



REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION R15-03

Vehicle event data recorders

Background

On 18 September 2013, at about 0832 Eastern Daylight Time, westward VIA Rail Canada Inc. (VIA) passenger train No. 51 departed from the VIA Ottawa Station on time and proceeded enroute to Toronto. At 0847:27, OC Transpo double-decker bus No. 8017 departed from the Fallowfield Station on the OC Transpo bus Transitway. At 0848:06, while proceeding at about 43 mph, the train entered the OC Transpo Transitway crossing, located at Mile 3.30 of VIA's Smiths Falls Subdivision. At the time, the crossing lights, bells and gates were activated. The northbound bus was travelling at about 5 mph with the brakes applied when it struck the train. As a result of the collision, the front of the bus was torn off. The train, comprising 1 locomotive and 4 passenger cars, derailed but remained upright. Among the bus occupants, there were 6 fatalities and 9 serious injuries, and about 25 minor injuries were reported. No VIA crew members or VIA passengers were injured.

The Board concluded its investigation and released report R13T0192 on 2 December 2015.

TSB Recommendation R15-03 (December 2015)

The ADL double-decker buses were equipped with a video monitor that provides the driver with interior views and exterior views of the bus. However, the system monitoring the video cameras installed on the bus did not have recording enabled, and no video information was recovered from the system.

Each of the rail, air and marine modes of transportation require locomotives and many commercial aircraft and vessels to be equipped with event data recorders (EDRs) that record a number of specified elements. In contrast, the *Canada Motor Vehicle Safety Standards* (CMVSS) contain no requirements for buses (including school, transit and inter-city) to be equipped with an on-board crashworthy EDR. While nothing precludes an operator from installing such technology on its fleet, OC Transpo had no such requirement. As a result, the occurrence bus was not equipped with a crashworthy EDR (i.e. black box) to record and store vehicle operation data that occurred prior to and during the accident sequence. Consequently, 8 electronic units that contained non-volatile memory (NVM) were recovered and analysed.

Of the 8 units recovered, only the engine control module (ECM) retained useful data. The ECM is programmed to automatically record a sudden deceleration event when the bus decelerates at greater than 9.0 mph/s (14.5 km/h/s). Had the bus decelerated at less than 9.0 mph/s

(14.5 km/h/s), the ECM would have contained no data at all. While, in this case, the recovered ECM data were useful, when compared to locomotive event recorder (LER) data, the ECM data lacked sufficient detail to conduct a meaningful analysis. Specifically,

- there was no meaningful time stamp;
- no distance travelled was recorded;
- the recorded time interval of 1 second was not sufficient for detailed analysis;
- the operation of the anti-lock brake system and emergency brake was not identified;
- the ECM data indicated that the brakes had been applied, but no other meaningful braking information was recorded; and
- there was no brake line air pressure recorded to determine the amount of force applied to the brakes.

Consequently, a detailed braking analysis had to be performed to determine event timing, braking distance and amount of braking force applied by the bus during the accident. The complexity of this work added a number of months to the investigation process. In comparison, comprehensive data from the LER were available for review the next day. The LER data clearly identified the operating parameters of the train and actions of the train crew, which permitted investigators to make informed decisions as to the direction of the investigation and turn their attention to the condition and operation of the bus.

In the United States, the National Transportation Safety Board (NTSB) has recommended EDRs for buses since 1999. While progress has been made, the use of EDRs remains voluntary for roadway vehicles, and the NTSB has classified the related safety recommendations as “Open – Unacceptable Response” because the United States National Highway Traffic Safety Administration (NHTSA) has not required the use of EDRs on buses.

Through years of experience with EDRs in the air, rail and marine modes of transportation, the TSB, the NTSB and the transportation industry have learned a great deal about the effective use of recording technology. Establishing industry standards for recording in these modes has been critical to effective implementation of EDRs by ensuring consistency in the recorded data in standardized formats.

Railway companies routinely use LER data in conjunction with operator (driver) proficiency testing to identify potential areas of improvement within the context of a railway company’s safety management system (SMS).

EDRs have been commonly used by over 100 United States jurisdictions to manage school bus fleets. Studies have determined that, when integrated into a company’s safety program, the review of EDR data has led to operational safety improvements for vehicle fleets. A sampling and review of EDR data can identify emerging driver trends, and modifications to company training and/or employee mentoring can be made to improve safety accordingly. Such reviews can also be used to identify and reinforce positive and safe driver behaviour. This demonstrates that EDR information can be used in a non-punitive way as a tool for monitoring driver behaviour and performance in conjunction with a transportation company’s safety program that can further reduce risk and improve safety before an accident occurs.

Although accidents involving transit buses at level crossings are rare, they are considered to be high-risk events due to the number of passengers transported in each bus and the potential for injury to the travelling public. When these accidents occur, it is imperative that all investigators

have access to real-time recorded data that are consistent and meaningful to quickly identify safety deficiencies and prevent recurrence. Understanding driver behaviour and identifying the related human factors are critical to understanding why accidents happen.

All safety, regulatory, law enforcement and company accident investigations benefit from the efficient, timely and accurate collection, assimilation and analysis of available information. In many cases, EDRs provide and validate much of this valuable information. Early recovery of the information can also result in more timely communication of safety deficiencies and accident reports to industry, regulators and the public, which in turn can result in the implementation of measures to prevent a recurrence. Considering that today's vehicles are capable of supporting crashworthy technology that has the capacity to record safety-critical information that enables safety improvements as well as comprehensive and timely accident investigation, the Board recommends that

the Department of Transport require commercial passenger buses to be equipped with dedicated, crashworthy, event data recorders.

TSB Recommendation R15-03

Transport Canada's response to Recommendation R15-03 (February 2016)

Transport Canada acknowledges the recommendation.

There are no United States or United Nations safety regulations requiring EDRs on large commercial vehicles of any type. At the same time, Transport Canada will commit to scan current EDR technologies available for commercial passenger buses. This research will look at vehicle-based systems, engine-based systems as well as global positioning systems developed both by original equipment manufacturers and after-market suppliers. TC will review available international commercial vehicle EDR standards and recommended practices. Transport Canada will also evaluate the feasibility of developing a commercial passenger bus EDR standard by undertaking a review of technical and scientific reports/papers and validation studies on the accuracy, reliability and limitations of commercial vehicle EDRs. The results of this work would help to determine the need for standards and guide TC on how to proceed. Such work could produce useful guidelines for the installation of such equipment.

TSB assessment of Transport Canada's response to Recommendation R15-03 (March 2016)

Transport Canada has acknowledged this recommendation.

TC will initiate research on EDR technologies, including vehicle-based systems, engine-based systems as well as global positioning systems developed both by original equipment manufacturers and after-market suppliers. After reviewing the results of the research, TC will evaluate the feasibility of developing an EDR standard for commercial passenger buses. This work will help determine the need for standards and could lead to guidelines for the installation of such equipment.

The Board is encouraged that TC will initiate research to help determine the need for standards and/or guidelines for the installation of EDRs for commercial passenger buses. However, this work will take time, and no specific timeline has been provided. In addition, beyond this commitment, there are no explicit plans for the development of EDR standards for commercial passenger buses.

Therefore, the Board assesses the response to Recommendation R15-03 as being **Satisfactory in Part**.

Transport Canada's response to Recommendation R15-03 (February 2017)

TC will research current EDR technologies available for heavy commercial vehicles, document current EDR standards and recommended practices, undertake a thorough literature review of commercial vehicle EDRs, review any existing national or international standards and evaluate the feasibility of developing a commercial passenger bus EDR standard.

TC has posted the Request for Proposal (RFP) to hire a consultant to do the research. The bid period has closed and a contract has been awarded.

In addition, recognizing that it is important to develop expertise and operational procedures within TC for commercial vehicle EDRs, TC staff (a collision investigator and a defect investigator) have recently taken further training in "Accessing and Interpreting Heavy Vehicle Event Data Recorders".

TSB reassessment of Transport Canada's response to Recommendation R15-03 (March 2017)

TC recently hired a consultant to conduct research on EDR technologies. This work will include researching current EDR technologies for heavy commercial vehicles; documenting current EDR standards and recommended practices; undertaking a literature review of existing commercial vehicle EDRs; reviewing any existing national or international standards; and evaluating the feasibility of developing a commercial passenger bus EDR standard.

The Board is encouraged that TC has initiated research to help determine the need for standards and/or guidelines for the installation of EDRs for commercial passenger buses. TC has also invested in the development of in-house expertise by providing selected staff with specialized training. However, no explicit plans have yet been established for follow-up work, including the development of EDR standards for commercial passenger buses.

Therefore, the Board reassesses the response to Recommendation R15-03 as being **Satisfactory in Part**.

Transport Canada's response to Recommendation R15-03 (February 2018)

There are two components to the work that will be conducted as part of this recommendation:

- Transport Canada's (TC) Motor Vehicle Safety (MVS) Directorate will research current EDR technologies available for heavy commercial vehicles, document current EDR standards and recommended practices, undertake a thorough literature review of commercial vehicle EDRs, review any existing national or international standards and evaluate the feasibility of developing a commercial passenger bus EDR standard.
Status: TC has posted the RFP to hire a consultant to do the research. The bid period has closed and 3 responses were received. The contract has been awarded. The end date of the contract is March 31, 2018.
- Recognizing that it is important to develop expertise and operational procedures within TC for commercial vehicle EDRs, TC MVS has sent one collision investigator and one

defect investigator to the training course “Accessing and Interpreting Heavy Vehicle Event Data Recorders” offered by the Society of Automotive Engineers (SAE).

Status: The SAE course has been completed by both investigators.

An environmental scan of technical and scientific reports/papers and validation studies on the accuracy, reliability and limitations of commercial vehicle EDRs has been completed and submitted to Transport Canada. Many publications from the environmental scan were subject to Copyright Protection Laws; as such, the Department undertook to purchase the documents of interest. There are only a few outstanding items that need to be purchased.

A report with the highlights (observations and conclusion) compiled from the environmental scan of technical and scientific reports/papers and validation studies identified has been submitted to TC. The report is undergoing final review and formatting.

A three-day face-to-face meeting with Mecanica Scientific Services (the contractor) was held the first week of December. The summary report of the facts, based on analysis of the scientific reports/papers and validation studies was reviewed and final editing is being done.

A DRAFT summary report of all commercial vehicle-based systems, engine-based systems as well as global positioning systems developed both by original equipment manufacturers and after-market suppliers is currently being developed. This includes equipment requirements, operational requirements and technical specifications.

Interviews with key government and industry stakeholders are currently being formalized in terms of questionnaires and protocols. It is anticipated that some of these discussions will take place in Washington in late January during the SAE Government/Industry meetings.

Also it is worthy of noting that the SAE Truck and Bus Event Data Recorder Committee, which has been inactive since June of 2010, has been re-activated to review SAE J2728 (Heavy Vehicle Event Data Recorder [HVEDR] Standard - Tier 1), as well as further development of standards on Truck and Bus EDR. The re-activation of the committee is in large part due to a feasibility study that was launched by Transport Canada. Transport Canada is an active member of the committee.

TSB reassessment of Transport Canada’s response to Recommendation R15-03 (March 2018)

TC will research current EDR technologies available for heavy commercial vehicles, document current EDR standards and recommended practices, undertake a thorough literature review of commercial vehicle EDRs, review any existing national or international standards and evaluate the feasibility of developing a commercial passenger bus EDR standard. The status of the work (to-date) includes:

- An environmental scan of technical and scientific reports/papers and validation studies on the accuracy, reliability and limitations of commercial vehicle EDRs has been completed.
- A report with the highlights (observations and conclusion) compiled from the environmental scan of technical and scientific reports/papers and validation studies identified has been completed.
- A three-day meeting with Mecanica Scientific Services (the contractor) was held in December 2017 to discuss the results of the research.

- A DRAFT report is being prepared to summarize the commercial vehicle-based systems, engine-based systems as well as global positioning systems developed both by original equipment manufacturers and after-market suppliers.
- Interviews with key government and industry stakeholders are being formalized in terms of questionnaires and protocols. Some of these discussions were completed in January 2018.

The Truck and Bus Event Data Recorder Committee (Society of Automotive Engineers) was re-activated to review the SAE J2728 standard (Heavy Vehicle Event Data Recorder [HVEDR] Standard – Tier 1), and to further develop standards for Truck and Bus EDRs. The re-activation of the committee was in large part due to TC initiating the feasibility study to develop a commercial passenger bus EDR standard. Transport Canada is an active member of the Committee.

The Board is encouraged that the environmental scan of technical and scientific reports/papers and validation studies identified has been completed and that the Truck and Bus Event Data Recorder Committee (Society of Automotive Engineers) has been re-activated to assist with this work. However, no explicit commitments or timelines have been established for the development of EDR standards for commercial passenger buses.

Therefore, the Board assesses the response to Recommendation R15-03 as being **Satisfactory in Part**.

Transport Canada’s response to Recommendation R15-03 (February 2019)

Transport Canada continues to research current event data recorder (EDR) technologies available for heavy commercial vehicles, document current EDR standards and recommended practices, undertake a thorough literature review of commercial vehicle EDRs, review any existing national or international standards, and evaluate the feasibility of developing a commercial passenger bus EDR standard. The Department has advanced these efforts as follows:

- An environmental scan of technical and scientific reports/papers and validation studies on the accuracy, reliability and limitations of commercial vehicle EDRs was completed in early 2018.
- A report with the highlights (observations and conclusion) compiled from the environmental scan of technical and scientific reports/papers and validation studies identified was completed in March 2018.
- A three-day meeting with Mecanica Scientific Services (the contractor) was held in December 2017 to discuss the results of the research.
- A report has been prepared to summarize the commercial vehicle-based systems, engine-based systems as well as global positioning systems developed both by original equipment manufacturers and after-market suppliers.
- The Truck and Bus Event Data Recorder Committee (Society of Automotive Engineers) was re-activated in early 2017 to review the SAE J2728 standard (Heavy Vehicle Event Data Recorder [HVEDR] Standard - Tier 1), and to further develop standards for Truck

and Bus EDRs. The re-activation of the committee was in large part due to Transport Canada's initiation of a feasibility study to develop a commercial passenger bus EDR standard. Transport Canada is an active member of the Committee.

- For additional context, four types of data recorders were presented in the study: recording capabilities added to existing electronic control units; electronic logging devices; video data recorders; and stand-alone add-on recorders. Overall, the report findings indicate that over 99% of heavy vehicles currently have some degree of HVEDR functionality added to existing engine control units, and most Canadian vehicles are being designed according to the Society of Automotive Engineers (SAE) J2728 "Heavy Vehicle Event Data Recorders" recommended practice.
- While HVEDRs have also been studied in Europe and in North America, there are currently no regulations mandating their use. Due to the existence and adoption of SAE J2728 by industry, a review and update of this standard is considered the most effective course of action at this time. The SAE J2728 committee met on January 22, 2019 to continue reviewing the existing standard, standardizing data elements for crash reconstruction and adding additional features to monitor automated driving systems. Transport Canada will continue to be an active member of this committee.

TSB reassessment of Transport Canada's response to Recommendation R15-03 (March 2019)

In 2018, Transport Canada (TC) continued its work on event data recorder (EDR) technologies for heavy commercial vehicles. This work included documenting EDR standards and recommended practices, conducting a literature review of commercial vehicle EDRs, reviewing national and international standards, and evaluating the feasibility of developing a commercial passenger bus EDR standard.

Specific progress and observations on Heavy Vehicle Event Data Recorders (HVEDR) were made in the following areas:

- In early 2018, an environmental scan of technical and scientific reports/papers and validation studies on the accuracy, reliability and limitations of commercial vehicle EDRs was completed.
- In March 2018, a report that summarized the observations and conclusions from the environmental scan of technical and scientific reports/papers and validation studies identified was completed.
- A report was prepared to summarize the commercial vehicle-based systems, engine-based systems as well as global positioning systems developed both by original equipment manufacturers and after-market suppliers.
- While HVEDRs have been studied in Europe and in North America, there are currently no regulations mandating their use. However, it was determined that over 99% of heavy vehicles have some degree of HVEDR functionality added to existing engine control units and that most Canadian heavy vehicles are being designed to the Society of Automotive Engineers (SAE) J2728 "Heavy Vehicle Event Data Recorders" recommended practice.

Due to the adoption of SAE J2728 by industry, TC considers that a review and update of this standard will be the most effective course of action. In January 2019, the SAE J2728 committee met to continue its review of the existing standard, with consideration to standardize certain data elements to assist with crash reconstruction and to add additional features to monitor the automated driving systems. TC participated in the meeting and will continue to be an active member of this committee.

The Board is encouraged that a course of action has been identified and that the SAE committee (which includes TC participation) is actively reviewing the standard, with the intent to standardize and update certain areas of the standard. However, the timeline for completing the next steps has not yet been established. The Board assesses the response to Recommendation R15-03 as having **Satisfactory Intent**.

Next TSB action

The TSB will monitor progress on the planned activities.

This deficiency file is **Active**.