

Incident Summary #II-1691775-2024 (#45324) (FINAL)

SUPPORTING INFORMATION	Incident Date	March 29, 2024	
	Location	Vancouver	
	Regulated industry sector	Amusement Devices - Amusement ride	
	Impact	Qty injuries	0
		Injury description	N/A
	Damage	Injury rating	None
		Damage description	The bogey wheels and carriage frame on a miniature train car derailed, turned sideways, and dragged across tracks for approximately 30 feet damaging several track ties and the brake linkage on the bogey as a result of the impact.
		Damage rating	Minor
	Incident rating	Minor	
Incident overview	A train car designed for wheelchair accessibility, derailed on a rideable miniature railway amusement attraction while the train was being put away at the end of the day without any passengers riding on it.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>The miniature railway amusement attraction was designed, built, and opened to the public in 1964. The railway consists of a 20" wide narrow-gauge track that winds approximately 2 kilometers through the forest in the city park. The railway incorporates gasoline engine powered locomotives which tow up to 5 passenger carrying cars that can hold up to 70 passengers combined. One of the cars is specially designed with a platform and accessibility ramp which allows patrons in wheelchairs to board and ride the train.</p> <p>The miniature train is a regulated amusement device that must meet the requirements outlined in the adopted CSA Z267 <i>Safety code for amusement rides and devices</i>. The code outlines requirements for owner/operator responsibilities including:</p> <ul style="list-style-type: none"> • Implementation of a program of maintenance, testing and inspection. • Training for each person performing regular maintenance and inspections. • Emergency procedures in the event of abnormal conditions or interruption of service. <p>Railway tracks are a dynamic system that can change with environmental conditions such as drainage, heat from the sun causing linear expansion, vegetation such as trees and tree roots, and track wear due to age and operation. The tracks need to be regularly inspected and maintained to ensure they remain within the allowable tolerances for safe operation. The narrow-gauge tracks must remain clear, level and within 1/4" tolerance from their designed width. A track gauge measuring tool is used to walk the track and measure for tolerances. If areas of the track are found to be outside allowable tolerances, they should be repaired by a professional railroad contractor prior to the train being put into operation.</p> <p>Train operator employees must review a training manual and pass a written test before working with the railway. The railway Sub-Forman is responsible for the overall safety of the railway and the Operating Engineers are responsible for the safe operation of their trains. A daily safety check is required to be performed prior to</p>	

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	<p>operation that uses a checklist including walking of the track to inspect track conditions and looking for obstacles, obstructions, and defects.</p>
<p>Failure scenario(s)</p>	<p>The railway was last operated for a seasonal light display event between November 2023 and January 2024. After the train had shut down for the season, work began on the refurbishment of the accessibility train car. The work included installation of a new platform and folding wheelchair ramp designed by the manufacturer and new bogey wheels to replace the older worn wheels.</p> <p>Between October and November 2023 several trees were removed in the park to eliminate hazardous and standing dead trees infected by a previous moth infestation. Three trees were removed in the area of the track where the derailment occurred. The removal of the trees allowed sunlight to reach the track rails and another larger tree close to the rails with roots that traveled underneath the tracks.</p> <p>The weather during the days prior to the incident was very rainy with 40mm of precipitation falling in the area. The day of the incident, the weather had cleared, and was sunny and warm. The water saturated ground along with the growth of the tree and its roots from the newly exposed sunlight and linear expansion of the track from the direct sunlight exposure all created a section of track on a slight curve that was unlevel and out of width tolerance.</p> <p>Before train operation on the day of the incident the track was walked by employees to inspect for obstacles, debris, and track conditions. The track measuring gauge was not used, and the out-of-tolerance section of track went unnoticed. The track gauge used to inspect the track tolerances was not operational and had not been used in some time.</p> <p>The accessibility train car was refurbished in December 2023 and had a total of 9.5 hours of run time testing without incident before its first day of public operation on March 29th. During the public operation, the locomotive engineer noticed a “dragging” feeling multiple times when driving the train around a section of the track. The source of the dragging feeling was not inspected, and the train was continually used throughout the day carrying passengers. At the end of the day the engineer was driving the train to its storage location without any passengers on board at a higher rate of speed than when carrying passengers. When the accessibility car positioned at the end of the train passed over the out-of-tolerance area of track, the added weight of the accessibility ramp on the outside of the car, the tight tolerances of the new unworn bogey wheels, and the track that was unlevel and too narrow, caused the bogey wheels under the accessibility ramp to come off the track and the bogey to turn sideways dragging the wheels approximately 30 feet (10M) along the track damaging several rail ties and the bogey air brake line.</p>
<p>Facts and evidence</p>	<p>Track inspection and maintenance manual:</p> <ul style="list-style-type: none"> • Track structures are dynamic systems and require inspection and maintenance to minimize unforeseen risks. • The track should be inspected at least once per month by an employee with knowledge of the dynamic track structure. • Standard track gauge is 20” wide measured between the rails. • The gauge cannot be any tighter than 19.75” and no wider than 20.25” • Some things that may affect the condition, level, and alignment of the track are environmental conditions like the sun heating the rack and causing expansion, and vegetation such as trees and tree roots. • Adequate drainage must be maintained at all times.

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- Rail joints bars must have tight bolts and not allow excessive gaps or movement.

Manager and Sub-Foreman statements:

- The accessibility car had just been refurbished with a new folding loading ramp for wheelchairs and bogey frame and wheels.
- It had been raining for the two days prior to the incident, but the day of the incident was sunny and warm.
- Three trees had been removed from the area of the derailment earlier in the year which allowed more sunlight into the area of the track and the existing surrounding trees then previously experienced.
- During the time of the incident the locomotive was towing three cars with the accessibility car connected at the end of the train.
- The track was walked by employees the morning of the incident.
- The track gauge was heavy, difficult to use, and not functioning properly to accurately assess the track width and level and it had not been used in some time.
- On multiple instances on the day of the incident, the train engineer notices a feeling of the train “dragging” in the area of the track where the derailment occurred.
- Operation of the train continued for the day without investigation of the “dragging” feeling.
- The train does not have a speedometer but is operated at a speed based on engineer experience to align the ride with automated audio recordings played for the passengers.
- When the train was being operated at the end of the day without passengers it was travelling at a higher rate of speed than when passengers were on board.

Operating engineer statements and report:

- The area is known by operators to be sensitive to environmental events.
- Inspection of the area of track after the incident found an area of the track measured 19.5” in width which is ¼” narrower than allowable.
- The bolts on one track joint were found to be loose.
- A visible depression was observed in the track at the area of the derailment.
- A rail contracting company inspected, re-leveled, and re-aligned the affected section of track after the incident.
- After the area of the track was inspected and repaired after the incident, the train travelled over the area multiple times and the previously reported “dragging” feeling was no longer present.

Historical weather data

- From March 26-28 the total precipitation for the area was recorded as 40mm <https://vancouver.weatherstats.ca/metrics/precipitation.html>

Causes and contributing factors

It is very likely that the train being operated with a combination of track conditions out of specifications, new unworn bogey wheels, and unloaded train car orientation and speed caused the derailment.

Contributing factors to the track conditions include:

- The removal of trees in the location of the derailment allowed sunlight to warm the track causing linear expansion as well as allowing quicker growth of the existing trees and the tree roots passing under the area of track.

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- The recent wet weather contributing to the softening of the ground.
- The improper functioning track gauge and difficulty of use leading to no identification of the improper track conditions or potential repairs of maintenance before train operation.

Contributing factors of the train operation include:

- The train being continued to operate without inspection and repair of the issue after the engineer noticing a continued feeling of “dragging” at the same location of track.
- The accessibility car being placed at the end of the train with the loading ramp weight hanging on the outside of the car.
- The train being operated at a higher rate of speed with the cars unloaded while being put away at the end of the day.
- The new bogey wheels combined with the tight tolerances at the location of track.



Image 1 – The accessibility car jacked up and the derailed bogey.



Image 2 – The accessibility car ramp folded up adding extra weight to the outside of the car.



Image 3 – Accessibility ramp unfolded at the loading station.



Image 4 – Area of track where the derailment occurred after repairs, realignment and releveling completed by rail contractor.



Image 5 – Stump from one of the three large trees removed from the area allowing much more sunlight into the area.



Image 6 – Chance track gauge in use after it was repaired after the incident.



Image 7 – Track gauge with arrow showing needle indicating track width and tolerances.