

Executive Summary

On February 21, 2021, at approximately 0721 hours, a dense fog began to form and caused poor visibility on the northbound lanes of Provincial Highway 61 from the 255.72 km section to the 255.84 km section (approximately 2 km upstream) in Kouhu Township, Yunlin County, resulting in a major highway occurrence involving a chain collision of 21 large and small vehicles; 2 people were killed in this accident, and 10 were injured.

In accordance with the relevant articles of the Transportation Occurrences Investigation Act of the Republic of China, the Taiwan Transportation Safety Board is the independent agency that is responsible for investigating this accident. The agencies (institutions) that were invited to participate in this accident investigation included the Ministry of Transportation and Communication, the Directorate General of Highways, Xuansheng Transportation Co., Ltd., Zhengda Trucking Co., Ltd., Hotai Motor Co., Ltd., and Taikoo Motors Group.

The draft occurrence investigation report was completed in April 2022; it was submitted to the relevant authorities (organizations) for comments after undergoing a preliminary review and amendment by the Taiwan Transportation Safety Board at its 38th meeting, which was held on May 6, 2022, in accordance with the relevant procedures. After compiling the relevant opinions, the investigation report was reviewed and approved by the Taiwan Transportation Safety Board at its 40th meeting on July 1, 2022, and it was released on July 28, 2022.

On the basis of comprehensive factual information and analyses, the following 19 investigation findings and 4 safety recommendations were proposed.

Investigation Findings

Findings Related to Probable Causes

1. Most of the involved drivers were driving on the expressway into the foggy road section and continued to drive at a high speed despite the lack of visibility. The drivers failed to reduce the speed of their vehicles to less than 40 km/h in accordance with the relevant regulations, education, training, and publicized content of the Ministry of Transportation. Consequently, the vehicles bumped against the vehicles that were traveling at a low speed or stopped in the lane ahead due to insufficient time to brake.
2. After Accident Vehicle B collided with Accident Vehicle A, the two drivers parked their cars on the expressway lane, which had extremely poor visibility because of the dense fog. Subsequently, the other drivers also failed to avoid a secondary accident, which triggered a chain of car accidents.

Findings Related to the Risk

1. On the day of the accident, the wind speed was low, the surface air was stable, and the humidity level was high. In the morning, a thinner “radiation fog” was formed owing to the effect of radiative cooling. When the area received more sunlight, the ground temperature increased, and the fog began to dissipate. According to the video captured by the dashcam when the drivers were driving on that road section, they encountered discontinuous radiation fog with different

thickness, and the radiation fog dissipated shortly after the accident.

2. Although the drivers involved in the accident were in the same foggy environment, several drivers did not slow down appropriately and responded in various ways. In the foggy driving environment, which had poor visibility, their responses substantially increased the risk of accidents.
3. All the drivers involved in the accident held qualified driver's licenses, but most of them were unfamiliar with the traffic rules pertaining to abnormal weather conditions. The drivers involved in the accident knew that they should slow down; however, they didn't slow down when they entered the foggy road section, which did not create conducive conditions for safe driving. Their risk awareness was relatively weak.
4. The current system in Taiwan fails to ensure that the driver receives traffic safety-related information regularly after they obtain a driver license. If a driver does not take the initiative to update or review traffic safety-related information, they have limited access to safety knowledge or new regulations related to driving in foggy conditions.
5. Although the Road Traffic Safety Committee, the Freeway Bureau, and the Directorate General of Highways have provided the public with the relevant education information, the issue of driving in a dense fog has generally received limited attention, and the public's exposure to information on driving in dense fog has also been limited. The driver may also be an individual who does not proactively visit the websites of the Ministry of Communications to browse the relevant information or search for the relevant provisions. Therefore, their knowledge about driving in dense fog is limited.

6. Because the incident occurred on the expressway at the time when visibility was severely affected by a dense fog, it was difficult for a rear vehicle driver to detect the situation in front of their vehicle in advance, and it was difficult for the front driver to grasp the traffic situation behind them. Therefore, the existing accident handling procedures stipulated in the regulations, training, and guidelines for the prevention of secondary accidents are difficult to apply under such circumstances.
7. On expressways with extremely poor visibility, a driver involved in an accident may have insufficient time to move upstream to erect a warning sign before the vehicles behind approach them. In addition to the driver's inability to effectively prevent secondary accidents from occurring, the aforementioned situation also increases the risk of people being struck by vehicles from behind.
8. The driver of Accident Vehicle D failed to ensure that the seatbelts of four children in the back seat were properly buckled while their vehicle was moving, which increased the risk and severity of the injuries sustained by the four children in the accident.
9. In addition to a special report on the dense fog due to radiation fog, the traffic control center can reference the weather forecast and observation data released by the Central Weather Bureau to evaluate the possible occurrence of radiation fog in local areas and issue early warnings.
10. The type of dense fog that was present during this accident was a discontinuous radiation fog with varying shades, and it was not a normal phenomenon. Without the use of auxiliary detection equipment (e.g., dense fog detection equipment), detecting the occurrence of dense fog through manual surveillance and releasing the relevant

information accordingly are difficult tasks.

11. According to the statistics released by the Directorate General of Highways, the road section where the accident occurred is not a section that is typically prone to dense fog; therefore, this road section can be classified as a section that does not require the construction of weather data collection facilities. Because of factors and limitations associated with the installation location of fog detection equipment, such equipment may not be able to cover an entire road. Consequently, even if such equipment is installed, the dense fog phenomenon may not necessarily be detected when a similar accident occurs in the road section not covered by the detection equipment.

Other Findings

1. Each driver of the accident held a valid driver license issued by the Directorate General of Highways, Ministry of Transportation and Communication, and a valid registration plate issued by the regulatory agency was hung on all vehicles when the accident occurred; no abnormality was discovered with respect to the road engineering and traffic engineering performed at the accident section.
2. The empty liquid petroleum gas drums carried by Accident Vehicle A were not properly secured, causing the drums to be scattered on the road on Provincial Highway 61 during the accident.
3. The breath alcohol test result of the driver of Accident Vehicle D was 0.23mg/L, and the test result of the other involved drivers was zero.
4. The vehicle load of Accident Vehicle F was 7.68 tons, and the total amount of feed carried on Accident Vehicle F on the day of the accident was 15.81 tons, which exceeded the stipulated carry weight

by 8.13 tons.

5. The accident caused the deaths of the driver of Accident Vehicle B and the passenger in the passenger seat of Accident Vehicle U. The driver of Accident Vehicle B had a brief conversation with the driver of Accident Vehicle A on the driveway after Accident Vehicle B rear-ended Accident Vehicle A. The fatal injury was caused by the rear-ending vehicle when the driver of Accident Vehicle B returned to his vehicle. The passenger in the passenger seat of Accident Vehicle U was not severely injured when Accident Vehicle U rear-ended the stationary Accident Vehicle R; the fatal injury sustained by this passenger was caused by the vehicle behind that rear-ending of Accident Vehicle U, which occurred before the passenger could get off Accident Vehicle U. The fatal injuries of the two deceased individuals were caused in the secondary accident and were not related to the use of seat belts during the driving process.
6. The main purpose of installing closed-circuit television (CCTV) cameras is to help traffic control personnel to understand and monitor on-site traffic conditions. Therefore, at present, the traffic control surveillance images displayed at the center are displayed on a TV wall in a rotation mode instead of a fixed image display mode. Thus, for traffic control personnel, proactively detecting foggy road sections through surveillance images and disseminating the related information are difficult tasks.

Safety Recommendations

To the Ministry of Transportation and Communication

1. To improve driver education regarding the precautions that should be taken when driving into the foggy road sections of highways and expressways under poor visibility conditions; also to improve traffic control measures such that the drivers can respond earlier, thereby improving their driving safety.
2. To adjust the relevant regulations, licenses, education and training, and publicity content to prevent drivers from driving in foggy road sections without slowing down appropriately, thereby avoiding secondary accidents.

To the Directorate General of Highways, Ministry of Transportation and Communication

1. To improve the fog forecasting mechanism for expressways. Specifically, the weather information provided by the Central Weather Bureau should be analyzed daily. When the conditions for fog formation are present, the monitoring of areas where fogs are likely to form should be increased through measures such as the monitoring of CCTV camera images or increased patrolling; these measures allow for the early detection of foggy road sections and implementation of necessary traffic control measures that enable drivers to respond early.
2. To evaluate the feasibility of constructing variable speed limit control facilities on expressways; this measure enables drivers to reduce their driving speed when they encounter special road conditions (e.g., poor weather conditions, recurrent congestion because of accidents), avoid excessive speed difference, and reduce their risk of causing secondary rear-end collisions.