



MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY



INVESTIGATING REPORT

of the railway accident
occurred on the 16th of May 2010, on the running wire I,
between the flag station Valea Larga and the railway station CFR Sinaia



*Final EDITION
The 13th of October 2010*

NOTE

With reference to the railway accident occurred on the 16th of May 2010, at 11:45 p.m., on the range of activity of CFR Bucharest Regional Branch, the running section Campina-Brasov (double line electrified) , on the running wire I between the flag station Valea Larga and the railway station CFR Sinaia, on the bridge at km 121+672, by the derailment from the first axle in the running direction of the locomotive EA 40 0017- 0 (belonging to the railway undertaking SNTFM “CFR Marfa” SA) hauling the freight train no. 24796-1 (belonging to the same railway undertaking).

Romanian Railway Investigating Body investigation did not aim to establish the guilty or the responsibility in this case.

Romanian Railway Investigating Body considers necessary to take corrective measures in order to improve the railway safety and to prevent the accidents, so it included in the report a series of safety recommendations.

Bucharest, the 13th of October 2010

Approved by
Dragos FLOROIU
Director

*I agree the compliance with the legal provisions
on the investigation performance and
drawing up of this Investigation
Report that **I submit for approval.***

Chief Investigator
Sorin CONSTANTINESCU

This approval is part of the Investigating Report of the railway accident occurred on the 16th of May 2010, at 11:45 p.m., on the range of activity of CFR Bucharest Regional Branch, the running section Campina – Brasov (double line, electrified), on the running wire I between the flag station Valea Larga and the railway station CFR Sinaia, on the bridge at km 121+672, in the running of the freight train no. 24796-1 (belonging to the railway undertaking SNTFM “CFR Marfa” SA) by the derailment of the locomotive EA 40 0017- 0 (belonging to the same railway undertaking).

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I. PREAMBLE

I.1. Introduction

In the case of the railway accident occurred on the 16th of May 2010, at 11:45p.m., on the range of activity of CFR Bucharest Regional Branch, the running section Campina – Brasov (double line, electrified), on the running wire I between the flag station Valea Larga and the railway station CFR Sinaia, at km 121+664, in the running of the freight train no. 24796-1 (belonging to the railway undertaking SNTFM “CFR Marfa” SA) by the derailment by first axle in the running direction of the locomotive EA 40 0017 - 0, under the article 19 paragraph (2) of the *Law nr. 55/2006 on the railway safety*, corroborated with the art. 48 (1) of the *Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety*, approved by Government Decision no. 117/2010, in order to prevent accidents with similar causes, the Romanian Railway Investigating Body carried out an investigation.

Through the investigation, the information on the respective accident was gathered and analyzed, the conditions were established and the causes determined.

Romanian Railway Investigating Body investigation did not aim to establish the guilty or the responsibility in this situation, its objective being to improve the railway safety and railway incidents or accidents prevention.

I.2. Investigation process

Immediately after the occurrence of this railway accident, the Romanian Railway Investigating Body was notified by the Romanian Railway Safety Authority about the occurrence of the railway accident which involved the locomotive of the freight train no. 24796-1.

No deaths and injuries.

In accordance with the provisions of the art. 3, pt. 1 of the Law 55/2006 on the railway safety and under the art.7, paragraph (1), letter b) of the *Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety*, approved by Government Decision no. 117/2010 the occurrence is qualified as railway accident, so OIFR decided to open an investigation.

Through the decision no. 22 from the 17th of May 2010, of the OIFR Director, the investigation commission was appointed, consisting in:

- | | |
|-----------------------|----------------------|
| ▪ Ionuț-Cristian Bobe | - main investigator, |
| ▪ Stoian Eduard | - investigator, |
| ▪ Marin Drăghici | - investigator, |
| ▪ Sorin Burlea | - investigator |

A. BRIEF PRESENTATION OF THE ACCIDENT

A.1. Brief presentation

On the **16th of May 2010**, at **11:45p.m.**, on the range of activity of CFR Bucharest Regional Branch, the running section Campina – Brasov (double line electrified), between the flag station Valea Larga and the railway station CFR Sinaia, on the running wire I, on the bridge from km 121+672, at km 121+664 occurred the derailment by the first axle in the running direction of the locomotive EA 40 0017- 0 (belonging to the railway undertaking SNTFM “CFR Marfa” SA) hauling the freight train no. 24796-1 (belonging to the same railway undertaking).

The freight train no. 24796-1, consisting in 25 empty Habiis wagons (on 4 axles with sliding walls), 701 gt, tonnage braked after service book 351 tons automatic, 119 hand tons, real braked tonnage 744 tons automatic, 516 hand tons, length 581 meters, was running on the distance Ferry Boat – Vintu de Jos.

After the occurrence of this accident the line was affected on a length of about 80 m.

No damages to the locomotive hauling the train or to the railway installations.

No deaths or injuries.

A.2. Direct cause, contributing factors and root causes

A.2.1. Direct cause of the occurrence of this accident is the escalation of the rail corresponding to the outer wire of the curve, at km 121+664, by the wheel on the right of the first axle of the first bogie in the running direction, due to the inappropriate rehabilitation works to the rail superstructure of the bridge no. 20 between the flag station Valea Larga and the railway station CFR Sinaia.

Contributing factors to the occurrence of this accident were generated by the inappropriate composition of the rail superstructure on the area of the railway bridge and resulted:

- sleepers leaning with the bottom sole on the riveted joints, the bottom sole being inappropriately processed to provide support without strokes vertically;
- excessive cut of the sleepers bottom sole combined with the unfixing of these sleepers by the metallic elements of the bridge (designed for this purpose) in order to prevent longitudinal and transverse displacements;
- sleepers with cracks placed in long to the horizontal axis;
- sleepers with cracks on the upper side of the metal plates leaning point in the tightening direction of the coach screws.

A.2.2. Underlying causes of the occurrence of this accident were determined by the incompliance of the provisions from the art. 77 - 80 of the Instructions for the inspection and maintenance of railway bridges no. 309/2005, regarding:

- wooden sleepers binding against the displacement in long of the bridge under the action of the forces resulted from the rolling stock operation;
- wooden sleepers catching by the full heart beams of the bridge;
- ban of the sleepers leaning on the rivets ends;
- wooden sleepers interlocking next to the rivets ends on the full heart beams, to ensure the settlement of each sleeper on its entire contact surface with the metallic beam;
- maintaining in path of the wooden sleepers grips by lugs-angle complete and inactive.

A.2.3. Root causes

Lack of regulations for:

- the storage of recyclable materials for metal bridge superstructure rehabilitation and technical requirements that these must meet to be reinstate in path;
- the technological process, that has to be complied by the constructor, to execution of the rehabilitation works of the rail superstructure on the metal bridges with recovered wooden sleepers;
- actions prior to reopening the railway traffic and how it can be made, for cases where the constructor performs other works than those provided in the specifications, but with implications for traffic safety.

A.3. Severity level

According to the provisions of the art. 7, paragraph (1), letter b from Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety, approved by Government Decision no. 117/2010, the occurrence is qualified as railway accident.

A.4. Safety recommendations

The addressees of the safety recommendations are: Romanian Railway Safety Authority, public railway infrastructure manager CNCF “CFR” SA and TRANSURB TECHNIRAIL S.A. – TUC RAIL S.A. as consultant of the rehabilitation works of the segment Campina – Predeal in the Pan-European Corridor 4.

The recommendations are directed to settle the following issues:

1. Providing regulations for :
 - recovery, storage and reuse of materials resulting from dismantling the superstructure elements due to the execution of rehabilitation works of Pan-European Corridor 4;
 - operating mode and procedures that must be met by the beneficiary, constructor and consultancy for reopening the railway traffic on sections of the Pan-European Corridor 4, when it does not assume the obligation to carry out the reception of the work performed by the constructor.

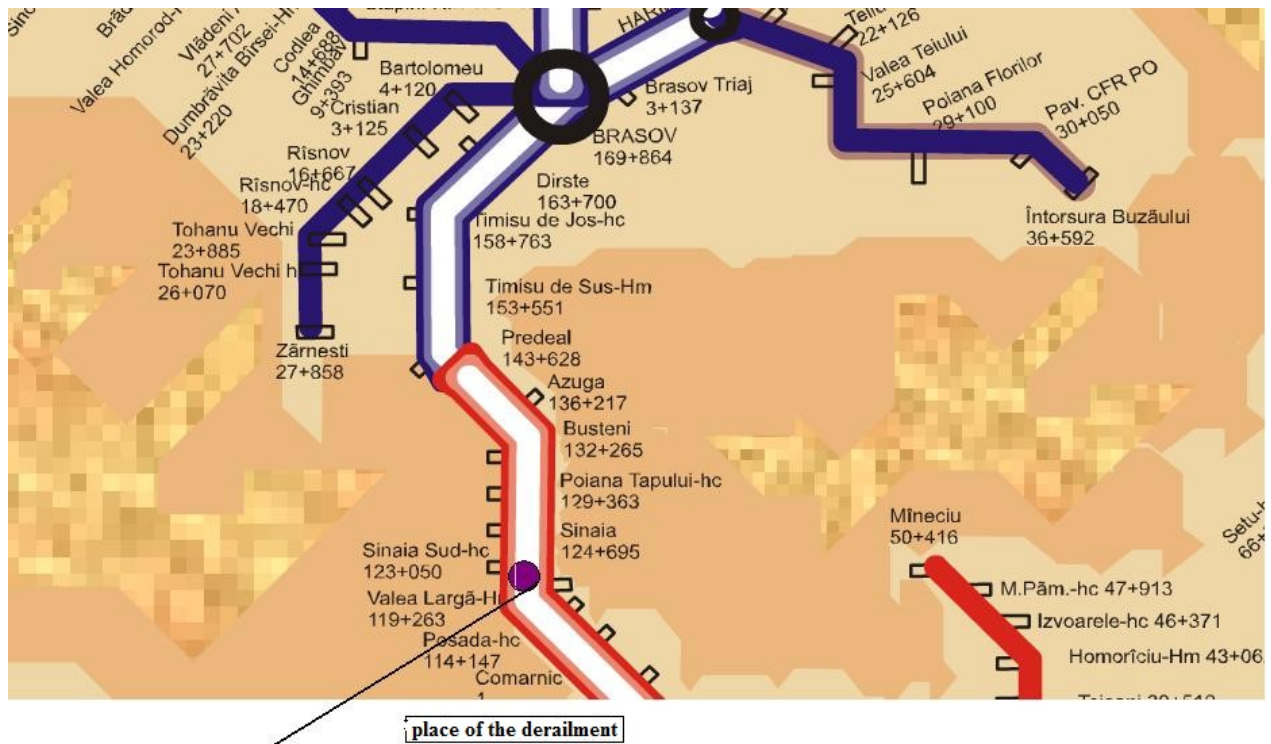
B. INVESTIGATING REPORT

B.1. Description of the accident

On the 16th of May 2010, at 11:45p.m., from the freight train no. 24796-1 running from the railway station CFR Ploiesti Vest to the railway station CFR Brasov, crossing over the railway bridge located in curve at km 121+672 (bridge no. 20 km 121+739 according to the specifications for the rehabilitation works of the path Bucharest - Brasov), from the running wire I Valea Larga - Sinaia, occurred the derailment of the first axle in the running direction of the locomotive EA 017 (belonging to Tg. Mures Depot) that was hauling the train.

On the date of the railway accident the maximum running speed on wire I between the flag station Valea Larga and the railway station CFR Sinaia was restricted to 30 km/h from the km 121+050 (farthest switch no. 2 from the Y end of H.m. Valea Larga) to the km 123+950 (farthest switch no.1A from the X end of the railway station CFR Sinaia) for the rehabilitation works of the Pan-European Corridor 4. The speed restriction was indicated on the spot and provided in the Bulletin of speed restrictions Approval valid for the second decade of May 2010.

The running speed in the moment of derailment was of 23 km/h.



Under these conditions when crossing the freight train no. 24796-1 (belonging to the railway undertaking SNTFM “CFR Marfa” SA) occurred the escalation of the wheel on the right of the first axle in the running direction of the locomotive EA 40 0017- 0 (belonging to the same railway undertaking) followed by the fall of the wheel on the left of the same axle between the two rail wires.

The wheels of the other axles of the locomotive and of the wagons in the composition of the train didn't derail.

The locomotive ran in this condition for a distance of about 80 m, running with the wheels bandages of the first axle on the end of the threaded rods of the vertical screws and the ends of the coach screws that provide metal plates fixing on the sleepers.

B.2. The accident circumstances

B.2.1. Involved parties

The running section where the railway accident happened is managed by CNCF “CFR” SA and maintained by its employees.

The railway infrastructure and the superstructure are managed by CNCF “CFR” S.A. and maintained by the employees of Lines District Sinaia of the Section L5 Campina, CF Bucharest Regional Branch.

Installations signaling, centralization and blocking (SCB) on the line Valea Larga - Sinaia are managed by CNCF “CFR” SA and maintained by the employees of the Section CT 4 Ploiesti, CF Bucharest Regional Branch.

The installation of railway communications between H.m. Valea Larga and the railway station CFR Sinaia is managed by CNCF “CFR” S.A. and maintained by the employees of SC TELECOMUNICATII CFR S.A.

The installation of power and electric traction (IFTE) is managed by CNCF “CFR” SA and maintained by the employees of SC ELECTRIFICARE CFR SA.

The installation of railway communications on the locomotive belongs to the railway undertaking SNTFM „CFR Marfa” SA and maintained by its employees.

The locomotive and the wagons in the composition of the derailed train belong to the railway undertaking SNTFM “CFR Marfa” SA and are maintained and inspected by its employees and the repairs are made by economic operators authorized as railway suppliers.

The investigation commission questioned the employees involved in the railway traffic management, railway lines maintenance.

B.2.2. Forming and equipments of the train

The freight train no. 24796-1, consisting in 25 empty Habiis wagons, 701 gt, tonnage braked after service book 351 tons automatic, 119 hand tons, real braked tonnage 744 tons automatic, 516 hand tons, length 581 meters belonged to the railway undertaking SNTFM “CFR Marfa” SA.

The automatic brake of the train was active, safety and vigilance devices (DSV), the equipment for the point control of the speed and hitchhiking (INDUSI) of the traction locomotive were active and instructionally working. The electric switch box handle of the INDUSI installation was in “M” position, corresponding to the freight trains.

B.2.3. Railway equipments

Description of the rail path

In the area of the occurrence of the railway accident, the rail path in plane consists of a curve with three circular radii of the same direction $R_1 = 410$ m, $R_2 = 385$ m, $R_3 = 375$ m, the theoretical arrows corresponding to these radii being $f_1 = 122$ mm, $f_2 = 129$ mm, $f_3 = 133$ mm, the over-enlargement $s = 0$ mm, the theoretical over-elevation $h = 85$ mm.

In profile in long the path is uphill (in the running direction of the train) with slope of 13.13‰.

On the date of the railway accident the maximum running speed on wire I between the flag station Valea Larga and the railway station CFR Sinaia was restricted to 30 km/h from the km 121+050 (farther switch no.2 from the Y end of H.m. Valea Larga) to the km 123+950 (farther switch no.1A from the X end of the railway station CFR Sinaia) for the rehabilitation works of the Pan-European Corridor 4. The speed restriction was indicated on the spot and provided in the Bulletin of speed restrictions Approval valid for the second decade of May 2010.

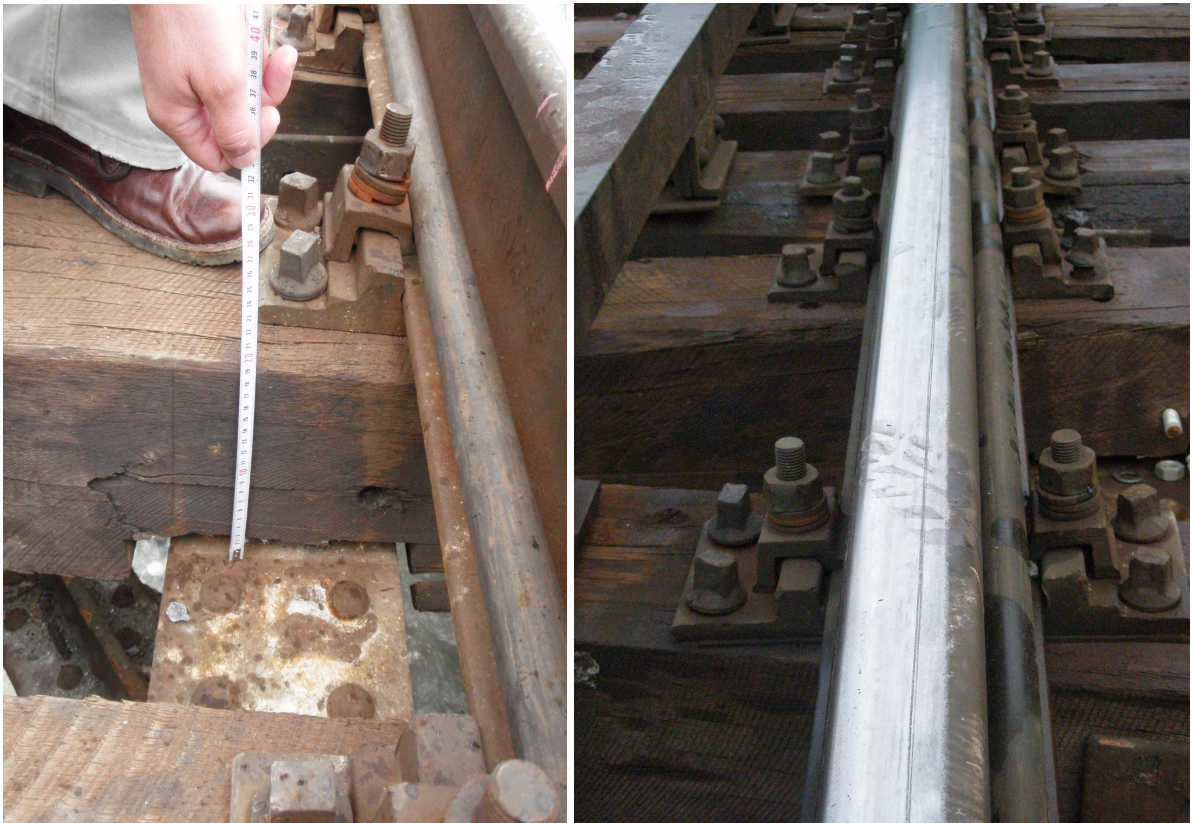
Description of the rail superstructure

The metallic bridge from km 121+739 has a total length of 39,75 m and consists of 3 full heart beams down path with a length of 11,7 each one and is located in curve, its geometrical elements presented above.

The rail superstructure on the bridge consists of rail type 65, with joints, wooden sleepers, indirect clamping type K.

After observing on the spot the construction elements of the rail superstructure there were found the following issues:

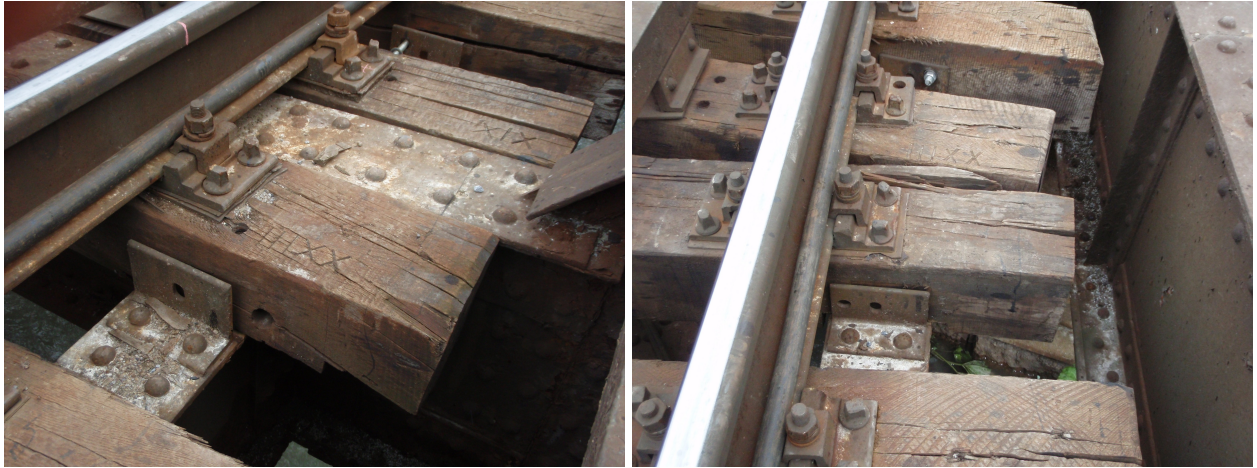
- there was not provided a perfect leaning of the sleepers on the upper soles sides of the bridge beams because some of them were leaning on the rivets head from the joints nodes;



- bottom clippers of the sleepers in some cases were much bigger than the clipper that these should have had according to their position;



- sleepers displacement prevention was not properly ensured, because the horizontal screws which were fixing the sleepers on the bridge construction elements designed for this purpose, in some cases were missing on both ends of the sleepers or they were providing the fixing only at one end;



- some sleepers had cracks in the end section along the sleepers or in the fixation area of the metallic plates on the fixing direction of the coach screws.



Description of the safety installations to control the railway traffic

The flag station Valea Larga and the railway station CFR Sinaia are provided with facilities for signaling, centralization and blocking type CR2 with automatic line block.

The installation of railway traffic control on the running wire I between the flag station Valea Larga and the railway station CFR Sinaia is automatic line block type (BLA) bidirectional double line.

Description of installations of power and electric power supply

The contact line, part of the installation of power and electric power supply, is made of the stranded suspension and its support system on metal poles.

Between the flag station Valea Larga and the railway station CFR Sinaia wire I the stranded suspension is fully compensated type.

B.2.4. Means of communication

The communication between the locomotive driver and the movement inspectors, so as between the locomotive driver and the train party was provided by radiotelephone installations.

B.2.5. Triggering railway emergency plan

Immediately after the railway accident, triggering intervention plan to remove damages and restore train traffic was performed in accordance with the Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety, approved by Government Decision no. 117/2010, from which there came representatives of the public railway infrastructure manager (CNCF "CFR" SA - CF Bucharest Regional Branch), the railway undertaking SC Grup Feroviar Roman SA Bucharest, the Romanian Railway Authority - AFER and of Rail Transportation Policy Operations.

B.3. Accident consequences

B.3.1. Death and injuries

None.

B.3.2. Material damages

The amount of material damages in accordance with the estimates prepared by the owner of the rolling stock, of the means of intervention and the public railway infrastructure manager, is as follows:

• at the locomotive EA 017	665.73 lei
• at the wagons	none
• at the line	none
• at the installations	none
• at the contact line	none
• cost of the means of intervention	none
The total amount of the damages	665.73 lei

B.3.3. Consequences of the accident in the railway traffic

The railway traffic was completely closed between the flag station Valea Larga and the railway station CFR Sinaia wire I from 11:45 p.m. on the 16th of May 2010 to 5:30 a.m. on the 17th of May 2010 and the wire II was already closed for the rehabilitation works of the Pan-European Corridor 4.

Train delays: - 5 passenger trains with a total of 194 minutes;

B.4. External circumstances

On the 16th of May 2010, between 11:00 p.m. – 10:00 a.m. the visibility was good, air temperature was about 1⁰ C.

The visibility of the light signals was in accordance with the specific regulations in force.

B.5. Investigation course

B.5.1. The summary of the of the involved staff statements

The driver of the locomotive EA 017, hauling the freight train no. 24796-1, stated as follows:

- around 11:45p.m. after crossing the bridge from the km 171+739 he felt a jerk which made him take action to brake the train;

- when he felt the jerk the running speed was of 26 km/h;
- after stopping the train he has taken action to ensure it and proceeded to check the locomotive;
- after checking he found that the locomotive derailed by axle no.6 (the first in the running direction) at a distance of about 1 cm from the rails,

The driver assistant locomotive EA 017, hauling the freight train no. 24796-1, stated as follows:

- on the running wire I Valea Larga – Sinaia at km 171+000 around 11:45p.m. he felt a strong jerk;
- after stopping the train as fast braking actions taken by the locomotive driver, he found that the wheels of the axle no. 6 (first in the running direction) were derailed, being at a distance of about 1 cm from the rails on which they were rolling, the wheel on the right being on the right of the rail on the outer wire of the curve (rail on the right) and the wheel on the left being on the left of the rail on the inner wire of the curve (rail on the left);
- after reporting the findings to the locomotive driver he tightened the handbrake of the locomotive and proceeded to ensure the train by tightening the handbrakes to the wagons equipped with handbrake according to the documents accompanying the train.

The head of the lines district no. 7 Sinaia - Section L5 Campina stated as follows:

- he took over the district in March 2010;
- during March-April 2010 he did not thoroughly check the curves on the range because during this period were made measurements of the path geometry and of the rail wear with the TMC autorailer, thereby replacing the checks carried out manually;
- when the fortnightly inspections were carried out to the bridge no. 20, according to the statement no. 4 from the Instruction for setting terms and order for the rail inspections no. 305 approved by OMT no. 71 on the 17th of February 1997, he found that there were missing the horizontal screws that were designed to prevent sleepers displacement, sleepers with inactive vertical grips and inappropriate wooden sleepers;

The Deputy Head of department - Section L5 Campina stated as follows:

- at the date of the railway accident he was Head of district at the Lines District no. 7 Sinaia;
- closing and reopening of the running wire I Valea Larga – Sinaia were done while he was Head of district;
- to reopen the running wire I Valea Larga –Sinaia, together with the SC responsible of the constructor, he checked the superstructure and the path direction on the bridge, but without checking also the curve arrows on the bridge no.20. On this occasion he found side wears of the rails;
- he didn't check if the sleepers were cut properly, so that these don't lean on the rivets heads from the metallic joints;
- after checking and replacing the worn sleepers he announced the head of department that the current line Valea Larga – Sinaia wire I may be reopened with the speed of 30 km/h;
- the railway traffic on the current line Valea Larga – Sinaia was reopened without the representative of the company that provides the technical assistance (the Consulting company);

The head of Section L5 Campina

- in order to reopen the current line Valea Larga – Sinaia wire I asked the head of lines district no. 7 Sinaia that together with the SC responsible of the constructor to carry out detailed checking of the rail condition on all bridges in this current line;
- after checking there were found enlargements grade IV due to side wears of the rails, so that he asked the replacement of these rails;
- on the 15th of January 2010 the current line Valea Larga – Sinaia wire I was reopened by the head of lines district no. 7 Sinaia and the SC responsible of the constructor;

The SC responsible of SC FRANZ KASSECKER GmbH Waldsassen Germany-Bucharest Branch – the works contractor stated as follows:

- on the current line wire I Valea Larga - Sinaia at the bridge no. 20 were not made dismantling works of the rails-sleepers panels;
- as far as he knows the sleepers image was met;
- he considers that the sleepers fixing on the bridge beams was made instructionally;

B.5.2. Safety management system

At the time of the accident CNCF "CFR" SA as manager of the railway infrastructure, had implemented their own system of railway safety management, in accordance with the provisions of the Directive 2004/49/CE regarding the safety on the community railways, of the Law no. 55/2006 regarding the railway safety and of the Order of the Minister of Transport no.101/2008 on granting the security authorization to the administrator / management of railway infrastructure in Romania, being in possession of:

- Safety Authorization – Part A with the identification no. ASA09002 – through which the Romanian Railway Safety Authority from AFER confirms the acceptance of the safety management system of railway infrastructure manager;
- Safety Authorization - with the identification no. ASB9007 – through which the Romanian Railway Safety Authority from AFER confirmed the acceptance of the provisions adopted by the railway infrastructure manager to meet specific requirements necessary to ensure safety of rail infrastructure, in the design, maintenance and operation, including where appropriate, maintenance and operation of traffic control and signaling system.

B.5.3. Norms and regulations. Sources and references for the investigation

In the investigation of the railway accident one took into account:

norms and regulations

- Instruction for setting terms and order for the rail revisions no. 305 approved by OMT no. 71 on the 17th of February 1997;
- Instruction for the lineman head of district for the rail maintenance no. 323/1965;
- Instruction for the activity of the foreman for the maintenance of the line no.322/1972;
- Instruction for the flagmen and rail or dangerous points inspectors no. 321/1972;
- Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989;
- Instructions for the census of the bad sleepers in the path, planning and monitoring their replacement no. 316/1963;
- Instruction for the use of rail measuring wagons no.329/1995
- Instructions for the diagnosis of the rail and of the contact line made with the TMC motorailer approved by the Order of the Minister of Transport, Constructions and tourism no. 2256/27.11.2006

Sources and references

- copies of documents submitted as annexes to the investigation file prepared by the investigation commission appointed through the decision of OIFR Director no. 22 from the 17th of May 2010;
- photos taken immediately after the railway accident by the members of the investigation commission;

- documents on the lines maintenance provided by the persons in charge with the maintenance;
- results of measurements made immediately after the railway accident at the rail superstructure and derailed locomotive;
- inspection and interpretation of the technical condition of the elements involved in the accident: infrastructure, rail facilities and train;
- questioning of the staff involved in the accident;

B.5.4. Work of the technical installations, infrastructure and rolling stock

B.5.4.1. Data found on the line

The technical condition of the line before the occurrence of the railway accident. Railway traffic reopening on wire I between the flag station Valea Larga and the railway station CFR Sinaia.

For the rehabilitation works at the Pan-European Corridor 4, the running wire I between the flag station Valea Larga and the railway station CFR Sinaia was closed on the 12th of June 2009, at 10:00a.m. (Document no.105 in the register for the revision of lines and traffic safety facilities of the flag station Valea Larga).

The bridges rehabilitation works supposed the handover of their site to the works contractor, respectively SC FRANZ KASSECKER GmbH Waldsassen Germany-Bucharest Branch.

The bridge site from the km 121+672 (according to the topographic project the kilometer position of this bridge became 121+739 and the bridge was numbered with no. 20) was handed over on the 24th of August 2009, according to the minute made between Sinaia Bridges Workshop of the Section L5 Campina in CF Bucharest Regional Branch as representative of the public railway infrastructure manager and SC FRANZ KASSECKER GmbH Waldsassen Germany-Bucharest Branch as contractor of this bridge rehabilitation works.

After closing the running wire I Valea Larga – Sinaia and the handover of the bridge site no. 20, the contractor, respectively SC FRANZ KASSECKER GmbH Waldsassen Germany-Bucharest Branch dismantled the rails and the sleepers on the bridge, without other works for its rehabilitation.

Given that the rehabilitation works of this bridge have not been executed, the rehabilitation works of the running wire II Valea Larga – Sinaia should be started.

The start of rehabilitation works of the running wire II between the flag station Valea Larga and the railway station CFR Sinaia was conditioned by reopening of the running wire I.

In order to reopen the railway traffic on wire I Valea Larga – Sinaia, the rail superstructure on the bridge no. 20 had to be rebuilt.

To rebuild the rail superstructure of this bridge the constructor SC FRANZ KASSECKER GmbH Waldsassen Germany-Bucharest Branch used as materials for the construction, the old material originally taken out of the rail, but without verification of their technical condition and without reposition of the sleepers on the initial site.

Compliance with the initial position of the sleepers on the metallic beams of the bridge was necessary because they were cut to the bottom depending on the place where they were from the joints of the construction elements of the metallic beams.

The checks on the line in order to reopen the railway traffic consisted only of the measurement in static condition, with the rail measuring cart, of the gauge and of the rail transversal level.

There were not checked:

- technical condition of the remounted sleepers;
- geometrical elements of the curve where the metallic bridge no. 20 was located;

- sleepers position and their leaning on the metallic beams of the bridge in the points of their construction joints (nodes);
- prevention of the transverse and longitudinal displacements of the sleepers from the metallic beams of the bridge.

On the 12th and 13th of January 2010 the staff of District 7 Sinaia made replacement works of the worn-out rails in the curve from the km 121+330-121+940 on the current line wire Valea Larga - Sinaia, the worn-out rails being replaced on the areas between km 121+350 - 121+600 and respectively km 121+600 - 121+900.

After inspecting the rail superstructure and replacing the rails in the curve from the km 121+330-121+940 on wire I Valea Larga - Sinaia, the Head of the District 7 Sinaia, together with the SC responsible of SC FRANZ KASSECKER GmbH Waldsassen Germany-Bucharest Branch as performer of the works, prepared, on the 15th of January 2010 the minute through which they mentioned that the running wire I Valea Larga could be reopened and the line contact wire could be supplied with power.

Under these technical conditions and based on the minute mentioned above, the railway traffic on the wire I between the flag station Valea Larga and the railway station CFR Sinaia was reopened on the 15th of January 2010, at 6:30p.m., in the register of rails inspection and traffic safety devices of the flag station Valea Larga, signing for the line reopening both the representative for the works execution and the Head of District 7 Sinaia of the Section L5 Campina-CF Bucharest Regional Branch (document no.177).

At the rail superstructure checking to reopen the railway traffic did not take part the representative of the company providing technical assistance (consultancy) for the segment Campina – Predeal, respectively TRANSURB TECHNIRAIL S.A. – TUC RAIL S.A., because he was not informed about the constructor intention to reopen the railway traffic on wire I Valea Larga – Sinaia.

TRANSURB TECHNIRAIL S.A. – TUC RAIL S.A., the company providing technical assistance for the segment Campina – Predeal, only after a detailed checking of the rail superstructure, should have given its approval to reopen the railway traffic, if the rail superstructure was allowing it.

Through Document no. PTL 1380 – CP 9467/19.01.2010 TRANSURB TECHNIRAIL S.A. – TUC RAIL S.A. warned both the constructor, as the beneficiary of their obligation to inform the company that provides consultancy and to convene the commission, of which unconditionally the consultancy representative must be part , for technical checks on site in order to reopen the railway traffic.

Findings and measurements made at the line, after the derailment

After the locomotive restoration on the rails and the release of the current line, some noncompliances were found about the composition of the rail superstructure on the bridge as follows:

- some of the wooden sleepers were not leaning properly on the metallic elements of the bridge superstructure because when the sleepers were reassembled was not complied the initial laying plan. Because of this, these sleepers were leaning on the rivets head of the metallic beams soles or on the rivets head in the construction joints nodes and stiffening of the metallic beams;
- cut of the sleepers bottom soles was much bigger than the cut that these should have had corresponding to the new position;
- sleepers displacement prevention was not properly insured, because the horizontal screws that were fixing the sleepers on the bridge construction elements designed for this purpose, to some sleepers were missing at both ends and to others were missing from one end only;

- some sleepers had cracks in the end section along the sleepers or in the fixing point of the metallic plates in the tightening direction of the coach screws.

measurements at the line

Immediately after lifting the locomotive and releasing the current line measurements at the line were made as follows:

- from the first sign found on the side surface between the rail wires of the rail corresponding to the inner wire of the curve, in the opposite of the running direction of the train, checks were made with the rail measuring pattern to the gauge (E) and to the rail cross level (N), in points with equidistance of 2.5 m;

Gauge (Ec)	14	11	11	12	12	6	5	5
Cross level (N)	77	85	95	103	105	108	102	98

- the measured values are within the tolerances allowed by the Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989.

measurement of the curve km 121+330-121+940 on the current line wire I Valea Larga - Sinaia

The entire length of the curve was divided into equidistance of 10 m, in the resulting points (pickets) being made:

- measurements of the gauge and of the cross level with the rail measuring pattern;
- measurements of the curve arrows in the middle of the chord of 20 m;
- measurements to determine the vertical and side wears of the rails on the outer wire of the curve of the arrows.

Checking the gauge, the cross level, the curve arrows and the vertical and side wears of the rail corresponding to the outer wire of the curve were found the following values:

Number of picket															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ec	-3	-3	-3	-3	-1	-3	-2	-1	7	6	8	9	9	11	6
N	0	3	12	20	24	34	43	51	56	71	76	84	98	83	92
F	8	0	8	8	12	18	31	36	54	60	70	79	86	96	107
Number of picket															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ec	4	3	0	2	2	7	5	2	9	8	8	9	5	10	9
N	91	88	96	94	84	88	90	93	97	99	94	90	92	88	94
F	116	119	125	133	122	123	125	125	120	123	118	122	121	121	126
Number of picket															
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ec	9	15	3	24	14	5	9	11	11	11	4	8	5	11	11
N	91	80	83	75	83	82	76	76	74	82	95	109	108	104	105
F	121	123	129	126	110	140	147	114	135	152	112	128	131	135	135
Number of picket															
	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ec	5	2	6	5	5	4	3	1	0	-2	-2	-1	-2	0	0
N	99	87	78	67	58	47	39	34	24	24	17	12	8	2	-3
F	136	140	131	129	133	116	107	97	92	83	73	68	57	50	45

Note: picket no. 37 corresponds to the area where the rail escalation on the outer wire of the curve occurred and is across the circular curve with radius of 385 m.

<i>Ec</i>	=	<i>gauge</i>
<i>N</i>	=	<i>cross level</i>
<i>F</i>	=	<i>measured arrow</i>

The values of the rail vertical and side wear on the outside wire of the curve do not exceed the tolerances allowed by the Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989.

According to the provisions of the art.7 of the Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989, the tolerances to arrows in arc of circle curves for the curve with radii presented above and the running speed of maximum 30 km/h, the tolerance between the contiguous arrows is of 25 mm.

Analyzing the measured values of the arrows is found that this tolerance was exceeded by the arrows measured next to the pickets no. 35, 36, 37, 38, 40 and 41.

The point where the rail escalation occurred from the outside wire of the curve corresponds to the picket no. 37.

B.6. Analysis and conclusions

B.6.1. Conclusions on the technical condition of the rail superstructure

- noncompliances found on the composition of the rail superstructure on the bridge and exceeding of the tolerances between contiguous arrows under the action of loads given by the operating rolling stock favored the rail escalation from the outside wire of the curve by the wheel on the right of the first axle (in the running direction) of the locomotive;

B.7. The accident causes

B.7.1. Direct cause of the occurrence of this accident is the escalation of the rail corresponding to the outside wire of the curve, next to the kilometer position 121+664, by the wheel on the right of the first axle of the first bogie in the running direction, as consequence of inappropriate rehabilitation works to the rail superstructure of the bridge no. 20 between the flag station Valea Larga and the railway station CFR Sinaia.

Contributing factors to the occurrence of this accident were generated by the inappropriate composition of the rail superstructure on the railway bridge area and resulted:

- sleepers leaning with the bottom slope on the riveted joints, without an appropriate processing of the bottom slope to insure leaning without vertical strokes;
- excessive cut of the sleepers bottom slope combined with the unfixing of these sleepers on the metallic elements of the bridge (designed with this purpose) to prevent longitudinal and transverse displacements;
- sleepers with cracks placed in long to the horizontal axis;
- sleepers with cracks on the top of the leaning area of the metallic plates in the tightening direction of the coach screws.

B.7.2. Underlying causes

Underlying causes of the occurrence of this accident were determined by the noncompliance with the provisions of the art. 77 - 80 from the Instructions for the inspection and maintenance of railway bridges no. 309/2005, regarding:

- wooden sleepers binding against the displacement in long of the bridge under the action of the forces resulted from the rolling stock operation;
- wooden sleepers catching by the full heart beams of the bridge;
- ban of the sleepers leaning on the rivets ends;

- wooden sleepers interlocking next to the rivets ends on the full heart beams, to ensure the settlement of each sleeper on its entire contact surface with the metallic beam;
- maintaining in path of the wooden sleepers grips by lugs-angle complete and inactive.

B.7.3. Root causes

7.3.1. Lack of regulations for:

- the storage of recyclable materials for metal bridge superstructure rehabilitation and technical requirements that these must meet to be reinstate in path;
- the technological process, that has to be complied by the constructor, to execution of the rehabilitation works of the rail superstructure on the metal bridges with recovered wooden sleepers;
- operating mode for the situations when to reopen the railway traffic the works reception is not mandatory (on works phases or final).

C. SAFETY RECOMMENDATIONS

The addressees of the safety recommendations are: Romanian Railway Safety Authority, public railway infrastructure manager CNCF “CFR” SA and TRANSURB TECHNIRAIL S.A. – TUC RAIL S.A. as consultant of the rehabilitation works of the segment Campina – Predeal in the Pan-European Corridor 4

The recommendations are directed to settle the following issues:

1. Providing regulations for:

- recovery, storage and reuse of materials resulting from dismantling the superstructure elements due to the execution of rehabilitation works of Pan-European Corridor 4;
- operating mode and procedures that must be met by the beneficiary, constructor and consultancy for reopening the railway traffic on sections of the Pan-European Corridor 4, when it does not assume the obligation to carry out the reception of the work performed by the constructor.

This investigation report will be sent to Romanian Railway Safety Authority, to the public railway infrastructure manager CNCF "CFR" SA and to the freight railway undertaking SNTFM „CFR Marfa” SA.

Members of the investigation commission:

- | | |
|-----------------------|----------------------|
| • Cristian-Ionuț BOBE | - main investigator, |
| • Eduard STOIAN | - investigator, |
| • Marin DRĂCHICI | - investigator, |
| • Sorin BURLEA | - investigator. |