VIA Rail Canada Inc.
Technical Advice for Railcars Structural Inspection and Reinforcement

Summary Report

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1. Purpose

This report provides an overview of the technical advice and recommendations that Hatch Ltd. ("**Hatch**") provided to VIA Rail Canada Inc. ("**VIA**" or "**VIA Rail**") regarding a variety of structural conditions VIA identified on their Head End Power (HEP) fleet of stainless-steel passenger rail cars.

2. Introduction

1. VIA Rail's passenger rail fleet consists of approximately 400 passenger rail cars, of which about 200 have predominantly stainless-steel structures and were built by the Budd Company in the United States in the 1950s. This fleet is known as VIA's HEP fleet. These rail cars are designed for passenger service in mixed traffic on freight rail lines and were designed to the industry standards of the time (known as AAR S-034-45), to resist damage in the unlikely event of a train-to-train or train-to-other object collisions; these same standards remain in place today.

2. VIA launched its Heritage Program in 2018 to renovate 71 of these HEP cars to improve customer experience pending delivery of the new passenger train fleet to be delivered under VIA's Fleet Replacement Program, transforming the travel experience for Canadians. The Heritage Program work plan initially focused on upgrades of vehicle amenities and some onboard systems.

3. As the Heritage Program renovations progressed, a variety of structural conditions were identified on different cars. A fleetwide visual inspection was initiated by VIA on all HEP cars to identify any unsafe vehicles and immediately remove them from service and institute repairs.

    a) Six (6) unique conditions were initially identified initiating the fleetwide inspection.

    b) Two (2) further conditions were subsequently identified in the Heritage cars and additional fleet-wide inspections were initiated.

4. As fleetwide inspections continued during the Heritage Program, the findings suggested that all HEP cars likely have some degree of structural degradation of the strength of the car body.

    a) The conditions identified on the HEP fleet do not affect the structural performance of the HEP cars under normal operating loads, meaning that they will not fail in regular service.

    b) Unfortunately, in most cases, the remaining car body strength of the HEP fleet cars is likely less than original design standards.

c) Operationally, this reduction in car body strength could result in increased injury risks in the case of train-to-train collisions. The extent of this risk is difficult to quantify. Like automobiles, even brand-new rail cars can suffer high levels of damage in collisions above certain speeds. With the deterioration found on the HEP fleet cars, this higher level of damage may occur at lower collision speeds than on a rail car that still complied with the original design standards.

5. When the deterioration found exceeds Transport Canada regulations, VIA is repairing these cars to restore car body strength to their "original configuration, strength level and crashworthiness" according to:

   a) American Association of Railroads standard AAR-S-034, which defines the original design conditions, and

   b) American Passenger Transit Association standard APTA PR-CS-S-020-03, the "Standard for Passenger Rail Vehicle Structural Repair," which defines applicable repair procedures.

3. Hatch's Mandate from VIA Rail

Based on the progress of the ongoing structural repairs and recent findings, VIA sought external technical advice from Hatch with a mandate to:

i. Identify risks associated to the current operation of the HEP rail cars;

ii. Advise what is required to keep the affected HEP cars in service, if possible;

iii. Confirm the course of actions taken by VIA through its structural inspection and monitoring program;

iv. Recommend measures to further mitigate operational risks on the aging HEP fleet;

v. Provide an opinion to identify other wear, corrosion or other structural issues that should be considered;

vi. Advise any other elements regarding the management of an aging fleet based on industry practices.

4. Summary of Findings

- Based on Hatch's observations and the material provided by VIA, Hatch considers that VIA has been diligently addressing the issues around the known structural conditions as they have been discovered.
- VIA's repair approach for each of the known eight (8) conditions is in accordance with industry standards.
- Considering the age of the current fleet and the planned operation until 2035, Hatch has provided VIA Rail with key recommendations around fleet replacement, a

structural reinforcement program for the current fleet, temporary operational mitigations and updates to VIA's risk assessment to support decisions around proposed mitigation measures.

5. Key Recommendations

Hatch provided the following key recommendations to VIA:

1. Initiate a replacement program for the HEP fleet. By 2035, most of VIA's HEP fleet will be greater than 80 years old. Considering the age of the fleet, continued deterioration due to corrosion is expected despite any further mitigations taken in the interim. The only long-term solution is the replacement of the fleet.
2. Plan and implement a structural reinforcement program for the entire HEP fleet that restores the strength of the vehicle structure of the HEP cars to their original design capacity. This program will mitigate the increase in employee and passenger safety risks by returning each car's collision strength to the original design standard.
3. While reinforcements are underway, implement operational mitigations aimed at reducing the consequences of a collision event if feasible and shown to be effective through engineering analysis or simulation. Two such operational mitigations to consider are:
    1. Reducing the employee and passenger safety risks from train-to-train collision on unrepaired cars by positioning empty (i.e., non-passenger carrying) cars or baggage cars directly behind both the locomotive and as the last car in the train to act as a buffer should collision loads occur.
        a) This mitigation should be assessed by engineering analysis or simulation to optimize the selection and placement of buffer cars for each of VIA's train configurations for their many different routes. Hatch has been engaged by VIA to perform this analysis. Preliminary results of this work show that the use of the buffer cars is an effective means of mitigating the increased injury risk caused by the structural degradation observed by VIA.
        b) To support this analysis, VIA should also perform a compression test of a sample, unrepaired HEP car to better characterize the remaining structural strength of the cars and inform the design of the structural reinforcement program. VIA should also consider a compression test of a fully repaired car to confirm that the reinforcement program is effective. The planning for the proposed compression load test of a sample of unrepaired cars has commenced and Hatch is supporting VIA to expedite the testing.
    2. Consider instituting a reduction in speed at grade crossings considered as higher-risk for significant collisions. The amount and location of speed reduction should be determined by VIA through a review of past incident data and the

unique risk characteristics of different grade crossings on third-party host railway infrastructure (i.e. CN, CP).

a) Hatch's initial review of VIA's grade crossing incident history does not identify a current need for VIA to change operating speeds at grade crossings. This conclusion may be reassessed after structural testing and teardown inspections of the HEP cars, which should include an assessment of the condition of vehicles' side structure.

The temporary mitigations describe above do not eliminate the possibility of vehicle damage in a collision scenario, rather, they can reduce the severity of the consequences to VIA employees and passengers if such an event were to occur by reducing the energy seen by the cars during a collision.

6. Conclusion

Hatch supports VIA's decision to maintain regular service within their normal operating parameters by implementing the recommended mitigations described above. Hatch is continuing to work diligently with VIA as a member of their technical task force to ensure this program is completed at the earliest time and will provide updates to this report periodically as the task force's actions are implemented.