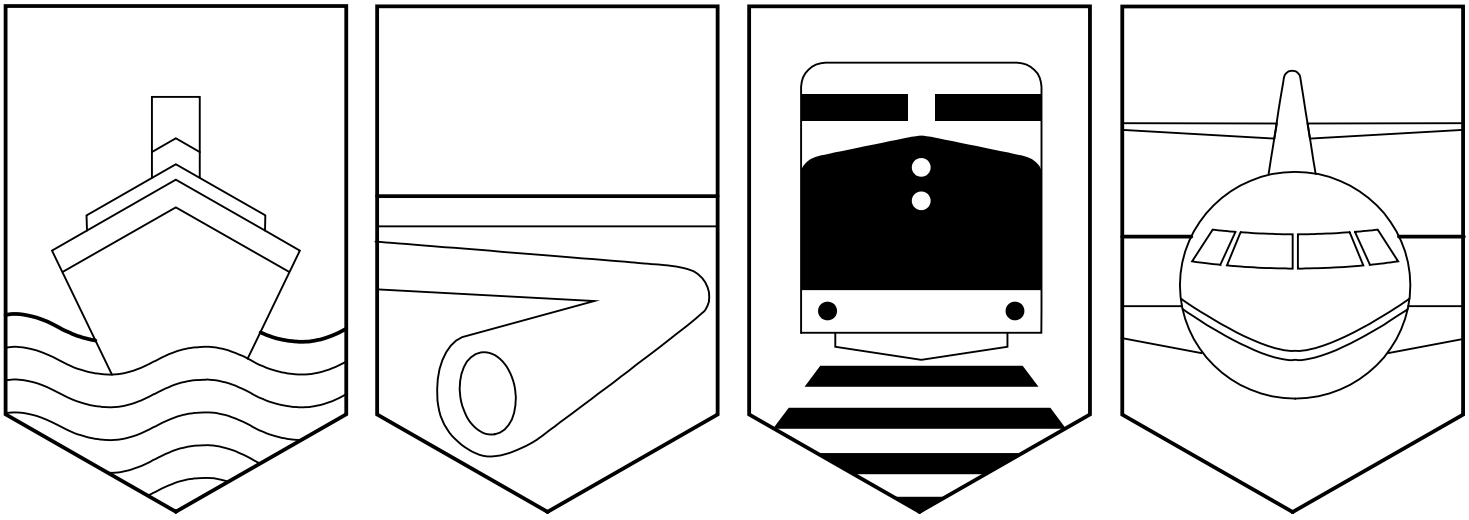
Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada



RAILWAY OCCURRENCE REPORT

DERAILMENT

VIA RAIL CANADA INC.
VIA PASSENGER TRAIN NO. 60
MILE 301.4, KINGSTON SUBDIVISION
OSHAWA, ONTARIO
21 MARCH 1996

REPORT NUMBER R96T0095

Canada

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The *Canadian Transportation Accident Investigation and Safety Board Act* provides the legal framework governing the TSB's activities.

The TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability.

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Railway Occurrence Report

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VIA Passenger Train No. 60
Mile 301.4, Kingston Subdivision
Oshawa, Ontario
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Synopsis

On 21 March 1996, at approximately 1250 eastern standard time, VIA Rail Canada Inc. train No. 60, travelling eastward at approximately 30 mph, derailed coach No. 3336 at Mile 301.4 of the CN North America Kingston Subdivision at Oshawa, Ontario. There were no injuries.

The Board determined that the derailment was caused by undetected slid-flat wheels on the No. 4 axle of coach No. 3336. Moisture had entered the disc brake actuator and frozen, causing the disc brakes to seize and preventing the wheels from turning for over 240 miles. Contributing factors included: a disc brake actuator design that did not resist moisture intrusion; inadequate supervision of mechanics to ensure that instructions with respect to draining disc brake actuators were followed; inadequate inspection practices/equipment to detect slid-flat wheels; and the lack of emphasis placed on safety inspections of passenger train brakes.

Ce rapport est également disponible en français.

1.0 Factual Information

1.1 The Occurrence

VIA Rail Canada Inc. train No. 60 (VIA 60) departed Union Station, Toronto, Ontario, Mile 333.8 of the CN North America (CN) Kingston Subdivision at approximately 1200 on 21 March 1996, destined for Central Station in Montreal, Quebec. As VIA 60 approached Guildwood Station (Mile 321.2), the train crew felt that the train was handling normally. Upon departure from Guildwood Station, the train crew noted that the train was jerking. The conductor then walked through the train and checked the hand brakes on the cars and found them all in the release position. The train crew then decided to test the brakes while stopped at Oshawa Station (Mile 302.2). At Oshawa, the locomotive engineer applied the brakes and released them. The conductor walked the station platform and determined that the brakes applied and released as indicated by the lights in the side of the car. He did not inspect the wheels or visually confirm the brake application and release. When they departed Oshawa, the locomotive engineers believed that the train was handling normally. At approximately 1250, as VIA 60 slowed to pass over the crossover at Mile 301.4, the locomotive engineer requested permission from a track maintenance foreman working in the area to pass through his work limits. After VIA 60 passed over the crossover, the work crew observed a derailed truck and issued an emergency radio broadcast. The locomotive engineer responded and immediately made an emergency brake application to stop the train.

After conducting the necessary emergency procedures, the crew determined that the leading truck (No. 3 and No. 4 wheel sets) of the first car behind the locomotive, Light, Rapid, Comfortable-2 (LRC-2) coach No. 3336, had derailed.

The tread surface of each wheel of the leading wheel set (No. 4 location) of coach No. 3336 had a 15½ -inch flattened area.

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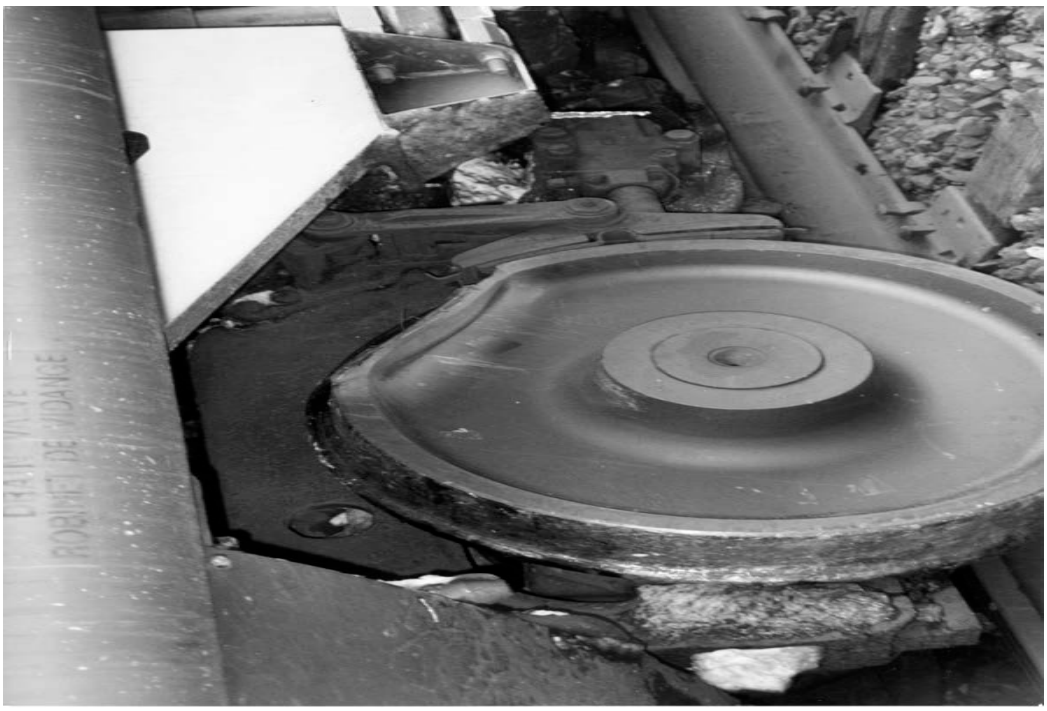
[1] All times are eastern standard time (Coordinated Universal Time (UTC) minus five hours) unless otherwise stated.



Passengers from coach No. 3336 did not detrain but were moved into the trailing coaches. Coach No. 3336 was uncoupled from the train and VIA 60 continued on to Montreal.

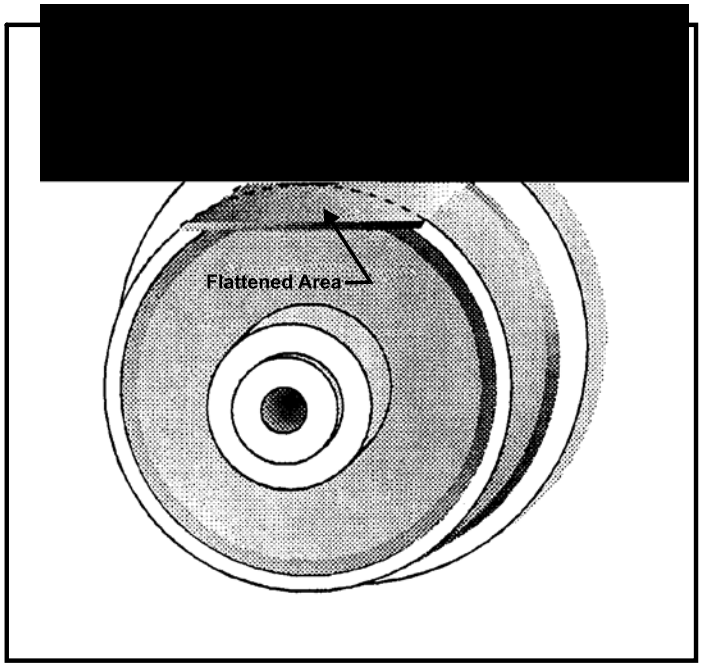
1.2 Injuries

There were no injuries as a result of this derailment.

1.3 Damage

1.3.1 Equipment

Damage to rolling stock included extensive damage to the No. 4 wheel set on coach No. 3336.



1.3.2 Track

Approximately 1,500 feet of track was extensively damaged in the area of Mile 301.4. The hot box and dragging equipment detector (HBD) heat sensors, located next to the ball of both rails at Mile 305.0, were destroyed.

1.3.3 Wheel Flange Marks

Wheel flange marks were evident along the gauge side splice bars and frogs along three subdivisions: the Dundas Subdivision (Mile 37.6 to Mile 0.0), the Oakville Subdivision (Mile 36.9 to Mile 0.0), and the Kingston Subdivision (Mile 333.8 to Mile 301.4), a total distance of over 240 miles.

1.4 Personnel Information

The operating crew consisted of two locomotive engineers, a conductor and an assistant conductor. They were qualified for their respective positions and met fitness and rest standards established to ensure the safe operation of trains.

Five on-duty on board service employees were positioned throughout the train.

1.5 Train Information

VIA 60 is a regularly scheduled passenger train operating from Toronto to Montreal. On the day of the derailment, it consisted of one locomotive, VIA No. 6411, LRC-2 coaches Nos. 3336, 3339 and 3316, LRC club car No. 3464 and baggage car No. 8618. There were 260 passengers on board the train when the derailment occurred.

The same consist had operated as VIA train No. 70 (VIA 70) from Windsor to Toronto (224 miles) and had been "laid-over" at Windsor Station during the night of 20 March 1996 after arriving from Montreal.

1.6 Particulars of the Track

In the derailment area, the subdivision is double main track and handles both passenger and freight traffic.

The authorized timetable speed is 100 mph for passenger trains and 60 mph for freight trains. The maximum permissible speed for trains travelling over the crossover at Mile 301.4 is 45 mph.

1.7 Method of Train Control

Train operations from Mile 332.6 to Mile 52.4 are controlled by the Centralized Traffic Control System authorized by the Canadian Rail Operating Rules and supervised by a rail traffic controller (RTC) located in Toronto.

1.8 The Weather

The temperature at the time of the derailment was minus three degrees Celsius, the winds were calm and the skies were clear. Between 20 March and 21 March 1996, the temperature had not risen above the freezing point in the Toronto-Windsor area.

1.9 Recorded Information

The event recorder transcript indicated that the speed was 30 mph, with the throttle in the No. 8 position, when the operator initiated the emergency brake application at a time of 1236:34. At a time of 1224:31, the train was travelling at a speed of 91 mph.

A review of recorded data from HBDs located at Mile 330.3, Mile 320.4 and Mile 305.0 revealed that there were no abnormal wheel bearing temperatures or dragging equipment as the train passed these locations. The HBD at Mile 305.0 was not triggered by the slid-wheel condition and the bearing temperature sensors registered only the locomotive before they were destroyed. The employee monitoring the HBDs interpreted the reading at Mile 305.0 as representing the passage of a Hi-rail vehicle. The system did not identify the device as having been rendered inoperative.

1.10 Other Information

1.10.1 The Air Brake System

The LRC-2 coach air brake system is comprised of both disc brakes and wheel tread brakes. Two disc brake assemblies (rotors and calipers) are mounted on each axle and each wheel is equipped with wheel tread brakes. Each disc brake and wheel tread brake is activated by a separate brake actuator. Both the disc

brake actuators and the tread brake actuators use hydraulic pressure to apply braking force. A hydraulic-pneumatic converter controls the four actuators located on each wheel set (four hydraulic-pneumatic converters per coach). The hydraulic-pneumatic converters provide the means to convert air pressure to hydraulic fluid pressure. Unlike the tread brake actuators, the disc brake actuators are not visible or easily accessible from either side of a coach.

The No. 4 wheel set was changed at the derailment site. The change-out required a release of all brakes at the No. 4 location. It was noted that the tread brakes released as expected; however, both disc brakes were seized and did not release. The hydraulic lines were removed to relieve the pressure; however, the brakes still did not release. The disc brakes were forcibly released by the use of a wedge and hammer.

An examination of the No. 4 hydraulic-pneumatic converter revealed that the breather vent, which is threaded onto the top of the converter, was missing, leaving a 10-millimetre-diameter opening. The breather vent is designed to prevent water ingress while allowing air to pass through.

On 25 March 1996, the bottom drain plugs on the two disc actuators and the two tread actuators on coach No. 3336 at the No. 4 location were removed and accumulated water was drained. The following amounts of water were found in the respective reservoirs:

Location	Actuator	Amount of water
R-4	Tread	57 ml
L-4	Tread	28 ml
R-4	Disc	57 ml
L-4	Disc	57 ml

On 25 March 1996, the actuators at the No. 1, No. 2 and No. 3 locations on coach No. 3336 were also drained; there was no accumulation of water found in their reservoirs.

1.10.2 Recurrent LRC-2 Brake Problems

On 28 December 1995, VIA 70 departed Windsor Station at 0600. At 0755, approximately one mile east of London Station, London, Ontario, and 108 miles from Windsor Station, the crew set-off LRC-2 coach No. 3304 after discovering a nine-inch slid-flat wheel. There were four train crew members and 442 passengers on board. VIA concluded that water entered into the disc actuators and froze, seizing the disc brakes. It is not known if the breather vent on the hydraulic-pneumatic converter was missing as it was not checked.

On 21 March 1996, VIA train No. 81 (VIA 81) departed London Station at 0645, and at 0715, 30.8 miles from London Station, LRC-2 coach No. 3321 was set-off after a six-inch slid-flat wheel was discovered. There were four train crew members, five on board service personnel, and 143 passengers on board. Samples taken from two of the disc brake actuators contained approximately 30 ml of water each. The breather vent on the hydraulic-pneumatic converter was not missing. This car had been released to service after scheduled maintenance, known as an "E Inspection", at the Montreal Maintenance Centre (MMC) on 23 February 1996.

1.10.3 Service Bulletin

As a result of prior problems with water entering the LRC-2 hydraulic brake system from an undetermined source, VIA issued a notice on 12 January 1996 (VIA file No. 4902-12-11). The notice stated that:

> The following preventive action should be taken for each LRC-2 car while in the MMC Maintenance Shop for inspection or repair:
>
> > At each tread and disc actuator (total sixteen per car), with the car brakes released, open the bottom plug and drain approximately two ounces of liquid, or until clean brake fluid flows from the plug opening. Do not use the side plug for this purpose; use the bottom plug to ensure that as much water as possible is drained from the actuator.

The notice was circulated to VIA maintenance management and maintenance supervisors who verbally informed the mechanics.

On 24 January 1996, VIA issued an *Equipment Maintenance - Service Bulletin* (No. C-083). It stated:

> Effective immediately and until further notice the following preventive maintenance must be completed on each LRC-2 car while in a Maintenance Centre for repairs or scheduled maintenance.

At each tread and disc actuator (total 16 per car), with the car brakes released, open the bottom plug and drain approximately 57 ml (2 oz) of liquid or until clean brake fluid flows from the plug opening. Do not use the side plug for this purpose; use the bottom plug to ensure that as much water as possible is drained from the actuator.

This bulletin was circulated to VIA maintenance management and maintenance supervisors who verbally informed the mechanics of the new requirement.

1.10.4 Scheduled Maintenance

An "E Inspection" is performed on LRC-2 coaches at the MMC every 90 days. The last scheduled maintenance for coach No. 3336 was performed just a few weeks before the derailment, on 08 March 1996. MMC records indicate that the tread brake actuator at the R-4 location was replaced at this time. Coach No. 3336 successfully met all maintenance requirements when released to service.

Maintenance Program work reporting sheets are maintained when a car undergoes regularly scheduled maintenance. The sheets are detailed listings of tasks required to be performed during scheduled maintenance. Once a task is complete, employees record relevant details (i.e., "work to do", "work done") with their initials. The new procedure to drain the actuators was not included on the reporting sheets. The reporting sheets for coach No. 3336 did not include any record of having had the brake actuators drained.

1.10.5 Wheel Set Repair History of LRC-2 Coach No. 3336

VIA records indicate the following:

DATE	MAINTENANCE CENTRE	DEFECT
26 January 1996	Toronto	No. 1 wheel set bad ordered*
07 February 1996	Toronto	No. 4 wheel set bad ordered - tread grooved
24 February 1996	Toronto	No. 3 and No. 4 wheel sets bad ordered*
17 March 1996	Montreal	No. 4 wheel set bad ordered*

* The nature of the defects was not recorded.

1.10.6 Management Control System

Of all unsafe acts and conditions attributable to maintenance personnel and procedures, omissions are the most common. Maintenance activities most vulnerable to being omitted include repetitive tasks and the implementation of new procedures.

Taking time to develop task procedures and practices for the critical work activities will save a great deal of time in the long run. They provide carefully thought out guidance, based on the best available knowledge, of how to do critical tasks in the most efficient way.

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2 Reason, James, personal communication, 10 May 1996

3 Frank E. Bird and George L. Germain, *Practical Loss Control Leadership*, 2nd edition (Loganville, Georgia: International Loss Control Institute, 1995), page 163

When new procedures are developed for the maintenance of a complex vehicle, such as an LRC-2 coach, it is important to ensure that the work is performed in accordance with acceptable standards. Developing a standardized approach and effectively communicating this standard to heavy-duty mechanics will ensure that:

a. the mechanics are aware of the new requirements;

b. the mechanics or their supervisors stipulate how and where in the process the new procedures are o be implemented;

c. all mechanics have the necessary tools, knowledge, and time to perform the procedure; and

d. effective measures are introduced to ensure that the mechanics perform the procedure in ccordance with relevant standards.

When it became apparent to the VIA management that the actuator draining procedure was being omitted, as the subsequent seized wheels demonstrated, the employees were not informed. Mechanics interviewed by TSB investigators were surprised to learn that there was evidence indicating the omission of the procedure. VIA employees asked for copies of the TSB photos of the flat wheels to use as a reminder and reinforce for themselves the importance of the procedure.

1.10.7 No. 1 Brake Test

The Transport Canada approved Railway Freight and Passenger Train Brake Rules require that:

> A No. 1 brake test shall verify:
>
> (a) the integrity and continuity of the brake pipe;
> (b) the condition of the brake rigging on each car in the train;
> (c) the application and release of each car brake; and
> (d) that piston travel on each car is within limits.
>
> A No. 1 brake test shall be performed by a certified car inspector where a train is made up at a safety inspection location and while en route at the subsequent safety inspection location(s) designated by the railway company for that train.

The Railway Freight and Passenger Train Brake Rules define a certified car inspector as: "... a person who is trained and qualified to inspect and maintain car brake equipment." These rules do not outline the steps necessary to grant or obtain "certification." VIA has interpreted these rules to mean that its mechanics, on the basis of their experience and expertise, meet this definition.
A No. 1 brake test was successfully completed on VIA 70 in Windsor before departure to Toronto. Mechanics performing the No. 1 brake test on VIA 70 were not certified car inspectors as outlined by the Railway Freight Car Inspection and Safety Rules. In these rules, a certified car inspector is defined in the same manner as in the Railway Freight and Passenger Train Brake Rules, however it is outlined in the Railway Freight Car Inspection and Safety Rules that the training and qualification are pursuant to Section 5.1. Section 5.1 of the Railway Freight Car Inspection and Safety Rules indicates that:

> A railway company shall ensure that its car inspectors are trained and qualified to perform safety

> inspections of freight cars in compliance with these rules. Car inspectors must demonstrate to a railway company by means of oral or written examinations and on-the-job performance a knowledge and ability concerning safety inspection of railway freight cars. Car inspectors shall be issued a certificate attesting to the employee's qualifications.

This part of the Railway Freight Car Inspection and Safety Rules also outlines other aspects to qualify including the filing of a full description of the training program and criteria with Transport Canada, and records keeping and certified issuing requirements. The Railway Freight and Passenger Train Brake Rules are silent in these areas and, therefore, the employees' qualifications were not in conflict with these rules.

Transport Canada has been preparing similar rules for passenger cars. Work in this area was under way in the mid- to late 1980s, but it was not completed.

1.10.8 No. 2 Brake Test

The Railway Freight and Passenger Train Brake Rules require that:

> A No. 2 brake test shall verify:
>
> (a) the integrity and continuity of the brake pipe; and
> (b) the application and release of each car added to the train.
>
> A No. 2 brake test shall be performed by qualified persons when:
>
> (a) cars which have not been previously tested at that location are added to a train; or
> (b) the locomotive engineer has been changed.

A "qualified person means, in respect of a specified duty, a person who, because of his/her knowledge, training and experience, is qualified to perform that duty safely and properly."

Before departure from Union Station, a No. 2 brake test was successfully completed on VIA 60. The mechanics performing the No. 2 brake test on VIA 60 were "qualified persons"; however, they were unaware that the test was a Transport Canada requirement. The VIA management personnel were also unaware that this test was a requirement.

1.10.9 VIA Inspection Requirement

Under the direction of VIA's Layover and Turn Around (Run-through) Inspections, a mechanic at Windsor (Layover) is required to "inspect condition of wheel sets." This inspection was performed by mechanics at Windsor and no exceptions were noted.

Wheel sets are not specifically mentioned in VIA's Layover Inspection and Turn Around (Run-through) Inspection requirements for the inspection performed at Union Station; however, the inspection includes a "check for any fire or accident hazard found on the car." VIA equipment and management personnel were unaware of the Run-through inspection requirement at Union Station. Two mechanics did mention, however, in an interview that, while standing on either side of the track, they watched VIA 60 as it entered Union Station and did not notice anything unusual.

1.10.10 TSB Engineering Branch

Hydraulic brake fluid samples taken from the No. 4 disc brake actuators on 25 March 1996 were sent to the TSB Engineering Branch (report No. LP 62/96). The TSB Engineering Branch forwarded the samples to the National Defence Quality Engineering Test Establishment for analysis. The analysis revealed the following:

1. Microbial contamination was observed or suspected in all the samples due to the presence of an bnormally large quantity of water.

2. The amount of water and microbiological growth indicate that the water accumulation occurred ver an extended period of time, and was not just a random, recent introduction of water.

3. The presence of water in the brake system can cause various problems such as loss of power, resence of rust, premature wear or presence of ice at temperatures below the freezing point.

1.10.11 Slid-flat Wheel Condition

A slid-flat wheel condition develops when the axle is prevented from rotating and results in flattened area(s) of the wheel tread.

2.0 Analysis

2.1 Introduction

No rail defects or track geometry irregularities were evident in the derailment area. Neither inappropriate train operation nor track conditions caused or contributed to the derailment.

VIA 60 was travelling at 91 mph just 12 minutes before the emergency brake application. Derailment at such a speed could have resulted in loss of life and serious injury.

The analysis will focus on the development of the slid-flat wheel condition, the accumulation of water in the disc actuators, the brake tests, the implementation of the service bulletin, VIA's inspections and management quality control.

2.2 Consideration of the Facts

2.2.1 The Derailment

While VIA 70 had remained overnight in Windsor on 20 March 1996, in sub-freezing temperatures, water that had accumulated in the No. 4 disc actuator froze. The ice formation did not allow the proper operation of the disc actuator on the No. 4 disc brake, preventing the disc brakes from releasing and the No. 4 wheel set from turning. This resulted in the No. 4 wheel set sliding on the surface of the rail from Windsor to Union Station, and finally to Oshawa. As the wheels slid along the rail, the treads became progressively worn and the wheel flanges became progressively lower until they began contacting and damaging track components. A flange contacted the frog as the train passed through the crossover, derailing the wheel set and the truck.

Water in the disc brake actuators is believed to have migrated from the hydraulic-pneumatic converters. In this instance, water may have gained entry to the hydraulic-pneumatic converter through the unprotected breather vent opening (breather vent was missing), but such situations (the absence of breather vent) are believed to be rare. In most cases, water entry is probably attributable to snow build-up and subsequent melting around the breather vent, rain water being blown about the breather vent during service or condensation from air drawn into the hydraulic-pneumatic converter at each brake application.

Considering the laboratory analysis of the brake fluid, indicating that water had been in the brake system for a considerable length of time, and the relative recent and apparent first encounters with seized brakes attributable to the contaminated brake fluid, it can be concluded that the water build-up was gradual and eventually reached a point when, especially in freezing conditions, it interfered with the brake functions. It is apparent that either the design of the converter (i.e., open to the environment) or the location of the vent was inappropriate for the operating conditions. It is also evident that the scheduled maintenance program did not provide direction for the detection of water contamination of the brake actuator system although such contamination could have been expected given the location of the breather vent and the often adverse operating conditions.

2.2.2 Brake Tests

Although a No. 1 brake test was performed in Windsor, it is not surprising that the seized disc brakes

went undetected. The location of the disc brakes makes it difficult, if not almost impossible, for the mechanic to inspect their operation. In the No. 1 brake test, there is no specific mention of testing both the tread brakes and the disc brakes. Industry practice has focussed on the tread brake operation and not on the performance of the disc brakes. Had the mechanics been required to test the disc brakes, they would have found that they were not operating properly and they could have taken the appropriate action immediately.

2.2.3 Implementation of Service Bulletin No. C-083

When VIA issued the special bulletin, the mechanics performing maintenance or repairs on a coach were required to drain all 16 actuators. By conscientiously draining the actuators, the mechanics would ensure that water, which might have entered into the brake system, would be removed. This task was both new and repetitive and, therefore, vulnerable to omission. It is apparent that two disc brake actuators on coach No. 3336 (VIA 60) and two disc brake actuators on coach No. 3321 (VIA 81) were not drained at their last "E Inspection" despite new instructions to do so.

VIA maintenance management had verbally informed the mechanics of the new requirement and expected that it would be done properly. Apparently, the vulnerability of the work to inadvertent human error was not considered adequately in either the way the requirement was communicated to employees or the way in which implementation was planned. For example, neither the VIA notice of 12 January 1996 nor the Service Bulletin of 24 January 1996 included an explanation of the consequences of water entering the brake system to provide employees with the rationale and importance of the new procedure. Such explanation could have improved the effectiveness of the communication. Similarly, had the new task been incorporated into the Maintenance Program work reporting sheets, the mechanics would have had a reminder of the requirement to drain each actuator.

2.2.4 Wheel Repair Frequency

Between 26 January 1996 and 17 March 1996, coach No. 3336 was removed from service on four occasions for wheel repair. The No. 4 wheel set had drawn attention to the car on three of the four instances. It is considered highly likely that the car had experienced periodic seized disc

brake actuators which continually damaged the wheels during this time period. VIA maintenance procedures and car maintenance records did not identify this car as experiencing a continuing wheel problem. Such identification undoubtedly would have led to the discovery of the malfunctioning brake system.

2.2.5 VIA Safety Inspections of Passenger Cars

Although internal VIA inspection procedures are detailed in the Layover and Turn Around Inspections, both VIA management and mechanics did not fully understand the requirement. A brake inspection was required at Union Station; however, both VIA management and mechanics were not aware of this requirement and thus it was not done. Had a proper inspection been performed, the slid-flat wheel condition probably would have been discovered at Union Station.

The train-handling irregularities prompted the train crew to suspect a sticking brake. They were not, however, sufficiently concerned to visually inspect the running gear of their train. It is apparent that, in such a situation, a thorough visual inspection of wheels and brakes is warranted.

2.2.6 Transport Canada Requirements

The Railway Freight and Passenger Train Brake Rules indicate that a certified car inspector must be trained and qualified to inspect and maintain car brake equipment. It is obvious that they are viewed by the Railway Freight and Passenger Train Brake Rules as being trained and tested beyond the limits of "qualified" persons who are not sanctioned to perform No. 1 brake tests. The VIA inspectors in this occurrence were only required to be in compliance with the Railway Freight and Passenger Train Brake Rules.

Requirements for a certified car inspector to perform a No. 1 brake test are impossible for mechanics to meet as VIA does not require its passenger car mechanics to be certified car inspectors.

Mechanics working in the freight car industry require certification and are closely monitored by Transport Canada. However, at the time of the occurrence, there was no passenger car equivalent to the Railway Freight Car Inspection and Safety Rules. Work to develop such rules was under way in Transport Canada at least eight years ago. The investigation was unable to determine why this aspect of an industry transporting passengers was not monitored as closely as one transporting freight.

3.0 Conclusions

3.1 Findings

1. The leading wheel on the leading truck of coach No. 3336 derailed as a result of a slid-flat wheel ondition.

2. The disc brake actuator at the L-4 location had seized with the brake applied, preventing the No. 4 axle from turning.

3. Water, which had contaminated the brake fluid, froze in the disc brake actuator causing the nechanism to malfunction.

4. The wheel set slid on the surface of the rail for over 240 miles.

5. Although the breather vent on the No. 4 axle hydraulic-pneumatic converter was missing, water ntry into the brake system is likely attributable to normal operation of the equipment.

6. The design of the hydraulic-pneumatic converter was not suitable for the operating environment.

7. Scheduled maintenance did not provide for brake actuator hydraulic fluid water contamination hecks although such contamination could have been expected.

8. Brake tests and inspections did not reveal the slid-flat wheel nor the seized disc brake condition.

9. VIA had recognized recurring water contamination of brake actuators and seized brakes on LRC-2 oaches.

10. VIA issued a notice on 12 January 1996 highlighting problems connected with water entering the RC-2 hydraulic brake system.

11. Special Bulletin No. C-083 was issued on 24 January 1996 in recognition of the problems ssociated with water accumulation in disc brake actuators.

12. Mechanics were verbally informed by maintenance supervisors of the new requirements to drain vater from the brake actuators during scheduled maintenance or repairs. However, there was no explanation of he reason for the new requirement.

13. No written instructions were conveyed to the shop floor and the mechanics Maintenance Program work reporting sheets were not amended to reflect the new requirement to drain water from the brake actuators.

14. Transport Canada did not require passenger car mechanics to be certified car inspectors.

15. The VIA equipment and management personnel at Union Station were not aware that a No. 2 brake test was a Transport Canada requirement for VIA trains at Union Station.

16. The VIA equipment and management personnel at Union Station were not aware that Layover and Turn Around (Run-through) Inspections were a VIA requirement for VIA 60 at Union Station.

17. Train-handling irregularities did not prompt the crew of VIA 60 to conduct a visual examination of the train's running gear.

3.2 Cause

The derailment was caused by undetected slid-flat wheels on the No. 4 axle of coach No. 3336. Moisture had entered the disc brake actuator and frozen, causing the disc brakes to seize and preventing the wheels from turning for over 240 miles. Contributing factors included: a disc brake actuator design that did not resist moisture intrusion; inadequate supervision of mechanics to ensure that instructions with respect to draining disc brake actuators were followed; inadequate inspection practices/equipment to detect slid-flat wheels; and the lack of emphasis placed on safety inspections of passenger train brakes.

4.0 Safety Action

4.1 Action Taken

4.1.1 Braking System Modification

This occurrence identified the limitations of the disc brake actuator design in resisting moisture intrusion. Therefore, VIA (VIA Rail Canada Inc.) implemented modification M-82622-B which requires the raising of the breather vent away from the converter top and the application of pipe sealant on the threads of both the extension adaptor and the breather plug. This is being implemented to improve the resistance of the breather to water ingress.

4.1.2 Draining Hydraulic Actuators

A notice and service bulletin were circulated to VIA maintenance management and maintenance supervisors. Verbal instructions were then given to the mechanics when they were initially informed of the new requirement to drain the hydraulic actuators. Since the derailment, VIA has included a sign-off sheet on their single car test reporting forms for the draining of all hydraulic actuators on LRC-2 cars.

4.1.3 Washing LRC-2 Trucks

VIA has prohibited the washing of LRC-2 trucks in order to reduce the potential for water ingress to the hydraulic actuators.

4.1.4 Roll-by Inspections

Since the occurrence, VIA has implemented a new procedure that requires a mechanic to perform a roll-by inspection of a train once a No. 1 brake test has been successfully completed. As the train is in motion when the roll-by inspection is performed, the inspector is able to see and hear the rotation or lack of rotation of the wheels. The procedure should reduce the potential for slid-flat occurrences.

4.1.5 Railway Passenger Car Inspection and Safety Rules

In early May 1997, the Railway Association of Canada submitted a draft of the proposed Railway Passenger Car Inspection and Safety Rules to the Minister of Transport. Part of the submission has addressed the requirement for the passenger car inspectors to be certified. As of February 1998, when these rules are scheduled to come into effect, all passenger car inspections will have to be conducted by a certified car inspector.

4.1.6 Air Actuator Brake System

VIA is currently in the process of replacing the oil-actuated brake system on its LRC fleet with an air actuator brake system. It is anticipated that this conversion will eliminate all possible occurrence of wheel lock-up in service due to the causes outlined in this report. This is a very progressive initiative and should enhance the reliability of disc brake actuators in VIA's LRC-2 trucks.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 5 November 1997.