

Seikan Railroad Ferryboat Accident

[September 26, 1954 near Nanaehama on Hakodate Gulf, Hokkaido]

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The Seikan (Hakodate-Aomori) railroad ferryboat, Toyamaru (Photo 1, Fig. 1, 3,899 tons) left Hakodate port while Typhoon #15 was approaching. The ferryboat encountered unexpected size and strength of wind and waves outside the harbor, and it lowered the anchor in the harbor there. The big waves brought water inside the ship and caused the steam engines to stop. Around 10pm, the ship overturned near Nanaehama. 1,172 people died. This disaster was due to unprecedented speed and strength of the typhoon as well as improper actions taken against the typhoon.

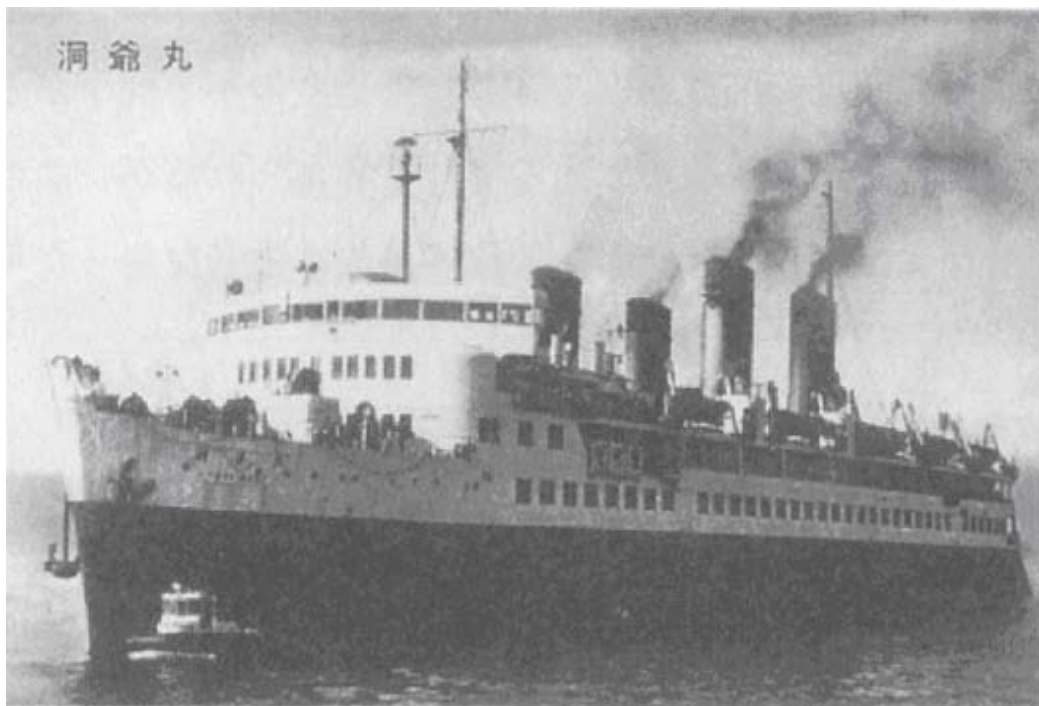


Photo 1, Toyamaru [2]

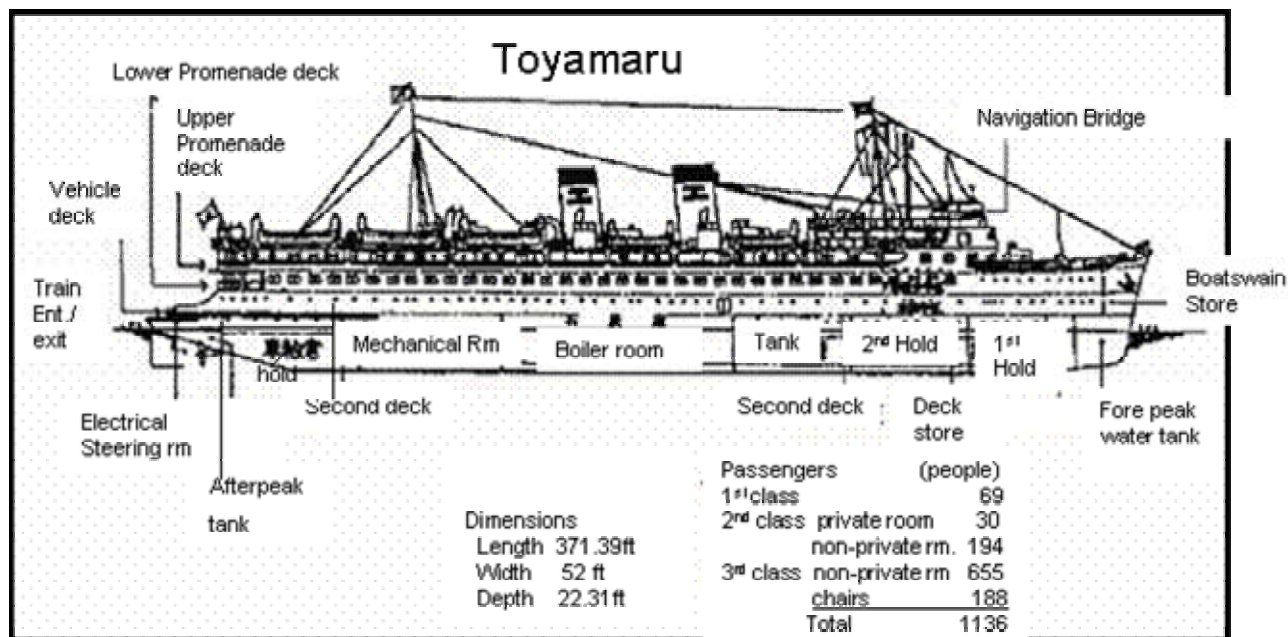


Fig. 1 Cross Section of Toyamaru [2]

1. Event

The Seikan railroad ferryboat, Toyamaru left Hakodate port while Typhoon #15 was approaching. The ship encountered unexpected size and strength of wind and waves outside the harbor, and it lowered the anchor there. Then big waves brought water in the ship and caused the steam engine to stop. Around 10 pm, the ship overturned and struck rocks near Nanaehama and resulted in a disaster with 1,172 people dead.

2. Course

- (1) On September 26th at 3:00am, typhoon #15 was near Kagoshima City in the southern island of Japan. The typhoon traveled through the Japan Sea as it increased its speed, then moved north at an astonishing speed of 62 miles/hour. It reached the sea west of Hakodate (Fig. 2) around 8:00 pm on the same day of the 26th. Then, it slowed down once, but again increased its power to 956hPa (Fig. 3) and hit Hakodate gulf with gusty winds at the maximum instantaneous wind speed of 57m/sec. Not only the waves from the Japan Sea storm directly hit the Hakodate Gulf, but gusty winds also came in from the South opening of the gulf.
- (2) The captain of the Toyamaru, unaware of the Typhoon's quick move to the north and sudden slowdown, misinterpreted the change of pressure and calm weather in Hakodate area around 5 pm as the passing of typhoon's eye. Actually, the weather at the destination, Aomori was relatively calm; however, there was

gusty winds of 20m/s outside the breakwater in Hakodate Harbor even though the winds inside the Hakodate Harbor was only 10m/s from south-south-west. The captain thought there would not be a problem to voyage since winds would be coming from the land now and the weather would calm down. Based on this estimation, he left the pier with 1,220 passengers, 111 crew members and 41 officials: total of 1,331 people at 6:39 pm.

- (3) After the ship left the breakwater of the Hakodate Harbor, they encountered gusty winds of 40m/s and large waves entering Hakodate gulf that had developed in the Japan Sea. The captain realized that it was impossible to continue the voyage, and decided to take one of the common actions for bad weather, that is, anchoring. He had the anchor lowered and moved forward at a very low speed to turn the ship to the south.
- (4) Stronger winds, with a maximum instantaneous speed of 57m/s, pushed the ship to the coast while the ship swayed left and right like a pendulum around the anchor (Fig. 4). The ship, like a typical train carrier, had a train entrance on the back. Big waves poured water into the ship from the gaps in this entrance area and the water made its way to the engine room causing the engine to stop. The ship lost control and crashed into the rocks. A total of 1,172 people, passengers and crew were killed (Photo 2). The reason why the death toll was so high seems because of no one imagining such a sequence of events and they were not ready to guide the passengers for evacuation.

At the same time, other ships anchored in Hakodate Gulf went through similar situations. Four other ships shown below sank and a total of 275 people died (Fig.4).

Hidaka-maru	Commuter cargo	3232 tons (US)	Sank
Kitami-maru	Commuter cargo	3228 tons (US)	Sank
Tokachi-maru	Commuter cargo	3210 tons (US)	Sank
Seikan-maru #11	Commuter cargo	3143 tons (US)	Sank

Another ferryboat, Taisetsu-maru also tried to anchor itself in Hakodate Gulf at first, but the ship left the gulf in order to avoid crashing into other ships floating in the gusty wind. Fortunately, this action saved the ship from sinking.

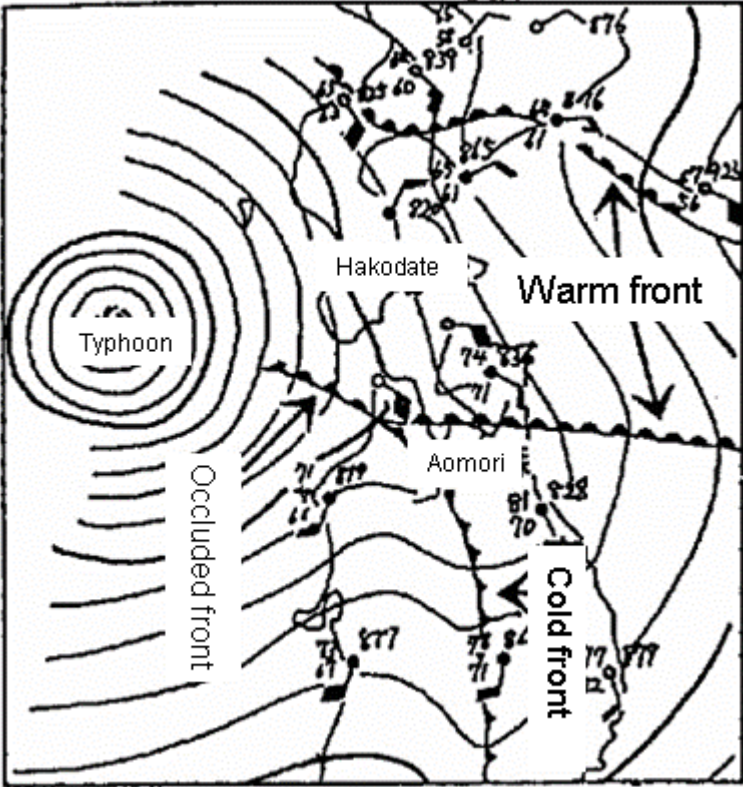


Fig. 2, Weather Chart at 4:00 pm on the 26th [2]

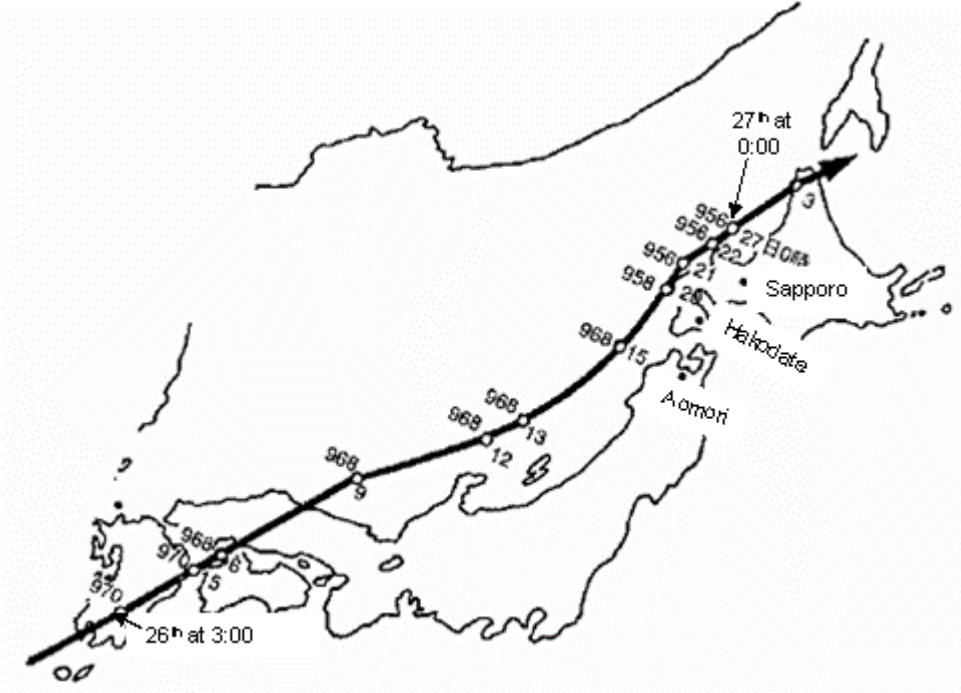


Fig. 3, Typhoon #15 route (right numbers indicate time, left the pressure(mbr)). [2]

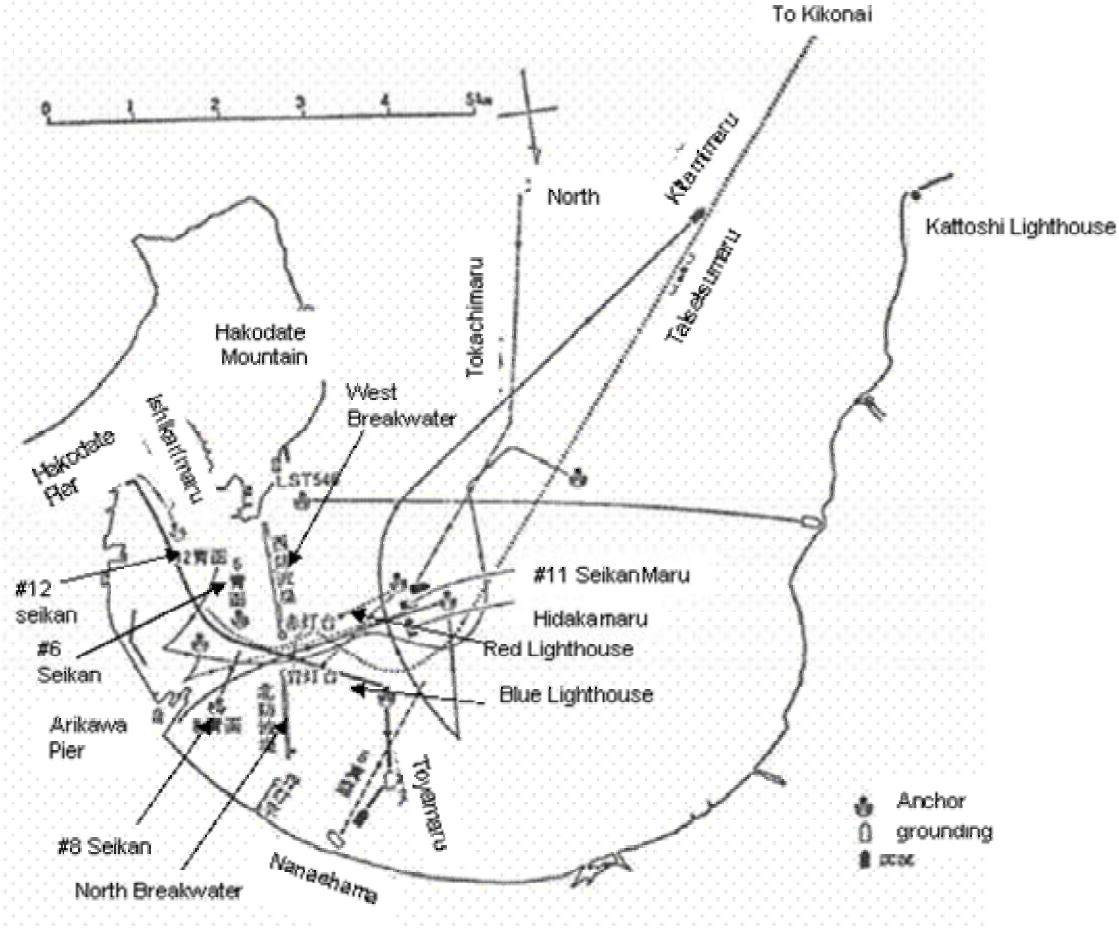


Fig. 4, Movement of ferries in Hakodate Gulf [3]



Photo 2, Shipwreck (Nanaehama) [4]

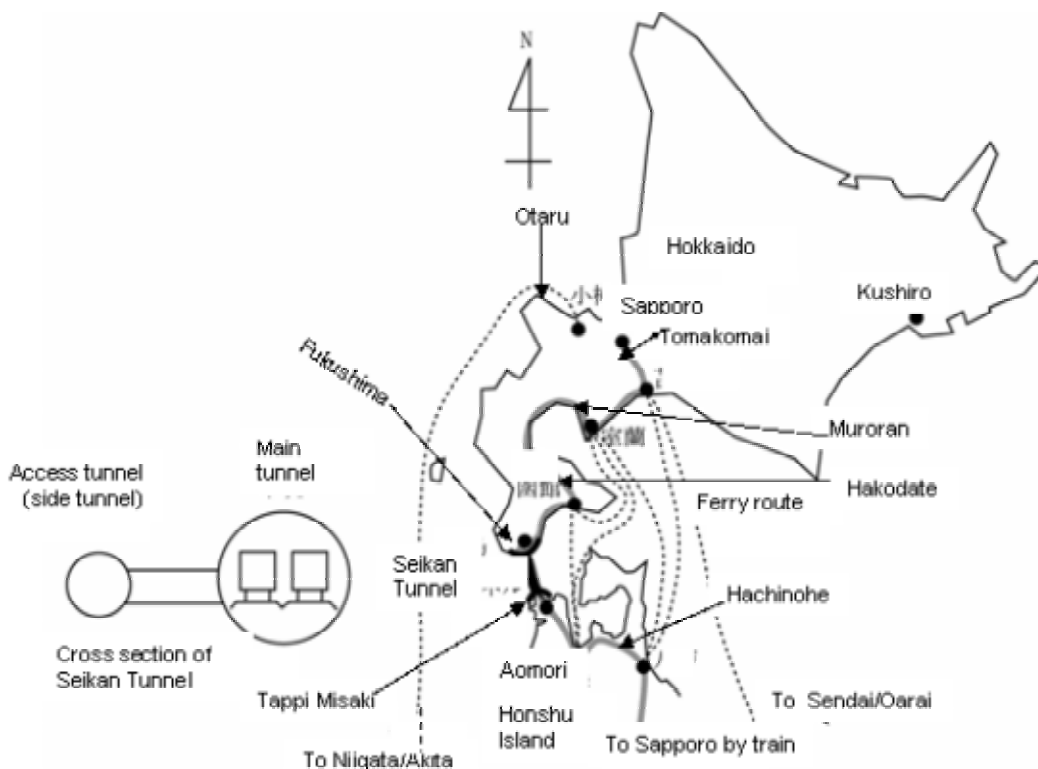


Fig. 5, Seikan Tunnel

3. Cause

- (1) At that time, the only major transportation connecting the main island of Japan and Hokkaido Island was the Seikan Commuter Ferry, and it had a very important responsibility of connecting cities of the two islands. This importance of “providing a connection” is likely to have largely affected the captain’s decision that had the sole authority about operation decisions.
- (2) The meteorological observation technology of that time was not capable of providing accurate typhoon information due to the unusually high speed of the typhoon at about 68 miles/hour. Furthermore, weather around Hakodate area was calm as if the eye of the typhoon was passing. At the same time, the typhoon was at the sea west of Hakodate, and rapidly decelerating while increasing its wind speed. Unexpected wind gusts occurred for the unexpected time, and the damage increased. The weather conditions of winds and waves were greatly different between inside and outside of the gulf even near the Hakodate area.
The captain of Toyamaru was an expert and knew all about weather. People even called him the “weather chart”. He probably studied information from the radio, pressure gauges, and nearby wind conditions, and judged from his experience that “the typhoon has past and the weather will significantly calm down.”
- (3) As a measure to cope with gusty winds and big waves, they took the anchoring

method, that is, to cast an anchor and face the ship to the wind by slowly moving forward. This method works well for normal storms had problems in exceptionally strong waves. An anchor stayed in one point at the bottom of the sea and the end of the rope was tied to the bow of the ship. When the ship slowly moved forward in this situation, the strong wind swayed it left and right around the anchor. Having an anchor point while moving up and down produced large tension in the anchor chain and vigorously shook the boat. Furthermore, the typical railroad ferry structure (Fig. 1) of having a train entrance at the back of the boat made a way for water to enter the lower rooms and engine room. The boiler got flooded and eventually the engine stopped. These factors combined, the boat lost control, tilted by the force of winds and waves, and could not recover. In the strong winds and waves such as a typhoon, it is better to pull up the anchor, face the bow towards the wind to avoid waves from hitting the sides, and avoid strong impact from the anchor. When a boat encounters a typhoon in the middle of the ocean, they have been using this method to avoid any accidents. After all, Toyamaru should have left the gulf as Taisetsu-maru did.

4. Immediate Action

In the evening of the 27th, Minister of Transport and Vice president of the Japanese National Railways (JNR) rushed to Hakodate. Shipwreck investigation agency started investigating the cause of the accident.

On the 28th, The House of Representatives Transportation Committee called the head of JNR in and inquired their measures.

Since the captain of the ferryboat died, the committee collected information from the second mate, highest in rank among the survived crew. He said "We were scheduled to depart at 2:50 pm, but we delay the departure due to rough waves. At about 5:30, the weather got better. There was a storm warning, but we did not get any damage from Typhoon #12, we did not expect the weather to get that bad. We departed at 6:40, and immediately after the departure, we encountered winds of 32m/s. When we went out of the gulf, the weather was terrible, so we headed back. We put the anchor down outside the breakwater, but we could not fix the anchor. We ran the engine at full speed against the wind, but both engines stopped around 10 o'clock, the ship was beaten by the rough waves and hit rocks at 10:26. The ship turned over about 7 to 8 minutes after that. Passengers with life jackets immediately jumped into the sea. Our estimate of the typhoon's behavior was wrong."

5. Countermeasure

(1) The ship operation improved by adding the land station to the decision making

instead of giving the captain the sole responsibility. In addition, a system was installed to automatically stop operations including railways when weather condition exceeds certain parameters.

- (2) Action guidelines in case of typhoons changed to moving toward the winds while lifting the anchors and letting the boat float while avoiding getting hit from the sides. (This method is effective in avoiding unendurable impacts from anchors. This method has helped ships escape from the middle of typhoons.)
- (3) Modified the structure of the ferry body as follows:
 - Train entrance doors at stern of the ferry were modified to have water proof structures
 - Turnover prevention system on the ship body was improved.
 - Coal turbine systems was replaced by diesel engines.
- (4) In order to replace the railroad ferryboats, they started planning the Seikan tunnel as the transportation system between Aomori and Hakodate.

6. Summary

Although a typhoon with unbelievable strength was approaching to Hakodate, the captain who was responsible for the operation assumed the winds would get weaker and decided to take off with the passengers. Soon after they started, they encountered gusts of winds. They immediately anchored and stayed within the gulf, but the water entered the ship and caused the ship a disaster of hitting rocks and turning over.

7. Knowledge

- (1) No matter how prominent a person is, the Mother Nature may exceed his estimation or judgment. If there is any chance of danger, safety caution must take place. In this case, even if the captain had decided not to take the passengers, the ship would have anchored itself and had sunk in the gulf with the captain and the crew, but at least lives of the passengers would have been saved.
- (2) Commonly used actions (such as anchor and stay method in this case) should be used under certain circumstances. If the conditions were more severe than originally expected, commonly used actions should have been reviewed. It is essential to carry out simulations for more severe situations.

8. Background

Seikan (Aomori-Hakodate) railroad ferryboat, Toyamaru was placed in service in 1947 to provide a way of commuting between Aomori and Hakodate ports. It was part of the project to increase the number of commuting ships between Aomori and Hakodate that had been almost destroyed during the war. In 1950, it was the first cargo-passenger ship in Japan to have the latest technology and radar installed. At

that time, Seikan Tunnel did not exist. The ferry was the only means to connect the main island of Japan (Honshu) and Hokkaido; its mission was important.

The weather observation technique at the time, differently from today's satellite technology, were simple and inaccurate in terms of locating the typhoon, telling its strength, speed and direction.

9. Sequel

Since this accident, preparation for the Seikan (Aomori-Hakodate) tunnel project accelerated as Fig. 5 shows. In the evening of March 13, 1988, the last railroad ferryboats left Hakodate and Aomori port and closed the 80 years of Seikan railroad ferryboat history. That same morning, Seikan tunnel started the operation. Seikan Tunnel kept the lead tunnel next to the main tunnel, so upon a fire, people can go to the lead tunnel through the number of side tunnels for evacuation. Another underwater tunnel, the tunnel under the Strait of Dover also has a lead tunnel between two main single lined tunnels for evacuation.

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