Executive Summary

TRA's Train No.6432 at Xinma Station

On October 21, 2018, Puyuma train 6432 (the train in the occurrence) of the Taiwan Railway Administration, MOTC (TRA) departed from Shulin Station bound for Taitung Station at 14:50. At 16:49, as the train traveled southward on the eastern main line and arrived at the right-turn transition curve on the fourth track at Xinma Station, Suao, at a speed of 140 km/h, the leading car (8^{th} car) of the train overturned at mileage K89+251, causing all cars of the train to derail. Four cars, namely cars 8, 7, 5, and 3, overturned. The connections between cars 8 and 7 and between cars 7 and 6 broke; the right rail of the sixth track at Xinma Station fractured, broke the eighth window of car 6, and penetrated all the way through the top of the car. Four gantries on the overhead lines at Xinma Station were fractured. Among 370 people on board, 18 received fatal injuries, 17 received serious injuries, 274 received minor injuries, and 61 were not injured.

This occurrence was attributable to the driver's misjudgment of the cause of a train malfunction while the train was running; the driver then isolated the automatic train protection (ATP) manually and maintained the train's speed. Consequently, the train lost its automatic speed limit function. After the train departed from Luodong Station, the driver maintained the train speed at 140 km/h, which exceeded the maximum speed limit (130 km/h) designated by the TRA for

all train types. While the train was in motion, the driver was distracted by communication with staff members, including the trainset dispatcher and mechanic. This distraction caused the driver to miss the speed limit sign located next to the railway at mileage K88+900 (the speed limit for Puyuma trains at this location is 75 km/h), thereby failing to reduce the train speed before entering the curve. This investigation report details all factors that potentially led to the occurrence and the following safety factors: the driver, the dispatcher, the mechanic, reporting of train malfunctions and abnormalities, accession and management procedures for malfunctions and abnormalities, ATP isolation procedures, train operation speed limit, communication procedures, man–machine interface (MMI), routine and non-routine maintenance check at all levels, maintenance work order and parts management, the supplier manuals, warranties and contracts, track maintenance, drivers work units, training and independent assessments for staff, TRA procedural manual, safety data analysis, medical examination system, drug use guidelines, emergency responses of attendants, response drills for staff, supplier's system design, recorders, manual content, the supervisory authority of the Railway Bureau, cameras in the driving cab, passenger seat belts, train tilting control system, air suspension, and the safety management system in railway operation agencies and institutions.

This occurrence investigation is expected to provide references for the TRA, Railway Bureau, and Ministry of Transportation and Communications to ensure that such an occurrence will not happen again and to secure the future

safety of railway transportation. The Taiwan Transportation Safety Board has also provided several recommendations for safety improvements to the TRA, Sumitomo Corporation, Railway Bureau, and Ministry of Transportation and Communications to eliminate the safety flaws identified in the investigation report.

According to the Transportation Occurrence Investigation Act, the Scope of Major Transportation Occurrences defined in the act, and relevant content in the Legislative Yuan's resolution document, the TTSB serves as an independent agency responsible for a supplementary investigation of the 6432 occurrence. Agencies and institutions engaged in the investigation include the TRA and Railway Bureau of the Ministry of Transportation and Communications, Taiwan Railway Union, Nippon Sharyo, Ltd., Toshiba Electronic Components Taiwan Corporation, Taiwan Nabtesco Service Co., Ltd., and Bombardier Transportation Taiwan Ltd.

On the basis of comprehensive factual information and analyses, this investigation proposes the following 50 findings and 27 recommendations:

Findings

This investigation report summarizes three categories of investigation findings on the basis of factual information and comprehensive analyses collected during the investigation period: **investigation findings related to probable cause, findings related to risk, and other findings.**

Findings related to probable cause

1. The train’s main air compressors (MACs) in cars 1 and 8 experienced forced stops in the period between arriving at and departing from Shulin Depot. The drivers of the train 110B and the occurrence train 6432 may have failed to report the fault message to the mechanic in accordance with relevant regulations. Additionally, the pre-departure inspection items for Puyuma trains were incomplete; a list specifying the minimum equipment requirements was lacking; therefore, no specific standards were provided to drivers to determine whether the train was ready for departure. This caused the driver to miss the timing for replacing the faulty train with one that works properly.
2. Of the four MACs installed in cars 1, 3, 6, and 8 of the train, those in cars 1 and 8 were forced to stop before the train’s departure from Shulin Station, and those in cars 3 and 6 exhibited poor performance. The Yilan Line has various curves; the air pressure in the MACs was reduced every time tilting control system was activated when the train encountered a curve. Frequent tilting control system actuation caused the MACs to consume excess air, and had insufficient pressure; thus, the train control system cut off power automatically or even stopped the train during operation.
3. The TRA’s lack of training and certification procedures were the reasons for the driver’s unfamiliarity with the train systems and operations, making him unable to correctly identify the cause of the train malfunction in time. Additionally, the driver’s report of the train’s

abnormalities to the support staff member was delayed. Furthermore, in the report, he failed to include the fault code displayed on the DDU and MAC pressure and mistook the fault information, which appeared after the ATP was isolated, as a sign of a train malfunction. These caused the support staff member's failure to provide timely and effective help.

4. When MAC pressure was insufficient, no warning sound or message was displayed on the DDU; the pressure value was displayed only on the pressure gauge located in front of the driver on the control panel in the driving cab. The driver did not check the pressure gauge and misjudged the train power cutoff as being caused by an ATP failure. At 16:17:55, the driver isolated the ATP without reporting to the dispatcher as required by the regulations, which caused the train to lose automatic speed limit function.
5. The TRA did not provide the operation manual for Puyuma trains that train drivers should follow. Hence, no supplier operation manual for Puyuma trains was available for the train driver to perform the correct procedures. When a MAC was forced to stop, the driver should first check the MAC's pressure; if the pressure was less than 6.5 bar, the driver should stop the train immediately, report to the operation control center, and await instructions. Instead, the driver attended to the malfunction while the train was running.
6. The train departed from Luodong Station at 16:44:53. The driver was under the pressure because of the train's

delayed arrival at Luodong Station due to its abnormal power; the train dispatcher asked the driver to increase the train speed to the best of his capacity. Because of misunderstanding in communication, the driver thought he was not allowed to stop the train at Toucheng station for inspection. Therefore, the driver maintained the traction control handle at the position 140 (the speed limit along the railroad section is 130 km/h). The driver continued to discuss with the trainset dispatcher and depot mechanic how the circuit breaker continued tripping off when reset; consequently, the driver failed to notice the speed limit sign at mileage K88+900 (the maximum speed limit for Puyuma trains is 75 km/h). The train passed by at 16:49:20, missing the point at which the train should have decelerated.

7. Between 16:49:19 and 16:49:26, the train driver read out verbatim the fault code message of the forced stop of the MACs displayed on the driver display unit (DDU) to mechanic at the depot. At 16:49:27, the train's speed was 140 km/h; the driver's brake was not actuated; and the traction control handle was switched from the position 140 to the position OFF, causing the train to overturn in the transition curve section in front of Xinma Station at mileage K89+251.

Findings related to risk

Operation management

1. The driver failed to reduce the train speed in compliance with the speed limit sign the train passed before and after

he isolated the ATP. The TRA's regulations failed to elaborate on the definition and details of drivers' requirements to "proceed with caution" (e.g., paying attention to the speed limit signs along the railroad) after ATP isolation, and the regulations contained no provisions on the practice of reciting speed limit signs.

2. After the driver reported the train malfunction, the train dispatcher immediately forwarded the report to the trainset dispatcher. However, the trainset dispatcher had no ability of fault isolation in this train; thus, according to their experience, the trainset dispatcher forwarded the report to the mechanics on duty at the Shulin Depot, only few of them were familiar with the Puyuma train system. Due to this prolonged process, the driver spent approximately 62% of the time between 16:17:55 (ATP isolation) and 16:49:27 communicating with different people, which distracted him while the train was running.
3. The TRA did not provide the driver the operation or fault isolation manual for Puyuma trains, making the driver unable to assess the status of the train system or operate the train correctly. Because the driver had been assigned to drive mostly non-Puyuma trains in the past, he received little training for Puyuma trains. Additionally, the following factors may have contributed to the driver's unfamiliarity with the system and operation of Puyuma trains: (1) no certification was required after training; (2) the Puyuma trains run less often than other types of train services did; (3) and training for Puyuma train operation was inadequate.

4. The TRA provided incomplete operation regulations concerning items that drivers must report if a train malfunction occurs. This led to the failure of the driver and mechanic at the depot to identify the train fault according to the fault code displayed on the DDU and to resolve the malfunction in time in accordance with the trouble-shooting procedures in the supplier’s operation manual.
5. The TRA had specified that when an abnormality occurs on a train, the driver must first report to the station, which would then forward the report to the train dispatcher at the operation control center. However, this indirect reporting procedure and all parties’ failure to use standard communication language to repeat the information correctly and confirm the safety instructions in radio communications resulted in the incomplete, incorrect, and delayed transmission of information in the occurrence.
6. After the driver isolated the ATP, the train still experienced power cutoff. However, the driver did not overturn his previous judgment of the ATP being the cause of the malfunction and did not reset ATP function.
7. The ATP activation information of the Puyuma train was not connected to the operation control center, thus, the train dispatcher could not acknowledge in real time that the ATP had been isolated. Therefore, the train dispatcher could not inform the driver of supplementary procedures following ATP isolation in time. The TRA also did not request the train dispatchers to confirm the

reason for ATP isolation if adopted by a driver; moreover, the TRA did not authorize the train dispatchers to stop a train at any time if the reason for ATP isolation has not been confirmed.

8. The chief dispatcher at the TRA operation control center failed to play the role of coordinator and decision-maker. In addition, the TRA did not provide complete regulations for the reporting mechanism from station and the trainset dispatcher to the chief dispatcher; hence, the chief dispatcher could not gather comprehensive information in real time or act accordingly.
9. The DDU of Puyuma trains provided drivers with information regarding the operation and fault statuses of the trains. The display system has room for improvement; the display of information is complex and inconsistent, the displayed text contains inconsistent wording, and that the system provided no warnings for major faults. Improvements in these areas could have reduced the driver's pressure in identifying and interpreting information on the DDU.

Maintenance management

10. Excessive foreign matter and dirt had accumulated on the cooling fins of the MACs in cars 1 and 8, excessively increasing the working oil temperature and causing a forced stop in the MACs when the train arrived at the Shulin Depot. Because the hollow fiber membrane filter of the dehumidifier was stained with lubricating oil and the dehumidifier exhibited air leaks, the four MACs of the train (located on cars 1, 3, 6, and 8) had a low

compressed air supply rate, with an air compression performance 0.22 times that of a new MAC.

11. The TRA, expressing a need for dispatching trains, asked the Taipei Railway Workshop to pare down maintenance items and delay the heavy maintenance schedule. For example, according to the resolution of a maintenance agenda meeting, the level 3 and 4 heavy maintenance agenda involved only changing the air compressor lubricating oil. The TRA delayed level 4 heavy maintenance schedule of Puyuma trains and misjudged the train make-ups as being still under warranty; thus, they determined that the MACs did not yet require to be replaced. In addition, the TRA maintenance manual did not comply with the supplier's maintenance manual, which recommends that the filter should be replaced every 3 years. Therefore, the hollow fiber membrane filter of the dehumidifier in the MACs of Puyuma trains had not been replaced for nearly 6 years that contributed to the poor performance of the MACs.
12. The air inlet of the MACs were located underneath the train, and the direction of air inflow was the same as the direction of the train's movement. This design increased the possibility that foreign matter on the track would be sucked into the MACs. Specifically, the inlet filter had a large mesh, which reduced the filter's ability to block such matter. In addition, cooling devices were located at the bottom of the MACs, and its upper part of the cooling device was covered by a cowling, which hindered the detection of foreign matter accumulation and thereby

resulted in the excessive accumulation of foreign matter and dirt on the cooling fins of the MACs. This reduced the performance of lubricating oil cooling and resulted in an excessively high working oil temperature, which was among the main causes of forced stops in the MACs on cars 1 and 8. Neither the supplier's nor the TRA's maintenance manuals specify a cleaning interval for cooling devices; according to the trouble-shooting procedure in the supplier's maintenance manual, cooling device cleaning is required only when an MC is forced to stop.

13. The TRA maintenance manual fails to provide clear details on the steps of maintenance tasks, parts, tools requirements, instructional graphics, and standards for check items, as specified in the supplier's maintenance manual. In addition, the TRA did not convert such details into a job card for mechanics to follow. This may have caused the mechanic in the occurrence to add an excessive amount of lubricating oil to the MACs; the oil then stained the hollow fiber membrane filter of the dehumidifier.
14. The TRA and the Puyuma train supplier Sumitomo Corporation did not specify specific remedies for a breach of warranty, which led to the prolonged back-and-forth official correspondence between the two parties before the occurrence. Therefore, the TRA lost the opportunity to resolve the faults in the MACs.
15. TRA did not specify timing or procedures for mechanics to review the maintenance log for depot trains, control

panel systems in the driving cabs, or fault codes on the train control and monitor system (TCMS) when trains return to their depots. Therefore, the mechanics could not identify the train fault immediately after its occurrence.

16. The TRA did not request mechanics to include all fault information in the maintenance log for depot trains, level 1 and 2 non-routine maintenance items and TCMS faulty items into the maintenance management system, which hindered the timely identification and repair of faults.
17. The lateral communication mechanism and parts authorization for inquiry on the stock levels were absent in the TRA's supply department and maintenance departments that resulted in the ineffective management and planning of the supply and demand of train maintenance parts.
18. The TRA did not install anti-derailment guard rails along the Xinma Station section of the railroad between mileages K89+023 and K89+070, which violated the length requirement for anti-derailment guard rails specified in relevant regulations by the Ministry of Transportation and Communications. Under current walking inspection methods adopted by the TRA and their duration, defects in tracks were easily neglected. Because few track geometry cars were available to the TRA, a follow-up inspection after track maintenance could not be conducted in a timely manner, which made the quality of the track difficult to be assured after maintenance.

Organizational management

19. The TRA failed to formulate operation, fault-isolation, and maintenance manuals for each train type in accordance with supplier manuals; this caused confusion for drivers and their incorrect adoption of operation procedures when operating different types of trains. Furthermore, maintenance manuals written by mechanics according to their personal experience may fail to address all maintenance items for each train type, as required by suppliers.
20. No standard procedures have been implemented for the selection of trainers for driver and mechanic training or the formulation of training content, training assessments, or certification in the TRA. This results in inconsistent professional skills and capacity among TRA staff. The TRA staff training center manages only administrative matters of staff training and has no role in the actual training of staff or the establishment of the training system. Therefore, the staff training center did not have any training management function.
21. Training, assessment, and certification for TRA drivers are all conducted by one unit. Trainers and examiners have no qualification standards, and trainees have no passing standards. Therefore, ensuring satisfactory effectiveness and fairness of certification is difficult. In addition, no certification is required for TRA mechanics; the granting of a mechanic license requires only review and approval by the director of the unit. This may have resulted in large discrepancies in the professional competence of mechanics.

22. TRA driver's licenses are categorized by train type, and no additional testing is required for drivers licensed for one train type to operate trains of different models of this train type. In the biennial skill certification, drivers who are qualified to drive various train types are required only to take a test for one train model instead of taking tests for all the train types that they are licensed for. Therefore, drivers' familiarity with the train models that they are licensed for is not ensured, thereby increasing the risk that drivers are unfamiliar with the train systems.
23. Drivers and mechanics are managed by the same unit of the TRA; this may cause business concern to be prioritized over railroad safety in decision making.
24. The TRA did not have a standard procedure, classification system, or ranking system for staff of all types to use or follow. Moreover, the TRA did not have an operational manual for drivers, mechanics, or dispatchers, who thus have nothing to reference in basic and nontechnical procedures.

Other safety factors

25. Managing the ATP data of TRA trains by computers fail to detect instances of ATP being isolated for unknown reasons while a train is running. This creates safety flaws in the TRA's management of drivers' use of ATP and means that abnormality statistics cannot reflect actual situations.
26. The TRA fails to implement thoroughly random medical examinations and urinalysis for qualified drivers. In addition, the design of the medial examination form and

the examination method render it difficult to detect physical or psychological conditions in drivers that pose a high risk in train driving. The TRA also did not have drug use guidelines for drivers as a reference for medical examinations and the determination of whether drivers are applicable for on-duty.

27. The TRA did not specify the safety responsibilities of train attendants in accidents or provide them with relevant training; it also did not arrange any emergency evacuation drills for conductors, attendants, or drivers. This undermines the evacuation efficiency and safety of people on board.

Other findings

1. According to Kunieda's formula, with the track gauge set to 1,132 mm, the initial overturning point at the center of car 8 was between mileages K89+223 and K89+224. The Simpack simulation results for the four cars indicated that all wheels on the right side and the front wheels of the first bogie on the left side of car derailed at mileage K89+251.172, which was determined to be the overturning point of car 8. This result was consistent with recordings obtained from the train's camera.
2. The train entered the transition curve of Xinma Station at approximately 140 km/h and activated its tilting control system from 0° only after it reached the starting point (K89+073) of the transition curve. Car 8 derailed and overturned at mileage K89+251 before it reached the 2° tilting angle. Also moving at 140 km/h, the car that reached the 2° tilting angle overturned only 0.175 s after

those that did not reach the tilting angle. Accordingly, the tilting had little effect on when the train overturned. The train's TCMS data displayed no record of any fault messages concerning breaks or leaks in the air suspension, indicating that the air suspension function was normal during the occurrence.

3. Although the installation of audio recorders or cameras in the driving cab potentially infringes upon the privacy of drivers, the privacy of individuals in key job roles that concern the safety of others must not be prioritized over the interest of public safety. Nevertheless, appropriate limitations on and regulations for the access to and use of data from these recorders should be in place.
4. Before the occurrence, the Railway Act in Taiwan did not enforce a clear rule regarding the installation of safety management systems (SMSs) in railroad agencies or institutions. The TRA had a partial SMS in place before the occurrence but had not yet established comprehensive policies, organizations, responsibilities, documents, procedures, activities, or training in accordance with the required elements of an appropriate SMS.
5. The supervisory agency's responsibilities should include at least the formulation of legal safety regulations, establishment of an inspection mechanism, testing and granting of licenses to staff, and organization of investigations of incidents. The Railway Bureau's supervisory organization and relevant regulations were incomplete, and the Railway Act did not authorize the

Railway Bureau to exercise supervisory powers. Such powers were authorized on a case-by-case basis by the Ministry of Transportation and Communications. Therefore, improvements to the regulations are required.

6. When train 110B arrived at the Shulin Depot, the DDU successively displayed fault information on forced stops for the MACs on cars 1 and 8. According to a test conducted by the TTSB, when such a fault code occurs, the driver would be warned by a flashing red light (main malfunction light), a flashing fault acknowledge button on the DDU, and a 60-decibel warning sound.
7. Thirty seconds before the occurrence, the ATP was isolated, and the train speed was not displayed on the MMI. The train speed recorded by the ATP recording unit was 140 km/h, which should be consistent with the speed indicated on the driver's digital speedometer.
8. The ATP speed limit setting on the Puyuma train was not reduced in accordance with Operation Telegram 111, therefore, the train's ATP speed limit for curves was 10 km/h higher than the speed limit specified in said telegram.
9. According to the command records for the position of traction control handle, train speed, and Pulse-Width Modulation (PWM), after the driver pushed and pulled the handle and input a speed command (e.g., at the position 140), he operated the power system appropriately and maintained the train speed at 140 km/h correctly through traction or brake commands.

10. After a train is braked automatically by the ATP after a speeding instance, drivers must pull the traction control handle back to position OFF to restart the train. This was consistent with the driver's practice of repeatedly pulling the traction control handle to position OFF and then pushing it to the position 140 after the train power cutoff.
11. When Puyuma drivers isolate the ATP manually, the TCMS displays fault code 915, which reads "ATP data are unavailable when the tilting driving mode is on." However, in the supplier's operation manual for Puyuma trains and the malfunction & incident TCMS specification manual, the message of the fault code was wrongly input as "ATP Failure."
12. To ensure that major occurrence data are complete, the tilting control system should be equipped with real-time data recordings to provide references for subsequent investigations.
13. The Railway Act authorizes the Ministry of Transportation and Communications to hire experts and scholars for investigations of major railway occurrences which overlaps with the TTSB's investigation authority specified in the Scope of Major Transportation Occurrences, leading to a conflict on investigation mechanism. Approximately 600 railway occurrences in Taiwan each year were outside the scope of TTSB's investigative authority and were thus subjected to small-scale investigations by the relevant operating agencies or institutions. The intensity and breadth of supervisory

actions of the Railway Bureau (the supervisory agency) were obviously insufficient.

14. The suspected point of derailment and the broken track ballast and sleepers between the rails identified at mileage K89+218.75 may have been caused by the derailment of other cars after car 8 overturned.
15. No evidence has indicated that the driver's performance at the time of the occurrence was undermined by fatigue or the use of medication, alcohol, or drugs.
16. According to relevant international studies, seat belt installation is ineffective in preventing passenger casualties in occurrences of train derailment or overturning.

Safety Recommendations

For the TRA, Ministry of Transportation and Communications

Operation management

1. Impose strict requirements for drivers to report train faults immediately after they occur, report before isolating ATP, and comply with speed limit regulations.
2. Provide a minimum equipment list requirements for each train type; elaborate on the meaning of "proceed with caution"; consolidate standard radio call-and-responding items, standard pre-departure inspection procedures for each train type, and regulations for fault reporting; and modify the speed limit settings in ATP.
3. Establish a surveillance system for ATP isolation, provide a single-window communication channel for

drivers, and authorize dispatchers at the operation control center to supervise drivers' implementation of supporting safety measures after ATP isolation.

Maintenance management

4. Establish a non-routine check mechanism for mechanics of arriving trains; formulate and implement strict regulations for compiling fault information from all sources (e.g., maintenance log for depot cars, reporting by drivers, fault information from TCMSs, and findings of routine check at all levels) into a maintenance management system; and consolidate standards for maintenance parts changing and the modification of maintenance check interval to ensure that safety will not be undermined by the pursuit of business concern.
5. Conduct routine check of all levels thoroughly; establish a work order and maintenance management system to strengthen maintenance procedures and traceability; and review the parts management system to enhance lateral communication with the maintenance department.
6. Consolidate the operating procedures for track inspection, particularly those related to the description of the manifestation of malfunctions and provision of examples for determining fault levels; provide appropriate measurement tools and auxiliary equipment such as track geometry cars; and comply closely with requirements for the installation of anti-derailment guard rails.
7. Collaborate with train suppliers to redesign air inflow direction, filtering methods, and cooling device cleaning

frequency for MACs in accordance with the working environment in Taiwan.

Organizational management

8. On the basis of supplier documents, formulate operation, maintenance, and fault-isolation manuals for each train type for drivers, mechanics, and dispatchers to refer to in their operations.
9. Strengthen and employ the functions of the staff training center; establish a management mechanism for standard training manual formulation, training material design, and trainer training for drivers, mechanics, and trainset dispatchers for all train models; emphasize drivers' simulated fault-isolation training and trainset dispatchers' fault- isolation training for multiple train models; and establish separate systems for training and certificating.
10. Review the organization of the TRA, separate the units of drivers and mechanics stage by stage, and strengthen the management of professional division of labor.
11. Standardize regulation manuals by providing guidelines for their formatting, writing, review, approval, publication, revision, distribution, and abolishment.
12. Establish standard procedural and nontechnical operation manuals for staff at all levels, including drivers, dispatchers, and mechanics.
13. Formulate standard communication manuals that specify a standard communication language and procedures for making calls and recitation procedures.

14. Provide clear regulations regarding the safety responsibilities of staff in response to train occurrences and organize emergency evacuation drills and training for relevant staff members, such as conductors, attendants, and drivers, to ensure the efficiency and safety of emergency evacuations.

Other safety factors

15. Review and enhance the establishment of the SMS.
16. In collaboration with train suppliers, review the MMI to ensure that fault messages are displayed clearly in real time; review the remedies for breaches of warranty specified in contracts and provide clear descriptions of the rights and obligations of both parties.
17. Enhance the real-time input, collection, and analysis of ATP, TCMS, and tilting control data to improve safety management.
18. Enhance the regulations for drivers' medical examinations and drug tests and provide drug use guidelines for drivers.

For Sumitomo Corporation

1. Review the remedies for breaches of warranty specified in contracts and provide clear descriptions of the rights and obligations of both parties.
2. Review the train MMIs to ensure that fault messages are displayed clearly in real time.
3. Optimize the storage of tilting control data and design a real-time input function for the data.

4. Enhance the management of content in the supplier manuals and ensure word choice consistency in information displayed on equipment and included in documents.
5. Reconsider the direction of air inflow, filtering methods, and cooling device cleaning frequency for MACs responding to the working environment in Taiwan.

For the Railway Bureau, Ministry of Transportation and Communications

1. Enforce the installation of anti-collision and fireproof audio recorders and cameras in the driving cab. The recorders and cameras must be able to record continuously for at least 2 hours. The audio and video recordings shall be used only in occurrence investigations; appropriate limitations and regulations shall be in place regarding the disclosure of such recordings.
2. Consolidate skill certification regulations for railway staff; establish and implement thorough regulations to assign responsibilities of granting licenses to drivers and mechanics to the supervisory agency.
3. Amend relevant railway legal regulations; specify the elements and guidance documents required to construct SMSs for railway transportation in Taiwan; develop and establish measurement tools and capacity for railway SMSs; and establish regulations to enforce the establishment of SMSs in railway operating agencies and institutions.

For the Ministry of Transportation and Communications

1. Review the Railway Act and Railway Traffic Regulations; authorize the Railway Bureau with supervisory powers; and assign the Railway Bureau responsibility for investigations of railway and atypical occurrences beyond the scope of the TTSB's investigative responsibilities.

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