

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF COLORADO

PROCEEDING NO. 19I-0347R

IN THE MATTER OF THE REGIONAL TRANSPORTATION DISTRICT'S CORRECTIVE ACTION PLAN REGARDING THE SABLE BOULEVARD AND EXPOSITION AVENUE DERAILMENT, RULE 4 CCR 723-7-7347.

**COMMISSION DECISION APPROVING
RTD'S CORRECTIVE ACTION PLAN**

Mailed Date: October 11, 2019
Adopted Date: October 9, 2019

TABLE OF CONTENTS

I.	BY THE COMMISSION	1
A.	Statement	1
B.	Analysis	10
C.	Conclusions	11
II.	ORDER.....	12
A.	The Commission Orders That:	12
B.	ADOPTED IN COMMISSIONERS' WEEKLY MEETING October 9, 2019.	13

I. BY THE COMMISSION

A. Statement

1. By Decision No. C19-0535 mailed June 19, 2019, the Commission opened an Investigation and required the Regional Transportation District (RTD) to file its Corrective Action Plan (CAP) and any associated hazard analysis, if necessary, for Commission review and approval in this investigation proceeding within 30 days of the decision.

2. RTD filed its CAP and associated hazard analysis in this proceeding on July 18, 2019. The CAP contains all of the information required by Rule 7347 of the Commission's Rules Regulating Railroads, Rail Fixed Guideways, Transportation by Rail, and Rail Crossings, 4 *Code of Colorado Regulations* 723-7.

3. RTD performed a hazard analysis of the derailment at this crossing. Looking at the number of trains that have maneuvered this crossing since service started on the R-Line, there have been approximately 26,052 round trips completed from January 2018 through January 2019. Thus the one derailment that occurred during this one-year timeframe occurred with a probability of 3.8384E-05, which would put derailments at this crossing at a risk assessment code of 2D/E. An analysis looking solely at the train involved in the January 28, 2019 event shows that the first run through the crossing was successful, but the second was not, giving the probability of derailment at 0.5 or a risk assessment code of 2A. However, since risk assessment is not reviewed solely on a single train and operator, the overall risk assessment for the crossing and corridor would be at a 2D/E.

4. RTD's investigation of this incident and the results of the accident reconstruction determined that weather was not a contributory factor to the derailment and that only human factors caused the derailment. Because of the nature of the accident, this CAP is being required as a result of the human factors cause of the accident and not as a result of the hazard analysis of the corridor. Because of the human factors elements of the accident, RTD has convened a series of meetings with Rail Operations, Maintenance of Way, Training, and Safety to discuss this event and possible mitigation measures to address how to prevent reoccurrence of similar events in the future.

5. RTD proposes the following mitigation measures in its CAP: 1) Evaluation of current “return to work” policies and procedures for RTD staff authorized to operate trains with a specific focus on employees returning from extended time away; 2) Investigation/Assessment/Implementation of Psychological Fitness for Duty policies and procedures under direction of RTD’s medical provider for “return to work” programs; 3) Development of means and methods by RTD Rail Operations for evaluating and tracking all train operators; 4) Review and reassessment by the RTD Transportation Department including Standard Operating Procedures and Rule Book materials with a focus on inclement weather operations; 5) Confirmation of current placement and the addition of permitted speed signs in multiple locations in Downtown Denver and the R-Line in Aurora; 6) Publication of a bulletin that is signed for by Operators regarding permitted speed on the alignments and adherence to posted speeds; 7) Reminders included in Train Orders of speed limits on the light rail alignments; and 8) Implementation of a Field Supervisor campaign focused on speed adherence with violations of posted speeds triggering face to face meetings with Operators regarding speeding.

6. For mitigation area 1, RTD is providing specific focus including a combination of classroom time combined with revenue service performed on all lines of service that will be dependent on how long the employee has been away from the last regularly scheduled shift with different combinations for employees with less than 30 days, between 31 and 60 days, between 61 and 90 days, between 91 and 180 days, and between 181 and 364 days away from their last regularly scheduled shift.

7. For mitigation area 2, RTD’s developed means and methods for evaluating and tracking all train operators includes both announced and unannounced ride checks/efficiency evaluations at least quarterly, assessment of operating rule violations including moving violations

(e.g., speed, unfavorable signals – also known as (a.k.a.) red signal violations, switch violations – a.k.a. trailed or split switch violations), development and implementation of programs that address identified deficiencies in training and retraining, and disciplinary actions that are consistent with the collective bargaining agreement.

8. The proposed actions by RTD in the remaining mitigation areas are straightforward and do not need additional explanation or detail.

9. RTD has taken immediate action pursuant to the above mitigation actions and is incorporating these actions as routine actions for all of its Light Rail Divisions. RTD will continuously investigate and evaluate the mitigation actions that have been put in place for effectiveness and will evaluate other means and methods to manage similar noted risks.

10. The proposed CAP will have an ongoing monitoring element, and ongoing noncompliance with permitted speeds by Operators will follow the established disciplinary process outlined in the RTD Collective Bargaining Agreement. RTD's Safety Division will monitor compliance with the CAP through ongoing documentation reviews and as part of the internal Safety Division review process described in RTD's Public Transportation Agency Safety Plan.

11. The RTD departments responsible for implementing this CAP are the RTD Rail Operations and Transportation Division with efforts being monitored by the RTD Executive Safety and Security Committee under the Assistant General Manager of Safety, Security and Asset Management and the Chief Safety Officer.

12. On July 31, 2019, the Commission issued Decision No. C19-0665 mailed August 6, 2019, requesting additional information and actions to be included in RTD's CAP.

Specifically, the Commission required the following additional information to be provided by RTD with this CAP including:

- a) An analysis of the light rail alignment for locations where radar based speed violator strobe signs would be effective and will be installed;
- b) A report of the analysis performed by RTD of the LRV door design and what, if anything, can be done to mitigate the door failure that occurred during the January 28, 2019 derailment from occurring again under a similar set of circumstances in the future should such circumstances occur;
- c) Additional information from RTD on any additional information obtained and an analysis performed by RTD on anything else learned from this incident that can be used by RTD going forward to better prepare future operators or analyze operator awareness while they are operating light rail vehicles;
- d) Additional information from RTD on any issues they are having with obtaining and retaining operators and/or how the limited numbers of operators may be creating or leading to issues that may have led to or contributed to the derailment.

Decision No. C19-0655 at p. 6.

13. On September 4, 2019, RTD filed an Unopposed Motion to Permit Limited Provision of Report Materials to Manufacturer and on September 5, 2019, RTD filed an Unopposed Amended Motion of RTD to Permit Limited Provision of Report Materials to Manufacturer.

14. By Decision No. C19-0768 issued September 19, 2019, the Commission granted the limited provisioning of report materials to RTD's manufacturer for the purpose of performing additional analysis to respond to the additional information and questions posed to RTD as part of this CAP.

15. On September 16, 2019, RTD filed an addition to its CAP in this matter responding to the questions proposed by the Commission and adding additional mitigation measures to the proposed CAP. These additional mitigation measures include: 1) Addition of

radar based speed monitoring units to alert operators based on RTD's analysis of its light rail alignment; 2) Provision of an initial report from Siemens Mobility (Siemens) and a report from door manufacturer Innovations for Entrance Systems (IFE) with plans to provide a follow-up report from Siemens after their final analysis based on being able to review additional accident report information to be provided to them; 3) Review and enhancement of RTD's operator training program, retraining program, scheduling of monthly safety campaigns, and addition of efficiency testing; 4) a review of additional technology that may be considered to enhance light rail system safety; and 5) RTD analysis and efforts to address obtaining and retaining operators.

16. For additional mitigation area 1, RTD has added permitted speed signs in multiple locations in Downtown Denver and on the R-Line where crossings similar to the Sable/Chambers crossing exist. RTD has also performed a complete analysis of its system and has determined eight locations to target installation of the radar based speed monitoring units. One sign has been received and an additional seven are on order and are proposed to be installed at the following locations: Sable and Exposition, Aurora Metro Center horseshoe curves, the Iliff Flyover, the Colfax and 13th Avenue locations on the R-Line, the Mile High Station curve on the CPV Extension, and the curves entering and exiting the Federal Center on the W-Line. Additionally, RTD's Change Management Committee will continue to review these locations after sign installation and will continue to review data and the light rail alignment for installation of additional signs at any future identified locations.

17. For additional mitigation area 2, RTD provided a copy of the report from door manufacturer IFE. The analysis shows that the door was properly manufactured and performed per manufacturer and design specifications. The accident in question created forces acting on the train during the derailment that far exceeded the design specifications and contributed to the door

movements. LRV manufacturer Siemens provided a draft report to RTD that RTD found to be incomplete as it did not consider any structural deformation of the car shell due to the car step thresholds contacting the street surface during the derailment. RTD has requested additional information from Siemens about the car shell design force tolerance during these types of derailments, if the car shell performance contributed to the opening of the door which allowed the passenger to be ejected, what the estimated abnormal forces experienced on the car shell were, how the car shell performed regarding structural deformation as the step thresholds contacted, and how the car shell could be modified to prevent the door from opening if the car shell deformation contributed to ejection of the passenger. RTD will provide a copy of the final report to the Commission once it has been completed as part of the CAP.

18. Additionally, Siemens and IFE will be working together to answer some additional questions RTD has posed regarding the LRV door design force tolerance during derailments of this type, if the car shell's contact with the pole and street contributed to the opening of the door allowing the passenger to be ejected and how a person thrown against the door contributed to the opening of the door allowing the passenger to be ejected, an estimate of the abnormal forces experienced on the door, how the door performed as far as structural resistance to coming open during the derailment, and how the door could be modified to prevent the door from opening if the roller and roller track system contributed to the ejection of the passenger. This information will also be provided to the Commission as part of this CAP once the report is complete.

19. For additional mitigation area 3, RTD has performed a full review of its training curriculum to determine if there was any deficiency that could have contributed to the accident. While no direct causation could be attributed to gaps in the training curriculum, RTD has

determined that additional enhancements to the training program and oversight by supervisors will be added to its existing programs. Training enhancements include increasing testing of operators during training from 4 exams to 13 exams and should increase comprehension and familiarity of the new information being learned. Operators will also be given a practical test on all portions of the light rail alignment. An additional week of training for revenue instruction will also be required to be completed before a new operator is released for solo revenue service. With the enhancements, any deficiencies detected during training will be addressed and corrected before the operator trainees are released to the next phase of training. Finally, ride checks will be given on all areas of the alignment through ride checks on all lines prior to the operator trainees being released for revenue service, which will complete their initial training.

20. RTD also plans on scheduling monthly campaigns for the street supervisors to complete in addition to the current speed, station, policy, and safety checks currently made on a daily basis. Topics through the rest of 2019 starting in August include speed in curves, radio procedures, 20-second gated crossing checks, speed in stations, and cell phone policies.

21. RTD will also be piloting efficiency testing of its Operators with forms developed to create an electronic tracking process that will help identify hotspots on the light rail alignment concerning operators and identification of other data trends.

22. RTD is also refining its previous proposed original mitigation area 1 retraining of operators after a prolonged absence. RTD is now proposing ride checks and retraining depending on how long the employee has been away from the last regularly scheduled shift for employees returning between 31 to 40 days, 41 to 60 days, 61 to 90 days, 91 to 180 days, and 181 to 364 days.

23. RTD has also looked at possible technology that could be installed in the light rail vehicles that would either enhance operator awareness, provide better oversight of operations, or that could even prevent speeding in light rail vehicles. These technologies include the following: 1) upgraded cameras to include in cabs and forward facing cameras which have been included in the 29 new LRVs placed in service, but which will need to be added to the existing 172 vehicles, which will cost approximately \$4M for which no budget has been identified or appropriated in the short- or long-term; 2) enhanced ATC which would establish vehicle to wayside communications to monitor vehicle position and speed and would provide signal enforcement and civil speed control of all trains, thus eliminating red signal violations and govern the speed of all trains at a cost of \$12 to 15M for which \$7M is in the current short term budget for 2019, \$2M in the 2020 budget, and \$1M per year in budget years 2021 through 2025 (this budget allows for some type of enhanced ATC system, but is insufficient to acquire any type of system currently available for a fleet of RTD's size); 3) communication based train control/ultra wide band communications, which would provide very sophisticated control of train position, speed, braking distance, signal systems, etc. at an approximate cost of \$100M, which is cost prohibitive for RTD. RTD is evaluating grant funding opportunities, alternatives, and budget adjustments. However, the technology enhancements are cost prohibitive in the short-term and long-term under RTD's current budgeting.

24. For additional mitigation area 4, RTD has been experiencing significant shortages in train operators. RTD has 216 train operator positions, but currently has only 163 full time operators. With on the job injuries, Family and Medical Leave ACT absences, scheduled days off, and call in absences, RTD states that the operators available on any given day are typically 12 to 15 less than the 163 full time operators. Because of the workload being demanded of its

operators, RTD has seen a significant increase in its attrition rate and has not been able to hire and train enough operators to maintain its current staffing level, creating a need to mandate operators to work six days a week. Exit interviews confirm that the additional mandatory work is leading to the increase in attrition. RTD does monitor hours worked by operators, and while the total number of hours has not exceeded Department of Transportation (DOT) hours, many RTD operators are near the DOT hours of service limits on a regular basis, leading to driver fatigue. While fatigue was not determined to be a direct causal factor in the derailment, the increased workload and overtime could be contributing to operator fatigue, inattention, and potential distraction due to stress and the lack of a work/life balance. RTD is working on an analysis of how mandating history, hiring, retention, absences, on the job injuries, etc., may lead to accidents and will provide information to the Commission no later than October 30, 2019.

B. Analysis

25. The additional information and additional mitigation areas added by RTD to this CAP address our additional questions. The proposed mitigation measures address the human factors issues identified in the accident investigation and now provide additional mitigation measures for signage to be placed along the light rail alignment. Additional information is forthcoming regarding some of the potential mechanical issues and staffing issues. Information has been provided about additional equipment that could be used on the alignment to alert operators to speed restricted areas, and we will require RTD to provide a full analysis of its budget issues regarding adding this type of equipment and provide to the Commission a plan of how RTD proposes to move forward with enhancing its system and operations with additional technologies by April 30, 2020.

C. Conclusions

26. We concur with RTD's hazard analysis regarding this matter. The frequency of an event such as the January 28, 2019 derailment does appear to have a remote frequency of occurrence. In this situation, the cause of the accident can solely be contributed to human factors and the operator's disregard to the speed limit for the curve of the crossing. The proposed mitigation measures and the additional mitigation measures added address our questions and address the human factor elements that likely contributed to the accident. Additionally, RTD is performing further analysis into the performance of the light rail vehicle and doors to answer additional questions on how the stresses from the derailment factored into the accident and what possible mitigation can be made to the light rail vehicles to mitigate future occurrences, and is performing an analysis on how limited personnel issues may be contributing to the possibility of a similar type of accident occurring in the future and what needs to be done to mitigate this issue.

27. We will approve the CAP and amended CAP submitted by RTD for the Sable and Exposition Derailment for the mitigation of the human factors elements. We will require RTD to file the additional information discussed in its amended CAP that RTD is continuing to work on to provide additional information about other mitigation matters. We will require RTD to verify implementation of each of the mitigation measures as described in the CAP through a review of the new and revised documentation for each mitigation item with Staff of the Commission (Staff). We will require Staff to monitor the progress of the CAP completion through field visits, and ongoing discussions with and documentation review of RTD for mitigation area 2 until April 30, 2020. Staff shall file a report in this CAP proceeding regarding its review of the new and revised documentation and its monitoring of the CAP at the end of this period of time prior

to closing this investigation. Once the additional reports have been filed by RTD, the Commission will determine if any additional elements should be added to this CAP.

II. ORDER

A. The Commission Orders That:

1. The Corrective Action Plan (CAP) filed by the Regional Transportation District (RTD) on July 18, 2019 and amended on September 16, 2019 is approved. RTD is approved to move forward with the proposed mitigation measures discussed in the original and amended CAP filings. RTD is also required to file the additional two documents after analysis of the car shell and door interaction has been completed by its contractors and after RTD completes its analysis of staffing issues and possible mitigation for that issue.

2. RTD is required to provide a full analysis of its budget issues regarding adding technological mitigation to its light rail system and provide the Commission with a plan of how RTD proposes to move forward with enhancing its system and operations with additional technologies by April 30, 2020.

3. RTD is required to verify the implementation of each mitigation measure as described in the CAP as amended through a review of the new and revised documentation for each mitigation item with Staff of the Commission (Staff).

4. We will require Staff to monitor the progress of the CAP completion through field visits and ongoing discussions with and documentation review of RTD for mitigation area 2 until April 30, 2020 at which time Staff shall file a report in this proceeding regarding its review of the new and revised documentation and its monitoring of the CAP.

5. The Commission retains jurisdiction to require additional mitigation measures be added to the CAP based on the outcome of the two outstanding items to be filed at a later date in this proceeding.

6. This Decision is effective on its Mailed Date.

**B. ADOPTED IN COMMISSIONERS' WEEKLY MEETING
October 9, 2019.**

(S E A L)



ATTEST: A TRUE COPY

Doug Dean,
Director

THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

JEFFREY P. ACKERMANN

JOHN GAVAN

Commissioners

COMMISSIONER FRANCES A. KONCILJA
ABSENT.