

# MINISTRY FOR INNOVATION AND TECHNOLOGY

# TRANSPORTATION SAFETY BUREAU

# FINAL REPORT (EXTRACTION)



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# Railway accident / Derailment

10 July 14 July 2020

Lillafüredi ÁEV, 24 June

# 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 24 June, 10 July and 14 July 2020, along the Miskolc – Lillafüred – Garadna line of Lillafüredi Állami Erdei Vasút (Lillafüred State Forest Railway), the passenger wagons with register numbers 012 and 301 (which had gone through general reconstruction shortly before) derailed at two scenes on three occasions.

After the second and third occasions, the IC inspected the scene of the accident and then examined the derailed passenger wagons, reviewed the processes of their reconstruction as well as the organising and management of such reconstruction and the rules and regulations which determine or relate to reconstruction.

The direct cause of the occurrences is that the reconstructed wheels are more sensitive to track anomalies, and the rails have become rough due to wear (excessive friction), and

- Due to the quality of the reconstruction of the wagon with reg. № 012, the rotation of the bogie was obstructed and the wagon was sensitive to the plane distortion of the track;
- At the accident of the wagon with reg. № 301, its coupling device got tangled up with that of the next wagon, due to alteration of its layout during the reconstruction.

Factors contributing to those above:

- Organisation of the reconstruction which involved the reconstruction of a lot of vehicles within one project;
- Lack of standards and specifications fit for the railway system, and as a result, the use of incompatible standards;
- The supervision of tracks and vehicles at the railway company is unresolved;
- Insufficient management of the reconstruction project.

TSB issued a safety recommendation in the course of the investigation already, addressing the engineering decisions related to the coupling device reconstruction and the reconstruction process.

# 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) Direct technical causes:
  - 1. Low wheel flange angle of the derailed vehicles, which is a normal result of the reconstruction;
  - 2. Excessive friction between the wheels and the rails, which can be attributed to:
    - High proportion of reconstructed vehicles, and
    - Lack of rail lubrication;
  - 3. High loads on the derailed wheels, because:
    - The modified coupling device of the wagon turned the bogie outwards in Track Section 43;
    - Due to wear of its sliding plate, the wagon was not able to follow the change of the track's curve radius in Track Section 77 and the cant of the track was also too low;
  - 4. The wheel load of the wagon with reg. № 012 was low, because the wagon did not tolerate the plane distortion of the track well;
- b) Further indirect causes:
  - 1. Presence of a relatively large number of reconstructed wagons on the line;
  - 2. Wrongly modified coupling devices design;
  - 3. The general of the reconstruction of the wagon with reg. № 012 was poor, the organisation carrying out the reconstruction had no adequate experience with railway technology and had no licence from the relevant authority;
  - 4. Use of standards and specifications which were incompatible with the railway system
    - In the absence of own standards and standards for forest railways;
    - Similar specifications of another railway company were adopted without due criticism.

#### 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) Track supervision is the responsibility of the Railway Operations Manager in addition to his managerial duties, in the absence of a contractor or a colleague who could do the job; no action had been taken to involve a contractor or extend the company's headcount;
- b) The controllability of the quality management processes is weak with the organisation carrying out the reconstruction: several work processes and vehicle features were not documented;
- c) No dedicated personnel or contractor is available for vehicle supervision or maintenance.

#### 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:

- a) In project management:
  - 1. The tasks involving different types of vehicles were not divided into different tenders during the public procurement process, due to:
    - Short deadline for accounting for the grants, and
    - The related market risks;
  - 2. Proficient project management was unresolved; within that, there was no assigned engineer (engineering entity) in the execution, the engineering role was played randomly by the players.
- b) In vehicle maintenance:
  - 1. The maintenance system is not based on continuous reconstructions;
  - 2. The maintenance and technical supervision of the vehicles is unresolved at the railway operations;
  - 3. The infrastructure for vehicle maintenance is absent due to a decision of the company;
  - 4. No sufficiently detailed drawings of the reconstructed bogie are available which would enable an external contractor to reconstruct it correctly.
- c) In the field of regulation:
  - 1. The applicable track supervision rules are outdated;
  - 2. There are no internal technical specifications which would match the railway activity and railway systems;
  - 3. The authorisation processes are typically of administrative importance; the too strict requirements prevent players from complying with such requirements at any level.
- d) The company management did not respond to the risks implied by the excessive workload of the managers (already explored earlier) of the railway operations, which was worsened by not involving an extra professional in the execution of the reconstruction project which gave extra tasks.

# 5.2 Actions taken

After the occurrences, the railway operations introduced track lubrication, which brought favourable experiences: rough wear of the rails stopped. It should also be mentioned that this is not general in the network, i.e. selection of the line sections to be lubricated was based on assessment of other risks (hazard of skid).

As regards coupling of vehicles: as a permanent solution was yet to be found, the company returned to the use of the earlier pins with smaller diameter (which loosely fit in the existing broader bores); no tangling of coupling devices has occurred since then.

The IC issued safety recommendations during the investigation as well, on 1 September 2020. The railway company made the following comments to such safety recommendations:

- To the safety recommendation № BA2020-0685-5-01A which relates to the coupling devices:

"Relating to the occurrences concerned, ÉSZAKERDŐ Zrt. has comprehensively reviewed the issues relating to the coupling devices used at LÁEV railway operations. Until a newly designed, safe coupling device is produced, the Company determines the groups of connectible or nonconnectible vehicles via the book of orders. The newly made pins with 50 mm diameter have been replaced by used pins with smaller diameters until a reassuring solution is found. The contractor has replaced the incompatible buffers of the wagons with JAH freight wagon undercarriage with compatible buffers, and a coupling element with appropriate geometrical dimensions has been designed to provide coupling of wagons equipped with buffers manufactured to O&K and MÁV standards.

As regards the involving of other railway operations, we should note that LÁEV has been among those railway operations which have been operating in a well-organised way, as far as the narrow-gauge railway practice in general is concerned. LÁEV had an accepted and consistently used (although not written) set of rules relating to what types of wagons can and must be coupled by what types of coupling elements ("medium" and "large" "figure eight"). That system had worked flawlessly until the reconstructions. In contrast to that, several other railway operations routinely apply long straight rods or Z shaped coupling elements (working as stiff coupling rods) to bridge the buffer height differences and buffer type differences, or other solutions which also disregard the fact that in the case of push mode the generated forces are not transmitted by the buffers but exclusively by the coupling rods. The practice applied by LÁEV has always offered a solution for avoiding the risks resulting from that, and our Company has invariably expected the contractor to design an appropriate coupling element and to determine an appropriate pin diameter with that practice in mind."

– To the safety recommendation № BA2020-0685-5-02A which relates to the person responsible for technical decisions:

"There was no time and possibility to carry out changes in the project organisation on that scale (e.g. to assign a technical inspector) in the vehicle reconstruction project which was coming to an end. However, the pending track reconstruction project is carried out under supervision of technical inspectors employed by a specialised external contractor."

Északerdő Zrt. added the following information:

- To subsection 3 Section 4.1.1 of the Draft Report:

"ÉSZAKERDŐ Zrt. is also aware of the obsolence of the legal environment and technical specifications applicable to narrow-gauge railways such as LÁEV. The biggest problem is the complete lack of specifications and instructions relating to the operation and maintenance of the vehicles.

After realising those shortcomings several years ago, the Company set the goal to substitute at least those of the missing elements which relate to its own railway functions and vehicles with rules developed on their own. At the same time, creation of rules demands considerable capacities from the Company's employees involved in railway operation therefore such rules can only be created after completion of the reconstructions underway. In addition, the new rules applicable to vehicles should largely be based on the documentations to be supplied with the reconstructed vehicles.

Regardless of that, LÁEV Directorate has already taken actions for stricter vehicle inspections: stricter daily checks, introduction of weekly checks (on

a garage pit), which allowed them to detect several irregularities (e.g. spring fractures) which were only revealed after derailment events in the past.

The Company also plans to renew the "Local Annexes" relating to its two railway operations functions, which may take place after the pending and scheduled reconstructions at latest. Until that, the regulations needed for daily operation will be issued via the book of order by the operations managements."

- To subsection 1 Section 4.1.7 of the Draft Report:

"In the meantime, ÉSZAKERDŐ Zrt. signed a contract with PEKA BAU 2000 Kft. for carrying out the tasks of railway track supervision. In line with its intents, the Company determined the terms and conditions of the contract signed on 6 April 2021 in such manner that, based on earlier experience, the contract should serve the practical utilisation of the results of track supervision as well. Accordingly, the Contractor is expected, among others, to arrange for on-site marking of the defect locations. The Company cannot give account of substantial experience with the track supervision activity carried out by the new Contractor, because little time has lapsed since signing the contract."

# 5.3 További észrevételek

Other factors which cannot be linked to the case but increase risk:

- a) In the vehicle reconstructions reviewed:
  - 1. The modified coupling devices become hazardous in certain situations where pushing forces occur;
  - There are excessive wheel diameter differences within a bogie in the wagon with reg. № 012;
  - 3. The entity performing the reconstruction issued incomplete documentation of vehicle measurements: the control measurements did not confirm dimension compliance;
- b) At the railway operations:
  - 1. The railway division management is overloaded, but the Company did not respond to that concern raised earlier;
  - 2. Proper vehicle maintenance has been unresolved for a longer time, repairs are carried out via case-by-case contracts, which hinders the elimination of minor defects that are beyond the means of the railway operations;
  - 3. The track maintenance instruction is incomplete and is not consistent with the technical designs of the vehicles used;
  - 4. Full reconstruction of the railway tracks has been started without the shaping of adequate technical rules.

# 5.4 **Proven procedures, good practices**

The IC identified no factors which would have mitigated the consequences of the occurrence or would have helped avoiding more a serious outcome.

#### 5.5 Lessons learnt

#### Project Management

Similar projects imply a number of risks which tend to multiply and worsen with the increase of project volume. Suitable and proficient project management can

manage such risks, but otherwise they may become a hazard for railway safety (in addition to the financial risks implied by the project volume).

#### Vehicle maintenance

The railway company must arrange for continuous technical supervision of its vehicles by finding suitable staff and elaborating appropriate technologies. It is also necessary to prepare sufficiently detailed technical documentations, especially for the purposes of another reconstruction in the future or for maintenance to be carried out by an external contractor.

#### Regulation

It is indispensable to renew the technical rules applicable to narrow-gauge railways and to create missing rules, but always keeping in mind that such rules should provide solutions for safety on narrow-gauge railways which are functional even within the limitations of such railways. It should also be taken into account that narrow-gauge railways do not constitute a network with the need for interoperability; to the contrary, their separate operations are extremely different, adapting themselves to local needs and possibilities. Railway operation entities are necessarily not uniform, which highlights the importance of local solutions tailored to their unique needs.

As part of the latter, LÁEV's rules should be created by tailoring them for LÁEV's network, i.e. the railway operations staff cannot decline this task, and at the same time, those who create higher tier rules should leave some possibilities open for individual, local rules.

# 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 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 Safety recommendations issued during the investigation

Considering that vehicle reconstructions on the railway and preparatory works for track reconstruction were underway in the course of the investigation, TSB issued safety recommendations before closing the investigations so that existing results of such investigation can be utilised for subsequent works.

#### 6.1.1 BA2020-0685-5-01

The investigation found that certain coupling devices and coupling elements are not safe when coupled with each other. More specifically, the tangling of coupling devices in curves with small radii tends to cause derailment of vehicles. The devices applied are only partly standardised, they also involve technical solutions of experimental nature.

Number: BA2020-0685-5-01

Date of issue: 1 September 2020

Addressee: Északerdő Zrt.

Responsible for introduction: Északerdő Zrt.

TSB recommends the elaboration of standards applicable to the coupling devices for all types used (or which may be used), including provisions of safe coupling and/or the specifying of limitations for applicability, in a joint effort with other similar railway companies.

By acceptance and expected implementation of the safety recommendation, it can be determined exactly during repairs and reconstructions what coupling device designs and dimensions are acceptable, and the use of such coupling devices may eliminate the associated risks for running safety.

#### 6.1.2 BA2020-0685-5-02

The investigation found that there is no clearly assigned and accepted expert responsible for technical decisions among the parties involved in the vehicle reconstruction project; occasionally, such decisions are not made or are made by different people but not necessarily in conformity with one another. Consequently, it is not assured that technical expectations and decisions are generated in a properly managed, consistent decision process which takes safety into account, too.

Number: BA2020-0685-5-02

Date of issue: **1 September 2020** 

Addressee: Északerdő Zrt.

Responsible for introduction: Északerdő Zrt.

TSB recommends that pending vehicle reconstruction projects (as well as the planned track reconstruction projects) should clearly designate a person who will make and be responsible for technical decisions.

By acceptance and expected implementation of the safety recommendation, inconsistent or contradictory technical details may be excluded, as well as situations where technical decisions are not made because the parties involved wait for one another to make a decision.

The actions taken on the basis of the safety recommendations are indicated in section 5.2.

# 6.2 Safety recommendation issued upon closing the investigation

#### 6.2.1 BA2020-0685-5-03

The investigation found that the technical rules applicable to narrow-gauge railways are outdated and incomplete and often adopt rules from nation-wide networks, which may occasionally result in hazardous situations.

#### Number: **BA2020-0685-5-03**

Addressee: Railway Technical Committee

Responsible for introduction: Railway Technical Committee

TSB recommends that technical rules applicable to narrow-gauge railways should be elaborated by meaningfully involving the professionals of narrowgauge railways and with respect to regulatory requirements that are proportional to the risks and possibilities pertaining to such railways.

By acceptance and expected implementation of the safety recommendation, such technical rules can be elaborated which fit to the system and can be applied by the railway companies. The relevant authorities will be able to enforce compliance with such rules without making the operation of railways impossible – consequently, such technical rules will indeed serve safe operation.