to closure.
- Improve and expand our tabletop exercises to better incorporate passenger communications elements.
- Procure technology and develop protocols for rapid, reliable staff notifications and positive verification that staff are responding.

Thank you.



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