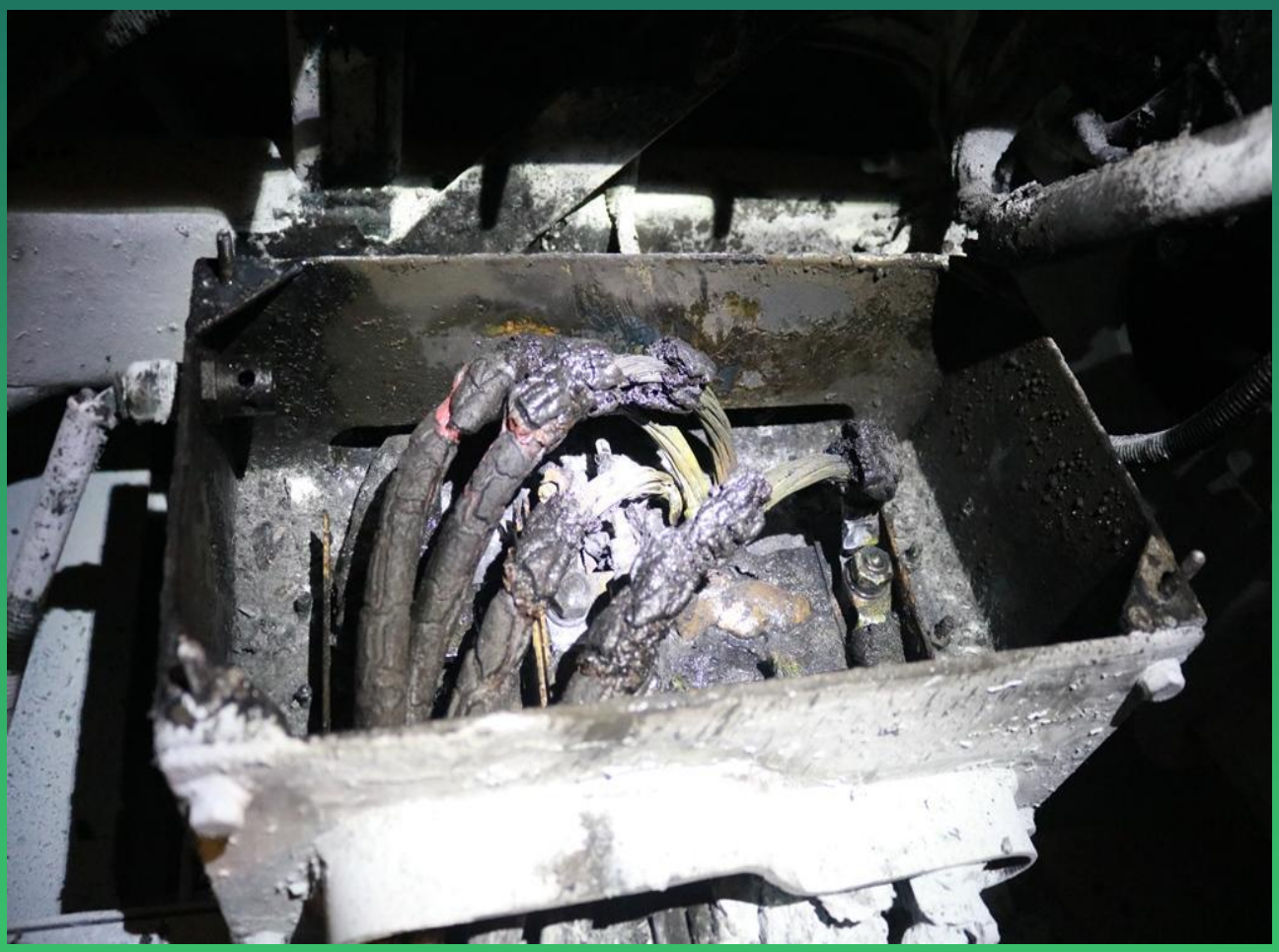
MINISTRY OF
CONSTRUCTION AND TRANSPORT
TRANSPORTATION SAFETY BUREAU

FINAL REPORT (EXTRACTION)



2022-1166-5
(HU-10322)

Railway accident / Fire in rolling stock
Budapest M1, Deák Ferenc tér, 17th October 2022
Budapest, M1 Széchenyi fürdő, 21st October 2022

Translation

This document is the translation of Points 1, 5 and 6 of Hungarian version of the Final Report. Although efforts have been made to translate the mentioned parts of the Final Report as accurately as possible, discrepancies may occur. In this case, the Hungarian Final Report is the authentic, official version.

Basic principles of the safety investigation

The purpose of the safety investigation fulfilled by Transportation Safety Bureau (TSB) as National Investigation Body of Hungary is to reveal the causes and circumstances of serious railway accidents, railway accidents and railway incidents and propose recommendations in order to prevent similar incidents. The safety investigation is not intended to examine and determine fault, blame or liability in any form.

The findings of the safety investigation are based on an assessment of the evidence available and obtained by TSB in the course of the investigation, taking into account the principles of a fair and impartial procedure. In the Final Report, the persons involved in the occurrence shall be referred to by the positions and duties they had at the time of the occurrence.

The Final Report shall not have binding force and no appeal proceedings may be initiated against it.

This safety investigation has been carried out by TSB pursuant to relevant provisions of

- Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents;
- Commission Implementing Regulation (EU) 2020/572 of 24 April 2020 on the reporting structure to be followed for railway accident and incident investigation reports;
- in the absence of other related regulation of the Act CLXXXIV of 2005, the TSB conducts the investigation in accordance with Act CL of 2016 on General Public Administration Procedures.

Act CLXXXIV of 2005 is to serve compliance with Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety.

The competence of the TSB is based on Government Regulation № 230/2016. (VII.29.) on the assignment of a transportation safety body and on the dissolution of Transportation Safety Bureau with legal succession.

The safety investigation is independent of other investigations, administrative infringement or criminal proceedings, as well as proceedings initiated by employers in connection with the accident or incident.

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1. SUMMARY

On 17 October 2022, a fire started on the M04 train (train with reg. № 33) arriving at the Deák Ferenc Square station of the M1 metro line in Budapest, which was extinguished by the driver using a fire extinguisher, and the intervention of the Emergency Response Service was not required. During the investigation, it was found that one of the heavy-current cable clips in the motor wiring junction box in the so-called B-C tunnel duct of the train had broken, but the motor current remained in the form of an electric arc and ignited the sheathing of the other cables in the junction box.

On 21 October 2022, on the same metro line, on the train M10 (train No 40) arriving at Széchenyi Bad station, the driver detected smoke coming from the B-C tunnel duct, which he extinguished with the help of a fire extinguisher. The on-site inspection and subsequent investigation revealed that the glow in the tunnel duct was caused by the reversal cylinder. The investigation revealed that one of the moving contacts of the reversal cylinder had broken off and caused an electrical short circuit.

It can be argued that, although the immediate causes are two isolated events, at a systemic level both events are caused by obsolete vehicle design and use beyond the design life.

The investigation also revealed that platform guards on duty at stations do not have the possibility to continuously monitor the areas under their supervision at all times, as the design of the stations and the lack of technical equipment for monitoring do not allow that.

In connection with the fire of 17/10/2022, the TSB issues a safety recommendation to BKV Zrt., the operator of the vehicles, for the sake of protection of the motor cabling and cable clips in the tunnel ducts of the vehicles from extra mechanical stresses.

As a result of the investigation of the two incidents, the TSB will also issue a safety recommendation to BKV Zrt. for making better use of the technical equipment already installed on the M1 metro line in order to help the platform guards to perform their duties more efficiently.

5. CONCLUSIONS

5.1 Summary

5.1.1 Direct causes

Acts, mistakes, events or conditions or a combination thereof the elimination or avoiding of which could probably have prevented the accident or incident:

a) 17/10/2022: the clip of a high-current motor cable broke in the junction box of the B-C tunnel duct, and the resulting electric arc caused a fire;
b) 17/10/2022: due to the design of the vehicle, the heavy-current power wiring is subject to continuous mechanical stress (static and dynamic);
c) 21/10/2022: one of the high current moving contacts of the reversal cylinder in the B-C tunnel duct broke and caused a short.

5.1.2 Indirect causes

Acts, mistakes, events or conditions which influenced the occurrence by increasing its probability, accelerating the effects or the severity of the consequences, but the elimination of which would not have prevented the occurrence:

a) 17/10/2022: during maintenance work in the tunnel ducts, the heavy-current power cabling and cable clips running through the floor are subjected to additional stress due to accidental stepping on or kicking into the cables;
b) 21/10/2022: due to obsolete design of the vehicle, the heavy-current connections are implemented by equipment containing moving parts.

5.1.3 Systemic factors

Causal or contributing factors of organisational, management, social or regulatory nature which are likely to have an effect on similar or related occurrences, particularly including regulatory framework conditions, the design and use of the safety management systems, the skills of the personnel, the procedures and maintenance:

c) the use of Ganz MillFAV vehicles beyond their designed lifetime;

5.2 Actions taken

According to the information provided by BKV Zrt.:

- Due to vehicle design constraints, no substantial design modifications are possible beyond the earlier retrofitting of the fire alarm system. Following the events described in this final report, the towing specialist service operating the vehicles has carried out an inspection of the structural parts involved in the fires and will continue to monitor their condition as a matter of priority.
- The system for displaying the station’s camera images in the Deák Ferenc Square platform guard room is under construction at the time of the Final Report.

5.3 Additional notes

No risk-increasing factors, unrelated to the occurrence of the incident, have been identified by the EC.

5.4 Proven procedures, good practices

In order to reduce the consequences of the incident and avoid a more serious outcome, the passengers left the train after the doors were opened without being asked to do so, and the driver de-energised the train and extinguished the fire using a fire extinguisher.

5.5 Lessons learnt

The event teaches us the lesson that, although railway vehicles are designed to operate reliably for a much longer period of time than other vehicles, operating beyond their design lifetime will entail increasing and growing risks, even with the most careful maintenance. The continuous deterioration of vehicle design and the increasing difficulty of obtaining replacement parts will make consistent levels of operation more difficult and reduce availability.

The Ganz MillFAV trainsets currently in operation had to be designed to run in a tunnel that was almost 100 years old when the vehicles were designed, which meant that the designers had to make a number of compromises in the placement of the technical equipment. This was the case, for example, with the positioning of the engine cabling as described in section 4.2.2.1. Also reflecting the technical standard of the 1960s and 1970s is the large number of moving parts in the main circuit and control circuits, which perform functions that can be performed in today's equipment by units without moving parts (e.g. speed-brake control, reversal, etc.). Heavy-current switching devices with moving parts entail the risk that, in the event of a component failure with current flowing through it, the component moving out of position will cause a short circuit, thus transferring the heavy current to places that are not prepared to withstand it.

Although it can be seen that this final report is about two fire cases with different causes, the systemic factor in both cases is the obsolete and worn-out vehicle structure. In this situation, the only long-term solution is the procurement of new, modern vehicles, which, due to the specific operational environment, requires specific design and manufacturing, and thus a longer time and significant cost investment.

6. SAFETY RECOMMENDATION

Safety recommendations, together with the findings and conclusions in the final investigation report, represent important information for the further improvement of railway safety. Accordingly,

The addressees of safety recommendations can be the national rail transport authority (ÉKM VHF), other agencies and authorities, the European Union Railway Agency (ERA) and another EU Member State. The organisations responsible for implementation (implementers of the safety recommendations) are, within their respective areas of responsibility, the contracting railway undertakings, infrastructure managers, maintenance organisations and other actors in the railway industry. Accordingly,

- The authorities responsible for safety shall take action as necessary to ensure that safety recommendations are duly taken into consideration and applied where appropriate.
- The organisations responsible for introducing such safety recommendations shall start, with no delay, the risk assessment and risk management activities related to the contents of such safety recommendation within the procedural framework of their safety management system.

Within 90 days of the issue of the safety recommendation, they shall report back to the IC on the actions taken or planned or on their non-acceptance (with justification) of such safety recommendation.

6.1 BA2022-1166-5-01

During the investigation, the IC concluded that the fire on 17/10/2022 was caused by a broken clip of a heavy-current cable, which was due to the combined effect of the load on the cable caused by the vehicle design and the additional load during maintenance, and therefore the TSB issues the following safety recommendation:

number: **BA2022-1166-5-01**

addressee: **BKV Zrt.**

responsible for introduction: **BKV Zrt.**

The TSB recommends that the competent vehicle maintenance service of BKV Zrt. investigate the possibility of installing a treadplate to protect the engine wiring during maintenance in the tunnel ducts of MillFAV vehicles.

By acceptance and expected implementation of the safety recommendation the damage to the wiring running through the floor of the vehicle tunnel ducts as a collateral consequence of maintenance work in the tunnel ducts could be avoided.

6.2 BA2022-1166-5-02

During the investigation, the IC found that visibility of the stations from the platform guard rooms on the M1 metro line is not always adequate, and therefore the IC issues the following safety recommendation:

number: **BA2022-1166-5-02**

addressee: **BKV Zrt.**

responsible for the introduction: **BKV Zrt.**

The TSB recommends that the competent infrastructure management service of BKV Zrt. to consider investigating ways of providing platform guards with a continuous overview of events at the stations under their supervision.

If this recommendation is adopted and implemented, platform managers will be able to inspect the stations under their supervision more effectively, and will therefore be able to react more quickly to any emergency situation and inform KFM.