

MARINE OCCURRENCE REPORT

ACCIDENT ABOARD SHIP

ON THE PASSENGER FERRY "QUEEN OF COWICHAN"
HOWE SOUND, BRITISH COLUMBIA
21 SEPTEMBER 1995

REPORT NUMBER M95W0145

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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Summary

At about 1000, the "QUEEN OF COWICHAN" was approaching the ferry terminal at Langdale. Passengers, including a large number of teenage school children, were proceeding by escalators to the disembarkation point on the main car deck. Several children mistakenly left the escalator tower at the upper car deck level. When re-entering the escalator tower to continue down to the main car deck, they caused congestion at the foot of the upper escalator which caused several children to fall backwards on the moving escalator. One of those who fell cut her eyelid and nose on the escalator treads, her coat was pulled into the gap between the treads, trapping the fingers of one hand in the folds of the coat. A second child's clothing went between the treads and the side panels of the escalator which triggered the emergency shut down switch. The escalator stopped before causing more serious injury.

Ce rapport est également disponible en français.

¹ All times are PDT (Coordinated Universal Time minus seven hours)

Factual Information

Particulars of Vessel

Name	"QUEEN OF COWICHAN"
Port of Registry	Victoria
Flag	Canada
Official Number	370065
Type	RoRo Passenger/Car Ferry
Gross Tonnage	6551.18
Built	1976, Victoria, British Columbia
Owners	The Royal Trust Company of Montreal, Montreal, Quebec & British Columbia Ferry Corporation Victoria, British Columbia

The ferry "QUEEN OF COWICHAN" is a double ended vessel having a propeller and rudder at each end. The two ends are almost identical and, for identification, are numbered "1" and "2" by the Ferry Corporation.

There are three car decks, the "upper car deck," the middle "gallery deck" and the lower "main car deck." The upper car deck is accessed from the shore by way of the terminal's upper ramp system, which rests on the upper deck during loading and discharge. The terminal's lower ramp system, which rests on the main car deck during loading and discharge, gives access to both the main and gallery car decks.

At each end of the ferry is an escalator tower, in which there are three separate, reversible, escalators. One escalator runs between the passenger and the upper car deck, a second from the upper car deck to the gallery deck and the third between the gallery deck and the main car deck. The deck crew use keyed switches at each escalator to reverse the direction of the escalators for embarking or disembarking passengers. The escalators are stopped during the passage from terminal to terminal.

In each tower, there is a video camera at the top of each individual escalator. The six cameras are monitored in the engine room control room, but the camera positions do not give a clear view of the whole escalator system. Only the top landings of the escalators can be seen on the monitors when passengers are using the escalators. The television monitors are positioned above the control room office desk, but a partial bulkhead blocks them from the view of the engineer,

whenever only one engineer is present in the control room and is monitoring the main engines during the vessel's docking manoeuvres. At this time, the escalators are in use by the passengers who are going to their vehicles on the car decks.

At the upper and gallery deck levels, passengers have to make a 180° turn from the bottom of one escalator to the top of the next.

At the upper car deck level a waist high barrier is installed to separate the passengers going out to the upper car deck from those who are going round the corner to the head of the next escalator.

At the Horseshoe Bay Terminal, the ferry embarks foot passengers at the vessel's number "1" end, at the upper car deck level, over the terminal's upper ramp. At the Langdale Terminal, passengers disembark from the number "2" end at the main car deck level over the terminal's lower ramp.

On 21 September 1995, a party of approximately 200 Grade 8 Vancouver school students was en route from Vancouver to the Sunshine Coast for an overnight camping trip. Supervised by a few teachers and Grade 12 students, they were transported to the Horseshoe Bay ferry terminal by school bus. Most students carried a bag and a rolled up sleeping bag; some were also toting backpacks. The students boarded the ferry on foot at the upper car deck level; the school buses did not accompany them.

The ferry corporation provides a free service for hand baggage. Bags are transported from the terminal to the ferry and delivered to the terminal at the other end for pick-up. Unaware of the service, the students embarked and carried their baggage into the passenger area.

As the ferry was approaching the Langdale Ferry Terminal at 1000, an announcement to passengers was made over the vessel's public address system. Passengers were advised to proceed to the car decks and to the foot passenger disembarkation point. Unsupervised by the adult members of the school party, the students started out for the disembarkation point via the escalators.

In the escalator tower there is no sign indicating the upper car deck level. There is a small sign (275 mm square) on the door to the upper car deck which states "All foot passengers disembark on the main car deck." The sign does not indicate where the main car deck is to be found. With the exception of a graphic sign referring to the position of hands and feet when travelling on the escalator, signs in the escalator towers are in English text. Some of the students descended on the escalator from the passenger to the upper car deck. Instead of continuing down the next two escalators to the main deck level, they exited the escalator tower to the upper car deck, the level at which they had boarded. Ferry staff on the upper car deck redirected them to the escalator tower.

On re-entering the tower by the door, the students found that they were obliged to pass round the waist-high barrier while carrying their baggage. To do this they had to go against the flow of passengers descending the escalator from the passenger deck. The area quickly became congested, effectively blocking access to the next escalator to the gallery deck. The upper escalator continued to deliver passengers to the upper car deck level.

Students on the upper escalator continued to arrive at the upper car deck level but they could not continue downward to the next escalator. They started to fall over backwards near the foot of the still moving upper escalator.

About two-thirds of the way down the escalator, one student fell backwards and other students fell on top of her. In the fall she caught her face on the grooved treads of the escalator, badly cutting her eyelid and nose. She twisted onto her back but her coat became entangled in the moving treads. It was pulled into the gap between the front of one tread and the rear of the tread ahead. The fingers of her left hand were caught in the coat and trapped. Fortunately the escalator was stopped at this point either by clothing trapped in the side of the treads or by someone falling against the escalator sides; either event could have tripped the safety shut off switches.

The gap between the front and rear of the treads and between the treads and the side walls is approximately 4mm and this appears to be a safe dimension based on adult anthropometric data. In this case however the teenager involved had much smaller digits than the average adult.

About half way down the escalator, going to a car deck, were the only three adults in the tower, a man and two women. When the students further down the escalator started to fall backwards, a young girl fell against the first adult woman on the escalator. The woman's legs were lacerated by the treads. The back of the girl's coat, caught in the space between the moving treads, was pulled into the gap between the front of one tread and the rear of the tread ahead. Both the girl and the woman were effectively trapped by the time the escalator stopped.

The man began to clear a way to the bottom of the escalator to help the trapped girl there. He first released the trapped girl and the woman next to him by pulling the girl's coat free of the treads. Leaving them in the care of the second woman, he found that his way to the bottom of the escalator was blocked by a mass of fallen teenagers and baggage, intermixed.

To clear the way, he pulled bags free and threw them to the bottom of the escalator which made it possible for the students to get up from where they had fallen. When he got to the trapped student at the bottom of the escalator, he saw that she was badly hurt. He told the other students to evacuate the escalator tower, which they promptly did. He was unable to free the girl from the treads but comforted her until help arrived.

Meanwhile the uninjured woman told the students at the top of the escalator to go for help. She then helped the injured woman to the top of the escalator and prevented any more passengers entering. Ferry staff, alerted by the students from the top of the escalator, arrived on the scene and administered first aid to the girl trapped at the bottom of the escalator.

The Chief Engineer had been monitoring the escalators from the engine room control room. He saw on the upper monitor that there was heavy congestion on the top portion of the escalator, indicating a problem lower down the escalator. He turned to stop the escalator but, before he reached the switch, the top escalator had already stopped. He then sent the First Engineer to the escalator to see what needed to be done.

The ferry docked as scheduled. An ambulance boarded the vessel and its paramedics took over the treatment of the injured girl from the ferry staff. After consulting with the paramedics, the First Engineer used his key to locally control the escalator. The direction of the escalator was reversed, the escalator treads were inched back, the girl's clothing released from the treads and the girl freed.

The ambulance attendants treated the girl and put her into the ambulance. The ambulance was taken to Horseshoe Bay aboard the ferry, where the girl was transported to a Vancouver hospital and admitted for treatment.

The escalator tower was secured until the escalator could be checked by the manufacturer's representatives the following day.

The escalators have emergency stop switches mounted at the sides of the escalator just below the level of the treads, at both the top and the bottom of the escalator. These switches are activated by clothing or debris entering between the treads and the sidewalls.

In the sidewalls themselves there are safety switches which are activated by something heavy slamming against the sides. These can be activated by someone falling heavily against them.

Thirdly there are manual emergency stop buttons, one each mounted at the top and bottom of the escalator. These emergency stop buttons are red and are identified by labels; their presence is also identified by signs above them near the handrail to enable riders to locate them. These Emergency stop buttons stop only the escalator to which they are adjacent. The other two escalators in the tower continue to run until they are also shut off.

The engineers can stop all three escalators in either escalator tower by using the appropriate shut down switch in the engine room control room.

The escalator was subsequently checked out. All the treads were individually checked for wear and cracks; all were in good condition. All the emergency stop safety switches were tested and verified as being in operational condition. The drive chains, tensioners and broken chain shut-off switches were also tested and proven to be operating within normal parameters. The gaps between the treads and between the treads and the side wall were checked and were normal.

While escalators are covered under the Canada Shipping Act, their regulation is determined by reference to the Canadian Standards Association (CSA) B 44-1975 Code, which does not require direct inspection by Transport Canada Marine Safety Inspectors. Consequently, British Columbia Ferry Corporation (BCFC) has made arrangements with the Provincial Safety Engineering Services Division of the Ministry of Municipal Affairs for inspections on a biannual basis. Additionally they have a service contract with the manufacturer's representatives in British Columbia for routine preventative maintenance and emergency repair services. Ministry of Municipal Affairs inspectors last carried out an inspection in June of 1993; the escalators were due for re-inspection. The manufacturer's representatives last serviced the escalator on the 18 August 1995.

There are eight vessels in Canada with escalators on board, five in the BCFC's fleet and three in the Marine Atlantic Ferry fleet.

Analysis

Because the control and monitoring of the escalators are divided between the deck and engine room staff, no one is in overall charge of the escalators' operation. Deck staff reset the escalators for direction of flow and the engine room staff monitor their safe operation by means of the video camera system.

The monitoring video cameras are poorly positioned. Only portions of the upper part of each escalator can be seen when the escalators are carrying passengers. The video monitors in the engine room control room are also poorly sited as the engineer's view of them from the main engine station, should operational requirements or emergency drills leave only one engineer in the control room, is blocked by a partial bulkhead. The engineer has a choice of monitoring either the engines or the escalators, but cannot do both. Even when an engineer is looking at the monitors, the siting of the cameras is such that potential trouble cannot be seen to be developing. The engineer can thus only react to a situation which has already developed, e.g., when passengers are seen to be in trouble.

The students were allowed to carry on their baggage instead of using the ferry corporation's baggage system. The effect of this was to add to the congestion on the escalators during disembarkation. This could have been avoided had any of the supervisors told them to use the baggage system when disembarking from the school buses.

The sign on the upper car deck door states: "All foot passengers disembark on the main car deck," but there is no sign to tell the passengers where they are while reading the sign on the door. The size and location of the sign telling passengers to disembark on the main deck means that passengers are required to get close to the door and to be paying attention in order to read it. Nothing indicates that passengers must continue down the escalators to get to the main car deck. As a result, students unfamiliar with the ferry exited the escalator tower to the upper car deck. This indicates that the signs in the escalator tower did not achieve their purpose. Additionally, signs are almost exclusively unilingual English, without the benefit of graphics or a second language. It is not difficult for a disembarking passenger, unfamiliar with the ship, to pass on the wrong side of the waist-high barrier in the hallway on the upper car deck level of the escalator tower. The design and layout of the barrier also prevented the students from easily re-entering the traffic flow.

The fact that the installation and inspection of escalators on board ships are covered by the Canadian Standards Association (CSA) B 44-1975 Code, which does not require direct inspection by Transport Canada Marine Safety Inspectors, means that escalators are treated as a normal stairway by inspectors. However, escalators are not normal stairways because the tread heights of a stopped escalator vary. Passengers who use the stopped escalator as a stairway between terminals may be unaware of this. The varying tread height may cause passengers to trip or to fall.

Findings

1. The students, carrying bulky baggage, were allowed to proceed to the disembarkation point without direct supervision from the adults in the school party.
2. There is no sign in the escalator towers that identifies the various car deck levels.

3. The small sign indicating that passengers should disembark on the main car deck is placed where it cannot be seen by passengers prior to their arrival at the upper car deck level of the escalator towers.
4. There is no sign at the upper car deck level to instruct passengers on foot to continue down the escalators for a further two levels to the main car deck.
5. Some students, unfamiliar with the ferry layout, mistakenly exited the escalator tower at the upper car deck level, the level at which they had boarded.
6. When the students attempted to re-enter the escalator tower, the placement of the traffic control barrier on at the upper car deck level of the escalator tower directed them against the flow of passengers stepping off the upper escalator.
7. The resulting congestion blocked the exit of descending passengers, trapped them on the moving escalator and caused many to fall.
8. Of the passengers who fell, one sustained injuries which required her hospitalization. In addition, she and another passenger were immobilized by clothing trapped between the escalator treads.
9. The siting of both cameras and monitors of the escalator surveillance system does not allow the vessel's engineers to simultaneously monitor the escalators, monitor the Engine Control Panel, and if necessary manoeuvre the engines in an emergency or drill.

Causes and Contributing Factors

The placement, size and content of passenger instruction signs in the escalator towers were inadequate to ensure that passengers on foot proceeded to the correct deck to disembark. Some unsupervised students mistakenly left the tower at the upper car deck level.

When the students attempted to rejoin the flow of passengers in the tower, they were hindered by a control barrier at the foot of the escalator and by the bulky baggage they and the passengers on the escalator carried. The area quickly became congested and passengers on the moving escalator were unable to leave it. Two of the many passengers who fell backwards were injured, one of whom required hospitalization.

The escalator surveillance system did not give an overall view of the escalators. The capabilities and overview of the system did not allow developing problems to be identified at an early stage. The placement of the monitoring system cameras precluded the vessel's engineers from continuously monitoring the whole length of any of the six escalators in use at the time of the occurrence.

Safety Action Taken

Following this occurrence, Transport Canada and the BCFC reviewed the three ferries fitted with escalators ("QUEEN OF COWICHAN," "QUEEN OF COQUITLAM" and "QUEEN OF ALBERNI"). Modifications were made to the "QUEEN OF COWICHAN"; the closed circuit TV screens were transferred to the chief steward's office for monitoring by a catering attendant as a sole duty while the escalators are in use, and an elevator has been installed to reduce the load on the escalators. It has also been transferred to a non-commuter route with fewer foot passengers and school parties travelling, and therefore lessening the congestion on the escalators. BCFC has also informed group users of the availability of baggage carrying facilities. (The vessel which replaced the "QUEEN OF COWICHAN" is fitted with stairs and three elevators.)

The "QUEEN OF COQUITLAM" and "QUEEN OF ALBERNI" are now used only where foot passengers do not have to use stairwells / escalators for embarking / disembarking. This reduces the risk of foot passengers getting lost in the stairwells.

Since the accident, the announcements of impending arrival at terminals have been advanced on all ferries, allowing passengers more time to make their way to their car or to the disembarkation point.

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 30 October 1997.