HARSIA
Hellenic Air & Rail safety Investigation Authority

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
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& **Α**σφάλειας **Μ**εταφορών (ΕΟΔΑΣΑΑΜ)
Σιδηροδρομικός Τομέας

Rail Accident Summary

Head-on collision between a passenger train and a freight train in Tempi, 28 February 2023

27 February 2025

1. Summary

1.1. The accident on 28 February 2023

1 On the evening of February 28, 2023, passenger train IC-62, with 352 persons on board and en route from Athens to Thessaloniki, departed Larissa station at 23:05, with a delay of 48 minutes. At almost the same time, freight train 63503 left the station Neoi Poroi towards Larissa, also with a delay on the planned schedule.

2 Shortly after 23:18 both trains collided head-on, with the freight train registering a speed of almost 90 km/h while the passenger train was travelling at an estimated speed of 150 km/h, both well within the allowed speed restrictions. The shock was violent and while the two locomotives of the freight train were pushed to the adjacent track to come to a crash against the vertical retaining wall, the locomotive and the first-class passenger car of the passenger train were catapulted to the other side of the track, where they landed on the ground below, completely destroyed.

3 In the meantime, a second, near head-on collision occurred between the restaurant car of the passenger train and the first flat car, loaded with steel plates, which were the first following vehicles in the passenger and freight train respectively. Following the direction of the vehicles ahead, the restaurant car and the subsequent second-class car of the passenger train also ended up on the lower ground. Meanwhile, a enormous fireball had formed that appeared to move with the passenger train. In the resulting fires on the lower ground, the restaurant and the second-class car were completely burned out.

4 In total, 57 people, of which 11 staff members or subcontractors working for Hellenic Train, lost their life in the accident, 81 people were seriously injured, and 99 had minor physical injuries. A substantial number of people, directly or indirectly involved with the accident, suffered shock and/or emotional trauma.

1.2. Conclusions of the analysis

5 The collision between passenger train IC-62 and freight train 63503 could happen because both trains were travelling in opposite directions on the same track between the stations of Larissa and Neoi Poroi.

1.2.1. Causal factors

6 The station master did not use the automated method to set the route for train IC-62 to leave Larissa station to the north, towards Neoi Poroi, which would have positioned all switches correctly. Instead, he commanded the individual switches manually and, while doing so, forgot to place the switches 118 A/B in the “main” position, herewith guiding train IC-62 towards the opposite direction of normal travel. This mistake went further unnoticed by the station master.

7 These actions and decisions of the station master need to be understood in the difficult operational context he was confronted with that night. Given the available evidence, it is very unlikely that the station master had the intention to put train IC-62 on the opposite track. The control panel he had to use to remotely operate the switches maybe easy to operate by more experienced station masters but can certainly lead to confusion when this experience has not yet been sufficiently acquired. This was certainly the case for the station master on duty that evening as the control panel contained relevant information in different places, different ways of operating switches were used interchangeably, and clearly written instructions were not available.

8 Moreover, his normal workload was severely strained by a series of aggravating factors. There were a series of technical failures, both temporary and not so temporary, which created additional tasks or made existing tasks more difficult. He had to deal with an unprecedented number of communications, many of which were not directly related to his task of controlling the train traffic. In addition, the design of the working environment, due to the positioning of the various resources to be used, did not allow for conversations to be held and at the same time keeping an eye on the train traffic. Finally, his attention, both cognitive and emotional, was occupied by the correction of an earlier error he made, when setting the route for another incoming, local train.

9 In a following sequence, the authorisation for train IC-62, to leave Larissa station towards the north, was given verbally by the station master of Larissa and was not confirmed through read-back by the train drivers of IC-62. This stayed without reaction by the station master, leaving it uncertain how the message was understood by the

train drivers.

10 This sequence of activities was highly affected by a general lack of strict application of the prescribed structured communication methodology. Furthermore, the methodology prescribed by the Greek rules is outdated compared to more recent international standards and the use of an open radio communication channel, which is common in Greek railways, does not allow for direct, uninterrupted safety-related communications between station masters and train drivers.

11 Ultimately, the potential barrier, where the train drivers of IC-62 could react to the conflicting information between the position of the switches and the granted movement authority, was missed. Although they would be expected to stop in front of the wrongly positioned switches 118 A/B and contact the station master to get clear instructions, there is no indication that the train drivers of train IC-62 reacted on the position of the switches not being compatible with the received order. The main factor that can explain this, is that it was not an unusual occurrence for train drivers to be directed to the opposite track. This had also happened earlier in the day on the section in question, between Larissa and Neoi Poroi, and for the train drivers involved even in the section they were driving on to get to Larissa station, from Paleofarsalo.

1.2.2. Underlying factors

12 The Greek railway sector suffered highly from the economic crises that started in late 2009 and reached a peak in 2010. This resulted in poorly maintained and increasingly degrading infrastructure and a structural shortage of staff to continue to provide the usual service. The railway system had not recovered from this situation by the beginning of 2023.

13 The infrastructure manager, OSE, does not provide in any preventive maintenance of its main assets for control, command and signalling. Interventions only take place when (critical) assets fail, even for renewal projects that are partly put in service. Furthermore, the way OSE is managing the competence of its station masters does not guarantee that they are competent in the safety-related tasks for which they are responsible, under all conditions. Also, no structured monitoring of the performance of any of the station masters was performed, leaving OSE unaware of any deterioration in the performance of safety-related tasks.

14 The necessary interactions between humans and other elements of a socio-technical system, whether technical or organisational, were not taken into account by OSE. This resulted in the equipment used, demanded tasks, available work environment and overall organisational arrangements stretching the limits of the operational staff beyond what is humanly acceptable in a sustainable way. A strong belief reigned that all operational risks can be controlled by strictly applying rules, under all conditions.

15 This had also an impact on the train drivers, who were confronted with changes due to ongoing works and/or failing assets on a daily basis, which required a continuous alertness and high level of resilience. In that context, Hellenic Train could not demonstrate that they had put in place an on-going training of their train drivers, in particular for safety-related communications and relevant non-technical competencies (skills, behaviours or attitudes). Also, no process was available within Hellenic Train to systematically monitor the performance of their train drivers regarding the quality of safety-related communications or other safety-critical activities.

16 Finally, by lack of a National Investigating Body to perform the independent analysis of accidents and events, the capability of the Greek railway sector to learn from adverse events relied entirely on the investigations performed by the operators as part of their SMS. These internal investigations, however, by focusing on the errors made by individual front line staff, systematically lacked the necessary depth to introduce sustainable changes, herewith limiting the learning potential to an extreme minimum. This situation was further reinforced by the way RAS focused on non-compliance in its investigations, analyses and recommendations.

1.2.3. Factors affecting the severity of consequences

17 Most of the victims of this accident are due to the impacts that took place after the collision of both trains. Railway vehicles are not designed for a collision with a speed above 36 km/h, so active safety measures should be in place to reduce the severity of consequences. It appears that no criteria nor arrangement existed within OSE to adapt the maximum allowed line speed to the condition of the signalling system.

18 Based on the observations that could be made, there is no indication that the technical equipment of the rolling

stock that was used, gave rise to the formation and expansion of the enormous fireball that arose after the impact, and subsequently resulted in the secondary fires. With the existing evidence is impossible to determine what exactly caused it, but simulations and expert reports indicate the possible presence of a hitherto unknown fuel.

19 Although there was no explicit legal obligation to do so, it remains to be evaluated whether equipping the rolling stock with better fire-retardant materials could have played a role in the survival chance of the few victims that had survived the initial collision and lost their lives from the fire.

20 There was/is a high risk of aggravation of the initial consequences related to the Post-Traumatic Stress Disorder, especially for all the ones who did not have the possibility to access this support in time. We note that there are at least still at least 22 persons at a 'severe' level or above, as revealed by a survey conducted by the investigation team (in fact, more than 1/4th of the survey sample).

1.2.4. Safety observations

21 Although not linked to causes of the accident or the severity of the consequences, the investigation has identified a series of additional elements that are relevant for a safe management of incidents on the Greek railways.

22 There was no actual coordination, whether at operational or strategical level, of the different services at the scene of the collision. Each service continued to operate under its own orders, initiatives, and personnel without any interaction at the organisational level. One particular result of this is the fact that no proper mapping of the accident investigation site was performed.

23 Knowledge for the correct application of "Human Loss Management Plan" was missing with several of the emergency services. No exercises to prepare for its coordinated implementation in a railway context have ever been organised, neither was any initiative taken afterwards to learn from the experience of the Tempi accident.

24 The initial collection of evidence for a further safety investigation shows several flaws, resulting in the loss of potentially vital information for understanding the causal and underlying factors of the accident and ultimately improving the safety of the railway system.

1.2.5. The role of the controlling authorities

25 In the beginning of 2023, as in the decade before, Greece had no functioning National Investigating Body that could independently investigate railway accidents and incidents. As a result, by lack of independent investigations, no sector wide lessons were learned from previous accidents and incidents. This is reinforced by the general accepted belief that a safe functioning of the railway system, under all circumstances, can be obtained by strict rule compliance, even if no supporting equipment or protection systems are in place.

26 The National Safety Authority, RAS, when issuing the safety authorisation for OSE, did not identify the above critical weaknesses in the Safety Management System. Several of these weaknesses in the implementation of OSE's Safety Management System were later identified during the supervision phase and notified to OSE for corrective measures, without leading to any noticeable change.

27 Relevant issues were identified by the European Railway Agency, either during the safety certification of railway undertakings or during the audit of NSA activities These did not lead to the necessary improvement quickly enough, which in turn may lead to a deterioration of railway safety in the long term.

1.3. Recommendations

28 During the investigation, an urgent safety recommendation was made, with the intent to address the combined risk of safety-related messages lacking structure and methodology as well as the use of an open communication system where safety-related communications cannot be prioritised over all other communications.

29 In addition, EODASAAM has made 17 more recommendations as a result of this investigation in the Tempi accident. Several of these recommendations go beyond the remit and powers of individual organisations and can therefore not be implemented without the support of the Greek Government. The Ministry for Transport and Infrastructure is therefore recommended to continue and enhance the implementation of the initiated

Action Plan to create a context in which the different responsible railway actors have the human, financial and organisational means at their disposal to meet the demands placed on them to develop and maintain a sustainable and safe railway system.

30 OSE needs to better understand the risks related to the operational reality of the current railway system in Greece and to improve the way it is controlling these risks. Furthermore, OSE needs to optimise the performance and reliability of its physical assets and manage the safety risks associated with, throughout their life cycle. OSE needs to regularly assess the competence of staff performing safety related tasks and needs to maintain them. This includes the set of competencies related to non-technical skills and arrangements regarding physical and psychological fitness, not only when recruiting staff but also during their entire career. OSE should develop a system for performance monitoring, to become aware of any deterioration in the performance of safety-related tasks by station masters or other staff performing safety critical tasks. Moreover, the potential for OSE to learn lessons from incident and accidents needs to be created. This should lead to implementing structural improvement measures that can create an environment that supports the work of operational staff. Finally, OSE should maximise the availability of recorded data which could assist accident and incident analysis and should reflect on the possibility to use these technologies for continuous monitoring of safety performance in a non-blaming context.

31 Hellenic Train is recommended to strengthen its competence management system, in order to ensure that train drivers (and other staff, whenever relevant) performing safety related tasks are prepared for this, that their competence is regularly assessed and maintained and that tasks are carried out accordingly, including the set of competencies related to the non-technical skills and arrangements regarding physical and psychological fitness. Furthermore, a system for monitoring the performance of train drivers should be developed, to create the capacity to become aware of any deterioration in the performance of safety-related tasks.

32 To strengthen the potential of the Greek railway sector to learn from adverse event, the National Safety Authority, RAS, should develop an occurrence reporting system that provides the necessary structure and taxonomy for the mandatory reporting of safety related occurrences by the infrastructure manager and all railway undertaking operating on the Greek network. At least as important, and even more urgent, is the need for RAS to strengthen its capacity for supervision with the aim of establishing a view on the level of safety performance of the Greek railway system.

33 The European Union Agency for Railways is recommended to take measures in order to generate a quicker implementation of on the one hand, SSC action plans, and on the other hand, NSA action plans in relation to identified deficiencies that prevent the NSA from effectively performing the monitoring of Safety Management Systems of railway actors. Linked to this, the European Commission is recommended to implement a framework to enforce Member States to adequately and timely satisfy the EU requirements on safety policy setting, the functioning of National Safety Authorities and National Investigating Bodies, and the system of national rules. In addition, a view should be generated on the adequateness of implementing EU specified operational safety rules within the national framework of Member States, at all levels.

34 Finally, the Greek Ministry for Climate Crisis and Civil Protection is recommended to develop, in collaboration with the different emergency services (Fire Brigade, Medical and Psychosocial Support, Police, Civil Protection) and based on international recognised good practice, detailed instructions for an Emergency Response and Crisis Management Plan that will enable rapid and, above all, coordinated assistance during an emergency situation. This plan should include clear instructions for the coordination of emergency situations at the operational and at the strategic management level, for setting up the perimeters, for the adequate mapping of the accident site, and for preventing and reducing the risks of Post-Traumatic Stress Disorder.