

# **CORRECTIVE ACTION PLAN**

## **CAP03-09212022**

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SUBMITTED PURSUANT TO  
4 CCR 723-7-7349  
FOR  
A1-09212022  
PROCEEDING NO. 22I-0471R

THE REGIONAL TRANSPORTATION  
DISTRICT (RTD) - DENVER

## **CAP03 – A1-09212022**

### **Proceeding No. 22I-0471R**

**Pursuant to Commission Decision, the Regional Transportation District (RTD) submits this Corrective Action Plan following its investigation of light rail vehicle (LRV) in-cab camera functioning and video footage recovery related to the September 21, 2022, R Line derailment at the Sable Boulevard and Exposition Avenue (the Accident). (Proceeding No. 22I-0471R, Decision No. C23-0044).**

#### **INVESTIGATION DESCRIPTION:**

RTD LRV Maintenance and Safety conducted a thorough investigation into the inability to recover in-cab<sup>1</sup> video footage from one LRV involved in the Accident. The investigative methodology used a systematic approach to investigate a variety of potential and contributing causes, including mechanical, environmental, and human factors. The investigation reviewed the overall functionality of the LRV video surveillance system and incorporated information from numerous sources, including:

- Interviews with LRV Maintenance and Security staff
- Surveillance System QA Checks
- LRV maintenance records

The following information was requested and reviewed:

- Event Data Recorder (EDR) from Light Rail Vehicle (LRV) 286 and 316
- Hard Disc Drives (HDDs) containing video
- LRV Operator, Video Investigations, and Vehicle Maintenance training materials and records

The investigation found:

- During HDD recovery from both LRV 286 and 316, the in-cab cameras did not appear to be obstructed and appeared to be functional
- LRV operators and mechanics have access to the LRV breaker panel which maintains power to the cameras and other LRV electrical systems (e.g., lighting, Automatic Train System bypass, doors)
- Camera system power is dependent on the power state of the LRV; however, if the camera system is powered off while the LRV is off, the camera system does not automatically turn on when the LRV power is turned on
- LRV 286 HDD was recovered, and video reviewed
- LRV 316 HDD was recovered, but video was not recovered
  - Camera system was determined to have been powered off at the locked breaker panel based on camera functioning as normal upon system reboot
  - HDD in the older "Safety Vision 4C DVR" systems are starting to fail and do not always write to the disc
- HDD chain of custody
  - Security division obtained the LRV 316 HDD, placed it in a docking station for review, and determined there was no video recorded. LRV 316's HDD was thus placed back into revenue service and overwritten.
  - At a subsequent evaluation, LRV Maintenance was able to access video footage from HDDs that were previously identified by the Security division as having no video; therefore, suggesting there may be intermittent failures with HDD docking stations

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<sup>1</sup> LRVs 286 and 316 had only in-cab cameras installed. See RTD Safety Assurance and Safety Risk Management Analysis of 2019 Sable/Exposition Derailment Corrective Action Plan, filed November 30, 2022, Proceeding No. 22I-0471R, pp. 11-13, ¶¶ 40-44 (addressing upgrades to in-cab and forward-facing cameras consistent with Rule 7349(b)).

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- Inconsistent re-installation practices of formatting HDDs before they are swapped to ensure DVRs are recording properly.
- LRV surveillance system functionality
  - No current daily check to ensure camera functionality prior to revenue service
  - Overall system was checked in March 2021. Surveillance identified 21% LRVs had functional cameras and hard drives (sample size 56 of 201)

As a result of its investigation, RTD determined that the most probable and contributing causes for the lack of footage from the in-cab camera are:

- Inadequate procedures for removal and installation of HDD into DVR as well as information retrieval from the HDD
- Inadequate employee training on data retrieval for HDDs
- Failure to check and monitor that LRV surveillance equipment is functional

Other contributing causes identified were:

- Reliability due to the useful life of the camera and HDD
- Potential tampering with the system

#### **EACH CAP AND ASSOCIATED HAZARD ANALYSIS SHALL, IN ACCORDANCE WITH:**

**1. 4 CCR 723-7-7347(b)(I) - Identify the element or activity identified including the assigned tracking number.**

RTD is reporting CAP03-A2-09212022 pursuant to Decision No. C23-0044. Both trains (LRV 286 and 316) involved in the Accident have in-cab cameras installed, but in-cab video footage was only recovered from LRV 286.

RTD assigned CAP tracking number: CAP03-A2-09212022

**2. 4 CCR 723-7-7347(b)(II) – Identify the actions to be taken by the RTA to minimize, control, correct, or eliminate the risks and hazards identified by the CAP.**

- Develop a formal process to verify and monitor functional surveillance systems are in place, including daily check to ensure camera functionality prior to revenue service.

**3. 4 CCR 723-7-7347(b)(III) - Identify the interim measures the RTA plans to implement to prevent recurrence before the final corrective actions are implemented.**

- The LRV Maintenance division will wire all current 4C DVR surveillance systems directly to the power source via remote fuse to ensure tamper resistance.
- The LRV Maintenance division will update the existing surveillance systems with new Solid State Drives (SSDs) until the new Denver VIII style surveillance system is installed on all LRVs.
- Update procedures for handling of cameras, hard drives, and DVRs, including hard drive installation, troubleshooting, recovery, retention, and chain of custody.
- Train all impacted employees on procedures above.

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- Conduct LRV operator education campaign on rule infraction for obstructing or tampering with onboard cameras (Rule 3.6 and Bulletin TR-22-05), including operator signed acknowledgement of receipt of Bulletin.
- Evaluate potential for alternative remote access to retrieve video files.

**4. 4 CCR 723-7-7347(b)(IV) - Identify/provide the CAP implementation schedule (to include interim correction actions timeline).**

<b>CAP Implementation Schedule</b>			
<b>Type</b>	<b>Corrective Action</b>	<b>Target Date</b>	<b>Date Complete</b>
Interim	The LRV Maintenance division will wire all <u>current</u> 4C DVR surveillance systems directly to the power source via remote fuse to make tamper resistant.	03/31/2024	
Interim	The LRV Maintenance division will update the existing surveillance system with new SSDs until the new Denver VIII style surveillance system is installed on all LRVs.	03/31/2024	
Interim	Update procedures for handling of cameras, hard drives, and DVRs, including hard drive installation, troubleshooting, recovery, and chain of custody	09/30/2023	
Interim	Train all impacted employees on procedures above.	12/31/2023	
Interim	Conduct LRV operator education campaign on rule infraction for obstructing or tampering with onboard cameras (Rule 3.6 and Bulletin TR-22-05), including operator signed acknowledgement of receipt of Bulletin.	03/31/2023	
Interim	Evaluate potential for alternative remote access to retrieve video files.	09/30/2023	
Final	Develop a formal process to verify and monitor functional surveillance systems are in place, including daily check to ensure camera functionality prior to revenue service.	03/31/2024	

**5. 4 CCR 723-7-7347(b)(V) - Identify the method(s) the RTA will use to validate the effectiveness of the corrective measures.**

Regular reviews of items above will be communicated to the CPUC quarterly.

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**6. 4 CCR 723-7-7347(b)(VI) - Identify the individual, including position title, responsible for the CAP implementation.**

The RTD individual responsible for implementing this corrective action is, the Assistant General Manager, Rail Operations. This effort will be monitored by RTD’s Leadership Safety Committee under the direction of the Chief Safety Officer/Senior Manager, Safety and Environmental.

**7. 4 CCR 723-7-7347(b)(VII) - Identify any specific actions required by the Commission.**

The RTD will await any specific actions required by the Colorado Public Utilities Commission related to this CAP.

**REFERENCES AND RESOURCES**

RTD Safety Assurance and Safety Risk Management Analysis of 2019 Sable/Exposition Derailment Corrective Action Plan, filed November 30, 2022, Proceeding No. 22I-0471R, pp. 11-13, ¶¶ 40-44 (addressing upgrades to in-cab and forward-facing cameras consistent with Rule 7349(b))



Dan McClain  
Chief Safety Officer/Senior Manager, Safety and Environmental

February 14, 2023  
Date

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**RISK ANALYSIS**  
**Findings of A2-09212022**

**CAP No: CAP03-09212022**

Complete below hazard analysis table as it relates to the above referenced CAP.

<b>Item #</b>	<b>Hazard Description</b>	<b>Hazard Cause</b>	<b>Hazard Effect</b>	<b>Hazard Category and Probability</b>	<b>Hazard Resolution/Reduction</b>
1	Lack of video footage	Potential tampering, Equipment reliability, Insufficient training, Inadequate procedures	Inability to retrieve and view video footage	5A: Negligible / Frequent	Refer to corrective actions provided above

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To determine the appropriate severity category as defined in Table I for a given hazard at a given point in time, identify the potential for death or injury, environmental impact, or monetary loss. A given hazard may have the potential to affect one or all these three areas.

**TABLE I: SEVERITY CATEGORIES**

Enter CAP Severity Category: \_\_\_\_\_ 5 - Negligible

<b>SEVERITY CATEGORIES</b>		
<b>Description</b>	<b>Severity Category</b>	<b>Mishap Result Criteria</b>
Catastrophic	1	Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or monetary loss equal to or exceeding \$10M.
Grave	2	Could result in one or more of the following: permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceeding \$1M but less than \$10M.
Significant	3	Could result in one or more of the following: injury or occupational illness resulting in one or more lost work day(s), reversible moderate environmental impact, or monetary loss equal to or exceeding \$100K but less than \$1M.
Modest	4	Could result in one or more of the following: injury or occupational illness not resulting in a lost work day, minimal environmental impact, or monetary loss less than \$100K.
Negligible	5	Could result in one or more of the following: no injuries or occupational illness, no environmental impact, minor public inconvenience, or nuisance or monetary loss less than \$25K.

**TABLE II: PROBABILITY LEVELS**

Probability is defined as the likelihood of the number of times that a specific event will occur during the planned life expectancy of a system. A risk probability may be derived from the analysis of a transit system’s operating experience, evaluation of RTD safety historical data, or the analysis of reliability and failure data. Probability is categorized as Frequent, Probable, Remote, Improbable or Highly Improbable.

Enter CAP Probability Level: \_\_\_\_\_ A - Frequent

<b>PROBABILITY LEVELS</b>			
<b>Description</b>	<b>Level</b>	<b>Specific Individual Item</b>	<b>Fleet or Inventory</b>
Frequent	A	Likely to occur often in the life of an item	Continuously experienced
Probable	B	Will occur several times in the life of an item	Will occur frequently
Remote	C	Likely to occur sometime in the life of an item	Will occur several times
Improbable	D	Unlikely, but possible to occur in the life of an item	Unlikely, but can reasonably be expected to occur
Highly Improbable	E	So unlikely, it can be assumed occurrence may not be experienced in the life of an item	Unlikely to occur, but possible

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**TABLE III: RISK ASSESSMENT MATRIX**

Enter CAP Risk Assessment: 5A – Medium- Acceptable with review

<b>RISK ASSESSMENT MATRIX</b>					
<b>Severity</b> <b>Probability</b>	<b>Catastrophic</b> <b>(1)</b>	<b>Severe</b> <b>(2)</b>	<b>Serious</b> <b>(3)</b>	<b>Limited</b> <b>(4)</b>	<b>Negligible</b> <b>(5)</b>
<b>Frequent (A)</b>	<b>High</b>	<b>High</b>	<b>Serious</b>	<b>Medium</b>	<b>Medium</b>
<b>Probable (B)</b>	<b>High</b>	<b>High</b>	<b>Serious</b>	<b>Medium</b>	<b>Moderate</b>
<b>Remote (C)</b>	<b>Serious</b>	<b>Serious</b>	<b>Medium</b>	<b>Moderate</b>	<b>Low</b>
<b>Improbable (D)</b>	<b>Medium</b>	<b>Medium</b>	<b>Moderate</b>	<b>Low</b>	<b>Low</b>
<b>Highly Improbable (E)</b>	<b>Medium</b>	<b>Moderate</b>	<b>Low</b>	<b>Low</b>	<b>Low</b>

<b>Risk Level</b>	<b>Acceptability</b>	<b>Resolution Requirement</b>
<b>High</b>	<b>Unacceptable</b>	Correction required
<b>Serious</b>	<b>Undesirable</b>	Correction may be required, decision by management
<b>Medium</b>	<b>Acceptable with review</b>	With review and documentation by management
<b>Moderate</b>	<b>Acceptable</b>	With review
<b>Low</b>	<b>Acceptable</b>	No action needed