Incident Summary #II-1748898-2024 (#50469) (FINAL)

SUPPORTING INFORMATION	Incident Date		August 13, 2024
	Location		Kootenays, BC
	Regulated industry sector		Amusement Devices - Amusement ride
	Impact – Injury	Qty injuries	2
		Injury description	Rider #1 – Concussion, 5cm bump, bruising and hematoma. Rider #2 - Whiplash, headache and soreness in hips.
		Injury rating	Moderate
	Impact – Damage	Damage description	N/A
		Damage rating	None
	Incident rating		Moderate
	Incident overview		Several coaster carts operated by individual riders were on a mountain amusement track which allows the customer to travel up to 40-50 kph. One individual stopped their cart at the start of the braking area as required, but the second rider did not apply their brake and collided into the first at full speed resulting in injury to both individuals.
INVESTIGATION CONCLUSIONS	Site, system and components		The mountain coaster (toboggan) installed in 2016 is an amusement device where a rider sits on a cart that travels down a set course attached to a rail. Used in the spring, summer and warmer fall they are stored over the winter. They are powered by gravity and the operator controls the deceleration and stopping with a hand lever brake. There are two mountain coaster tracks at the resort. Both tracks are 1.4 km in length that take patrons for a downhill ride of twists and turns across ski runs on a single-track that drops 279 vertical meters (915 feet) over 1.4 km (0.87 miles), between glades and through a tunnel at up to 42 kilometres per hour. The ride duration is between 2.45 – 4 minutes. **Seat Design** The ride seats have a lap belt and can be equipped with a low cushioned backrest but no head rest for this model (Image 4). Head rests are a feature on other models from the same manufacturer. **Ride details and operator restrictions** Warning on the website and on signs around the ride entrance have several restrictions listed. For example, “no smoking or intoxication is permitted while riding”. However, no warnings are observed specifically for operations at ride the location regarding medications or other concerns that may causing drowsiness or impaired faculties.

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This is a “family-friendly ride” that allows the rider to control their own speed which makes it “ideal for people of all ages” however, to ride alone you must be at least 4'1" or taller and at least 7 years old. Other children can ride with parents.

Cart Components

- The cart is equipped with a lap belt. (There is no shoulder belt preventing forward motion).
- A control/brake handle is between the rider’s legs that the rider uses to control the speed of the cart with a brake. This function is a slightly different stretch for pulling and pushing for a smaller framed child than it is for a larger adult.
- The rider pushes the handle forward to release the brake and pulls the handle back towards themselves to apply the brake.
- The handle has a spring to automatically pull the handle if released by the rider, causing the brake to apply.
- The cart is powered by gravity and the speed is governed by a set of centrifugal brakes (safety speed limiting devices). These are in the wheels that travel on the rail.
- The rail has a single fin that acts as a guide for the cart adding appropriate side camber when cornering and keeping the cart upright on the rail.
- The single fin also acts as a friction surface for the cart’s handle operated brake.

At the end of the track there is a carpet strip for slowing the cart as you enter the brush braking band system that slows the cart down to a speed that is considered manageable by an operator but also allows the cart to be pushed forward to an area for the rider to unload.

The carts are spaced on the track by the operator stationed at the starting point. A timer (set to 20 second intervals) starts once a cart departs the starting point. The operator is presented with a red light until the 20 seconds has passed, then the light turns green, indicating the next cart can be sent.

Ride operation

Once on the track, the cart spacing is maintained by the rider using the brake. There is signage telling riders not to tailgate and to leave at least 40 meters between carts.

The spacing is also maintained by a series of speed zones in various locations with poorer lines of sight. As a cart travels through a speed zone, a set of lights turns red adjacent to the track telling the next rider that there is someone in that zone. Once the first cart passes a second set of sensors exiting the zone, the light turns green, signaling to the second cart that the zone is clear.

At the bottom of the track prior to the brush braking band, there are a series of signs (Image 1 & Image 2) telling the rider that they are approaching the end of the track and to slow down.

Then signs (Image 2) tell an exact distance to the brush braking band and indicate it is time for the rider to actively brake the cart. However, final signage at finish says push lever forward, which is the opposite of previous signage coming into the area (Image 3).

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	Centrifugal Braking: A maximum speed of 42kph will be managed by a pushing the brake lever forwards causing the cart to accelerate, and pulling it backwards brakes the cart. **Ride attendant training and procedures** The ride attendants employed by the resort receive training and follow written procedures to ensure safe operation of the ride. The training and procedures include rider orientations, rider suitability, and monitoring for overspeed and weather conditions and stopping the operation of the ride if any concerns are identified. **Signage** It is noted that just because signage exists does not mean the rider understands requirements for distance and breaking or has the ability should the weather change. **Communication** Operators have no communication with riders on track. **Manual Override** No manual override exists to assist with breaking should someone be incapacitated or unable to operate the centrifugal breaking.
Failure scenario(s)	In 2016, the mountain resort added a mountain coaster to its summer attractions. They retained a professional to complete the required engineering review for the design registration with the BC Safety Authority. The engineer reviewed the overall ride design, structural and mechanical component design, and operation and maintenance documents. An important aspect of this assignment was the review against applicable safety codes. They also provided an acceptance testing procedure and completed the acceptance test prior to the ride's opening. On the morning of the incident the weather at the resort was overcast but dry. A parent and child received the orientation and training from the resort workers. The child met the minimum requirements of age and height to ride the coaster alone. The parent and child rode the mountain coaster about seven times that day prior to the incident. At the beginning of the last time down the coaster the weather changed, and it began to rain. The operators allowed the riders to continue using the coaster during the changing weather conditions. The parent was the first rider down the track followed by the child. The parent noticed that the brakes became less effective on the wet track. When they got to the bottom of the track they came to a stop at the beginning of the brake band. The child had difficulty seeing while traveling in the rain and their hands became slippery on the brake handle. When they reached the end of the track, they did not apply the brakes and collided at nearly full speed into the parent in front of them who had come to a complete stop. The carts did not have full back support, or a head rest and the collision caused the parent, who was hit from behind, to received whiplash to their neck and hip and shoulder soft tissue injuries. The carts only had a lap belt and no upper body restraint, and the collision caused the second rider, an eight (8) year old child, to

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	strike their head on the top of the brake lever of the cart which is located between the legs and experienced an injury to the head and face from the impact with the brake lever.
Facts and evidence	Resort training is designed to address operational procedures in compliance with CSA Z267.00 and the manufacture's set limitations. **Visual Warnings** Warning systems and signage for riders was in place and functional throughout the track which include: • Warning lamps when distance is closing on a fellow rider. • Posted signage SLOW, SEAT BELT, BRAKE, NO STOPPING etc. (Image 6). **Site Observations** • The cart seats do not support the upper back, neck or head. The carts have a lap belt but no restraint above the waist to prevent a person's body of a certain size from extending past riding position to protect the face or head from striking the brake lever handle which sits between the legs (Image 7). • Although minimum restrictions were met for rider age and size. The minimum size of the child who collided from behind at full speed was such that allowed the child's head to contact the breaking stick between the legs. **Verbal warnings and Instructions** Riders are given a scripted speech by the ride attendants prior to riding the device, points covered in speech include: • Push forward to go, pull back to brake. • No stopping on track. • Stay 40 m apart from other riders. • Keep your seatbelt on, arms and legs inside the cart. • Obey all signage, if a caution sign is flashing then slow down. • Please slow down when entering the brushing system at the bottom. • Please stop at the attendant where they will remove your seatbelt. **Training for Attendants** Standard Operating Guidelines: **PURPOSE:** Coaster Attendants must operate the coaster safely during poor weather conditions. **RESPONSIBILITY:** All lift/coaster operations personnel. **GUIDELINE:** 1. Ensure speed monitoring components are in place and functioning properly. • Speed monitoring components are to be checked by lift maintenance during line check in the morning. 2. Know the safe operating parameters for the coaster, including max speed and weather restrictions.

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- Water on the track can allow the carts to travel at speeds greater than the designed limit of 42 km/hr. all coaster operations must halt during these times.
- The Mountain Coaster may need to be suspended temporarily or closed during rain, snow, thunderstorms, lightning or high winds. The Mountain Coaster will reopen as soon as safe operations can be assured.

3. Know the importance of regularly monitoring the track.
   - Operators are to continually monitor the track to watch for over speed issues relating to weather conditions.
4. Observe signs of changing weather. Contact lift maintenance if concerned.
5. Stop loading passengers if at all concerned about weather conditions.
6. Refrain from loading passengers if red traffic light flashes on the speed monitoring system, this indicates an over speed.
7. Obtain assistance from your supervisor or maintenance personnel if necessary.
8. Cease loading and clear the line if directed to do so by your supervisor or maintenance personnel.

Wet Track Braking Results from Acceptance Test 2016 - same model/conditions

- The dry average distance for stopping was measured at 6M. The wet average distance for stopping was measured at 25M.
- The weight and size of riders had very little factor to braking distance on average.
- Riders are given warning at 50 M to stop ahead.

Statements

Operator statements:

- Rain started 3 -5 minutes before the riders started their last ride.
- The first rider stopped their cart at the start of the brush braking band when they reached the bottom of the ride.
- The second rider who was behind them came flying down at full speed and didn't brake at all colliding with the first rider.
- Both riders had successfully ridden the device 7 times that day prior to the incident that took place at approximately 14:00.

Rider one (1) adult statements:

- Rain started approximately 45 seconds into the run, about mid track according to Rider one (1).
- After several repetitive rides completed over the day, rider one stated they had been "quite confident", and they stated operating "faster for longer times" especially the last rides. Their child was operating the ride behind the parent and was "not able to maintain the distance and collided at full speed".
- Was stopped in an active area of the track long enough to be impacted by second rider. "No emergency-stop after impact, kept moving for what seemed like 20 feet".
- Rider two (2) told his parent that they "couldn't see because of the rain and grip the wet brake".
- Rider one (1) was able to break requiring more force than previous rides that day due to the wet track.
- Wasn't allowed back cushion on last ride.
- At no time were the riders told the ride would be affected by rain or what track changes could be like.

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	Rider two (2) statements: • I couldn't see well, and my hands were slippery on the handle and then I hit the back of the cart. **Rider Fitness Criteria** Resort policy and preload signage states that children under 8 years old are prohibited from using a cart alone and must be a minimum of 4'1" tall". Rider two (2) met the conditions set out as he was 8 years old and 5'2" tall and met the minimum physical resort criteria to be a solo rider. All riders must be able to judge distance and decipher signage.
Causes and contributing factors	The failure of the second rider to correctly apply the brake caused the collision between the riders resulting in injuries. Contributing factors to the incident include: **System design** • Safe braking operation is solely reliant on the performance of the rider and does not include any engineered controls to prevent collisions in the event of human error. • The carts do not have headrests to support the upper back of neck from potential collision injuries • The seatbelt lap strap does not restrain the upper body to prevent injuries from a collision. • Although minimum restrictions were met for child rider age and size. The minimum size of the child who collided from behind at full speed was such that allowed the child's head to contact the braking stick between the legs. **Weather** • The ride was not shut down due to changing weather and rain as outlined in the training for ride attendants allowing the riders to continue in wet track condition. • The rain and wet track conditions caused reduced braking of the carts. • The rain caused limited rider visibility and ability to apply brake force to the brake handle. **Signage** • Clarity of signage at finish could be confusing as several signs say slow and brake and then accelerate signage at the finish which is meant to release drag for entrance into the unstrapping exit area but is not distinct from the release or accelerate signage to push controller stick forward.

Image 1 - Bottom of track approaching Brush Braking Band “SLOW!! 50m until end of track”.

Image 2 - Signage further downhill.

Image 3 - Final signage before Brush/Conveyor “Push Handle Forward” instructions for Brush Braking Band to function. Signage shows same signage which indicates push to accelerate at finish.

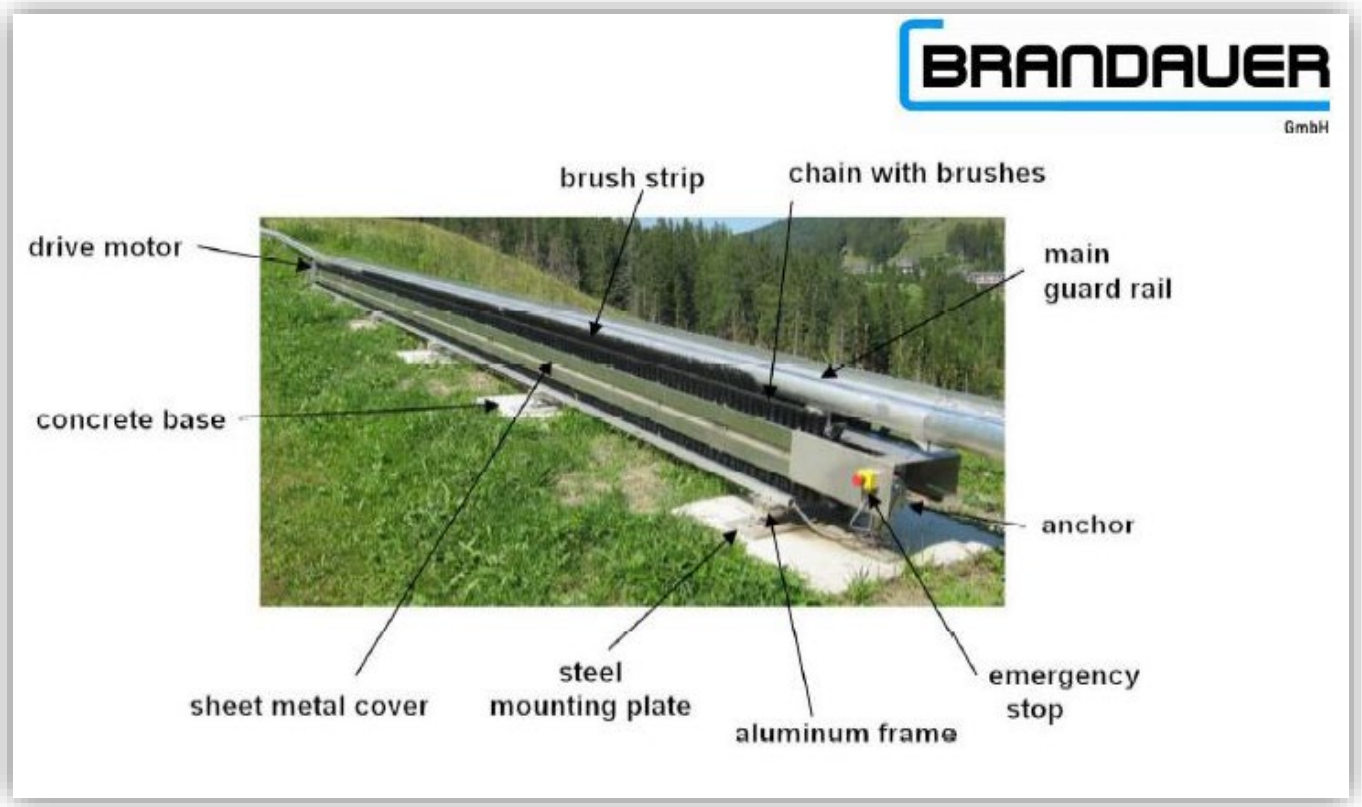

Image 4 – Brush band diagram from the manufacturer.

Image 5 – Seat showing no head rest (Below shows same manufacturer has design incorporating backrest.) Although backrest shown not every rider gets a backrest.

Image 6 – Warning signage before brush band.

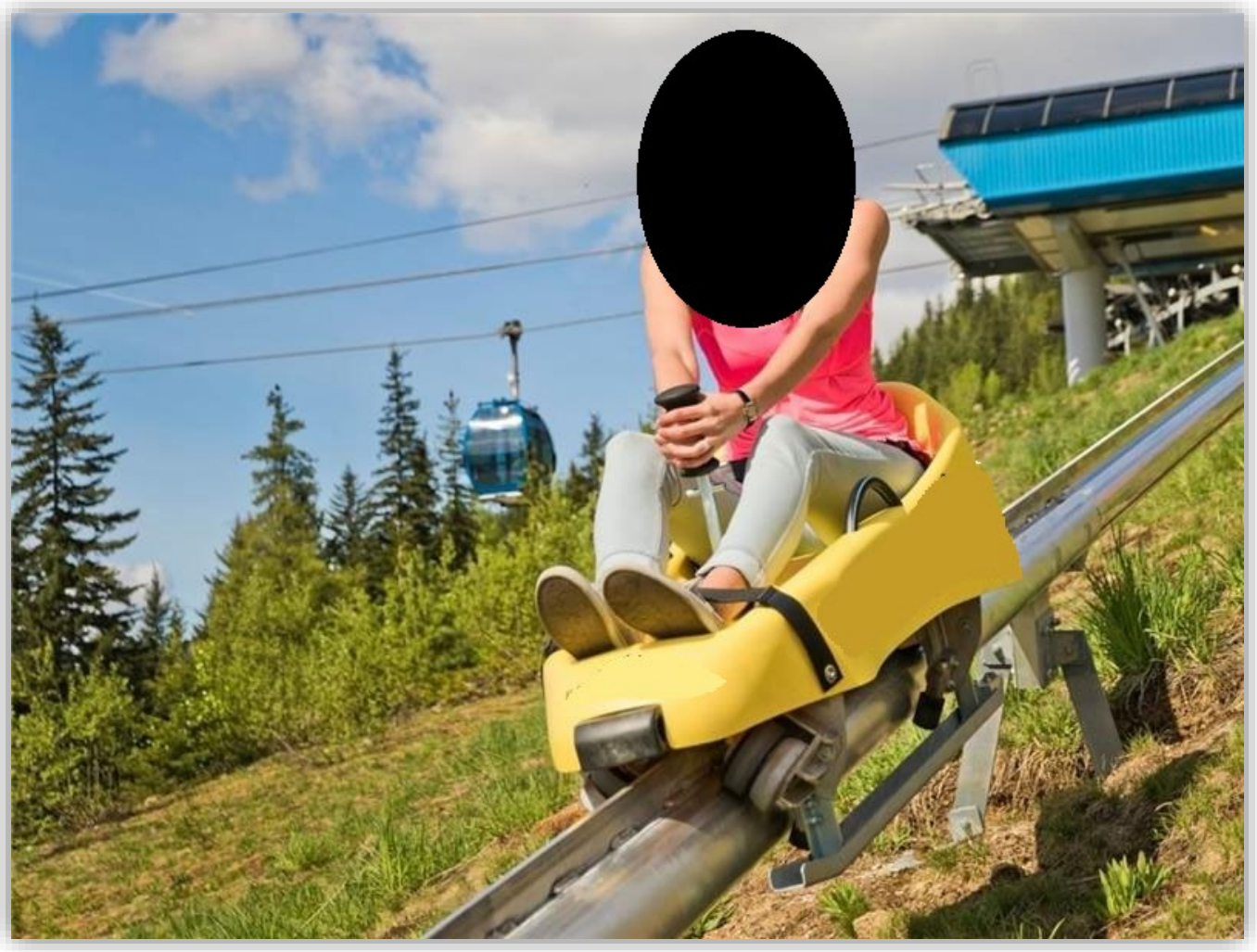

Image 7 – Adult Rider (Source: Sutton Hotels).