Executive Summary

TRA's Train No. 611 at Fenglin Tunnel

On December 1, 2021, the Fu-Hsing Semi Express train No.611 of Taiwan Railways Administration, MOTC (TRA), departed from Taitung station and was bound for Hualien station. At 20:42 the train was traveling between Wanrong Station and Fenglin Station, the car No.3 was separated from car No.4. After recoupling, the train continued to Fenglin Station. There were no fatalities or injuries in this occurrence.

According to the Transportation Occurrences Investigation Act, the Taiwan Transportation Safety Board is responsible for investigating major transportation occurrences that arise in the R.O.C. territory. This accident is considered as a major transportation occurrence within the scope of investigation. The TRA, Eastern Region Engineering Office of Railway Bureau, Kung Sing Engineering Corporation and CECI Engineering Consultants were invited to participate in the investigation.

The investigation report was approved by the 46th Board Meeting on January 6, 2023, and published on January 12, 2023.

After comprehensive investigation and analysis of the factual data, a total of seven conclusions and six safety recommendations were obtained, which are detailed as follows:

Findings

Findings related to probable causes

1. When the construction unit, Kung Sing Engineering Corporation (KSECO), moved the construction fence, the old construction fence

holes were re-welded with the result of enlarging of the welding holes and continuation of rusting; even though additional diagonal brace steel bars were used for reinforcement, the stress resistance of the original design was not met. After many trains passed by over approximately a month, the welding points of the construction fence gradually loosened, and the stress that could be resisted progressively reduced. When the accident train passed, the fence could not stand the wind pressure and was pulled down.

2. When the accident train passed through the section, it began to collide with the fallen fence from the first car and continued to the second, third, and fourth cars. The manual unlocking device handle on the rear end of the third car was left with red paint on it, which is highly related to the paint used on the construction fence, indicating that it had collided with the fence, leading to the separation of the train due to the disconnection of the coupler.

Findings related to risk

1. When spot checks were carried out by the *Eastern* Region Engineering *Office*, Railway Bureau and CECI Engineering Consultants, INC (CECI), it was found that the construction fence erected on site by the construction unit KSECO had not been maintained according to regulations and also intruded the structure gauge, however, correction by KSECO was not immediately demanded, which was unfavorable for construction fence safety management.
2. The construction drawings of the construction fence by KSECO did not match the actual site conditions, including not indicating the construction method if the construction fence encountered a drop inlet, and also the steel bars of a basal pillar in the drawings were located in gaps in the ballast wall, which was not favorable for onsite

construction by workers to construct according to the drawings, making it impossible to confirm that the construction fence met existing stress test calculation standard and hypothetical conditions.

3. TRA does not stipulate confirmation procedures and conditions for resuming normal operations after a train separation accident. When there are foreign objects or equipment on the track, they can easily be hit by oncoming trains, causing a secondary accident.

Other findings

1. Manual operation of the unlocking device handle, the height difference of the couplers, and the rear end of the train running into the front car can be eliminated as causes of this train separation accident.
2. The choice to secure the construction fence to the ballast wall will affect the direction the fence falls if it comes loose. If the construction fence is erected on a ballast wall facing an operating track, when it comes loose and falls, as it is not blocked by the ballast wall, there is a relatively high risk that it will fall toward the operating tracks and threaten the operating safety.

Safety Recommendations

To TRA

1. Establish operating regulations or SOPs, including the onsite confirmation procedures and conditions for resuming normal operations after train separation accidents to avoid secondary accidents.

To Railway Bureau, MOTC

1. For re-used construction fences, review the need for additional strengthening or monitoring measures and the configuration method between the trackside construction fences and ballast wall to prevent

construction fences from coming loose.

2. Enhance the quality verification contents for trackside construction fences, verifying whether the fences intrude structure gauge and its stability conditions as crucial points to ensure construction fences meet the requirements of installation regulations.
3. Supervise the revision of operating regulations or SOPs by TRA, including the onsite confirmation procedures and conditions for resuming normal operations after train separation accidents.

To CECI

1. Enhance the spot check mechanism for trackside construction fences, including whether the fences intrude into the structure gauge, stability conditions, and maintenance conditions to ensure the quality of trackside construction fences.

To KSECO

1. For re-used construction fences, review the need for additional strengthening or monitoring measures and the configuration method between the trackside construction fences and ballast wall to prevent construction fences from coming loose.

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.