



## INVESTIGATING REPORT

Of the railway accident  
Occurred on March 14, 2009 to Comarnic railway station



*Final edition  
October 22, 2009*

The Romanian Railway Investigating Body developed an investigating action according to the provisions of the Law no.55/2006 on the railway safety, in case of the railway accident occurred on March 14, 2009 in the railway station Comarnic.

By this investigating action were collected and analyzed the information related to the occurrence of this accident and also the causes were established and determined.

The action of the Romanian Railway Investigating Body didn't have as purpose to establish the guilty or the responsibility in this case.

The Romanian Railway Investigating Body considers that is necessary to be taken a series of corrective measures in order to improve the railway safety and to prevent the accidents reason for which in the present report were formulated a series of safety recommendations.

Bucharest, October 22, 2009

Director  
Dragoş FLOROIU

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## **I. PREAMBLE**

### **I.1. Introduction**

Romanian Railway Investigating Body – OIFR started an investigating action in order to prevent some accidents with similar causes by establishing the conditions, determining the causes and issuing some safety recommendations.

The OIFR’s investigating action didn’t have as purpose to establish the guilt or the responsibility, its objective being to improve the railway safety and to prevent railway accidents.

### **I.2. Investigation process**

OIFR performed its activity according to the Law no.55/2006 taking acknowledge of the railway accident occurrence, respectively the derailment of a passenger train, went to the place of the accident and found the results, respectively the derailment of first axle in the traffic direction of the locomotive EA 906 belonging to SNTFC „CFR Călători” SA, that was hauling the passenger train no.3028 on the area of the curve located after the switch no.10 which gives access to the deflecting section 1.

The occurred facts are qualified as railway accident, according to the provisions of article 3, item 1 of the Law no.55/2006 on the railway safety reason for which the OIFR’s director took the decision of performing an investigating action.

By decision no.10 of March 16, 2009, the OIFR’s director the investigating commission was appointed being composed of:

- OLARU Mihai – chief of department - investigator in charge
- DRĂGHICI Marin - investigator - member
- SFÂRLOS Dumitru - investigator - member
- STROIE Tinca – investigator - member
- CIOBANU Eugeniu - investigator - member

Representatives of Romanian Railway Safety Authority, of the National Company of Railways“CFR” - SA and of the National Society of Passenger Railway Transport “CFR Călători” - SA.

## **A. RAILWAY ACCIDENT SUMMARY**

### **A.1. Short description**

On March 14, 2009, at 21:50 o'clock, the passenger train no.3028 that was running on the route Braşov – Ploieşti Vest, at the entrance to Comarnic railway station, on the area of the curve situated behind the switch no.10 which gives access to deflecting section 1 in the area of the end of Y from Brasov derailed the first axle from the locomotive EA 906 in the traffic direction. The train had the incoming route in station with permissive light YF on the deflecting section 1 from Comarnic railway station and entered in the railway station with a speed of 23 km/h.

The place of the accident is located in the area of the curve behind the switch no.10 which gives acces to deflecting section 1 on the adjustment rail from type 60 to tipe 65 from the end of Y of Comarnic railway station at the km 109+775.

The passenger train no.3028, hauled by the locomotive EA 906 that had in composition the locomotive EA 292 (inactive) connected to the hauling locomotive, six passenger wagons, all belonging to SNTFC „CFR Călători” S.A.

The railway accident occurred by derailment of first axle from the hauling locomotive EA 906 in the traffic direction on the area of the curve behind the switch no.10 which gives acces to deflecting section 1.

There were no injured persons or damages of track, installations or wagons.

Comarnic railway station is located on the running section Câmpina – Braşov, belonging to CNCF „CFR” SA - Railway County of Bucharest.

### **A.2. Direct cause and root causes**

**A.2.1. The direct cause** of the accident was the climbing on the outter rail (left – in the traffic direction) of the curve behind the heal of the switch no.10 by the left wheel of the axle no.6 (the first in the traffic direction) of the locomotive EA 906 followed by the falling of the wheel in the exterior of the track. The wheel's derailment from the right part of the axle by wheel's falling inside the track represents a consequence of the left wheel's derailment.

#### **Factors which contributed**

The climbing of the outter rail occured as result of exceeding the safety limit on the conditions of increasing the guiding force (horizontal) on the conducting wheel on the curve of the heal of the switch no.10, fact connected with the lowering the contact point between the tyre's lip and the active lateral surface of the rail and with the increase of the adhesion coefficient between the wheel and rail.

The increase of the (horizontal) guiding force occured because:

- exceeding the maximum speed allowed on the curve located behind the heal of the switch no.10, following the keeping on the track of a curve located behind a switch, without a mandatory introduction of an intermediar alignment with a minimum length (corresponding to the maximum running speed) as is foreseen in the chart no.16, item 10-11 of the Instruction of norms and tolerances for constructions and track maintenance - lines with standard gauge no.314/1989;
- exceeding the tolerances when operating for the values of the adjacent amounts of deflection on the curve.

Lowering the contact point between the tyre's lip and the active lateral surface of the rail is due to:

- lateral wear of the rail in the climbed area with values of 9 mm;
- the existence in the area where occurred the climbing (at approximately 1 metre) of a joint with unsuitable fish plates as it had cuttings in vertical section on the half of the fish plate and holes that were cutted with autogenous welding and presented bigger ovalizations than those allowed, fact that allowed the creation of a vertical shoulder and implicitly the increase of the deformation in vertical plan of the outter rail of the curve.

The increase of the adhesion coefficient between the wheel and rail occurred due to:

- the lack of the greasing oil between the wheel and rail as result of the non-functioning of the installation of greasing the tyres lip;
- the running surface of the first axle had a degree of roughness bigger than that from general operation because the locomotive EA 906 performed its first route after the turning of the wheel's tyres.

### **A.2.2. Root causes**

**The root causes of the accident are the following:**

1. Non-introducing an alignment between the switch and the graduated transition curve with the line 1 when placing the switches, fact that modified the running conditions by decreasing the running speeds. The need of introducing this alignment is foreseen in chart 16, item 10-11 of the Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989.
2. Using the fish plates with oblong holes on the breaking areas fact that influenced the appearance of bigger rail-joint gaps.
3. Non-analising the amount deflection diagram from the heel of the switch no.10 and the wear of the rails running surfaces in order to find possible plane deformations of the curve according to the provisions of the sheet no.4, article 8 of the Instruction for fixing the terms and the order that must be performed the track's inspections no.305/1997.

### **A.3. The severity of the accident**

According to the provisions of article 3, item 1 of the Law no.55/2006, by its consequences, the event is qualified as railway accident.

### **A.4. Safety recommendations**

The beneficiaries of these recommendations are: Romanian Railway Safety Authority, Romanian Railway Notified Body, the public railway infrastructure manager CNCF "CFR" SA, the noninteroperable infrastructure administrators, the railway undertaking SNTFC „CFR Călători” SA and „CFR SCRL Braşov” SA.

Recommendations are given in order to solve the following aspects:

1. Performance by the public railway infrastructure manager and the noninteroperable railway infrastructure administrators of some inspections on the technical conditions of placing the curves after the switches and the running speeds allowed on these areas. For the situations that aren't

foreseen in the instructional provisions, for each case it will be established the necessary measures to be taken, in order to observe the technical conditions foreseen in the Instruction of norms and tolerances for the track construction and maintenance – lines with standard gauge no.314/1989.

2. Modification of the specific regulations in force on the periodical inspections of the locomotives in the sense of introducing the obligation of examining the functioning of the installation of greasing the tyre's lip with the occasion of performing these inspections or after performing the turning of the locomotives wheels tyres.
3. Modification of the technical specification ST 21-008 in order to explicitly establish how to examine the degree of roughness of the running surfaces and also the necessary devices necessary for this examination.
4. Obtaining by CNCF "CFR" SA the safety authorization according to the provisions of article 11 of the Law no.55/2006 on the railway safety.

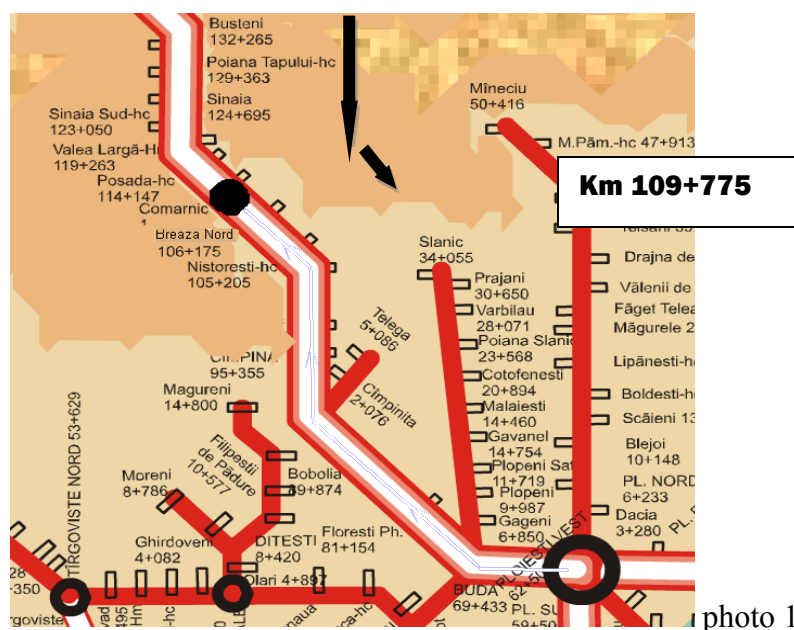
The present investigating report will be sent to the Romanian Railway Safety Authority, Romanian Railway Notified Body, the public railway infrastructure manager CNCF "CFR" SA, the noninteroperable infrastructure administrators, the railway undertaking SNTFC „CFR Călători” SA and „CFR SCRL Braşov” SA.

According to the provisions of the Law no.55/2006 on the railway safety, the Romanian Railway Safety Authority will follow the way of implementing these recommendations.

## **B. THE INVESTIGATING REPORT**

### **B.1. Description of the accident**

On March 14, 2009, the passenger train no. 3028 that circulated on the route Braşov - Ploieşti Vest moved from Valea Largă halt at 21:33 o'clock, circulated without stopping until Posada halt when it stopped for one minute leaving at 21:42 o'clock and running to Comarnic railway station (photo 1).



According to the scheduled train path, after leaving from Posada halt the next stop was Comarnic railway station (photo 2).

The train circulated on the running line 1 to Comarnic railway station with speeds between 49 and 27 km/h.

According to the document of the speed restrictions approval available for the period March 11-20, 2009, the maximum running speed was restricted to 50 km/h until entering to Comarnic railway station where, at 21:50 o'clock in the moment of passing from the switch no.10 (photo 2) of acces to deflecting section 1 occurred the derailment of axle no.6, the first in the traffic direction of the locomotive EA 906.

## COMARNIC STATION

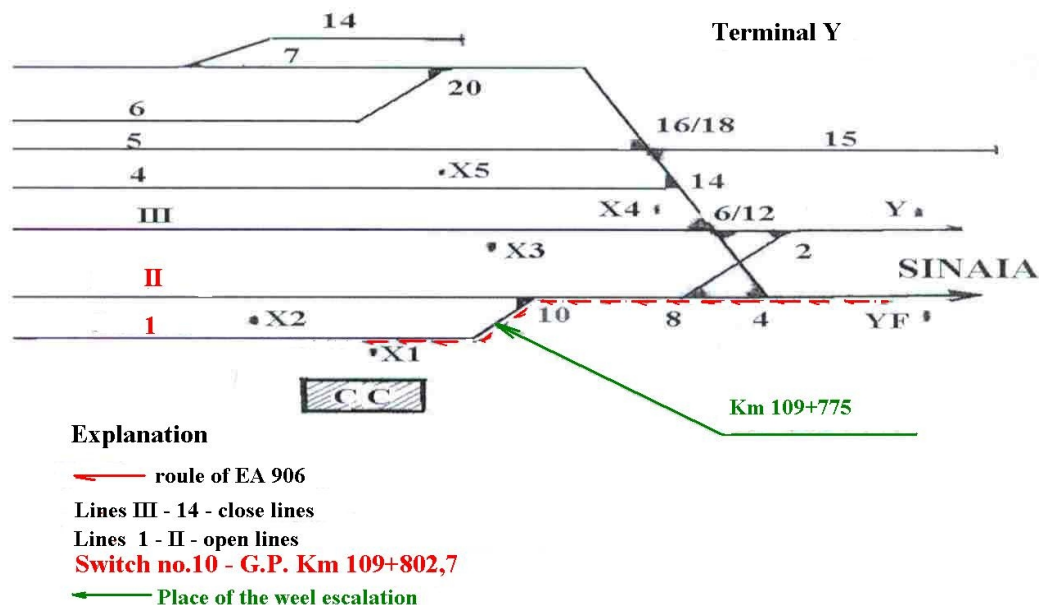


photo 2

## B.2. The railway accident circumstances

### B.2.1. Involved parties

The running section where the railway accident took place is managed by CNCF „CFR” SA and maintained by its employees.

The railway infrastructure and superstructure from Comarnic are managed by CNCF „CFR” SA and maintained by the employees of the Permanent-way district no.6 within Section L5 Cîmpina, Railway County of Bucharest.

The railway traffic control installation and also the interlocking system of Comarnic railway station are managed by CNCF „CFR” SA and maintained by its employees.

The installation of railway communications of Comarnic railway station is managed by CNCF „CFR” SA and maintained by SC TELECOMUNICATII CFR SA employees.

Power for electric traction is owned by CNCF „CFR” SA and maintained by SC ELECTRIFICARE CFR SA employees.

The locomotive's railway communications installation is the property of SNTFC „CFR Călători” SA and is maintained by its employees.

The train's hauling locomotive, the hauled locomotive (inactive) and the wagons of the train's composition are the property of SNTFC „CFR Călători” SA being inspected on the route and maintained by its employees and the repairs are performed by the economic agents, authorized railway suppliers.

The investigating commission asked the employees involved in track maintenance and used the train's staff statements (engine driver, driver's assistant, conductor) that are found in the investigating file.

The investigating commission didn't asked other witnesses when the accident took place (passengers, other witnesses) as this wasn't necessary in order to establish the causes of the railway accident occurrence.

### **B.2.2. Composition and equipments of train**

The train was composed of six passenger wagons and hauled locomotive EA 292 (inactive), 373 tons, 24 axles, automatic braking 232 tons, actually braked 384 tons plus 152 tons comparative with the working timetable, manual braking 44 tons, actually braked 120 tons plus 76 tons, length of 200 metres and was hauled by the locomotive EA 906 , all belonging to the railway undertaking SNTFC „CFR Călători” SA.

The safety and vigilance devices, the speed punctual control installation and the Automatic Train Protection from the endowment of the traction unit were active and were functioning according to the instructions with the automatic brake active.

### **B.2.3. Railway equipments**

The switch no.10 has the geometrical point at the km 109+802.73 and is located into a straight area between the point of the switch 8 and the direct line II.

The switch no.10 is of type 49, with tangent 1/9, deviation on left, radius of 300 m with flexible points and is fitted on wood sleepers.

In the area of the railway accident occurrence, the railway infrastructure is in mixed transverse profile, in ramp (in the sense of the distance of kilometres) with a gradient of 5.57 ‰ (according to the operational longitudinal profile from the evidence of Tracks Division within the Railway County of Bucharest).

The line 1 of arriving dispatching from Comarnic railway station is located to the heel of the switch no.10 on its deflecting section and has the superstructure built of rail type 65 with indirect fastening type „K” on concrete sleepers T 17 and T 26, track without joints.

The connection between the switch no.10 type 49 and line 1 built with rail type 65 is performed with two pannels with adjustment rail from type 60 to type 65 (numbered in the train's traffic direction) with the following characteristics:

- Pannel 1– the right rail (exterior to the curve), rail type 49/65, with a length of 10,941 m ;  
–the left rail (interior to the curve), rail type 49/60, with a length of 10,910 m ;
- Pannel 2 – right rail, rail type 60/65, with a length of 9,000 m ;  
– left rail , rail type 60/65, with a length of 8,925 m ;

The climbing of the wheel from the left of the first axle in the traffic direction from the hauling locomotive occurred on an area between the length of the second adjustment rail at 1 metre from the joint, in the area with rail type 60 and the wheel's falling in the exterior of the curve occurred also on the first part of the second adjustment rail (in the traffic direction of the train), on an area with a rail type 60, at 4 metre from the first trace of climbing.

On March 13, 2009 on the line 1 in the vicinity of the railway accident occurrence were not performed works to the railway installations or lines, the last work in this area being performed on December 30, 2008.

#### **B.2.4. Communications means**

The connection between the engine driver and the movements inspector, also between the engine driver and the train crew was ensured by the radiophone installation.

### **B.3. The railway accident effects**

#### **B.3.1. Lost of human lifes and injured people**

Following the railway accident no victims or wounded persons were registered.

#### **B.3.2. Material damages**

According to the estimates drawn up by the owner of the rolling stock (document no. 154/206/2009) and the public railway infrastructure manager (document no.511/2009) no damage occurred to the lines, installations, locomotives, wagons and environment.

#### **B.3.3. Consequences of the railway accident on the railway traffic**

The first deflecting section from Comarnic railway station was closed to the railway traffic starting with March 14, 2009 at 21:50 o'clock until March 15, 2009, 2:50 o'clock.

Following the railway accident occurrence, five passenger trains delayed with a total of 251 minutes.

### **B.4. External circumstances**

On March 14, 2009, in the interval 21:00-22:00 the visibility was good, the temperature was of approximately minus 2 °C, cloudy sky, with luminosity specific to the night.

In Comarnic railway station the line 1 and the direct line II were available and the direct line III, lines 4,5,6, 7, 11,14, 15 și 16 were permanently closed since 2007 for modernization works of Comarnic railway station.

In the area of the railway accident occurrence the line is curved and in ramp with a gradient of 5.57‰.

The visibility of the light signals were according to the provisions of the specific regulations in force.

### **B.5. Investigation performance**



### **B.5.1. Summary of the involved personnel testimonies**

**The engine driver of the derailed locomotive EA 906 that hauled the passenger train no.3028 stated the following:**

- The coupling of the locomotive EA 906 from the locomotive EA 292 was performed observing the instructional provisions ;
- The locomotives coupling to the train was performed by banking, the coupling being ensured by the conductor and the inspection was performed by the engine driver of the locomotive EA 906;
- There weren't problems in the train's circulation until the moment of derailment ;
- Until Comarnic railway station, the locomotive ran over the points in diverging position from the railway stations Azuga, Bușteni, Sinaia and Valea Largă.

**The driver's assistant** that accompanied the locomotive EA 292 being inactive when was coupled to the locomotive EA 906 stated the following:

- The locomotives were coupled to the train set no.3028 by the examiner and inspected by the engine driver of the locomotive EA 906;
- There weren't problems in the train's circulation until the moment of derailment ;
- In Comarnic railway station, after derailment, the locomotives uncoupling was performed by the conductor.

**The conductor** that accompanied the train no. 3028 stated the following:

- Immediately after the derailment occurrence , following the non-understanding through the radiophone installation by the movements inspector from Comarnic railway station, the conductor went to the movement office and communicated to the movements inspector the derailment of the axle of the locomotive EA 906;
- He assisted to the uncoupling of the two locomotives and for the uncoupling wasn't necessary to give coupling signals in order to compress the buffers.

**The train inspector** that accompanied the train no.3028 stated the following:

- The state of the couplers between the two locomotives was good and for the uncoupling wasn't necessary to compress the buffers;
- After uncoupling the locomotive EA 292 from the locomotive EA 906, the locomotive EA 292 together with the train's wagons were restabled to the direct line II from Comarnic railway station.

**The inspector of district** no.6 Comarnic within Department L5 Câmpina stated the following:

- Starting with the end of the year 2007 all the traffic through Comarnic railway station was performed only on the lines 1 and II, due to the modernization works of lines III, 4, 5, 6 și 7;
- At the last measurement of the heights of the curve from the line 1 of the heel of the switch no.10, performed on November 7, 2008 wasn't drawn the diagram of the heights of the curve in order to check the geometrical elements of the curve.
- Due to the extra-traffic on the lines 1 and II the acces was closed on tracks connections 7-11 from the end of X of Comarnic railway station due to the wear of the curved points from the double diamond crossing with slips 7/11, not taking another safety measure on the two lines and the access switch.

**The safety inspector L** of the Tracks Division within the Railway County of Bucharest stated the following:

- After the first trace of climbing was at 12,050 metres from the joint of the heel of the switch no.10 and the trace of the falling of the first wheel from the left was at 16,000 metres;
- The wear measuring with the gauge was performed on the rail section type 60 and not type 65, as it has been entered incorrectly in the minutes of the finding made by the investigation commission.

### **B.5.2. Safety management system**

In performing its tasks and responsibilities, the infrastructure administrator CNCF „CFR” SA didn't establish its own safety management system.

In this context, CNCF „CFR” SA doesn't ensure the control of all risks associated with the activity of infrastructure management, including the supply of critical railway products and services also the use of the contracting parties.

There isn't implemented a safety policy at the level of CNCF „CFR” SA that should express and reflect the commitment, the obligation ( mission) and the strategic vision of an organization as regards the railway safety that should include a statement of intent and to supply indications on global direction and to general objectives of the safety management system.

### **B.5.3. Norms and regulations. Sources and references for investigation**

At the railway accident investigation the following were taken in consideration:

- The photos realized immediately after the accident occurrence performed by the investigation commission members;
- the minute and the measurements performed immediately after the railway accident occurrence by the members of the examination commission members and those of the investigating commission;
- the documents on tracks and railway installations maintenance put at disposal by the maintenance responsables;
- Examination and interpretation of the technical state of the elements involved in the accident ( line 1 of Comarnic railway station and locomotive EA 906);
- Order no.113/4E/2181/1995 of SNCFR – General Department of Rolling Stock referring to the preparation of the electric locomotives type EA1 for running with speeds until 140 km/h;
- Order no.310/4/a/2800/1993 of SNCFR – Traction General Department referring to „Technical conditions of operating for the axles of the electric locomotives CFR”;
- Technical specification ST 21-2008 on the reprofiling the tyres to the axles of the railway vehicles on the underground lathe type Hegenscheidt of SC CFR SCRL Braşov SA, approved by AFER;
- Technical Regulation of Railway Operating no.002, approved by the Order of the Minister of Public Works, Transport and Housing no.1186 of August 29, 2001;
- Instruction on fixing terms and the succession in which must be performed the inspections of track no. 305, approved by the Order of the Minister of Transports no.71 of February 17,1997, in which are foreseen the terms and the succession of performing the inspections of tracks and curves behind the switches by the personnel in charge with the lines;
- Instruction of the permanent-way man district inspector on track maintenance no. 323/1965 in which are foreseen the attributions and responsibilities of the district inspector on examining the state of the lines from the railway stations;

- Railway technical norm “Railway infrastructure. Re-using track materials recovered following the track maintenance and repairing works” NTF no.7 -002/2006;
- Instruction for composing, maintaining and surveillance of the track without joints no.341/1997;
- Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no. 314/1989 in which are foreseen:
  - The tolerances values of the measurements performed to lines;
  - The method of placing the curves behind the switches and of the running speed allowed on this curves;
- Technical prescriptions on measuring the vertical and lateral wear of the rails 1987, approved by the Order no.30/1298/1987 of the Lines and Installations Department of Bucharest, that are stipulating the attributions and the obligations of track maintenance personnel as regards the rails wear;
- The synthesis of the technical inspection activity no. 6050/689/ 23.04.2009 of the Romanian Railway Notified Body - Products Conformity, Inspection Department, referring to the examination and repairing of the axles fitted;
- State Standard – STAS 112/3-90 „Tyres in changed state for railway vehicles with standard gauge;
- The questionnaires of involved employees.

#### **B.5.4. Functioning of the technical installations, infrastructure and rolling stock**

##### **B.5.4.1. Data found on tracks:**

On the direct line II where is fitted the switch no.10 of access to line 1, on the date of the accident occurrence was introduced a speed limitation of 50 km/h from the km 109+020 to the km 109+770, according to the bulletin in force of approval of the speed restrictions. (BAR)

The running speed established on the deflecting section of switch no.10 of access to line 1 was of 30 km/h, according to the Regulation of the Railway Technical Operation no.002/2001.

At the heel of the switch no.10 was a panel composed of rail type 49/65 on the right rail (exterior to the curve) and of rail type 49/60 on the left rail (interior to the curve), wood sleepers, indirect fastening type”K”, followed by a panel of rail 60/65 on both rails, concrete sleepers T26 and T17, indirect fastening type”K”.

On the right rail (exterior to the curve), between the adjustment rail from type 49 to tupe 65 and adjustment rail from type 60 to type 65, the continuity is ensured by fish plates type 65 cutted to the inferior part with oxyacetylene flame (photo 3).

The connection fish plates that connects to the joint the rail section type 65 to the rail section 60 are cutted to the inferior part and have holes widen by cutting with oxyacetylene flame that allowed the creation of a rail joint gap of 20 mm between the extremities of rail type 65 and 60 ( photo 3);



photo 3

The last works to the line in the area of the derailment occurrence were performed on December 30, 2008 and consisted on replacing the studs on the rail exterior to the curve from the km 109+750 to 109+770.

The last measurement performed with the track measuring truck of line 1 from Comarnic railway station was performed on March 4, 2009. According to the data resulted by decoding the band, on the circular curve behind the switch no.10 was identified an area with widenings of level 2 ( $10 \text{ mm} < \delta < 13 \text{ mm}$ ), widenings that on the moment of the accident occurrence weren't solved.

On March 14, 2009 the specialists within CNCF „CFR” SA – Railway County of Bucharest performed measurements to the gauge and level with the gauge measure to the measuring basis of 2,5 metres on an area between the joint from the heel of the switch no.10 and the rail climbing point by the left wheel of the axle no.6 of the locomotive, the values being illustrated in chart 1.

chart 1 [mm]

Point	1	2	P1	3	4	5	6	7	8	9
f - 18.03.2009	36	69		45	6	20	10	25	12	2
f - 07.11.2008	20	28		28	30	30	24	20	15	10
f teoretic	19	38		38	38	38	38	30	23	15
Lateral wear of the rail UL	0	8	9	5	3	0	0	0	-	-
Point	1	1bis	2	2bis	3	Measurements from 2,5 to 2,5 m (according to the report)				
E-14.03.2009	+8	+3	-2	+1	+14					
N-14.03.2009	13	11	11	3	3					

On March 18, 2009 the investigating commission performed on the line 1, measurements of the arrow (f) from 5 to 5 metres with a wire of 10 metres on the curve's length starting with the joint from the heel of the switch no.10 ( photo 4), the values being presented in chart 1.

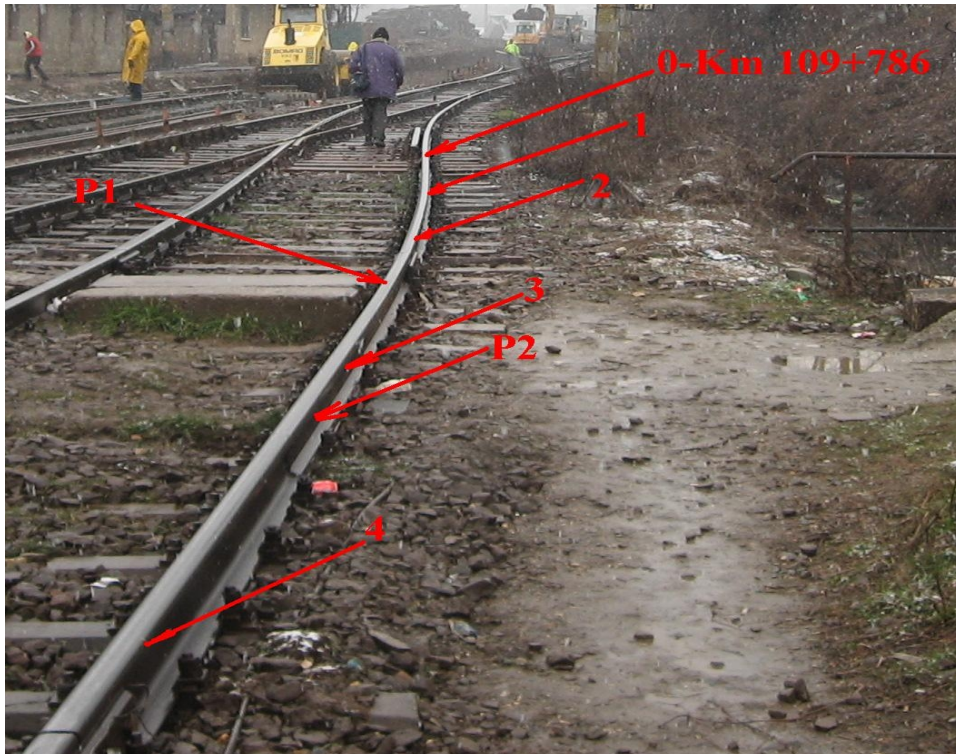


Photo 4

Also, the investigating commission performed measurements of the wear from the rail (the exterior rail) from the right of the curve of the heel of the switch no.10, the values being presented in chart 1;

In the performed analysis were used the measurements from the book of inspection of the curves behind the switches, performed on November 7,2008 by the district inspector Comarnic, the value of the heights of the curve and lateral wear being presented in chart 1.

According to the data from the curves album Section L5 Câmpina, the curve from the heel of the switch no.10 was designed and placed without intermediary alignment by the switch.

The kilometric position of characteristic points and geometric elements (designed) of the curve are the following:

- Alignment point –connection (AR) at km 109+731,
- Connection point – circular curve (RC) to km 109+756,
- Circular curve point – connection(CR) km 109+776
- Connection point – alignment (RA) km 109+786 – coincide with the jpoint from the heel of switch no.10
  - gauge widening,  $s = 10 \text{ mm}$
  - radius,  $R= 330\text{m}$
  - the height of the curve measured at 5 metres,  $f = 37,9 \text{ mm}$
  - cant of rails ,  $h= 0$

At the moment of performing the measurements by the investigating commission, the broken concrete prism in the joint area and of the panel with rail type 60 was choked and predisposed to transformation in muddy area during the rains.

#### **B.5.4.2. Data found at the functioning of the rolling stock and technical installations:**

The speed punctual control installations (INDUSI) and of indicating and showing the speed type IVMS 2001 and also of safety and vigilance were functioning and sealed.

Following the analysis of the records of installation IVMS 2001 from the locomotive EA 906 it was found that on the moment of the derailment occurrence, the locomotive's speed was of 23 km/h, value inferior to the maximum allowed speed on that part of the line (30km/h).

In the machines hall, the machines blocks (S1 - S8) were sealed.

The braking installation of the locomotive was in function and sealed and the brake cock type KD2 was on the position of fast braking.

According to the findings of the investigating commission the flange-lubricating device of the locomotive EA 906 didn't function.

According to the measurements performed by SC „CFR SCRL Braşov” SA – Department of Locomotive's Repairing of Brasov, after performing the inspection type R1, on March 13, 2009, the values of the geometric elements from the axles tyres of the locomotive EA 906 were included in the values allowed by the Regulation of Railway Technical Operation no.002/2001(values foreseen in chart no.2 from below), but the difference between the diameters of the running treads of the wheels from the axle no.2 was exceeding the limit imposed by the technical specification ST 21-2008 on “Reprofiling the tyres to the axles of the railway vehicles on the underground lathe type Hegenscheidt”, so in the measurement sheet after reprofiling the wheels this difference was of 0,5 mm, value superior to that established by the above mentioned technical specification (0,3 mm).

Chart no. 2

Measured dimensions	Measured values (mm)											
	Axle 1		Axle 2		Axle 3		Axle 4		Axle 5		Axle 6	
	ST	DR	ST	DR	ST	DR	ST	DR	ST	DR	ST	DR
A	0	0	0	0	0	0	0	0	0	0	0	0
B	65	64,5	67	68	59,5	59	58	58	63	63	57	58
C	31	31	31,5	32	31	31,5	31	31	31,5	32	30,5	31
q <sub>r</sub> -şablon	>6,5	>6,5	>6,5	>6,5	>6,5	>6,5	>6,5	>6,5	>6,5	>6,5	>6,5	>6,5
q <sub>r</sub> -măsurat	11	11	11	11	11	10,5	11	11	11	11	11	10,5
Φ <sub>st/dr</sub>	1230,07	1229,95	1233,78	1233,28	1217,71	1217,72	1217,57	1217,65	1225,59	1225,71	1217,89	1217,60
D(N)	1360		1360		1359,5		1360		1360		1360	
E(K)	1422		1423,5		1422		1422		1423,5		1421,5	

The last measurement and the control of the loads repartition on the axle to the locomotive EA 906, was performed on the same date as the one when was performed the turning in order to reprofile the tyres of the locomotive's wheels (March 13,2009) and according to the sheet for measuring the axle load and of the mechanical clearances issued by SC „CFR SCRL Braşov” SA – Department of Locomotive Repairing of Brasov, the axle loads of this locomotive were included in the limits foreseen by the Order no. 310/4/a/2800/1993 of SNCFR – General Department of Traction referring to “Technical conditions of operation for the axles of the electric locomotives CFR”.

At the moment of the railway event occurrence wasn't known the technical state of the coupling andshock apparatus respectively the way of coupling to EA 906 and EA 292, as at the hour of the investigating commission arrival, the locomotives were untied and the specialists of the public railway infrastructure manager and of the railway undertaking didn't prepare a document in order to mention this.

On the journey report series G no.6379 corrections appear, contrary to the provisions of article 27, paragraph 2 from Instructions for the activity of the locomotive's personnel in the railway transport no.201/2007, especially the gross train tonnage – from „273 t” is corrected with „373 t”.

On the journey report are noted other mentions than those that must have been recorded according to article 25, annex 1 from Instructions for the activity of the locomotive's personnel in the railway transport no.201/2007, didn't result the way that the locomotive EA 292 was prepared in order to run to the home depot respectively “multiple” or “inactive”.

There weren't performed the corresponding registerings in the incident record of the locomotive, foreseen at article 88, paragraph 3, part II, respectively article 1, paragraph 4 b, annex 2 of the Instructions for the activity of the locomotive's personnel in the railway transport no.201/2007, respectively article 36, paragraph 3, item c and article 36, paragraph 5 of the Regulation of hauling and braking no.006/2005 and the specialists of the public railway infrastructure manager and of the railway undertaking, at the moment of the event occurrence, couldn't perform the findings on the preparation method of the locomotive EA 292 for hauled circulation such is, if the exchanger “traction- hauled” was in a corresponding position so, if the locomotive participated or not to the train's braking with direct implications that resulted in the circulation's dynamic, implicitly of the train's braking.

#### **B.5.5. Point of view of SNTFC “CFR Călători” SA reffering to the cause of derailment expressed with the occasion of examining the final report draft**

SNTFC “CFR Călători” SA affirms that the gradient mentioned in the file as being 5.2 ‰ is in fact of 9.83 ‰, this gradient doesn't observe the article 6, the fourth from the Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989 that foreseens that “The connection of gradients is performed outside the switches. The distance from the first or last joint of the switch to the gradients connection must be at least 5 metres. The connection in longitudinal profile in the area of the switches is approved in justified cases by the Department Lines and Installations at the proposal of the director responsible with the maintenance”.

SNTFC “CFR Călători” SA points out that from March 15, 2009 the access from Valea Largă – Comarnic to line 1 was closed, Comarnic railway station considering that this measure was taken by the manager of the railway infrastructure in order to avoid similar situations.

SNTFC “CFR Călători” SA points out that for connecting the deflecting section of the switch it is mandatory to introduce an alignment (g), where  $g \geq V/5$  on the lines where passenger trains are running ( $g=6$  m) and to line 1 of Comarnic railway station, this alignment doesn't exist.

SNTFC “CFR Călători” SA points out that the measurement to the track were performed in a static regime not a dynamic one, the value of the measurements in a dynamic regime being another one.

SNTFC “CFR Călători” SA didn't agree that the increase of the friction coefficient between the wheel and the rail due to the lack of the greasing oil and of the running surface with a higher level of rugosity than the one from operating and the findings on the track represents the main cause of the accident.



In this sense the arguments of SNTFC “CFR Călători” SA were the following:

- the device of greasing the tyre’s lip only has the role to reduce the wear of the tyre and rail, in time this uncontrolled wear can affect the traffic safety;
- the lack of the greasing oil as cause of derailment is argued by the specific literature respectively the Book of the electric locomotive engine driver-Drăghici and Călceanu and Dynamic of the railway vehicles - Sebeşan;
- the installation of lubricating the tyre’s lip type Secheron with intermittent running so it exists the possibility that this installation hasn’t ensured the lubrication in the moment of derailment;
- the national constructor of locomotives didn’t imposed by instructions the obligativity to have the device of lubricating the tyre’s lip in function at the exit from depot;
- there weren’t described cases of derailments because of the lack of the greasing oil ;
- the situation is similar to the railway administrations of France, England, Germany etc.
- the note drawn up by Feroviar Proiect Caransebeş, company that in 2000 participated to tests together with EBA and Deutsche Bahn AG for the locomotive LDE 2100 CP in Germany points out that the controlling forces aren’t significantly influenced by the existence of lubrication as the generated pressure destroys the lubrication film;
- also, at the request of SNTFC “CFR Călători” SA, the University of Politehnica Arad performed a study that points out that the functioning of the installation of lubricating the tyre’s lip can’t justify the locomotive’s derailment;
- it can’t be determined the roughness by measuring as SNTFC “CFR Călători” SA doesn’t have a measurement device;
- the automatic lathe of Brasov is designed to perform turnings with a roughness smaller than 12,5 µm in normal conditions of operation;

## **B.6. Analysis și Conclusions**

### **B.6.1. Dynamic of the curve geometrical elements evolution (track geometry) and the wear of the rails (track micro geometry) and implications on the traffic conditions.**

At the scale were represented the diagrams of the heights of the curve for the designed curve, the curve measured in 2008 and the curve after the derailment occurrence, over which overlapped (at different scale) the diagram of lateral wear of the rail from the exterior of the curve (the rail climbed by the left wheel of axle no.6). The graphic representation is illustrated in the drawing board no.1, according to the values registered in chart no.1.

It were calculated the values of the circular curve radius for the values resulted from the three cases, the values being registered in the drawing board no.1.

The minimum value of the curve’s radius, measured after derailment is of 181 metres, corresponding to the maximum of the heights of the curve.

The rail type 60, fitted on the line from the right of the curve (the exterior of the curve) has lateral wears, its value being between 5 and 9 mm, that corresponds to the area on which occurred the climbing of the wheel from the left of the axle no.6.

The areas with maximum values of the wears are corresponding to the areas with minimum values of the curve’s radius (areas with the maximum curvature-  $C_{\max} = 1/R_{\min}$ ).

It was calculated the value of the mandatory minimum length that an alignment must have for the case of placing the connection curve between the heel of the switch no.10 and deflecting section no.1 of Comarnic railway station in the conditions that the running speed established on this area was of 30 km/h.

According to the provisions of chart 16, item 10-11 of Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989, referring to the switches placing, for the speed of 30 km/h resulted the following values for the minimum length of the alignment (g):

- $g \geq 6$  metres on the lines where passengers trains are running;
- $g \geq 3$  metres on the lines where passenger trains are not running;

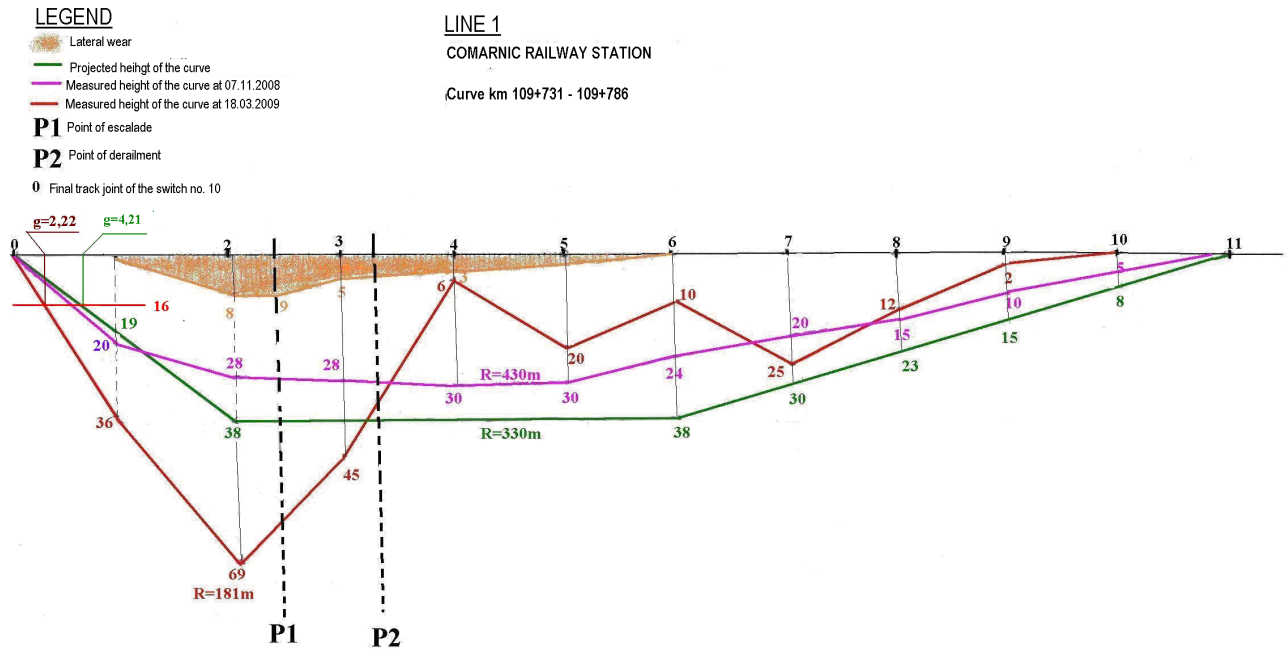
Taking into consideration a difference of maximum 16 mm between the height of the side curves corresponding to a maximum running speed of 30 km/h, value that is foreseen at chapter 1, article 7,B.1. of the Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989, it was calculated the maximum length of the alignment (deformed) inserted between the heel of the switch no.10 and the connection curve with the deflecting section no.1 for the following cases:

- the curved designed with the value of the height of the curve determined at 5 metres from the heel of the switch  $f = 19$  mm for which the length of the alignment is  $g = 4,21$  m;
- The curve existent at the derailment occurrence with the value of the height of the curve measured at 5 metres from the heel of the switch  $f = 36$  mm, for which the length of alignment is  $g = 2,22$  m.

Using the conditions foreseen to chart 16, point 10-11 of Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989 referring to the switches placing, were determined the values of the allowed running speeds (V) on the curve from the heel of switch no.10 for the two values of the alignment's length, previously determined, resulted the following values:

- For  $g = 4,21$  metres:
  - For the lines where passenger trains are running -  $g \geq V/5$  results that  $V \leq 5g$ , respectively  $V \leq 21,05$  km/h;
  - For the lines where freight trains are running -  $g \geq V/10$  results that  $V \leq 10g$ , respectively  $V \leq 42,1$  km/h;
- pentru  $g = 2,22$  metres:
  - for lines where passenger trains are running -  $g \geq V/5$  rezultă că  $V \leq 5g$ , respectively  $V \leq 11,10$  km/h (drawing board no. 1);
  - For the lines where freight trains are running -  $g \geq V/10$  results  $V \leq 10g$ , respectively  $V \leq 22,20$  km/h (drawing board no. 1);

drawing board 1



- the area between the heel of the switch no. 10 and the first 30 m of the connection curve with the deflecting section 1, because of the wrong design and construction, was permanently submitted to some additional running, running that increased following the permanent closing of the lines III, 4-14, from the railway station, for modernization works and change of the traffic on the direct line II and the deflecting section 1;
- the values of the track deflections, after the derailment, on the track section non-concerned indicate that, in conditions of running, in time, the values of the geometrical parts of the curve from the line 1 changed leading to the disappearance ( cancellation ) of the designed connection curve that was replaced by a circular curve with a radius between 330 m and 181 m;
- the proof of the distortion in time of the curve geometrical parts, that led to the decrease of the radius and the increase of the curvature, is the existence of the rail lateral wears of the outer rail with values between 5 and 9 mm ( tabel 1 and picture no. 1), occurred in those 5 months elapsed from the last measurements of those wears until the accident occurrence;
- the new values of the curve geometrical parts after the switch, correlated with the missing of the intermediate track led to the permanent decrease of the running speed accepted on the switch no. 10 and the connection curve with the deflecting section 1;
- at the date of the derailment was not observed either the condition  $g \geq V/5$  or the condition  $g \geq$  because the maximum speed accepted for the train running could not exceed 22,2 km/h and the imposed maximum speed in the area was 30 km/h;
- according to the data from the tabel 1, the gauge variation between the points 2 bis and 3 is 13 mm on 2,5 m, it exceeds the instruction limit of 3 mm/m stipulated in the chapter 1, art. 1, 14.2 from the Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no. 314/1989;
- the difference between the values of the close track deflections of 24 mm ( points 2 and 3 of the tabel no. 1) exceeds the maximum value of 16 mm stipulated in the chapter 1, art. 7 B.1 from the Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no. 314/1989;
- existence of the maximum rail lateral wears on the outside of the curve, on the maximum track deflections, confirms the hypothesis of the track distortion, during the time, in conditions of running, because of its increase following the permanent closing of the lines III, 4-16 for modernization works.

### B.6.2 Train running on the switch and the heel curve of the switch

The track section including the switch no. 10 and the connection curve with the deflecting section 1 was on the braking distance from the speed of 27 km/h to the speed of 23 km/h.

The rail on which happened the overclimbing of the outer rail by the wheel of the left axle 6, is type 60 and had the lateral wear between 5 and 9 mm.

The curve section on which happened the overclimbing of the rail is from the first buffer panel, in front of the breathing zone of the non welded track section from the line 1.

### Conclusions

- the overclimbing of the outer rail of the curve happened in the area with track deflection/maximum curvature (minimum radius) of the curve after the switch at a running speed of 23 km/h, over the speed accepted under the condition that the minimum length of the track between the turnout no. 10 and the connection curve with the deflecting section 1 be 4,6 m minimum;
- overclimbing of the outer rail of the curve happened on the rail section with the maximum lateral wear, by the first wheel having the running profile made by turning performed on the 13<sup>th</sup> of March 2009, this having the lip angle of 60<sup>o</sup>, so the derailment limit was low than at a wheel with normal operation wears at which the lip angle is 70<sup>o</sup>;
- overclimbing of the outer rail happened at a speed of 23 km/h over that of 22,2 km/h established under the condition  $g \geq V/10$  stipulated in the tabel 16, point 10 – 11 from the Instruction of norms and tolerances for construction and track maintenance – lines with standard gauge no. 314/1989;
- the buffer panels and the breathing zones from the non-welded track being submitted to some additional axial efforts in the rails, have the tendency of distortion in the clearing of ballast and muddy zones

### B.6.3 Remarks on the professional training of the employees involved in track maintenance from the railway station Comarnic.

According to the measurements from the 7<sup>th</sup> of November 2008, in the inspection book, the curve had the geometrical parts in track better than those of the designed curve, that is a radius of 430 m against 330 m, it questions the precision of this measurement or even its real performance.

According to the measurements performed on the 18<sup>th</sup> of March 2009, in the points 0,1 and 2 ( non affected by the derailment) the curve had a minimum radius of 181 m, and between the joint from the heel of the switch no. 10 and the circular curve, there is not the connection curve that is stipulated in the records of the Track Section L 5 Campina.

Connection of the switch no. 10 to the line 1 in the railway station Comarnic is made with 2 buffer panels of different lengths , buffer panels that are also transitory rail sections.

So on the right rail is put a transition rail 49/65 with a length of 10,941 and a transition rail 60/65 with a length of 9,00 m, and on the left rail is put a transition rail of 49/60 with a length of 10,910 m and a transition rail of 60/65 with a length of 8,925m.

The connection fish plate between the rail type 65 and 60 was made by cutting with oxyacetylene flame the inner part of the metallic fish plates type 65 connected to the rail type 60. Also, the holes of this fish plate had ovalizations over 6 mm made by the same process of cutting with oxyacetylene flame.

The glued insulated joints (JIL) on the line 1 at the km 109+679 are included , by welding, in the breathing zone at the end of the welding track section without joints. Also, the glued insulated joints are fitted up on the reinforced concret sleepers ....situated at about 60 cm one another ( picture 5 ).

### Conclusions

- during the last measurement of the curve from the 7<sup>th</sup> of November 2008 the possible differences of the geometrical parts against the designed curve were not analyzed as it is stipulated in the sheet no. 4, art. 8 from the Instruction concerning the establishment of the terms and order of the track inspections no. 305/1997;
- the provisions of the chapter II ( conditions of non-welding track constructions, rules for fitting up and fastening of the long welded track sections), art. 14 ( materials and parts used at the non-welded track ), point 14.7 from the Instructions for the constructions, maintenance and surveillance of the non-welded track no. 341/1980, in which is stipulated that “a connection track section is a track section with a length between 10 and 30 m, consisting in 2 or more different type welded rail sections were not observed;
- the provisions of the annex no. 3, point 4 ( hold up of the non-welded track in the area JIL ) from the Instruction for the construction, maintenance and surveillance of the non-welded track no. 341/1980 concerning the inclusion by welding of a JIL in the non-welded track were not observed;
- the provisions of the art. 2.3.1.2 from the Railway technical norm NTF no. 7 – 002/206 “Railway infrastructure. Re-using of the track parts taken back following the maintenance and repair works” were not

observed, because a fish plate type 65, having ovalization holes over 6 mm, non-reconditioned, was put in track;

- the provisions of the art. 2.3.1.3 of the Railway technical norm NTF no. 7 – 002/2006. Re-using of the track parts taken back following the maintenance and repair works” were not observed because the fish plates having wears at a height over 4 mm (the cutting by welding from the fish plate is over 4 mm ) declassified.

#### **B.6.4 Remarks concerning the turning of the wheels of the locomotive EA 906**

The last reprofiling of the axle tyres from the locomotive EA 906 was performed on the 13<sup>th</sup> of March 2009 by CFR SCRL Brasov SA – Locomotive Repair Section from Brasov.

This work was performed on the underground lathe following a numeric order HEGENSCHIEDT type MFD 106 CNC.

After the reprofiling work, the geometrical parts of the tyres from the axles of the locomotive EA 906 were measured and these were in the accepted limits stipulated in the technical specification ST 21-2008 concerning “ Reprofiling of the tyres from the railway vehicles on the underground lathe type HEGENSCHIEDT”, excepting the difference between the diameters of the running treads of the wheels from the axle no. 2 that were of 0,5 mm, value that exceeded the limit imposed by this specification – 0,3 mm ( to see the table no. 2 ). It’s necessary to underline that it has no causal link with the derailment, according to the tabel no. 1 from the Instruction for the repair of the pair of wheels from the railway vehicles no. 931/1986, operated, this value has not to be over 1 mm.

In the technical specification ST 21-008 is stipulated the measurement of the degree of roughness of the running surfaces and a limit value of the roughness degree of the running surface after turning is stipulated ( $\leq 12,5 \mu\text{m}$ ), but the necessary equipments and the performance way of this inspection were not stipulated.

By the paper no. 103/1/93/24.04.2009 – enclosed to the investigation file “CFR SCRL Brasov” SA – Locomotives Repair Division from Brasov admits that this inspection was not performed after finishing the turning, because it has not the necessary equipment in order to perform this inspection .

The locomotive EA 906 is running for the first time after the reprofiling by turning of the wheels tyres, it is supposed that the lips angle of the flange of the first wheel ( $\gamma$ ) was very close to the value of  $60^0$  ( according to the provisions of the STAS 112/3 – 90).

#### **Conclusions**

- because the inspections of the running surfaces roughness of the tyres after turning were not performed, there is no surety that the roughness degree value imposed by the technical specification ST 21-2008 ( $12,5 \mu\text{m}$ ) was met;
- The friction coefficient between the flange of the first wheel and the rail lip ( $\mu$ ), at the moment of the rail overclimbing, could exceed the value of 0,36 established by the Committees ORE B 55 and B 136, its increase being explained through:
  - the roughness degree of the running surface, according to a recent turning , its value could not be stipulated by “CFR SCRL Brasov”SA – Locomotives Repair Division from Brasov;
  - non-operation of the device for the wheel flange lubrication;
- the lips angle of the flange of the first wheel ( $\gamma$ ) that was very close to the value of  $60^0$  led to the decrease of the derailment limit up to a value very close to that determined by the Committees ORE B 55 and B 136 ( 0,85), this led to the overclimbing of the outer rail of the curve by the first wheel ( the right wheel of the axle no. 6)

#### **B.6.5 Deficiencies and gaps found out during the investigation, but irrelevant for the conclusions on the causes**

During the investigations of the railway accident a series of irregularities was found out, in charge of the staff responsible with the maintenance of the lines from the railway station Comarnic, without causal link with its occurrence, as follows:

- on the 18<sup>th</sup> of March 2009, on the turnout no. 10, the stroke-arresting device of the operation rod was fitted up upside down, together the screw C5 ( picture 6 );
- the curved point of the turnout no. 10 operated on open on the line 1 ( stucked on the right point ) was weared and non grinded in the

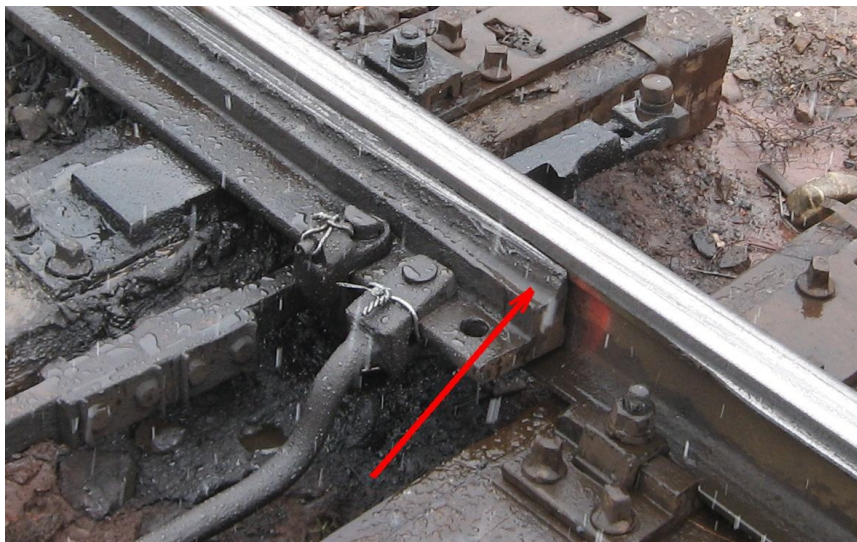


photo 7

### **Conclusions:**

- CNCF “CFR“ S.A, the public railway infrastructure manager didn't took additional measures of surveying the lines I and II, the traffic of Comarnic railway station being performed only on these lines due to the permanent closing of other lines from the railway station;
- Deficiencies found when mounting and maintaining the parts of the switch no.10 strengthens the conclusion of the need to complete the technical and theoretical knowledges of the personnel with responsibilities in maintaining the switch and also for the personnel with control, guidance and training attributions at the level of Department L5 Cîmpina and also at Track Section within the Railway County of Bucharest.

### **B.6.6. Other findings**

On December 13, 2007 a similar accident occurred to CFR Comarnic railway station by the passenger train 1641 derailment belonging to SNTFC “CFR Călători” SA on TJD 7/11. The investigating file was completed on November 18, 2008.

On this occasion were issued three recommendations.

The Romanian Railway Investigating Body didn't receive any answer on the recommendations implementation.

## **B.7. The causes of the accident**

### **B.7.1. Direct cause**

Taking into consideration the conclusions pointed out at chapter B.6., the investigating commission established the direct cause as being the climbing of the rail from the exterior rail (right- in the kilometric sense) of the curve situated behind the swotch no.10, by the left wheel of the axle no.6 (the first in the traffic direction) of the locomotive EA 906, followed by the falling of the wheel outside the track. The wheel's derailment from the right part of the axle, by the wheel's falling inside the track, is a consequence of derailment of the wheel from left.

#### **Factors that contributed**

The climbing of the exterior rail occurred as result of exceeding the safety limit at derailment in the conditions of increasing the (horizontal) guiding force on the first axle, at the running on the curve from the heal of the switch no.10, fact correlated with lowering the contact point between the tyre's lip and the active lateral surface of the rail and the increase of the friction coefficient between the wheel and rail.

The (horizontal) guiding force increase occurred following:

- The exceeding of maximum speed allowed on the curve situated behind the heal of the switch no.10, as result of maintaing in track a curve situated behind a switch, without a mandatory introduction of an intermediary alignment with a minimum length (corresponding to the maximum running speed) as is foreseen in chart 16, item 10-11 of Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989;
- Exceeding the tolerances when operating for the values of the height of the side curves; Lowering the contact point between the tyre's lip and the active lateral surface of the rail is due to:
- Lateral wear of the rail in the climbed area with values of 9mm;
- The existence in the area where the climbing took place (at approximately 1 metre) of a joint with nonconform fish plates as it had cuttings in the vertical section on half of the length of the fish plate and holes that have been cutted with oxyacetylene welding and presented ovalizations bigger than those allowed, fact that allowed the creation of a vertical threshold and implicitly the increase of vertical deformation of the exterior rail of the curve.

The increase of the friction coefficient between the wheel and the rail occurred following to:

- Lack of lubricating oil between the wheel and the rail as result of the non-functioniong of the installation of lubricating the tyres lip;
- The fact that the running surface of the first axle had a roughness bigger than that from operation because the locomotive EA 906 was performing its first route after the turning of the wheels tyres.

### **B.7.2. Root causes**

**The root causes** of the accident are:

1. Nonintroducing an alignment between the switch and the connection curve with line 1 when placing the points and crossings, fact that modified the running conditions by decreasing the running speeds. The need of introducing this alignment is foreseen in chart 16, item 10-11 of Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989;
2. The use of fish plates with holes slotted on braking areas, fact that influenced the appearance of bigger rail-joint gaps in track;



3. Non-analysing the diagram of the height of the curves from the heel of the switch no.10 and of wears of rails running surfaces in order to find potential deformations of the curve in plan, according to the provisions of the sheet no.4, article 8 of the Instruction on fixing terms and the chronology that the inspections must be performed no.305/1997;

4. The lack of a clear provision in the specific regulations in force by which to determine the obligatory examination conditions of the functioning of the installation of lubricating the tyres lip.

#### **B.8. Measures that were taken following the event**

With reference to the recommendations foreseen in the final report, SC CFR – SCRL Braşov SA communicated to the Romanian Railway Investigating Body through the document no. 121/49/28.09.2009 the following:

1. SC CFR SCRL Braşov SA will issue together with SNTFC Bucureşti the necessary dispositions in order to prohibit the routing of the locomotives from the depots with the non-functioning installations of lubricating the tyre's lip. In addition for the axles turned with subterrain lathes, at the exit from this will be performed a lubricating grease in the part of guiding the wheel rail.

2. SC CFR SCRL Braşov SA together with SNTFC Bucureşti bought a device for measuring roughness type Mahr, model MarSurf PS1, equipped with an indicator that can measure also in the curved parts of the running surfaces. Also were realized devices necessary for the examination. Also it was issued the technical specification where were foreseen the places of measuring and the maximum allowed values that was submitted to the Romanian Railway Authority – AFER in order to be approved.

3. SC CFR SCRL Braşov SA will perform in a short time the rectification of the technical specification ST 21-2008, according to chart no.1 of Instruction for repairing the fitted axles from the railway vehicles no. 931/1986.

4. SC CFR SCRL Braşov SA proposed the analyse by the railway undertakings of the opportunity of replacing the present running profile which is performed when turning the locomotive's axles with one of the profiles recommended by UIC and used by other railway undertakings from Europe.

#### **C. SAFETY RECOMMENDATIONS**

The addressees of these recommendations are: the public railway infrastructure manager CNCF "CFR" SA, the non-interoperable infrastructure administrators, the railway undertaking SNTFC „CFR Călători” SA, „CFR SCRL Braşov” SA, the Romanian Railway Notified Body and the Romanian Railway Safety Authority.

The recommendations are given in order to solve the following aspects:

1. Performing by the public railway infrastructure manager and by the non-interoperable infrastructure administrators an examination on the technical conditions of placing the curves behind the points and crossing and of the running speeds allowed on this areas. For the situations that are not foreseen in the instruction provisions it will be established, for each case, the necessary measures to be taken in order to observe the technical conditions foreseen in the Instruction of norms and tolerances for constructions and track maintenance – lines with standard gauge no.314/1989;

2. Modification of the specific regulations on periodic inspections of the locomotives, in the sense of introducing the obligativity of examining the functioning of the installation of lubricating the tyre's lip with the occasion of performing these inspections or after the turning operations of the tyres from the locomotive's wheels.

3. Modification of the technical specification ST 21 – 008, so to be explicitly established the method of examination of the roughness of the running surfaces and also the necessary instruments for this examination.

4. Obtaining the safety authorization by CNCF “CFR” SA according to the provisions of article 11 of the Law 55/2006 on railway safety.

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The present investigating report will be transmitted to the public railway infrastructure manager CNCF “CFR” SA, the non-interoperable infrastructure administrators, the railway undertaking SNTFC „CFR Călători” SA, „CFR SCRL Braşov” SA, the Romanian Railway Notified Body and the Romanian Railway Safety Authority.

According to the provisions of the Law no.55/2006 on the railway safety, the Romanian Railway Safety Authority will survey the way of implementation of these recommendations.

The members of the investigating commissions:

- OLARU Mihai - investigator in charge  
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- DRĂGHICI Marin -member  
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- SFÂRLOS Dumitru - member  
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- STROIE Tinca - member  
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- CIOBANU Eugeniu - member  
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