

Executive Summary

TRC's Freight Train No. 7501 between Shuangxi Station and Sandiaoling Station

On March 10, 2025, at 10:51:26, Freight Train No. 7501(occurrence train) of the Taiwan Railway Corporation, Ltd. (TRC), which was scheduled to operate from Hualien Station to Changhua Station, was travelling on the Yilan Line from Shuangxi Station toward Sandiaoling Station when its caboose derailed at K20+742 on the west main track. The occurrence caused delays to 87 train services, affecting approximately 16,105 passengers. The caboose wheelset and certain track facilities were damaged. No injuries were reported.

On the day of the occurrence, because diesel-electric locomotive No. R172 (lead locomotive) at the front of the occurrence train had insufficient traction while operating on an uphill section, electric locomotive E406 was coupled with the occurrence train after it arrived at Shuangxi Station. The train departed at 10:47:07. Based on the on-site inspection, Automatic Train Protection records, and dash cam images, at 10:51:26, the caboose of the occurrence train reached K20+745 while traveling at approximately 36 km/h and began to sway, with dust spreading around it. The first-axle wheelset derailed at K20+742, leaving continuous impact marks along the track. At 10:52:29, the speed of the occurrence train decreased to 0 km/h. The conductor called the lead locomotive engineer and instructed him to stop and inspect the train, whereupon it was discovered that two wheelsets of the caboose had derailed.

In accordance with the Transportation Occurrences Investigation Act, Taiwan, and the definition of major transportation occurrences specified

therein, the Taiwan Transportation Safety Board (TTSB) was the independent agency responsible for the investigation of this railway occurrence. The agencies (institutions) invited to participate in this investigation include: Railway Bureau of the Ministry of Transportation and Communications (MOTC) and TRC.

This occurrence investigation report was reviewed and approved in the 88th meeting of the TTSB on July 21, 2026 and released on August 6.

After comprehensive investigation and analysis of the factual data, a total of 10 findings and 4 safety recommendations were obtained.

I. Findings

Findings Related to Probable Causes

1. The spring constants of all four leaf springs on the occurrence caboose exceeded the specified standard values by approximately 0.4% to 50.2%. As a result, the caboose suspension system was unable to distribute the car weight evenly, significantly reducing the vertical wheel load exerted by the left wheel of the first axle on the rail and causing the wheel to lift during operation.
2. As the occurrence train traveled on the westbound main track between Shuangxi Station and Sandiaoling Station on the Yilan Line (K20+742 on a straight uphill section with a gradient of 17‰), the caboose coupler was subjected to the combined effects of the heavier cars ahead and the pushing force from the auxiliary locomotive at the rear. This caused the car to deviate horizontally, increasing the lateral force acting on the wheels. As the first-axle wheelset of the caboose shifted laterally to the left during operation, the left wheel, which was in a

lifted condition, could not maintain firm contact with the rail. Combined with the increased lateral force, this ultimately caused the first-axle wheelset of the caboose to shift to the left off the track and derail.

Findings Related to Risk

1. TRC has not established a specific mechanism for testing spring constant of leaf springs, consistent measurement standards, operating procedures, or requirements for the use of measuring tools. Consequently, maintenance data such as leaf spring camber and frame end-beam height did not adequately reflect the actual condition of the rolling stock. This allowed the caboose with abnormal leaf spring constants to remain in service, adversely affecting its operating stability.
2. TRC's current caboose maintenance procedures lack a comprehensive wheel-load testing and management mechanism. As a result, vehicles with uneven wheel-load distribution cannot be promptly identified and corrected during maintenance, leading to the inability to prevent rolling stock instability and derailment risks.
3. TRC's operating guidelines permit an auxiliary locomotive to be positioned behind the caboose and do not clearly restrict the arrangement of long and short cars or heavy and light cars within a train configuration. Consequently, the potential for increased longitudinal train forces to compress the caboose from both ends, causing horizontal car yaw and increasing the risk of wheel climb, was not adequately assessed.

Other findings

1. TRC used only the absolute value of the height difference between the caboose end beams as the assessment criterion, without considering the direction of end-beam inclination or changes to the inclination angle. This made it difficult for maintenance personnel to identify the car's horizontal condition promptly. Consequently, although the occurrence caboose's end-beam height measurements during successive inspections met the maintenance standards, the car had long remained in a tilted condition, with the left front higher and the right rear lower, affecting wheel-load distribution and operating stability.
2. Given that railways in countries such as the United States and Canada have adopted end-of-train devices in place of cabooses to perform emergency train braking, TRC could review the maintenance condition of its in-service cabooses and evaluate alternative devices with equivalent functions for brake-system monitoring as options for replacing cabooses or restricting their continued use.
3. Geometric measurements and 3D profile scans of the occurrence caboose wheelsets revealed no significant abnormalities. The possibility that the derailment was caused by wheelset misalignment or abnormal tread wear could therefore be ruled out.
4. A review of the related track regulations, periodic inspection and maintenance records, and on-site measurement results identified no track abnormalities. Track-related factors could therefore be ruled out as a cause of the occurrence.
5. Poor visibility due to weather conditions, unqualified personnel, and alcohol use can be ruled out as contributing factors in this occurrence.

II. Safety Recommendations

To Taiwan Railway Corporation, Ltd.

1. Evaluate the inclusion of wheel load as a vehicle maintenance indicator and establish management mechanisms. (This is an existing safety recommendation and still controlled by relevant sub-projects. This is the second time it has been proposed. Please refer to safety recommendation number TTSB-RSR-25-07-003 of the previous case when handling this recommendation.)
2. Refer to international standards to establish operating requirements governing the arrangement of auxiliary locomotives, long and short cars, and cabooses within train configurations. Evaluate alternative devices with functions equivalent to those of a caboose to reduce the risk of train derailment.
3. Review and clearly define the caboose maintenance standards, including requirements for bolster spring elasticity testing, end-beam inclination assessment, operating procedures, and the use of measuring tools, to ensure consistent maintenance criteria.

To Railway Bureau, Ministry of Transportation and Communications

1. Exercise your supervisory authority and include the safety recommendations issued to the Taiwan Railway Corporation, Ltd. concerning train configuration operating requirements and the

establishment of a wheel-load management mechanism into periodic or non-periodic inspections.

Note: The language used in the occurrence investigation Final Report is in Chinese. To provide a general understanding of this investigation for the non-Chinese reader, the Executive Summary of the Final Report was translated into English. Although efforts are made to translate it as accurately as possible, discrepancies may occur. In this case, the Chinese version will be the official version.