MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER
ROMANIAN RAILWAY INVESTIGATING BODY

INVESTIGATING REPORT

of the railway accident occurred on the 12th of November 2012,
in the activity of Infrastructure Manager **SC RC – CF Trans SRL Braşov**,
on the open line, at **km 94 + 910 – 95 +118**, from the line no. 117 Livezeni – Lupeni, after derailment first bogie in the running direction of the wagon no. 81536654856-9, (the 5th from the rear of the train) from the train 23815

Final edition
12th February 2013

NOTICE

According to the provisions of the *Regulation for the investigation of accidents and incidents, development and improvement of railway safety on Romanian railway and the metro network, approved by the Government Decision no. 117/2010,* Romanian Railway Investigating Body performed an investigation concerning the railway accident occurred on the 12th of November 2012, at around 17,00, in the activity of the Infrastructure Manager **SC RC – CF Trans SRL Braşov,** on the open line at **km 94 + 910 – 95 +118** from the line no. 117 Livezeni – Lupeni, after derailment first bogie in the running direction of the wagon **no. 81536654856-9,** the 5th from the rear of the train.

Through the performed investigation, the information concerning the occurrence of this accident were gathered and analyzed, the conditions were established and the causes determined.

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

Bucharest, the 12th of February 2013

Approved by
Director,
Nicolae SANDU

I ascertain the compliance with the
legal provisions concerning the investigation
and the drawing up of this investigating report that
I submit for approval

Chief Investigator
Eugen ISPAS

This notice is part of the Report for the investigation of the railway accident occurred on the 12th of November 2012, at around 16,50, in the activity of the Infrastructure Manager SC RC – CF Trans SRL in the running of the freight train no. 23815 (belonging to the railway undertaking SNTFM „CFR Marfă" SA), on the open line at km 94 + 910 – 95 +118 from the line no. 117 Livezeni – Lupeni, consisting in the derailment of the first bogie in the running direction of the wagon no. 81536654856-9, the 5th from the rear of the train.

SUMMARY

A. PREAMBLE

A.1. Introduction

Romanian Railway Investigating Body, hereinafter referred to as OIFR, performs investigations in accordance with the provisions of the *Law no. 55/2006* on the railway safety, hereinafter referred as *Railway Safety Law*, as well as of the *Regulation for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety*, approved by the Government Decision no. 117/2010, hereinafter referred as *Investigation Regulation.*

OIFR's investigation aims to improve the railway safety and to prevent the railway incidents or accidents.

OIFR's investigation is performed independently of any inquiry and does not aim to establish the guilt or the responsibility.

A.2. Investigation process

According to the art. 19, paragraph 2 from the *Railway Safety Law*, corroborated with the art. 48 from the *Investigation Regulation*, OIFR, in the situation of railway accidents or incidents, has to start investigations and to appoint a investigation commissions, in order to gather and analyze technical information, to establish the occurrence conditions and, if case, to issue safety recommendations in order to prevent similar accidents and improve railway safety.

Taking into account the informative note of the Regional Traffic Safety Inspectorate from Railway Operation, Maintenance and Repairs Branch Timişoara, hereinafter referred to as CREIR Timişoara, concerning the accident occurred on the 12th of November 2012, at around 17,00, in the activity of the Infrastructure Manager SC RC – CF Trans SRL Braşov, on the open line at km 94 + 910 – 95 +118, from the line no. 117 Livezeni – Lupeni, in the running of the freight train no. 23815 (belonging to the railway undertaking SNTFM „CFR Marfă" SA), consisting in the derailment of the first bogie in the running direction of the wagon no. 81536654856-9, being the 5th from the rear of the train and taking into account that the railway event is defined as an accident, according to the art. 7, paragraph (1), point b) from the *Investigation Regulation*, OIFR's director decided to start an investigation and appointed an investigation commission.

Through the Decision no. 100, from the 13th of November 2012 of OIFR`s director was appointed an investigation commission, consisting in staff from OIFR, Romanian Railway Safety Authority (ASFR) and from the Infrastructure Manager SC RC-CF Trans SRL Brasov, as follows:

▪ Luca PĂIŞ	OIFR investigator	main investigator;
▪ Livius OLTENACU	OIFR investigator	member;
▪ Mihai SURU	ASFR state inspector	member;
▪ Doru ERDEI	Safety Traffic responsible at SC RC - CF Trans SRL Braşov	member.

B. INVESTIGATION REPORT BRIEF PRESENTATION

On the 12th of November 2012, at around 17,00 o'clock, in the activity of the Infrastructure Manager **SC RC – CF Trans SRL Braşov**, on the open line at km 94 + 910 – 95 +118 from the line no. 117 Livezeni – Lupeni, in the running of the freight train no. 23815 (belonging to the railway undertaking SNTFM „CFR Marfă" SA) a railway accident occurred, consisting in the derailment of 4 wagons: wagon 1 nr. 82536655933-4 – both bogies, wagon 2 no. 82536655657-2 – both bogies, wagon 3 no. 81536653514-5 – bogie 2 in the running direction, **as a result of the derailment of the first bogie in the running direction of the wagon no. 81536654856-9, being the 5th from the rear of the train**.

Following this accident, the traffic between the railway stations Vulcan – Lupeni Grupa Tehnică was closed at the moment of the accident occurrence up to 22,10, on the 15th of November 2012.

There were no delays of freight trains, those being cancelled in the running program and for the passenger trains was assured an auto transport between the railway stations Vulcan and Lupeni.

There were no fatalities or injuries.

The direct cause of this accident was the fall from the interior curve rail of the wheel no. 2 from the bogie no. 1 of the wagon no. 5 from the rear of the train, as a result of the track over-widening under the conditions reduced mobility of the bogie no. 1.

Contributing factors

- the number of unsuitable sleepers on a panel track of 30 m, in a 25% percent vs. 7% admitted, as well as from their position on the panel resulted a number of 6 unsuitable sleepers which had to be urgently replaced, leading to movement under the action of the rolling stock of the metal plates between 8 mm (interior rail) and 24 mm (exterior rail); after measurements and calculations resulted, on the sleeper 19, a real value of the gauge of 1502 mm;
- lack of clearance on the side bearers, afferent the derailed bogie and the simultaneous support of the wagon frame on the two side bearers;
- partial damage of the polyamide liner of the centre pivot casting, through the fragmenting and the collection of this fragments in the inferior part of the centre pivot casting, fact which determined a direct contact (partial) of the upper centre pivot with the lower centre pivot with increasing of the friction coefficient between these two metallic surfaces.

Underlying cause

There were identified the following underlying causes on the skills

- for the ***track examiner*** position, at the track inspection are used track worker (not trained, unauthorized, without a certification of medical- psychological skills for the ganger position);
- for the ***track examiner foreman*** position are used track worker (not trained, unauthorized, without a certification of medical- psychological skills for the gang foreman position).

No underlying causes were identified on the procedures.

There were identified the following underlying causes on the maintenance:

- didn't made the removal of the track failures detected by the testing and measuring car, so the gauge failures detected on the curve from the km 94+955-95+310 in the area of the km 95+100-95+200, at the check from 25th of May 2011, resting until the 12th of November 2011, when the derailment occurred.

- didn't replaced the unsuitable sleepers, reviewed for the period 2011/2012 (described in the delivery documents of the Line 117 (Livezeni - Lupeni), by the L9 Track Section Simeria to the SC RC-CF TRANS SRL Brasov, in a number of 2150 pieces.

Weren't identified root causes.

No safety recommendations were issued.

C. INVESTIGATING REPORT

C.1. Accident presentation

On the 12th of November 2012, in railway station Lupeni Grupa Tehnică, was supplied the train no. 23815, composed from 22 loaded wagons, type Fals. The train was formed from 2 rake of wagons (first with 9 wagons, and the second with 11 wagons from industrial line "Peparaţia Lupeni"), 80 axles, 1600 t gross tonnage, automatic/hand braked after timetable 800/112 t, actually 1042/336 t, 325 m length, for the technical inspection of the train and the complete brake test which were made by only one examiner belonging to the Wagon Inspection from Simeria Marshalling Yard – Wagon Inspection Post Petroşani.

The technical inspection and the complete brake test were finished at 16,00 o'clock, and the train left the railway station Lupeni at 16,30 o'clock and arrived at km 94+700 at 16,40 o'clock, where the train stopped, due the breaking of the coupling, between the 20th and 19th wagons, the interruption of the general brake pipe and of the emergency brake as a result of the derailment of wagon no. 5 at km 95+118,80, then the train stopped and at 22,20 o'clock was the handing-over the locomotive driving.

The maximum running speed, from the departure from railway station Lupeni Grupa Tehnică and until the derailment occurrence was of 28 km/h, the maximum speed allowed for this train being of 40 km/h.

The place where the accident occurred is presented in photo 1.

Photo 1

The railway traffic between the railway stations Vulcani and Lupeni, on the railway section Livezeni-Lupeni was closed until 22,10 o'clock on the 15th of November 2012.

There were no delays of freight trains (those being cancelled in the route program), and for the passengers trains was assured an auto transport between the railway stations Vulcan – Livezeni - Vulcan.

Following the occurrence of the accident were not fatalities or injuries.

The derailed wagons were rerailed in the 13th of December 2012 and the railway traffic between the railway stations Vulcan and Lupeni was resumed at 21,10 o'clock at 15th of December 2012, after the line was repaired.

Following the notification of this railway accident, made according to the provisions of the specific regulations, at the accident place came the specialists of OIFR, Romanian Railway Safety Authority, railway infrastructure manager SC RC – CF TRANS SRL Braşov and freight undertaking SNTFM „CFR Marfă" SA.

According to the classification of the accidents, stipulated at the art. 7, paragraph (1), letter b) from the *Investigation Regulation*, the derailment of the wagon no. 81536654856-9, the 5th from the rear of the train no. 23815, on the 12th of November 2012, is defined as **railway accident** according to the **art. 7, point 1, letter b.**

C.2. Accident circumstances

C.2.1. Involved parties

The infrastructure and superstructure of the track where the accident happened are administrated by SC RC – CF TRANS SRL Braşov**,** infrastructure manager. The maintenance of the superstructure is made by the employees of the District Iscroni.

The hauling locomotive EA 852 and the wagons from the train no. 23815 are owned by the freight undertaking SNTFM „CFR Marfă" SA.

The communication equipment from the locomotive is owned by the railway undertaking SNTFM "CFR Marfă" SA and maintained according to the competences.

C.2.2.Composition and the equipment of the train

The freight train no. 23815, consisting in 20 wagons (loaded), 80 axles, 1600 gross tonnage, 325 m length automatic/hand braked after timetable 800/112 tons, actually 1042/336 tons was hauled with the locomotive EA 852, belonging to the freight undertaking SNTFM „CFR Marfă" SA.

C.2.3. Presentation of the railway equipments involved in the accident

C.2.3.1. Lines

Route presentation

From the dispatching railway station (Lupeni Grupa Tehnică) and until the place where the derailment happened (km 94+910 – 95+118) the train run a distance of 1,504 km, the plan track consisting in a series of straight lines and curves, the curve with the smallest radius (R=186m) being at the km 94+955 - 95+310 (the derailment area).

The track alignment is made of a series of gradients, the maximum one being of 12,5 ‰ at km 95+300-95+300 (gradient in the running direction of the train).

The gradient in the derailment area was of 11,5 ‰ from the km 95+100 - 95+300.

Superstructure presentation

The superstructure is composed from:
- rail type 49,
- wooden sleepers,
- track bed: clogged broken stone

The place of the derailment is located at km 95+118,80, on the curve at the km 94+955 - 95+310 which have, in the direction of track mileage increasing, the next elements:
- radius: 186 m;
- over-widening: 20 mm;

- cant: 60 mm;
- straight line/transition curve point (AR): km 94+955;
- transition curve length L_1 = 35 m (RC at km 94+990);
- circular curve length: L_c = 260 m (CR at km 95+250);
- transition curve length L_2 = 60 m (RC at km 95+310).

C.2.3.2. Equipment

The traffic system between the railway stations Vulcan and Lupeni Grupa Tehnică is made through telephonic arrangements (free pass system).

C.2.3.3. Wagons

The technical characteristics of the wagon no. 81536654856-9

- wagon type	Fals;
- automatic brake type	KE-GP;
- bogies type	Y25Cs;
- automatic brake rod adjuster	DRV 2 AT-600;
- wagon's wheel-base	9,00 m;
- length over buffers	14,54 m;
- tare	25,0 t;
- buffing gear	buffer with rectangular plate;
- draft gear	discontinuous;
- hand brake	handled from the platform;
- load capacity	55,0 t;
- date of the last scheduled repairs (RP)	20th of February 2009 at CTFB workshop;
- maximum period of repair	6 years.

C.2.4. Communication means

The communication between the driver and the movement inspectors was ensured through radio-telephone equipments.

C.2.5. Start of the railway emergency plan

Immediately after the railway accident, the intervention plan for the removal of the damages and for the restoration of the traffic was made in accordance with the information flow stipulated in the *Investigation regulation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety*, approved by the Government Decision no. 117/2010, according which, at the accident place came the representatives of SC RC – CF TRANS SRL Braşov, the railway infrastructure manager, of the railway undertaking SNTFM „CFR Marfă" SA, of OIFR, of Romanian Railway Safety Authority (ASFR) and of the Operative Department of the Railway Police.

C.3. Accident consequences

C.3.1. Fatalities and injuries

None.

C.3.2. Material damages

The value of the material damages, according to the estimations drawn up by the owner of the rolling stock and the railway public infrastructure administrator, is:

Material damages	Value (RON)
at the wagons – according to the estimation no. VSP2/522/2012 from 6th of December 2012	169.530,91

at the lines – according to the estimation no. 392/L/10th of December 2012 from the Section SC RC – CF TRANS SRL Braşov	36.062,69
lifting derailed wagons – according to the estimation no. 24/TM/300/L/2013	4.464,00
TOTAL	**210.057,60**

C.3.3. Consequences of the accident in the traffic

The accident consequences didn't affect the railway traffic, the freight trains being canceled, and for the passenger trains ensured transshipment.

C.4. External circumstances

On the 12th of November 2012, between the hours 12,00 and 18,00, the visibility was good, the temperature was between $+8^0$ C (12,00 o'clock) and $+2^0$ C (18,00 o'clock).

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

C.5 Investigation course

C.5.1. Summary of the involved staff testimonies

The examiner which performed the technical inspection of the train no. 23815 in the railway station Lupeni Grupa Tehnică stated:
- he made the technical inspection at the forming of the train no. 23815 in the railway station Lupeni Grupa Tehnică;
- he made the technical inspection at the arrival, at 2 rake of wagons (first with 9 wagons, and the second with 11 wagons), the wagons came loaded from the industrial railway "Preparaţia Lupeni", these two rake formed the trains no. 23815;
- from 13,30 o'clock he made the technical inspection of the train no. 23815, making also the necessary repairs at the wagons;
- at 15,20, he performed the full brake test with the locomotive of the train up to 16,00 o'clock;
- during the technical inspection, he observed that at 4 wagons the hand brake didn't correspond, he filled in the form „Brake sheets" and signed the route sheet of the locomotive;
- he couldn't identify the lack of cumulative clearance (zero) afferent to the side bearers from the bogie no. 1 of the wagon no. 81536654856-9 because „this is a cumulative failure on the both sides of the bogie and without a colleague I had none to communicate the findings ";

The track worker which performed the technical inspection of the track on the distance km 91 + 700 – 101 + 800 (according to the inspection diagram, it was made every 2 days) stated:
- during the check he didn't observe nothing unusual;
- he performed daily the checking of „track integrity", starting with the 5th of May 2012, receiving this task from the head of the district;
- the main tasks at the „track integrity" checking, established by the head of the district were: „following of the broken fish plates, the missing of vertical or horizontal bolts and fastening of the bolts from the points crossing";
- performance of the inspection was recorded in the „register for the equipment inspection", existing in the movements offices;
- on the 12th of November 2012 he didn't do this inspection, being convened at Hunedoara District, together with other collegues, by the head of the district;
- he doesn't know who did the track inspection on the 12th of November 2012;

The track worker which was the track examiner foreman on the distance where the derailment happened stated:
- he was the track examiner starting with September 2012, getting this task from the head of the district;

- the main tasks set by the head of the district for this job were the „measuring gauge, inspection of the cant, manual packing of sleepers", as well as knowledge about „track sections, inspection and fastening of the track parts";
- the last performed fortnightly inspection was in September together with the head of the district and he doesn't know who performed the fortnightly inspections in October, being on holiday;
- at this inspection he didn't find any failures at the track, in the area where the derailment occurred;
- he explained the missing track fastening parts on the exterior curve rail were the derailment took place by the its theft, by unknown persons with the right tools.

The head of the district which administrated the line Livezeni – Lupeni didn't made any statements and wasn't present at the questionnaires, although he was called by the management of SC RC – CF TRANS SRL Braşov – Branch Timişoara through the act no. 388/TM/300/1/2012, mailed with return receipt.

C.5.2. Safety management system

At the moment of the accident, SC RC – CF TRANS SRL Braşov, as manager of the railway infrastructure, had implemented its own railway safety management system, according to the provisions of the *Law for railway safety* and of the Minister of Transports' Order no. 101/2008 on the granting of the safety authorization to Romanian railway infrastructure administrator/manager, getting**:**

- Safety Authorization – Part A, identification number ASA 08001 (valid until the 27th of June 2018) – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER agrees the acceptance of the safety management system of the railway infrastructure manager;
- Safety Authorization – Part B, identification number ASB 12005 (valid until the 27th of June 2018) – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER agrees the acceptance of the dispositions taken by railway infrastructure manager in order to comply with the specific requirements necessary to ensure the railway infrastructure safety, in the designing, maintenance and operation, including if case, maintenance and operation of the system for the traffic control and signaling.

At the moment of the accident occurrence, SNTFM "CFR Marfă" SA, as railway undertaking had implemented its own railway safety management, according to the provisions of the *Law for railway safety* and of the Minister of Transports' Order no. 535/2007 for the approval of the norms for the granting of the railway transport licenses and the safety certificates in order to perform railway transport on Romanian railways, got:

- Safety Certificate – Part A, no. 0024 – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER agrees the acceptance of safety management system of the railway undertaking, in accordance with the national legislation;
- Safety Certificate – Part B, no. 0060 – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER agrees the acceptance of the dispositions taken by the railway company in order to comply with the specific requirements necessary for the safety operation on the relevant network, in accordance with the Directive 2004/49/EC and the national legislation.

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

In the investigation of the railway accident one took into account the next norms and regulations:

- Regulation for the train running and railway vehicle shunting no. 005, approved by Minister of Transports, Constructions and Tourism's Order no. 1816 from the 26th of october 2005;
- Instructions for the technical inspection and the maintenance of the wagons in operation no. 250, approved by Minister of Transports, Constructions and Tourism's Order no. 1817 from the 26th of October 2005;
- Instructions for the activity of the locomotive staff no. 201, approved by the Minister of Transports, Constructions and Tourism's Order no. 2229 from the 23rd of November 2006;

- Instruction for the establishment of the terms and order of the track inspections no. 305 approved by Order of Minister of Transports no. 71 from 17th of February1997;
- Instruction of norms and tolerances for the track construction and maintenance – lines with standard gauge no. 314/1989 approved by Order of Minister of Transports no. 89 from 10th of January 1989.

In the investigation of the railway accident one took into account the next sources and references:
- copies of the documents enclosed to the investigation file;
- photos taken soon after the railway accident by the members of the investigation commission;
- documents on the maintenance of the lines, provided by the persons in charge with their maintenance;
- results of the measurements and findings made soon after the accident at the superstructure and at the derailed wagon;
- examination and interpretation of the technical condition of the elements involved in the accident: infrastructure and wagons.
- questionnaires and statements of the employees involved in the accident, excepting the Head of the Permanent Way District.

C.5.4 Operation of the technical equipment, infrastructure and rolling stock

C.5.4.1. Data found out on the lines

Findings and measurements at the line, after the derailment

1. At the date of the derailment occurrence, the traffic speed between Vulcan and Lupeni, on the traffic section Livezeni – Lupeni, for the train no. 23815 was of maximum 40 km/h (Freight Timetable Timisoara pg. 119);
2. In the left curve (in the running direction of the train) from the km. 95 + 310 – 94 + 955, on the circular curve, in the point of the km 95+118,80, in the interior curve rail (left rail in the running direction) happened the loose of contact between wheel/rail through the fall of the first wheel (2), of the first bogie of the wagon no. 81536654856-9 between the sleepers 19 and 18 in the interior of the track, according to the below photo 1. It's stated that the distance of 10,80 is measured from the joint at the km 95 + 108. The wheel no. 1 of the axle 1- 2, situated on the right side in the running direction, run on the rail up to the point from km 95 + 075 (track on metallic floor, up track), where happened the rail climbing and the falling in the exterior of the track from the exterior curve rail, between the sleepers 26 and 25 of the bridge, moment in which is derailed also the axle corresponding to the wheels 3 - 4 (numbered sleepers from abutment 1 to the abutment 2), according to photo 2 from below.

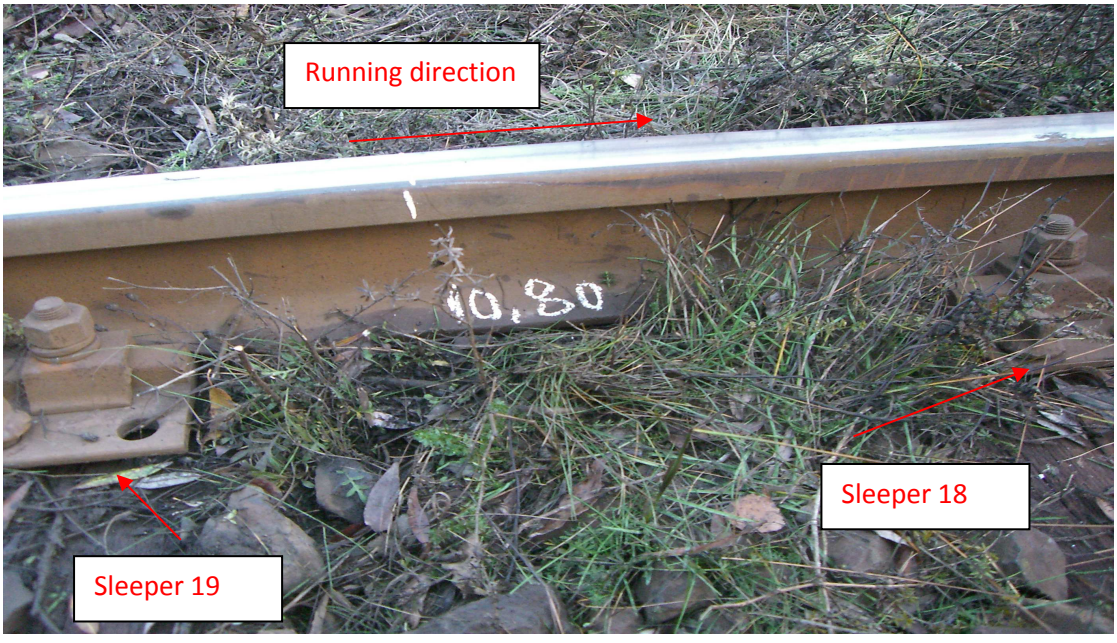


Photo 1

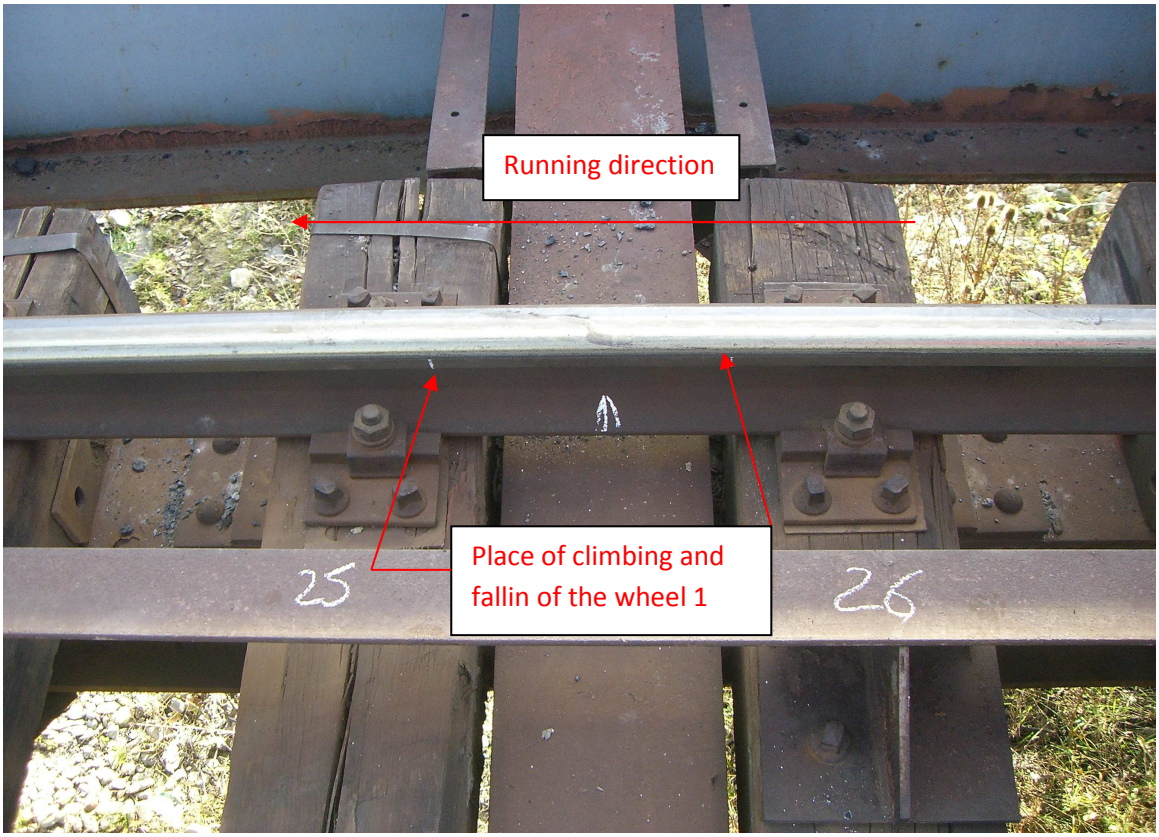
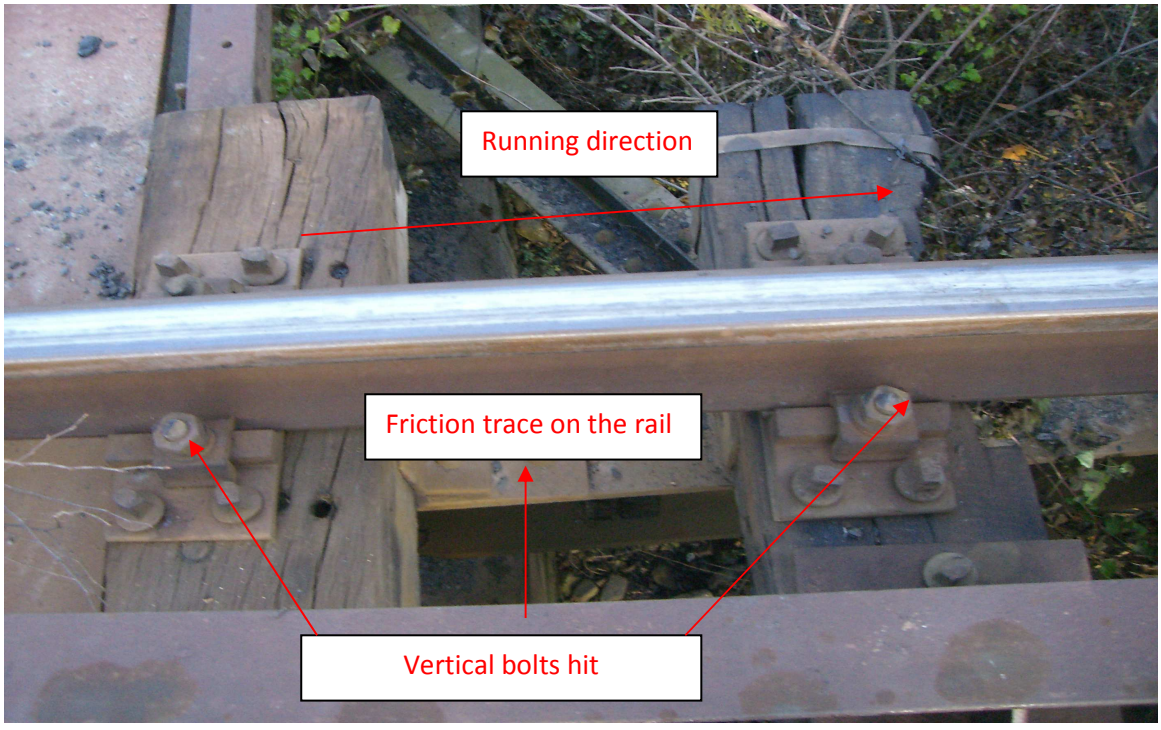


Photo 2

3. Starting his point (km 95 + 118,80 to km 94 + 910) on the vertical bolts from the track interior, on the interior curve rail, running traces from the tyre of the wheel no. 2 can be seen on a distance of 208 m and the friction on the interior lateral surface of the head of the rail by the exterior side of the tyre. Photo 3, taken on the track from the bridge, at km 95 + 075, is obvious.



4. Track panel with a length of 30 m, where the derailment occurred, positioned with the first joint at km 95 + 108, and the second at km 95 + 138. On this track panel have been counted and numbered 52 wooden sleepers, from 1 to 52 (starting from the first joint). The numbering was made reverse the running direction. The number of 52 sleepers on the track panel with a length of 30 m is corresponding to a picture of 1734 pieces/km.
5. The fall of the wheel 2 (left) on the interior curve rail, between the rails of the track, happened between the sleepers **19-18**, at km 95 + 118,80, with the following specifications:
   a. the train run in the sense of decreasing the numbering of the sleepers;
   b. at the sleepers no. 20, 19 and 17 is missing completely the fastening of the rail plate/sleeper corresponding to the exterior line; (eg. Photo 4 - sleeper 19);
   c. coach screws for fastening on the plate/sleeper corresponding to the interior line, reclined to the line exterior, allowing the lateral movement of the unit rail/plate and implicitly the over-widening of the track (eg. Photo 5 - sleeper 19)
   d. the sleepers from the area are classified, according to the Instruction no. 314/1989, art. 25 as unsuitable (advanced rotting of the whole sleeper, which makes it unsuitable for rail fastening), those didn't ensure the fastening of the rails and the gauge in the limit of allowed tolerance;
   e. calculation for the displacement of the fastening plates for:
      - exterior line:
        - real width of the metallic plate for wooden sleepers – 150 mm;
        - width of the plate image – 75 mm;
        - width of the displacement image – 12 mm;
        - resulting a real displacement of 24 mm;
      - interior line:
        - real width of the metal plate for wooden sleepers – 150 mm;
        - width of the plate image – 81 mm;
        - width of the displacement image – 4,5 mm;
        - resulting a real displacement of 8 mm;

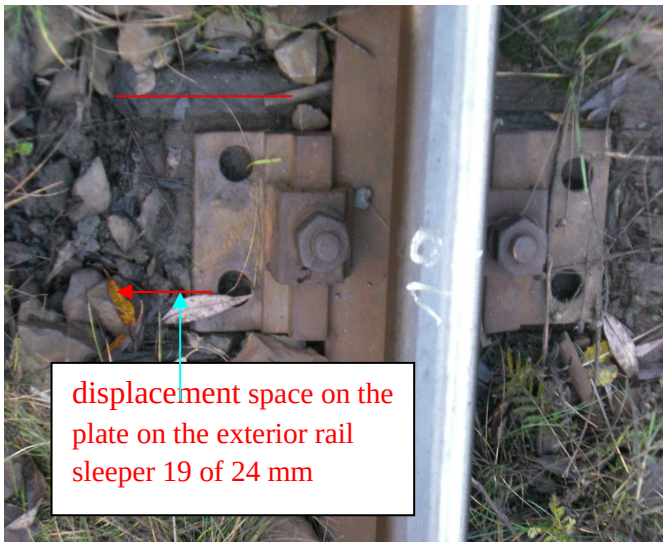


photo 5

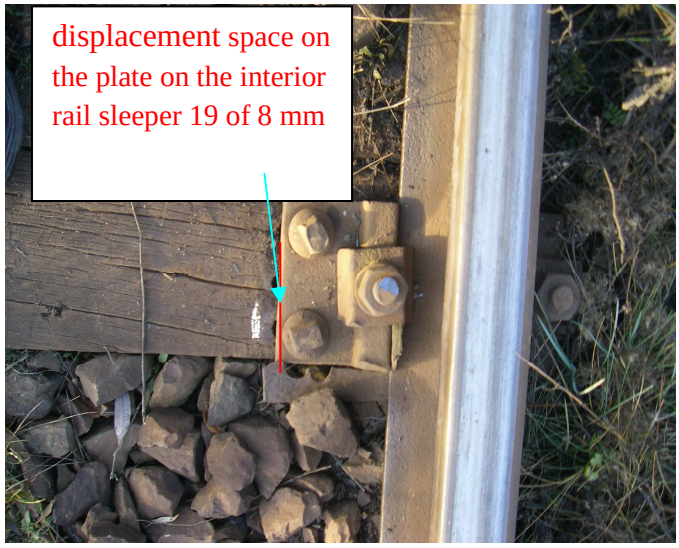


photo 4

   f. on the sleeper 19 the gauge value was:
      - nominal gauge value: 1435 mm
      - measured value: 35 mm
      - displacement value under traffic of the metal plate of the exterior line: 24 mm
      - displacement value under traffic of the metal plate of the interior line: 8 mm
      - total value gauge: 1435 + 35 + 24 + 8 = 1502mm
      - exceeding maximum admitted gauge: 1502 – 1470 = 32 mm

6. From 1,00 m, from the point of the wheel fall of the wheel no.2, reverse the running direction, there were marked the picket from 2,5 m in 2,5 m, in the resulting points were performed measurements of the gauge (E) and the cross level (N) of the track with the gauge measuring device. The track deflections (F) were measured from 5,0 to 5,0 m, with a 10 m measuring rope, and the horizontal (CO) and vertical (CV) wear also in the reading points of the track deflections. The reading values were the following:

Point/ sleeper no.	*-2*	*-1*	*0/20*	*1/25*	*2/30*	*3/34*	*4/38*	*5/42*	*6/46*
E			35	26	27	30	32	29	27
N			52	52	50	52	55	53	54
F	79		85		79		85		71
CV	148		148,5		148		148,5		148,5
CO	28		30,2		30,5		30,5		30,5

7. The above mentioned values were not over the admitted tolerances for the operation, accepted by the provisions of Instruction of norms and tolerances for the track construction and maintenance – lines with standard gauge no. 314/1989.
8. On the analyzed track panel (where the derailment happened) there was found a number of 13 unsuitable sleepers from the 52 existing, which represent 25% (exceeding with 18% vs. 7% admitted by the Instruction 314, art. 25 point 4 paragraph 2).

C.5.4.2. Data on the operation of the rolling stock and its technical equipment

Findings at the train wagons:

- the changeovers „Freight - Passengers" and "Empty - Loaded" were on proper positions corresponding to the wagon condition, respectively the positions "Freight" and „Loaded";
- all the wagons had active automatic brakes;
- the train had 4 wagons with the hand brake out of service, mentioned in the „Braking sheet";
- wagons coupling was proper;
- the coupling in service from the draft gears was fastened properly for freight trains;
- there were no ensured parts which could endanger the traffic safety;
- at the wagon no. 815536654856-9 was not found an over-load, from the Weight Sheet no. 9 from 29th of November 2012, resulting a minus of 1.050 kg.

Findings at the wagon no. 81536654856-9 at the accident site:

- first bogie, in the running direction, derailed from both axles;
- the buffer from the left, at the end of the wagon with derailed bogie, fallen between the track rails, with the rectangular plate cracked on a 70 mm length and with traces of fractioning on the buffer box, the image from photo 6 was realized in the Repairs Shop;

Photo 6

Photo 7

- there were 3 fastening screws found, from which one was in the corresponding hole and 2 screws in the wagon's beam, according to the photo 7;
- the safety stirrup-piece afferent wheel no. 2 was broken (new breakage).

<u>Findings at the wagon no. 81536654856-9 made at SIRV Constanta - IRV Petroşani Workshop:</u>

- clearance of the side bearers at the wheels no. 1 - 3 = 0, clearance of the side bearers at the wheels no. 2 - 4 = 0; **total clearance = 0**, the inferior side bearers of the both sides of the bogie was presenting traces of material snatching (Photo 8 – right side bearer; Photo 9 – left side bearer);

Photo 8

Photo 9

- the polyamide liners, at both centre pivot castings, complete wear with the material fragmentation;
- at the derailed bogie, on an area of about 30-40% from the contact surface between the two centre castings wasn't covered by the polyamide liner, existing traces of friction metal/metal between the two surfaces (upper centre casting/ lower centre pivot casting) (image from Photo 10 / derailed bogie, inferior centre pivot casting);

Photo 10

- material detachment from the wheel no. 2 (cast wheel) of dimensions with length from 10 mm up to 50 mm and width between 5 mm and 15 mm, according to the image from Photo 11; it is specified that a part of those fragments with old crack traces were found also on the open line (at the place of the wheel no. 1 fall), according to image from Photo 12.

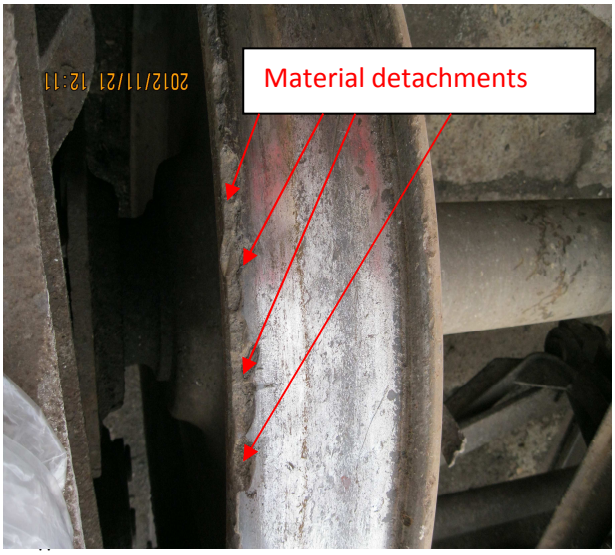


Photo 11

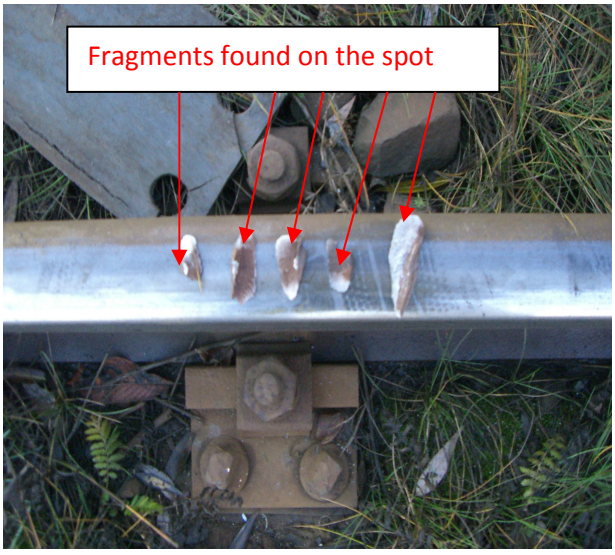
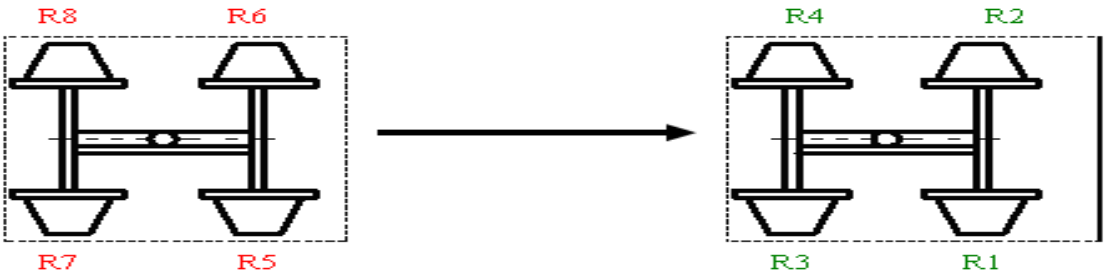


Photo 12

- at the measured values, in the Repairs Workshop, there were not found values over the admitted tolerances in operation by the Instruction no. 250/2005;
- at wagon no. 81536654856-9, there were found failures in the operation of the unit frame - bogie (total clearance between the side bearers on both sides of the bogie no. 1 equal with 0, vs. minimum of 6 mm, admitted by the Instruction 250/2005, table 6, point 2, failure which imposed the un-coupling of the wagon from the train). Both the lack of clearance on both sides of the bogie, and the quality of the surface of the side bearers (rough and with material snatching), also the partial lack of the polyamide liner, don't allowed the optimal turn of the bogie at the curve entrance, causing the increasing of the interaction forces lead wheel/ rail.
- the wheels of the two bogies were positioned with the odd axle journals on the right side and the even ones on the left sides, in the running direction of the train (as shown below);



C.6. Analysis and conclusions

C.6.1 Conclusions on the technical condition of the track superstructure

Taking into account the characteristics described at chapter *C.2.3.1. Lines*, presented in *Presentation of the railway equipment involved in the railway accident*, and the findings and measurements made on the line, after the derailment, described in chapter *C.5.4.1. Data found out on the lines* one can be said that the technical condition of the track superstructure determinates the derailment.

C.6.2 Conclusions on the technical condition of the train wagons

Taking into account the characteristics of the wagon described at chapter *C.2.3.3. Wagons*, presented in *Presentation of the railway equipment involved in the railway accident*, as well as the findings and measurements made at the wagon, after the derailment, described in chapter *C.5.4.2. Data on the operation of the rolling stock and its technical equipment*, it can be said that the technical condition of the wagon determinates the derailment.

C.6.3 Analysis and conclusions on the derailment of the train

After analyzing the findings at the place where the accident occurred, of the technical condition of the superstructure and involved wagon, of the photographs taken at the accident place, as well as the testimonies of the involved employees, one can conclude that the railway accident happened in the following conditions:

- at the passing of the first axle from the bogie no. 1 over the sleepers no. 20 and no. 19, at which the metal plates were not fastened on the exterior line, under the effect of the horizontal component of the forces which acted on the rail, this moved lateral together with the rail, determining a real gauge resulted from measuring and calculation of **1502 mm**, more over 1470 mm (maximum value admitted), so the wheel no. 2 fell from the rail of the interior curve line between the sleepers no. 19 and no. 18, at about 1/3 from the sleeper no. 19, from the distance between these sleepers and the wheel no.1 run normally on the rail;
- in the above mentioned conditions resulted a width of the guiding channel of:
  - 1502 mm – effective gauge of the track on the sleeper no. 19;
  - 1410,58 mm – effective gauge of the axle with the wheels no. 1-2
  - resulted guiding channel – 91,42 mm.
- the lack of clearance on both sides of the bogie, and the quality of the surface of the side bearers (rough and with material snatching), as well as the partial lack of the polyamide liner, don't allowed the optimal turn of the bogie at the curve entrance, causing the increasing of the interaction forces between lead wheel no. 1 and the rail, which determined de lateral movement of the rail of the exterior line and the fall of the wheel no. 2 between the rails of the track;
- after the fall of the wheel no. 2 between the rails of the track, at km 95 + 118,80, the wheel no.1 of the axle 1 - 2 run on the rail until km 95 + 075 (between the sleepers no. 26 and no. 25) on the metal bridge were it climbed on the exterior curve line, falling in the exterior of the track;
- also at km 95 + 075 (between the sleepers no. 23 and no. 22), from the metal bridge, occurred the derailment of the last wagon from the train;

- specific traces of the derailment of wagon no. **81536654856-9,** there were seen on the interior curve rail from km 95 + 118,80 to km 94+ 910, on a length of about 208,80 m.

D. ACCIDENT CAUSES

D.1. Direct causes

The direct cause of this accident was the fall from the interior curve rail of the wheel no. 2 from the bogie no. 1 of the wagon no. 5 from the rear of the train, as a result of the track over-widening under the conditions reduced mobility of the bogie no. 1.

Contributing factors

- the number of unsuitable sleepers on a panel track of 30 m, in a 25% percent vs. 7% admitted, as well as from their position on the panel resulted a number of 6 unsuitable sleepers which had to be urgently replaced, leading to movement under the action of the rolling stock of the metal plates between 8 mm (interior rail) and 24 mm (exterior rail); after measurements and calculations resulted, on the sleeper 19, a real value of the gauge of 1502 mm;
- lack of clearance on the side bearers, afferent the derailed bogie and the simultaneous support of the wagon frame on the two side bearers;
- partial damage of the polyamide liner of the centre pivot casting, through the fragmenting and the collection of this fragments in the inferior part of the centre pivot casting, fact which determined a direct contact (partial) of the upper centre pivot with the lower centre pivot with increasing of the friction coefficient between these two metallic surfaces.

D.2 Underlying cause

D.2.1 Underlying causes on competencies

There were identified the following underlying causes on the skills:

- for the ***track examiner*** position, at the track inspection are used track worker (not trained, unauthorized, without a certification of medical- psychological skills for the ganger position);
- for the ***track examiner foreman*** position are used track worker (not trained, unauthorized, without a certification of medical- psychological skills for the gang foreman position).

D.2.2. Underlying causes on the procedures

None

D.2.3. Underlying causes on maintenance

There were identified the following underlying causes on the maintenance:

- didn't made the removal of the track failures detected by the testing and measuring car, so the gauge failures detected on the curve from the km 94+955-95+310 in the area of the km 95+100-95+200, at the check from 25th of May 2011, resting until the 12th of November 2011, when the derailment occurred.
- didn't replaced the unsuitable sleepers, reviewed for the period 2011/2012 (described in the delivery documents of the Line 117 (Livezeni - Lupeni), by the L9 Track Section Simeria to the SC RC-CF TRANS SRL Brasov, in a number of 2150 pieces.

D.3 Root causes

Weren't identified root causes.

E. SAFETY RECOMMENDATIONS

No safety recommendations were issued.

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This Investigating Report will be transmitted to Romanian Railway Safety Authority, to the public railway infrastructure administrator S.C. RC – CF TRANS S.R.L. and to the railway undertaking SNTFM „CFR Marfă" SA.

Bucharest
12th of February 2013

Members of investigation commission:

▪ Luca PĂIȘ	OIFR investigator	main investigator;
▪ Livius OLTENACU	OIFR investigator	member;
▪ Mihai SURU	ASFR state inspector	member;
▪ Doru ERDEI	Safety traffic responsible at SC RC - CF Trans SRL Brașov	member.