MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY

INVESTIGATING REPORT

on the railway accident occurred on the 9th of July 2011,
on the range of activity of CF Iasi Regional Branch
between the railway station Podu Iloaie and the flag station Sarca

Final EDITION
The 5th of September 2011

NOTICE

With reference to the railway accident occurred on the 9th of July 2011 on the range of activity of C.F. Iasi Regional Branch, between the railway station CF Podu Iloaie and the flag station Sarca, at the km 42+620 consisting of the derailment by both axles of the last bogie, in the running direction, of the wagon Eaos no. 335 35301 979-7 in the composition of the freight train no. 70923, belonging to SC Grup Feroviar Roman, Romanian Railway Investigating Body carried out an investigation according to the provisions of the Government Decision no. 117/2010. Through the investigation, the information on the respective accident was gathered and analyzed, the conditions were established and the causes determined.

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

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

Bucharest, the *5th of September 2011*

***Approved by*,**
Dragos FLOROIU
Director

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

Chief Investigator
Nicu PĂLĂNGEANU

This approval is part of the Report for the investigation of the accident occurred on the 9th of July 2011 on the range of activity of CF Iasi Regional Branch between the railway station CF Podu Iloaie and the flag station Sarca, at the km 42+620 consisting of the derailment by both axles of the last bogie, in the running direction, of the wagon Eaos no. 335 35301 979-7 in the composition of the freight train no. 70923.

CONTENT

I. PREAMBLE

I.1. Introduction

The accident occurred on the 9th of July 2011 in the running of the train no. 70923 at the wagon Eaos no. 3353 5301 979-7 (structural subsystem – railway vehicle) by the derailment of a bogie, is an accident according to the art. 7, paragraph (1), letter b) of the ***Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety***, approved by Government Decision no. 117/2010 hereinafter referred as "***Regulations***" in the investigation report.

Taking into account those above mentioned and according to the art. 19, paragraph (2) from the *Law no. 55/2006 on the railway safety*, corroborated with the art. 48, paragraph (1) of the *Regulations*, an investigation commission was appointed by Romanian Railway Investigating Body.

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

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

I.2. Investigation process

Immediately after the accident, Romanian Railway Investigating Body was notified verbally and in written about it by CNCF "CFR" SA. After moving to the place of the accident, it observed:

- on the current line I Iasi - Pascani, between the railway station CFR Podu Iloaie and hm Sarca, at the km 42+620 occurred the derailment of the wagon Eaos no. 3353 5301 979-7 by the last bogie, by both axles, in the running direction, the last but one in the composition of the train no. 70923, the derailed wagon being stopped at the km 42+210;
- the wagon ran derailed from the km 42+620 to the km 42+210 on a distance of 410 m;
- the wheels on the right of the bogie, in the running direction, were fallen outside the path at 20 cm from the rail on the right;
- the wheels on the left of the bogie, in the running direction, were fallen inside the path at 20 cm from the rail on the left;
- the inductor of 1000/2000 Hz of the X input signal in hm Sarca was destroyed;
- the collision devices of the wagon Eaos no. 3353 5301 979-7 and of the last wagon in the train had the plates overlaid (jamming).

There were no deaths or injuries.

At the place of the railway accident occurrence were present the representatives of:

- National Railway Company "CFR" SA- CF Iasi Regional Branch;
- SC Grup Feroviar Roman SA Bucharest
- ASFR - Railway Safety Inspectorate Iasi

Through the Decision no. of the 12th of July 2011 of the OIFR Director, according to the provisions of the art. 19, paragraph (2) of the *Law no. 55/2006 on the railway safety*, corroborated with the art. 48(1) of the *Regulations*, the investigation commission was appointed, consisting in:

- Dumitru SFÂRLOS – OIFR investigator - main investigator
- Mihai GHENGHEA – regional inspector SC-T – RCF Branch Iasi - member
- Emil IRIMIA – regional inspector SC-V – RCF Branch Iasi - member

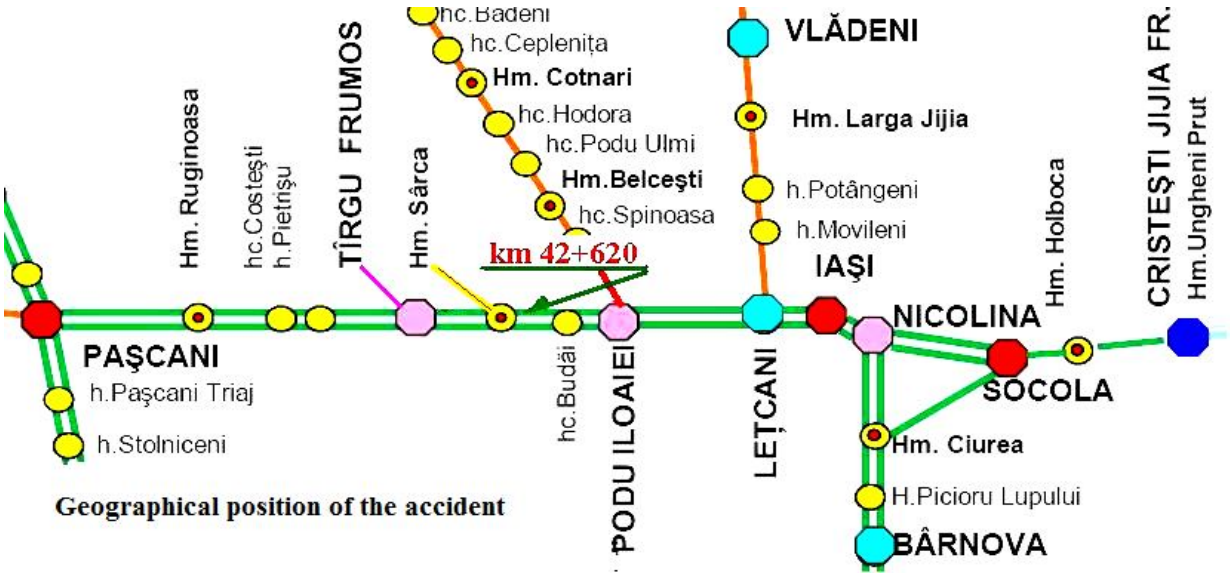
- Laurenţiu IONESCU – area director – SC Grup Feroviar Roman SA - member
- Costică ZAHARIA – V instructor – SC Grup Feroviar Roman SA - member

A. BRIEF PRESENTATION OF THE ACCIDENT

A.1. Brief presentation

On the 9th of July 2011, the freight train no. 70923, belonging to SC Grup Feroviar Roman SA, was running on the section Iasi - Pascani being composed of the locomotive EA 1022 and 40 wagons.

Running on the current line I, towards the flag station Sarca, at the km 42+620 occurred the derailment, by both axles, of the last bogie, of the last but one wagon (in the running direction), this running derailed till it stopped at the km 42+210.



The derailment of the bogie, occurred at 6:06p.m., was noticed by the path inspector who was performing the additional inspection of the path without joints. He announced by the mobile phone the movement inspector (IDM) on duty at hm Sarca, who at his turn announced through the radiotelephone the driver of the train no. 70923, while he was shunting the train at the deviated line 2 of receiving-shipping of hm Sarca.

The train no. 70923 was towed by the locomotive EA 1022 and was composed of 40 wagons.

The train had in composition 1 empty wagon after the locomotive, 14 loaded tank wagons, 23 empty tank wagons and the last 2 wagons, type Eaos, empty, defective, that were driven to the railway station CFR Pascani, to SC Remar SA, to be repaired. For this reason the train was running with the restricted speed of 50 km/h on current and direct line and 15 km/h on deviated line on the distance Iasi-Pascani, according to the traffic order series Fis no. 0140710 delivered at the railway station CF Iasi.

The place of the accident is located in the area of the km 42+620, on the current line I Iasi - Pascani, placed in mixed transverse profile, line in curve with the radius of 295 m and slope of 4.74‰.

The area of the railway accident occurrence is located on the running section Podu Iloaie - Pascani, belonging to CN CF "CFR" SA - CF Iasi Regional Branch.

A.2. Causes of the accident

A.2.1. Direct cause

The direct cause of the accident occurrence is the escalation of the outer rail of the curve, next to the kilometric position 42+620, by the wheel on the right, (the first in the running direction) of the last bogie of the wagon no. 3353 5301 979-7 (the 39th in the composition of the freight train no. 70923), followed by the fall of the wheel outside the path, which involved the fall of the wheel on the left of the same axle inside the path.
The escalation occurred due to some defects of the wagon, occurred after a previous incident, with the running conditions of the wagon on the curve that led to the increasing of the resistance at rotation of the pivot in the pallet and the discharge of the appeal wheel of the last bogie of the wagon. The derailment of the second axle is the direct consequence of the first axle derailment.

Contributing factors to the occurrence of this accident were the following:

- 80% destruction of the wear plate type "Railko" from the hemispherical pallet of the bogie derailed from soliciting and tilting of the wagon in an incident occurred on the 21st of June 2011, which made difficult the entry of the bogie in the curve;

- exceedance of the admitted values of the wagon chassis torsion with double values at the stringers level and up to 9 times at the extremities level of the front sleepers due to soliciting and tilting of the wagon in the incident occurred on the 21st of June 2011;

- deformation of the bogie frame whose nominal tolerance rates had been exceeded with values exceeding 10 mm due to soliciting and tilting of the wagon in the incident occurred on the 21st of June 2011;

- the construction modifications of the wagon box, near the bogie that derailed, by cutting the right side wall (in the running direction) of the wagon box on a length of 2.7 m and its deposit on the wagon floor near the same bogie, but to the left (in the running direction);

- running with reduced speed on a curve whose effective over-elevation of 110 m led to the occurrence of an excess of over-elevation higher than 100 mm and has as consequence the load discharge of the wheels on the right of the bogie in the running direction.

These factors created the conditions of the incomplete rotation of the pivot in the pallet, which impeded the entry of the bogie in the curve and the discharge of the appeal wheel on the right of the first axle from the last bogie in the running direction.

A.2.2. Underlying causes

None.

A.2.3. Root causes

None.

A.3. Severity level of the accident

According to the provisions of the *Regulations*, the event is categorized as accident under the provisions of the art. 7, paragraph (1), letter b.

A.4 Safety recommendations

None.

This Investigating Report will be sent to Romanian Railway Safety Authority, to the manager of the public railway infrastructure - CNCF "CFR" SA and to the railway undertaking SC Grup Feroviar Roman SA Bucharest.

B. INVESTIGATING REPORT

B.1. Description of the accident

On the 9th of July 2011 the freight train no. 70923 ran on the section Iasi - Pascani being composed of the towing locomotive EA 1022 and 40 wagons, belonging to SC Grup Feroviar Roman SA.

Running on the current line I to the flag station Sarca, at the km 42+620 occurred the derailment, by both axles of the last but one wagon (in the running direction), this running derailed to the stop at the km 42+210.

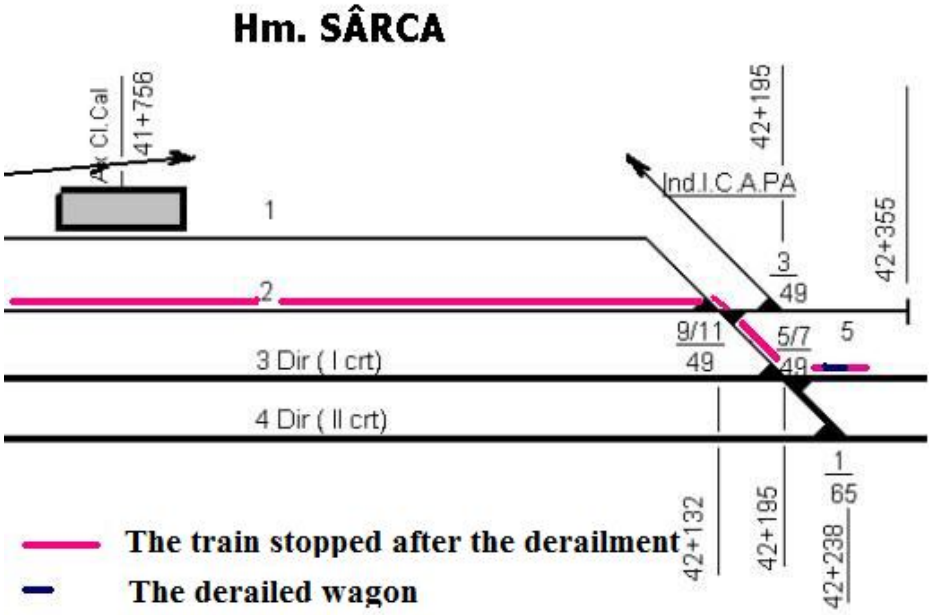
The wheels on the right of the bogie (in the running direction) ran outside the path on the sleepers end to the limit of the metallic clamping plates and the wheels on the left ran between the path wires from the limit of the metallic clamping plates to the path axis.

Km 42+620

Km 42+210

The derailment of the bogie, occurred at 6:06 p.m., was noticed by the path inspector who was performing the additional inspection of the path without joints. He announced by the mobile phone the movement inspector on duty of hm Sarca, who at his turn announced through the radiotelephone the driver of the train no. 70923, who he was shunting at the line 3.

The derailed bogie was stopped at the km 42+210, at 2 m from the shunting signal M 3 of hm Sarca and at 10 m from the first joint of the double-junction crossing 5/7 from the X end of the flag station.



Drawing hm Sarca, X end

The train no. 70923 was scheduled in traffic on the 8th of July 2011 to run on the 9th of July 2011 on the distance Cristesti Jijia – Ploiesti Est, having in composition 2 defective wagons for SC Remar SA Pascani.

On the 9th of July 2011, the operator from the wire RC 2 of the Traffic Controller Iasi, through the order no. 13, from 11:48 a.m., ordered the running of the train no.70923 under the conditions in the service book of the train no. 70298 a-1, with departure from the railway station CF Cristesti Jijia at 12:10 a.m., with a shunting at the railway station CF Socola and at the railway station CF Iasi with the exchange of the towing mean, having in composition wagons loaded with dangerous goods and a wagon with special running conditions (maximum speed of 50 km/h in current and direct line and 15 km/h on deviated line, accompanied by V organ – technical inspector of wagons).

On the 9th of July 2011, at 9.00 a.m., the technical inspector of wagons of SC Grup Feroviar Roman SA handed to the IDM on duty from the railway station CF Cristesti Jijia, the notice no. 008742, for the wagons **335 35301 979-7** – derailed wagon and 8453 5488 239-9 – with the defective traction device, with the destination for SC Remar SA Pascani and at the running conditions is specified that it will be accompanied by V organ to the destination and will run with maximum speed of 50 km/h in current and direct line and 15 km/h on deviated line.

The train no. 70923 was sent from the railway station CF Cristesti Jijia at 12:15 a.m. and was towed with DA 1541 having in composition 40 wagons, it passed through the hm Holboca at 12:26 a.m. and in the railway station CF Socola arrived at 12:39 a.m. at the line 6A.

In the railway station CF Socola were detached 14 empty wagons and were attached 14 loaded wagons after the locomotive, then it left at 3:12 p.m. with the same towing mean, with 40 wagons, 160 axles, 56loaded axles, 1732 gross tons, 831 net tons, having a necessary of braking at automatic 866 t, real in train of 1066 t, necessary maintenance in place 242 t, real in train 821 t, it passed through the railway station CF Nicolina at 3:22 p.m. and in the railway station CF Iasi arrived at 3:33 p.m. at the line 16.

In the railway station CF Iasi was made the exchange of towing mean (the locomotive DA 1541 was replaced with the locomotive EA 1022), then the train was sent to the railway station CF Pascani at 5:00 p.m.
Through the running order series Fis no. 0140710 delivered by the IDM from the railway station CF Iasi is highlighted in the composition of the train the defective wagon restricted and are mentioned the maximum running speeds of 50 km/h on current and direct line and of 15 km/h in deviation.

The train passed through the railway station CFR Letcani on the direct line II at 5:28 p.m. and through the railway station CF Podu Iloaiei on the direct line II at 5:41p.m.

From the railway station CF Podu Iloaie to hm Sarca, the train ran on the current line I and according to the indication of the input signal X of the hm Sarca it entered in deviation on the double-junction crossing (TDJ) 5/7 with access at the deviated line 2. In the X end of the hm. Sarca the running speed in deviation was limited to 10 km/h.

At 5:29 p.m. the operator from the wire RC 2 delivered the order no. 22 by which he ordered that the train no. 70923 to be received at the deviated line 2 from hm Sarca where was going to wait until in the railway station CFR Targu Frumos would be created the receiving conditions of the train.

At the moment of the derailment occurrence (6:06 p.m.) the last but one wagon was at the km 42+620 and the locomotive EA 1022 was on the deviated line 2 at 50 m from the heel TDJ 9/11 on the line 2 of delivery-shipping from the hm Sarca.

The wagon with the derailed bogie ran to the km 42+210. On the distance of 410 m the wheels on the right of the derailed bogie ran on the end of the sleepers distance from the outside rail of the curve being within 20 and 50 cm and the wheels on the right of the bogie ran on sleepers, between the path wires. On this distance occurred also the overlap (jamming) of the pads plates of the last but one wagon (derailed) with the ones of the last wagon.

The derailment of the bogie was noticed by the path inspector who was returning from the additional inspection of the path without joints, who announced by the mobile phone the IDM

on duty from the hm Sarca that from the train was derailed the last but one wagon by a bogie and the IDM announced through the radiotelephone the driver of the train to stop the train.

IDM from the hm Sarca through the telephonogram no. 10delivered at 6:07 p.m. transmitted to the traffic controller that at the shunting of the train no 70923 at the line 2 from the hm Sarca, the last but one wagon derailed and was stopped on the isolated section 033, at the km 42 + 210.

The place of the accident is located in the area of the km 42+620, on the current line I Iasi-Pascani, in mixed transverse profile, line in curve with the radius of 295 m, left deviation in the running direction and slope of 4.74‰, with ramp in the running direction, double line electrified, equipped with automatic line block (BLA), path with joints, rail type 49 on wooden sleepers, indirect clamping K and SKL.

The flag station Sarca is equipped with an electro-dynamic centralized installation (CED) type CR2.

The running wire I on the distance Podu Iloaie - Sarca was closed on the 9th of July 2011, from 6:17 p.m. to 11:53 p.m., the wagon being restored on the line at 10:35 p.m.

There were no injuries.

B.2. Circumstances of the accident

B.2.1. Involved parties

The involved staff belongs to SC Grup Feroviar Roman SA Bucharest and CNCF "CFR" SA-CFR Iasi Regional Branch.

The locomotive EA 1022 is the property of SC Grup Feroviar Roman SA Bucharest.

The wagon no. 3353 5301 979-7 type Eaos is the property of SC Grup Feroviar Roman SA Bucharest.

The railway infrastructure on which the accident occurred belongs to CN CF "CFR" SA - CF Iasi Regional Branch and is maintained by the staff of Section L3 Roman.

The installations signaling, centralization and blocking (SCB) between the hm Sarca and the railway station CF Podu Iloaie and from the hm Sarca are managed by CNCF "CFR" SA - CF Iasi Regional Branch and are maintained by staff belonging to Section CT 1 Iasi.

The installation of railway communications from the hm Sarca is managed by CNCF "CFR" SA and is maintained by staff belonging to SC TELECOMUNICATII CFR S.A.

The installation of communications on the locomotive and the mobile ones from the staff accompanying the train is the property of SC Grup Feroviar Roman SA Bucharest.

The investigation commission questioned the locomotive driver of the locomotive EA 1022, the guard and the technical inspector of wagons accompanying and took statements from the path inspector and the IDM on duty from the railway station CF Podu Iloaie and the hm Sarca.

B.2.2. Forming and equipments of the train

The train no. 70923 was towed by the locomotive EA 1022 and was composed of 40 wagons, with 160 axles, 1732 tons, 572 m length, braked insured. The train was formed of 1 empty wagon after the locomotive, 14 loaded tank wagons, 23 empty tank wagons and the last 2 wagons type Eaos empty defective.

The wagon no. 3353 5301 979-7 (placed the 39th in the composition of the freight train no. 70923) together with all the other 39 wagons were linked to the automatic braking installation, with the brake active.

The locomotive belongs to the railway undertaking SC Grup Feroviar Roman SA Bucharest.
The safety and vigilance equipments (DSV), the equipment for the point control of the speed and hitchhiking (INDUSI) in the equipment of the locomotive were in operation.

B.2.3. Railway equipments

The involved railway infrastructure, respectively the current running line between the hm Sarca and the railway station CFR Podu Iloaie, is managed by CNCF "CFR" SA – CF Iasi Regional Branch and is maintained by staff of Section L3 Roman.

The current line is in curve with radius of 295 m, left deviation in the running direction and slope of 4.74‰, with ramp in the running direction, double line electrified, equipped with automatic line block (BLA), path with joints, rail type 49 on wooden sleepers, indirect clamping K and SKL.

The flag station Sarca is equipped with an electro-dynamic centralized installation (CED) type CR2.

The running speed of the line Podu Iloaie - Sarca is of 95 km/h for the passenger trains and is restricted to 70 km/h on the portion between the km 42+773 and the km 41+920.

B.2.4. Means of communication

The communication between the locomotive driver and the movement inspectors was ensured through radio-telephone equipments in proper operating condition.

B.3. Consequences of the accident

B.3.1. Deaths and injuries

No deaths or injuries.

B.3.2. Material damages

- **at the locomotive** - none **0 lei**
- **at the derailed wagon** – according to the estimate no. G.12.1/1534/2011 of SC Grup Feroviar Roman SA **12000.00 lei**
- **at the lines** – according to the estimate no. 2.12/C4/45/11.07.2011 of CF Iasi Regional Branch, Section L3 Roman **4864.23 lei**
- **at the installations** – according to the estimate no. 4.1.2/1128/11.07.2011 of CF Iasi Regional Branch, Section CT1 Iasi **5011.60 lei**

- **at the environment – none** **0 lei**

Total material damages **21875.83 lei**

B.3.3. Consequences of the accident in railway traffic

The running wire I on the distance Podu Iloaie - Sarca was closed for railway traffic on the 9th of July 2011, between 6:17 p.m. and 11:53 p.m. to restore the wagon and the shunting of the two defective wagons in the hm Sarca.

Train delays:

As consequence of this accident 4 passenger trains were delayed by a total of 40 minutes.

B.4. External circumstances

On the 9th of July 2011, at the time of the railway accident occurrence, the visibility was good, clear sky, no wind and the air temperature was of about 27^0 C.

The accident occurred in the area of the km 42+620 in curve with radius of 295 m, left deviation in the running direction and slope of 4.74‰ with ramp in the running direction, on line with rail type 49, wooden sleepers, path with joints, double line electrified.

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

B.5. Investigation course

B.5.1. Summary of the involved staff statements

From the statements of the **locomotive driver** who drove the locomotive EA 1022 towing the train no. 70923 on the 9th of July 2011 one can retain the following:

- on the 9th of July 2011 was sent for towing the train no. 70923 with the EA 1022 from the railway station CFR Iasi to the railway station CFR Brazi;
- he drove without stopping from the railway station Iasi to the hm Sarca;
- at the signal announcing the hm Sarca, whose indication was flashing yellow, he was announced that he was going to enter at the deviated line 2 with a speed restricted to 10 km/h.;
- he decreased the train speed from about 22 km/h to about 7 km/h ;
- at braking there were no unusual reactions in the train;
- after passing by the movement office of the hm Sarca he was notified by the IDM through radiotelephone to stop and not to move the locomotive anymore;
- the train without the last two wagons left from the hm Sarca around 10:40 p.m.;

From the statements of the **guard** who served the train no. 70923 on the 9th of July 2011 one can retain the following:

- in the railway station CFR Iasi was performed the exchange of towing means and he linked at the train the locomotive EA 1022;
- he brought from the movement office of the railway station CF Iasi the train documents and the traffic order where was specified the existence in the train of a wagon with restricted speed;
- after the train shunting in the hm Sarca, without the last two defective wagons, he prepared a new description of the train with the remaining wagons and he continued the path without other incidents.

From the statements of the **technical inspector of wagons** who served the train no. 70923 on the 9th of July 2011 one can retain the following:

- he knows the works performed at the wagon Eaos no. 3353 5301 979-7, in the railway station CFR Cristesti Jijia, to be moved to SC Remar SA Pascani, these consisting of the replacement of both linking devices, correction of the poles and of the wagon box, cut of the side door and of a part of the box, measurement of the wheels after the derailment;
- the works were performed by a team from SC Remar SA Pascani;
- the restriction of the wagon speed was made because the wagon was previously derailed in the railway station CF Cristesti Jijia and the bogie frame and the chassis could not be checked in detail;
- the last two wagons of the train were defective;
- he noticed that the corner staircase of the wagon that was blocking the pad stroke, but he considered that the speed restriction in deviation to 15 km/h was enough as safety measure;
- he did not prepare an event report for the noncompliance with the provisions of the Instructions on technical inspection and maintenance for wagons in operation no. 250/2005, on how to introduce the defective wagons in the train;
- because of the big length of the train he was not able to supervise while running the two defective wagons.

From the statements of the **path inspector** who was at the additional inspection of the path without joints on the 9th of July 2011 one can retain the following:

- at 6:00 p.m. he was at the km 42+200 when he was coming back from the additional inspection of the path without joints scheduled on the running wire I from the km 47+600 to the km 51+000 and on wire II from the km 51+000 to the km 42+000;
- he noticed that at the last but one wagon of the freight train was a derailed bogie;
- he called on the personal mobile phone the IDM on duty from the hm Sarca and informed him about the derailment of the bogie from the last but one wagon and he stopped the traffic.

From the statements of the **IDM on duty** in hm Sarca, on the 9th of July 2011, one can retain the following:

- at 5:23 p.m., through the order no. 22 of the operator RC 2 Iasi the train no. 70923 was going to be received and to stop at the deviated line 2 of the hm Sarca, because of lack of free lines in the railway station CF Targu Frumos;
- around 6:00 p.m. he went out from the movement office to scroll the train no. 70923 at the line 2;
- he was called on the mobile phone by the path inspector who announced him about the derailment of the last but one wagon;
- he announced immediately through radiotelephone the driver of the train no. 70923 to stop the train.

From the statements of the **IDM on duty** in the railway station CF Podu Iloaie, on the 9th of July 2011, one can retain the following:

- at 5:28 p.m. he performed the passing command of the train no. 70923 through the railway station CF Podu Iloaie;
- at scrolling the train no. 70923 he did not found anything special;
- he communicated through the radiotelephone with the driver of the train no. 70923;
- at 5:41 p.m. he transmitted the passing approval towards the hm Sarca.

B.5.2. Safety management system

At the moment of the railway accident occurrence, CNCF "CFR" SA, as administrator of the public railway infrastructure, had implemented its own safety management system, according to the provisions of the Directive 2004/49/CE on community railway safety, of the Law no. 55/2006 on railway safety and of the Order of the Minister of Transport no.101/2008 on

granting the security authorization to the administrator / management of railway infrastructure in Romania, being in possession of:

- Safety Authorization - Part A with the identification no. ASA 09002 delivered on the 21st of December 2009 – through which the Romanian Railway Safety Authority from AFER confirms the acceptance of the safety management system of railway infrastructure manager;
- Safety Authorization - Part B with the identification no. ASB 9007 delivered on the 21st of December 2009 – through which the Romanian Railway Safety Authority from AFER confirms the acceptance of the provisions adopted by the railway infrastructure manager to meet specific requirements necessary to ensure safety of rail infrastructure, in the design, maintenance and operation, including where appropriate, maintenance and operation of traffic control and signaling system.

At the moment of the railway accident occurrence, SC Grup Feroviar Roman SA as railway undertaking had implemented its own safety management system, according to the provisions of the Directive 2004/49/CE on community railway safety, of the Law no. 55/2006 on railway safety and of the Order of the Minister of Transport no. 535/2007 regarding the approval of the licensing of railway and safety certificates in order to make rail services on the railways in Romania, being in possession of the following documents regarding the own safety management system:

- Safety certificate - Part A with the identification no. CSA 0014 delivered on the 6th of April 2010 – through which the Romanian Railway Safety Authority from AFER confirms the acceptance of the safety management system of the railway undertaking;
- Safety certificate - Part B with the identification no. CSB 0103 delivered on the 20th of June 2011 – through which the Romanian Railway Safety Authority from AFER confirmed the acceptance of the provisions adopted by the railway undertaking to accomplish the necessary specific requirements for safe operation on the relevant network in accordance with the Directive 2004/49/CE and with the national applicable legislation.

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

norms and regulations:

- Instructions on technical inspection and maintenance for wagons in operation no. 250 approved by the Order of the Minister of Transports, Constructions and Tourism no. 1817 of the 26th of October 2005;
- Railway Technical Norm "Railway vehicles. Technical prescriptions to repair the frames of the bogies in the equipment of the wagons and coaches" - NTF no. 81-005:2006 approved by the Order of the Minister of Transports, Constructions and Tourism no. 1404 from the 27th of July 2006;
- Railway Technical Norm "Railway vehicles. Wagons. Technical prescriptions for repair" – NTF no. 57-001:2006, approved by the Order of the Minister of Transports, Constructions and Tourism no. 1405 from the 27th of July 2006;
- Instruction for the repair of the frames for the bogies of the wagons and coaches no. 935/1988.
- Instruction for the repair of the chassis and the boxes of the coaches and wagons no. 936/1991;
- Instruction for the repair of the axles mounted on the railway vehicles no. 931/1986;
- Regulation for towing and braking no. 006 approved by the Order of the Minister of Transports, Constructions and Tourism no. 1815 from the 26th of October 2005;
- Instruction for setting terms and order for the rail inspections no. 305 approved by OMT no. 71 on the 17th of February 1997;
- Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989, approved by OMTTc no. 89 from 10th of January 1989;

- Regulations no. 005/2005 for the running of the trains and the shunting of the railway vehicles approved by the Order of the Minister of Transports, Constructions and Tourism no. 1816 from the 26th of October 2005;

sources and references:
- photos taken immediately after the occurrence of the accident, taken by the members of the investigation commission;
- documents on the lines maintenance provided by the responsible with their maintenance;
- results of the measurements performed immediately after the occurrence of the railway accident at the railway superstructure and at the derailed wagon;
- minutes and observation notes prepared at the examination and interpretation of the technical condition of the elements involved in the accident: infrastructure, railway installations and train;
- minutes and measurements performed immediately after the occurrence of the railway accident by the members of the investigation commission;
- measurement sheets performed at the axles, chassis, bogie frame and wagon box in SC Remar SA Pascani
- questioning and statements of the involved staff.

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

B.5.4.1. Data found on the work of the rolling stock and of the technical installations

at the locomotive:

The automatic brake of the train was active and the safety and vigilance equipments (DSV), the equipment for the point control of the speed and hitchhiking (INDUSI) in the equipment of the locomotive were in operation and normally working.

The installation of speedometer with flash memory type IVMS from the locomotive EA 1022 sealed and operating.

From the interpretation of the records of the installation type IVMS on the locomotive EA 1022, which towed the freight train no. 70923, resulted that after leaving from the railway station CFR Iasi, the train ran normally till the moment of the derailment, with speeds within 50 km/h and 26 km/h.
At the signal announcing the hm Sarca, the train speed was of 34 km/h, from where it started to decrease to 12 km/h at the X input signal of the hm Sarca. From the X input signal the speed continued to decrease to 6 km/h and, after a distance of 812 m, the speed decreased suddenly at 0.

at the involved wagon, no. 3353 5301 979-7:

Technical features of the wagon:
- series of the wagon - Eaos;
- year of construction - impossible to be determined;
- tare of the wagon - 22.000 kg;
- length of the wagon - 14040 mm;
- length of the chassis - 13300 mm;
- distance between the pivots of the bogie - 9,000 m;
- impact devices - pads with rectangular plates;

- traction device - discontinuous;
- bogies - Y25 Rsa;
- bogie wheelbase - 1,80 m;
- mounted axles - 4 axles type A1 with applied bandage;
- rolling circle diameter of the wheel - 920 mm;
- automatic brake - type KE-GP;

Inspections and repairs previously performed at the involved wagon

- periodic repair type RP on the 20th of December 2008 TMS (6);

Condition of the wagon before the derailment:

- the wagon was previously involved, on the 20th of June 2011, in an accosting occurred in the railway station CF Cristesti Jijia which had as consequence the derailment and the tilting of the wagon, incident after which the wagon was damaged;
- to be directed to SC Remar SA in the railway station CF Pascani at the wagon was performed, in the railway station CFR Cristesti Jijia, a temporary repair;
- after the performance of the temporary repair the wagon had the following technical condition:

* the right side wall (in the running direction) of the wagon box was cut on a length of 2.70 m and was deposited on the wagon floor, on which was fixed by welding;

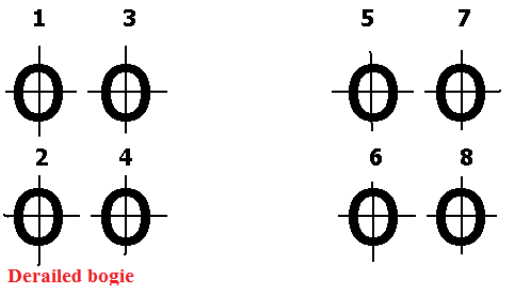
* The wagon box was temporary reinforced through inside by a metallic rod linked on the wall on the left (in the running direction) and welded on the wagon floor and on the broken or cracked areas of the wagon walls the reinforcement was insured through outside by welded metallic plates;

* The bogie frame Ycs 25, no. 07202 (derailed) had the limiter type T and a broken screw, next to the wheel 2, temporary repaired by welding;

* the corner scale on the right (in the running direction) next to the axle no. 2 was deformed under the impact device and was in contact with the rectangular plate blocking its active stroke;
* the central strut was cracked on a length of 500 mm next to the support of the upper hemispherical pallet.

Findings on the involved wagon at the checks performed after the occurrence of the accident:

- at the involved wagon were performed measurements in 3 steps that aimed to establish in a first stage the running conditions from the hm Sarca to the railway station CF Pascani and in a second to observe the deformation degree of the derailed bogie, of the chassis and of the wagon box.



- ***measurements performed on the 10th of July 2011 in hm Sarca;***

- measurements were performed to establish the running conditions from the hm Sarca to the railway station CF Pascani.

Measured elements	wheel * no. 1	wheel * no. 2	wheel * no. 3	wheel * no. 4	wheel no. 5	wheel no. 6	wheel no. 7	wheel no. 8
Distance between the upper level of the rail and the bottom side of the front sleeper of the derailed bogie (mm)	**675**	**627**	**620**	**665**	635	643	653	658
Wheels diameter (mm)	**876**	**876**	**876**	**876**	880	880	890	890
Distance between the inner sides of the wheels from the derailed bogie, measured in 3 points	**1358.35 1358.40 1359.15**		**1358.28 1358.03 1358.27**		-		-	

Note: * - the wheels of the derailed wagon

- after these measurements was found that, because of the torsion of the derailed bogie frame, this has to be replaced in the hm Sarca;
- the wagon remained stationed in the hm Sarca at the line 1 until the replacement of the derailed bogie frame.

▪ ***findings performed on the 28th of July 2011 in the hm Sarca:***

The findings were performed on the occasion of the replacement of the derailed bogie frame.
The wagon was restored and, after removing the frame of the bogie with the derailed axles, there was found the following:

- at the semispherical pallet of the derailed wagon the wear plate type "Railko" was destroyed in proportion of 80%;

- the central strut of the bogie was cracked on a length of 500 mm, near the support of the upper hemispherical pallet;
- after the replacement of the bogie frame was found the missing of the strokes at the diagonal sliding next to the boxes of the axles 1-3 and 6-8 which led to the conclusion that the wagon chassis is twisted and that it is necessary the measurement of the wagon box.

▪ ***measurements performed on the 3rd of August 2011 and the 5th of August 2011 at the SC Remar SA:***

At the involved wagon were performed dimensionally checks of the mounted axles, of the derailed bogie frame of the box and of the wagon chassis.
The measurements were performed in the workshops SC Remar SA Pascani on the 3rd of August 2011 and the 5th of August 2011.

The resulted values after these checks were the following:

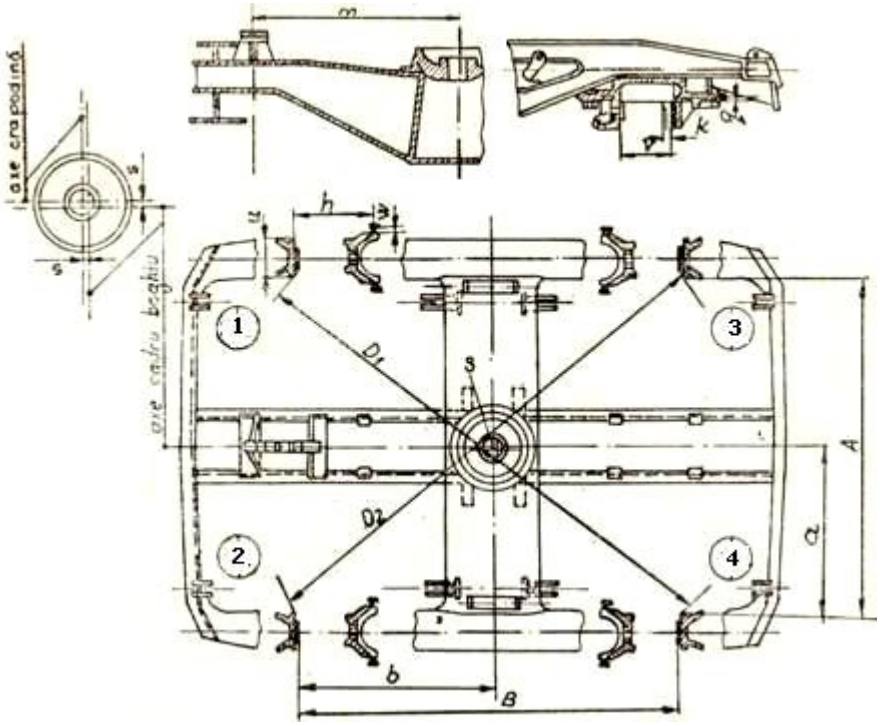
- ***measurements at the mounted axles***

Measured elements	Wheel no. 1	Wheel no. 2	Wheel no. 3	Wheel no. 4	Wheel no. 5	Wheel no. 6	Wheel no. 7	Wheel no. 8
Rim thickness (mm)	**31**	**31**	**32**	**30**	31	32	32.5	31
Rim height (mm)	**28.5**	**28.5**	**28**	**28**	30	30	28	27
Rate q_r (mm)	**8**	**8**	**7.5**	**7.5**	7.5	7	7.5	7
Distance between the inner sides K	**1361.3**		**1360.3**		1360.4		1360.2	
Diameters of the wheels in the plan of the rolling circle (mm)	**872**	**872**	**873**	**873**	880	880	866	866
Bandage thickness	**53**	**53**	**55**	**55**	57	57	52.5	51

The values of the mounted axles were within the instructional limits.

- ***measurements of the derailed bogie frame***

Rate symbol	Nominal rate (mm)	Tolerance (mm)	Maximum deviation (mm)	1	2	3	4
a	928.5	+2; -1	-	**924.5**	**924.5**	**927.5**	**925.5**
b	1037	+2; -1	-	**1044**	**1026**	**1025.5**	**1047**
b1-b2	-	-	1	**18.5**		**21**	
B1.3-B2.4	-	-	2	**39.5**			

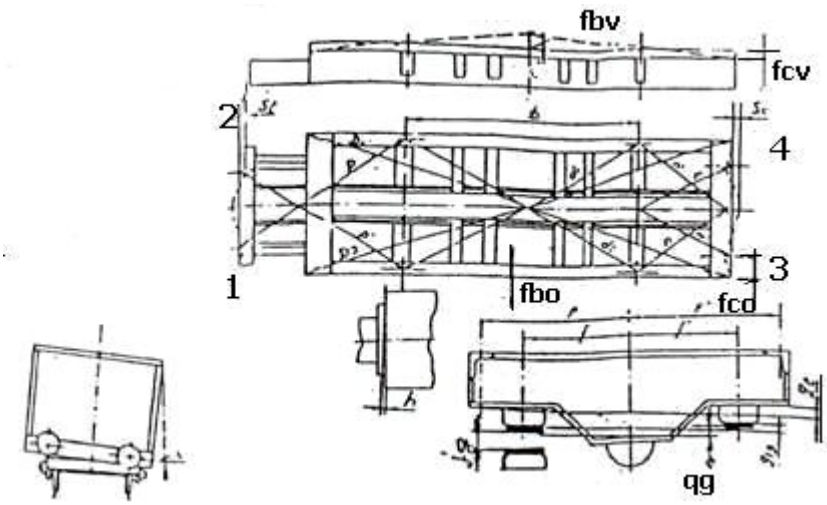


The values of the measurements of the bogie frame show its deformation over the admitted limits.

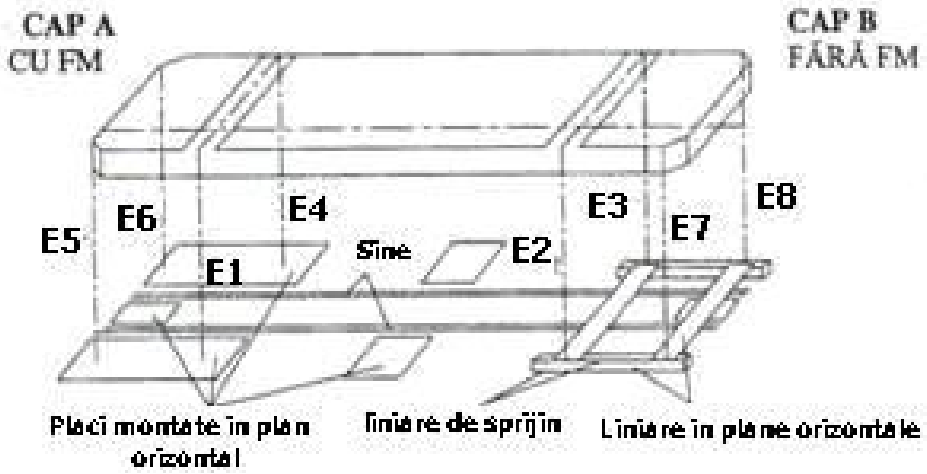
- ***measurements of the wagon chassis***

Rate symbol	Admitted tolerance at RP (mm)	**1** Spindle 1-3	**3** Spindle 5-7	**2** Spindle 6-8	**4** Spindle 2-4
f_{bo}	$\pm$ 15	**-20**		+14	
f_{co}	+15; -10	+14	-8	+7	-6
f_{bv}	+20; -15	**-20**		**-44**	
f_{cv}	$\pm$ 10	-2	**-25**	**-60**	**+17**
q_g	max.5	0		**-15**	

The values of the measurements at the wagon chassis show its deformation over the admitted tolerances.



- ***measurements of the chassis twisting***



- q_l - chassis twisting at the side struts level
  q_l=(E1-E4) – (E2-E3)
- q_c - chassis twisting at the consoles level
  Head A: q_{c1} = (E5-E6) – (E1-E4)
  Head B: q_{c2} = (E2-E3) – (E7/E8)
- q_t - chassis twisting at the front sleepers ends level
  q_t =(E5-E6) – (E7-E8)

Rate symbol	Measured rate (mm)	Admitted difference (mm)	Calculated value of twisting (mm)
E1	1581		
E2	1560		
E3	1560		
E4	1543		
E5	1621		
E6	1560		
E7	1560		
E8	1635		
q_l		Max 20	**38**
q_{c1}		Max 10	**23**
q_{c2}		Max 10	**75**
q_t		Max 15	**136**

The values of the measurements at the wagon chassis show a twisting that exceeds the maximum limits twice to nine times.

B.5.4.2 Data found on the lines

The place of the accident is located in the area of the km 42+620 on the running wire I Iasi - Pascani, disposed in mixed cross profile, line in curve with radius of 295 m, left deviation in the running direction and slope of 4.74 ‰ (ramp in the running direction), double line, path with joints, rail type 49 on wooden sleepers, indirect clamping type K and SKL.

Technical condition of the line before the occurrence of the railway accident
In the area of the derailment the line is in curve, with radius 295 m, with the over-enlargement of 15 mm, the over-elevation on the circular curve is of 115 mm, in mixed profile, sloping (in the mileage meter direction) of 4.64 ‰ from the km 42+450 to the km 43+200 and 3.52‰ from the km 42+200 to the km 42+450.

The line is built with rail type 49, on wooden sleepers in good condition, with indirect clamping type K and SKL active, path with joints with the prism of broken stone complete and unclogged.

The curve is with right deviation in the mileage meter direction and has the characteristic points placed as follows: AR at the km 42+250, RC at the km 42+320, CR at the km 42+650, RA at the km 42+770. The length of the circular curve is of 330 m.

On the distance Podu Iloaie – Sarca in the area where occurred the derailment, the line speed is permanently limited at 70 km/h because of the values of the geometric elements of the curve.

Findings and measurements performed at the line, after the occurrence of the derailment
There were performed measurements with the rail measuring pattern of the gauge and of the cross level, starting from the point from the km 42+645 in the running direction of the train, passing through the point "**o**" from the km 42+620 to the km 42+595.

point	1	2	3	4	5	6	7	8	9	10	"0"	12	13	14
E (mm)	18	17	17	16	18	17	18	17	15	14	15	15	15	17
N (mm)	112	110	110	111	111	111	112	112	111	110	110	110	110	110

point	15	16	17	18	19	20
E (mm)	19	18	18	19	18	19
N (mm)	113	115	114	112	111	112

note: "**o**" – place of the derailment at the km 42+620 ;
- distance between the measurement points 2,5 m;
- measurement direction is in the mileage meter direction (opposite to the running direction of the train).

There were also performed measurements of the circular curve arrow from 10 to 10 meters with the rope of 20 m starting from the km 42+660 to the km 42+570.

Km 42+.....	660	650	640	630	620	610	600	590	580	570
f (mm)	160	162	166	167	167	167	167	166	166	167

note: the theoretic arrow on the circular curve corresponding to R=295 m is f=169 mm

Before the point **"o"** where the derailment occurred were found the following:
- the instructional limit values of the gauge and of the path twisting were not exceeded;
- the operation deviation of the gauge variation of de 2 mm/m between the measurement points was not exceeded;
- the effective over-elevation was within the tolerances limits;
- the values of the effective arrows were within the tolerances.

At the checks of the sleepers condition on the measured length, before the derailment point, was found that the sleepers were appropriate, the clamping was active and the prism of broken stone was complete.

Data resulted from the analysis of the documents asked to the manager of railway infrastructure

The last maintenance work on the area of the derailment occurrence was performed on the 21st of April 2011 and consisted in the mechanical stuffing with the correction of the level and of the direction performed on the entire length of the curve with the stuffing machine Plasser 09.

The last measurement with the railway measuring cart was performed on the 15th of June 2011 when was found a defect J3 at the km 42+590, repaired on the 16th of June 2011. In the area of the derailment were not found defects at the width and the twisting of the rail on the occasion of this measurement.

The last measurement with the rail measuring pattern was performed on the 14th of June 2011 when was measured the distance from the km 42+600 to the km 42+700.

The annual measurement of the curve, on which occurred the derailment, was performed on the 19th of April 2011, on the distance from the km 42+600 to the km 42+700 the measured values of the arrows, over-enlargement, over-elevation, and vertical and horizontal wears were not exceeding the instructional limits for the value of the curve radius and of the running speed of 70 km/h.

B.5.4.3 Data found on the installations

Before the occurrence of the derailment the announcing signal XP and the input signal of the hm Sarca were normally working and the inducers of 500 hz and 1000/2000Hz were operational.

After the derailment the inducer of 1000/2000 Hz placed next to the input signal X was destroyed by the derailed wheels of the bogie.

The inducer of 1000/2000Hz of the signal X

B.6. Analysis and conclusions

According to the data resulted from the measurements and checks performed at the derailed wagon no. 3353 5301 979-7, in the hm Sarca and also in SC Remar SA Pascani, the derailment of the last bogie (in the running direction) occurred because of the high resistance at rotation of the pivot in the pallet and of the discharge of the appeal wheel on the right (in the running direction) of the bogie.
The increase of the resistance at rotation of the pivot in the pallet was due to the increase of the friction coefficient because of the destruction of the wear plate type "Railko", of formaldehyde resin.

The destruction of the wear plate occurred at the inclination of the loaded wagon at shunting in the railway station CFR Cristesti Jijia, at the railway incident occurred on the 21st of June 2011.

The discharge of the appeal wheel of the derailed bogie occurred mainly because of the deformation of the bogie frame and the exceedance of the admitted values of the wagon chassis twisting. The deformation of the bogie frame and of the wagon chassis occurred at the inclination of the loaded wagon and derailed at shunting in the railway station CFR Cristesti Jijia, at the railway incident occurred on the 21st of June 2011.

The factors that contributed additionally to the discharge of the appeal wheel were the running of the wagon with reduced speed on a curve with small radius and high over-elevation and also the cut of the side wall of the wagon box on a length of 2.7 m on the right (in the running direction) and movement of this load position to the left of the wagon floor (in the running direction).

The derailment of the bogie is a consequence of the modification of the construction parameters of the chassis, of the wagon box and of the bogie due to destructions and remanent deformations came after the accosting at shunting in the railway station CF Cristesti Jijia occurred on the 21st of June 2011.

B.7. Causes of the accident

B.7.1. Direct cause

The direct cause of the accident occurrence is the escalation of the outer rail of the curve, next to the kilometric position 42+620, by the wheel on the right, (the first in the running direction) of the last bogie of the wagon no. 3353 5301 979-7 (the 39th in the composition of the freight train no. 70923), followed by the fall of the wheel outside the path, which involved the fall of the wheel on the left of the same axle inside the path.
The escalation occurred due to some defects of the wagon, occurred after a previous incident, with the running conditions of the wagon on the curve that led to the increasing of the resistance at rotation of the pivot in the pallet and the discharge of the appeal wheel of the last bogie of the wagon. The derailment of the second axle is the direct consequence of the first axle derailment.

Contributing factors to the occurrence of this accident were the following:

- 80% destruction of the wear plate type "Railko" from the hemispherical pallet of the bogie derailed from soliciting and tilting of the wagon in an incident occurred on the 21st of June 2011, which made difficult the entry of the bogie in the curve;

- exceedance of the admitted values of the wagon chassis torsion with double values at the stringers level and up to 9 times at the extremities level of the front sleepers due to soliciting and tilting of the wagon in the incident occurred on the 21st of June 2011;

- deformation of the bogie frame whose nominal tolerance rates had been exceeded with values exceeding 10 mm due to soliciting and tilting of the wagon in the incident occurred on the 21st of June 2011;

- the construction modifications of the wagon box, near the bogie that derailed, by cutting the right side wall (in the running direction) of the wagon box on a length of 2.7 m and its deposit on the wagon floor near the same bogie, but to the left (in the running direction);

- running with reduced speed on a curve whose effective over-elevation of 110 m led to the occurrence of an excess of over-elevation higher than 100 mm and has as consequence the load discharge of the wheels on the right of the bogie in the running direction.

These factors created the conditions of the incomplete rotation of the pivot in the pallet, which impeded the entry of the bogie in the curve and the discharge of the appeal wheel on the right of the first axle from the last bogie in the running direction.

B.7.2. Underlying causes

None.

B.7.3. Root causes

None.

C. Safety recommendations

None.

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* *

This Investigating Report will be sent to Romanian Railway Safety Authority, to the manager of the public railway infrastructure - CNCF "CFR" SA and to the railway undertaking SC Grup Feroviar Roman SA Bucharest.

Investigation commission:

- Dumitru SFÂRLOS - main investigator
- Mihai GHENGHEA - member
- Emil IRIMIA - member
- Laurenţiu IONESCU - member
- Costică ZAHARIA - member