MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY

INVESTIGATING REPORT

on the railway accident
occurred on the 15th of February 2011, on the direct line II,
in the flag station Valea Alba on the 15th of February 2011

Final EDITION
the 23rd of May 2011

NOTICE

With reference to the railway accident occurred on the **15th of February 2011**, at **5:28 a.m.**, on the range of activity of **CF Craiova Regional Branch**, the running section Stehaia - Drobeta Turnu Severin (simple line electrified), **in the flag station Valea Alba**, at the km 349+000, on the direct line II, consisting of the **derailment of a wagon in the composition of the freight train no. 91797** (belonging to the railway undertaking S.N.T.F.M. "CFR Marfa" S.A.), 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

Approved by
Dragoş 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 15th of February 2011, at 5:28 a.m., on the range of activity of CF Craiova Regional Branch, the running section Stehaia - Drobeta Turnu Severin (simple line electrified), in the flag station Valea Alba, at the km 349+000, on the direct line II, consisting of the derailment of a wagon in the composition of the freight train no. 91797.

CONTENT

I. PREAMBLE

I.1. Introduction

In the case of the railway accident occurred on the **15th of February 2011**, at **5:28 a.m.**, on the range of activity of **CF Craiova Regional Branch**, the running section Stehaia - Drobeta Turnu Severin (simple line electrified), **in the flag station Valea Alba**, at the km 349+000, on the direct line II, consisting of the **derailment of a wagon in the composition of the freight train no. 91797** (belonging to the railway undertaking S.N.T.F.M. "CFR Marfa" S.A.), Romanian Railway Investigating Body carried out an investigation, according to the provisions of the Government Decision no. 117/2010, in order to prevent accidents with similar causes by establishing the conditions and determining the causes.

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

I.2. Investigation process

On the **15th of February 2011** Romanian Railway Investigating Body was notified by the Traffic Safety Regional Inspectorate of Craiova Regional Branch through the investigator responsible with the territorial structure, about the occurrence of a railway accident in Hm Valea Alba and moved at the place of the accident where found the **derailment of a wagon in the composition of the freight train no. 91797** (belonging to the railway undertaking S.N.T.F.M. "CFR Marfa" S.A.).

Taking into consideration that the occurrence is defined as accident according to the art. 3 point l of the Law 55/2006 on railway safety and that this accident is relevant for the railway system, in accordance with the article 19 paragraph (2) of the Law no. 55/2006 on railway safety, corroborated with the art. 49, paragraph 2, letter a of the Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety, approved by Government Decision no. 117/2010, the OIFR director decided to start an investigation. So, through the decision no. 51 from the 15th of February 2011, of the OIFR director, the investigation commission was appointed consisting of:

- Popescu Nicolae — main investigator
- Scăunaşu Fredi — Head of Regional Inspectorate SC – Craiova Regional Branch - member
- Brînzan Marius — Head of Control Service, P.P., S.U. Marfa Banat – Oltenia Branch - member
- Dorobanţu Ion — Regional Inspector SC L - Craiova Regional Branch - member
- Angelescu Marian — Regional Inspector SC V - Marfa Banat – Oltenia Branch - member
- Condel Miron — Regional Inspector SC MC- Marfa Banat– Oltenia Branch - member

A. BRIEF PRESENTATION OF THE ACCIDENT

A.1. Brief presentation

On the 15th of February 2011, at 5:28 a.m., on the range of activity of CF Craiova Regional Branch, the running section Stehaia - Drobeta Turnu Severin (simple line electrified), in the flag station Valea Alba, at the km 349+000, on the direct line II, in the running of the freight train no. 91797 (belonging to the railway undertaking S.N.T.F.M. "CFR Marfa" S.A.) occurred the derailment of the wagon no. 31535481610-2 (the 17th by locomotive), by a bogie, axles with the wheels 5-6, 7-8 the first in the running direction.

The place of the railway accident is located on the range of activity of Craiova Railway Regional Branch on the running section Strehaia - Drobeta Turnu Severin (simple line electrified), in the flag station Valea Alba, at the km 349+000.

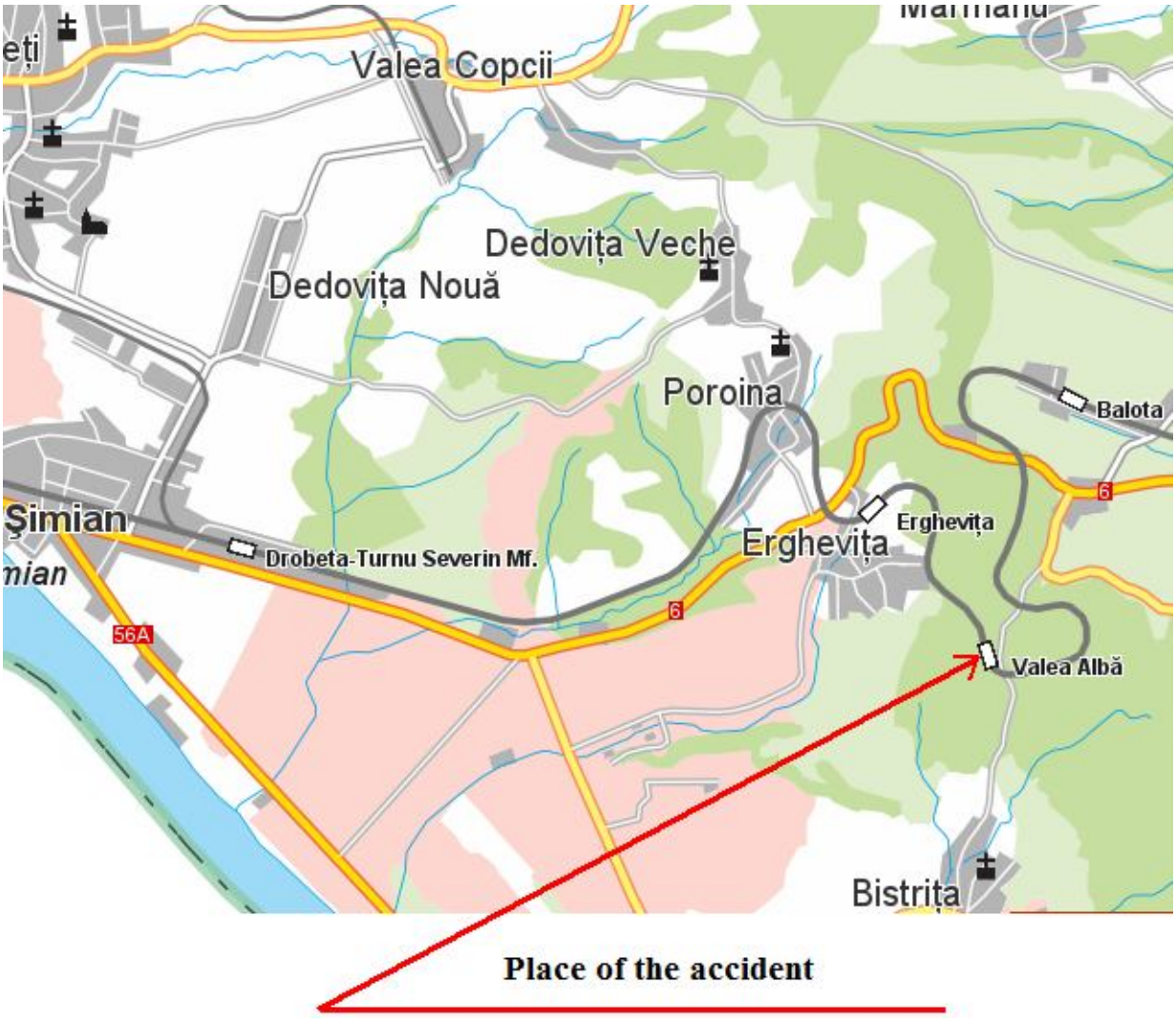

photo no. 1

The freight train no. 91797, composed of 40 wagons, 92 empty axles, 68 loaded axles, tare 915 tones, net 846 tones, 1761 gross tonnage, 597 meters, towed with the locomotive EA 088 in head and the pushing locomotive EA 625 belonging to the freight undertaking S.N.T.F.M. "CFR Marfa" S.A. was running on the distance Craiova -Ronat.

As consequence of this accident the line was damaged on a length of about 485 m at the railway installations and at the wagon no. 31535481610-2.

There were no damages at the towing locomotive of the train.

There were no deaths or injuries.

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

A.2.1 The direct cause of the occurrence of this accident is the escalation of the wire on the left, in the running direction, by the appeal wheel of the axle no. 4 from the bogie no. 2 (the first in the running direction) of the wagon no. 31535481610-2 (the 17th in the composition of the freight train no. 91797), as consequence of the exceeding of the safety limit at derailment caused by the increase of the guiding force while rolling on the circular curve (with right deviation) of the direct line II from the H.m. Valea Alba at the contact between this wheel and the left wire of the direct line no. II located on an area in curve. The increase of the guiding force occurred as consequence of the increase of the friction forces between the two parts of the pallet assembly from the first bogie in the running direction of the wagon no. 31535481610-2 (caused by the missing of some pieces from the wear plate placed between the top pallet and the bottom one) and also by the missing of the stroke at the friction stones measured on the wagon diagonal.

A.2.2. Underlying causes
None.

A.2.3. Root causes
None.

A.3. Severity level
According to the provisions of the art. 3, letter l of the Law no. 55/2006 on railway safety, the event by its consequences is categorized as railway accident.

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

A.4. Safety recommendations
None.
This Investigating Report will be sent to Romanian Railway Safety Authority, to the manager of public railway infrastructure CNCF "CFR" SA and to the freight railway undertaking SNTFM CFR MARFA S.A.

B. INVESTIGATING REPORT

B.1. Description of the accident
On the 8th of February 2011, at 4.30 p.m., arrived in the railway station CF Slatina the wagon no. 31535481610-2, empty with the train no. 83328 and was given over in order to be loaded to the company T.M.K. Artrom S.A.
On the 11th of February 2011, at 7.10 p.m., the wagon no. 31535481610-2 was given over to the staff belonging to Marfa Banat-Oltenia Regional Branch, the railway station C.F. Slatina in loaded condition with scrap metal (scrap) accompanied by the consignment note no. 602115.

On the 12th of February 2011 at 2.00 a.m. the freight train no. 96551 (having in composition the wagon no. 31535481610-2) was formed and directed from the railway station CF Slatina having as destination the railway station Ronat. On the distance Slatina – Craiova the train ran without railway safety problems and arrived to the railway station C.F. Craiova at 10.29 a.m.

On the 15th of February 2011, at 2.12 a.m., the wagon no. 31535481610-2 was sent from the railway station C.F. Craiova from the line no. 13 in the composition of the train no. 91797 that ran without railway safety problems to the Hm Prunisor where arrived at 4.20 a.m. After the attachment of the pushing locomotive EA 625, at 4.30 a.m. the train no. 91797 was sent towards the railway station C.F. Balota where arrived at 4.47 a.m. and stationed until 5.15 a.m. The train 91797 was sent from the railway station C.F. Balota at 5.15 a.m. Passing through the flag station Valea Alba on the direct line II around 5.28 a.m., at the km 349+000 occurred the derailment by the first bogie of the wagon no. 31535481610-2 placed the 17th by locomotive. The wagon ran in derailed condition a distance of about 485 meters. In the moment of the stop the derailed wheels were at a distance of about 30 cm from the rail head.

The derailment occurred on the circular curve with right deviation of the direct line II by the escalation of the rail head corresponding to the outer wire of the curve (he one on the left in the running direction) by the bandage rim of the wheel on the left of the first axle. After running on the rail head of a distance of about 80 cm, occurred the fall of this wheel outside the rail, followed by the fall of the wheel on the right of the same axle inside the path and by the derailment of the second axle.

B.2. Circumstances of the accident

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 are managed by CNCF "CFR" S.A. and maintained by the employees of the District 4 Balota in Section L4 Drobeta Turnu Severin, CF Craiova Regional Branch.

Installations signaling, centralization and blocking (SCB) in H.m. Valea Alba are managed by CNCF "CFR" SA and maintained by the employees of the Section CT 1 Craiova in CF Craiova Regional Branch.

The installations of railway communications on the locomotive are the property of the railway undertaking S.N.T.F.M. "CFR Marfa" S.A. and are maintained by its employees.

The installation of railway communications in H.M. Valea Alba is managed by CNCF "CFR" S.A. and is maintained by the employees of S.C. TELECOMUNICATII CFR S.A.

The installation of power and electric traction (IFTE) is managed by CNCF "CFR" SA and is maintained by the employees of S.C. ELECTRIFICARE CFR SA.

The locomotive EA 088, that was towing the train no. 91797 and the wagons in the composition of the train that derailed are the property of the railway undertaking S.N.T.F.M. "CFR Marfa" S.A. and are maintained and inspected in transit by its employees and the repairs are performed by companies authorized as railway suppliers.

The investigation commission questioned the employees involved in the management of railway traffic, in the maintenance of the railway lines and the locomotive driver.

B.2.2. Forming and equipments of the train

The freight train no. 91797 composed of 40 wag / 160 axles, 92 empty axles, 68 loaded axles, net tonnage 846 t, gross tonnage 1761 t, tonnage necessary to be automatically braked 969 t, hand braked 299 t, real tonnage automatically braked 1207 t, hand braked 764 t, length of the train 597 m, towed by the locomotive EA 088 in head and the pushing locomotive EA 625 belonging to the railway undertaking S.N.T.F.M. "CFR Marfa" S.A.

B.2.3. Railway equipments

Description of the railway path

The line II in H.m. Valea Alba is located in mixed profile, in right curve and slope (gradient) of 21.6 ‰.

The derailment occurred on circular curve with radius of 200 m, over-enlargement 20 mm, over-elevation 80 mm, right deviation, clamping type SKL and indirect system K.

The prism of broken stone was complete, the fixing system of the metallic parts on the sleepers being complete and active.

Description of the railway superstructure

The line II in H.m. Valea Alba, on which occurred the derailment, is composed of superstructure type 49, path with joints, wooden sleepers, clamping type SKL and indirect type K.

Description of the safety installations to control railway traffic

H.m. Valea Alba is provided with installation signaling, centralization and blocking type CR 2 and BLA.

Description of the installations of power and electric supply

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

The railway accident occurred on an area where the running speed of the trains is restricted to 50 km/h.

Description of the train equipments

Checking the wagons in the composition of the freight train no. 91797 was found:

- the position of the front air valves on the entire length of the train, inclusively the one on the locomotive: in opened position, excepting the extreme ones from the last wagon and from the locomotive;
- the front valves from the flexible air half-couplings coupled: in opened position and the valves from the flexible air half-couplings placed in the rest supports: in closed position;
- there were not found valves inappropriately closed;
- checking the air pressure in the main pipeline with the control manometer was found a value of 0 bars because between the wagon series Eacs no. 31535481953-6 and the wagon series Eacs no. 31535481610-2, as consequence of the derailment occurred the breaking of the general pipeline of the wagon 31535481953-6, placed in front of the derailed one;
- the automatic and hand brakes were found in action, respectively isolated, according to the form "Description of the wagons";
- the automatic brakes listed in the form "Note of brakes" were found isolated (the handle of the isolation valve was in horizontal position) and those that were not listed in the form "Note of brakes" were found in operation (the handle of the isolation valve was in vertical position);

- the wagons in the composition of the train which were not listed in the form "Note of brakes" were equipped with brake shoes, having the thickness according to the limit in the table no. 8, point 5-b from the Instructions no. 250/2005;
- the regime exchangers freight-passenger (G-P) and empty-loaded (G-I) were found in appropriate position;
- the linking couples (linking devices) in operation were tightened instructionally and the others remained free were placed in the rest support (hook);
- the percentage of braked weight insured at the automatic brake and also at the hand brake.

The freight train no. 91797 had in composition seven wagons with the automatic brake isolated: 31539339933-4, 33537851580-3, 33537966425-3, 33537987799-6, 84537987157-5, 31539333468-7 and 31539339282-6, these being in the positions 8, 19, 20, 24, 25, 30, respectively 35 by locomotive.

At the brake test (complete test) performed at the wagons in the composition of the train no. 91797 the tightening and weakening times were appropriate and also at the tightness test of the general air pipeline were found air leaks with values within the limits admitted by the provisions of the instructions no. 250/2005.
The automatic brake of the train was active. The safety and vigilance equipments, the equipment for the point control of the speed and hitchhiking (INDUSI) in the equipment of the traction locomotive were in operation and sealed.

After the lift of the wagon from the bogies, the geometric elements of the derailed axles were measured, according to the provisions of the Instructions no. 250/2005, table 1, point 1.

There was measured **the distance between the inner sides of the similar parties of the bandages** in three points placed at 120 degrees one from each other, each one in the lowest position, near the rail crown, with the spacer, being obtained the following values:

- the axle mounted with the wheels no. 5, 6 1359,5 mm 1359,15 mm 1359,15 mm
- the axle mounted with the wheels no. 7, 8 1358,4 mm 1359,15 mm 1358,15 mm

The rates resulted after the measurements are within the limits provided in the "Instructions on technical inspection and maintenance for wagons in operation no. 250/2005".

The measurements at the derailed axles were performed with the devices type DVI 1360 (to check the distance between the inner sides of the similar parties of the bandages) and type DVB 1-40 (to check the dimensions of the wheel rim). In order to check if the axle spindles are twisted or not, was performed a running test of the wagon with the covers of the axle boxes dismantled and was found that the axle spindles were not twisted. On the covers of the axle boxes associated to the axle spindles no. 5, 6, 7, 8 was marked with white paint the letter "D".

The wagon series Eacs no. 31535481610-2 was notified with the notice White with red stripe no. M 01-2/28032 and after the replacement of the derailed axles from the repairs line in the railway station C.F. Drobeta Turnu Severin, will be directed to S.C. I.R.V. – Rosiori Section to be measured the chassis and to be checked the axles on the lathe.

B.2.4. Means of communication
The communication between the locomotive driver and the movement inspectors and between the locomotive driver and the train party was provided through radio-telephone stations.

B.2.5. Triggering the railway emergency plan
Immediately after the occurrence of the railway accident, triggering the intervention plan to remove damage and to restore trains traffic was performed through the information flow mentioned in Chap. IV *Section 2* of the Regulations, so that there came representatives of CNCF "CFR" SA – the

manager of the public railway infrastructure, of the railway transport undertaking SNTFM CFR MARFA S.A., of the Romanian Railway Authority – AFER and of the Operative Department of Railway Transports Police.

Restore on the rails of the rolling stock was performed with local means.

B.3. Consequences of the accident

B.3.1. Deaths and injuries

None.

B.3.2. Material damages

The amount of the material damages according to the estimates prepared by the owner of the rolling stock and by the manager of the public railway infrastructure is the following:

• at the locomotive EA 088	none
• at the wagons according to the estimate no. 678/2011 of S.C. I.R.V. Rosiori	9 036.99 lei
• at the line according to the estimate no. 23/17/2011 of Section L4 Drobeta Turnu Severin	4 594.96 lei
• at the installations according to the estimate no. 221/1/443/.2011 of Section CT1 Craiova	5 768.14 lei
• at the contact line	none
• cost of the intervention means	none
• other damages	none
total amount of the damages	**19 000.09 lei**

B.3.3. Consequences of the accident in railway traffic

The trains traffic between the railway station C.F. Balota and the railway station C.F. Drobeta Turnu Severin Marfuri was completely closed between 5.28 a.m. – 11.29 a.m. on the 15th of February 2011 and it was reopened on the line no. I of the H.m. Valea Alba with the speed limit of 15 km/h from the km 349+400 to the km 349+460.

The line no. II in the H.m. Valea Alba remained closed until the 16th of February 2011 at 2.30 p.m.

Consequences in trains traffic:

- canceled trains - 10 passenger trains;
- trains delayed - 2 passenger trains with a total of 1055 minutes;
- there were put into traffic a number of 5 additional trains.

Between the railway stations C.F. Prunisor - Drobeta Turnu Severin Marfuri the transshipment of passengers was made by car.

The derailed wagon no. 31535481610-2 was restored on the rails at 10.55 a.m.

Checking the technical condition of the wagon no. 31535481610-2, were found the following:

- the wear plate of manganese austenitic steel from the dry friction damper type Lenoir, associated to the axle box from the wheel no. 7 was displaced from the welding without signs of tears or old cracks and it was deformed;

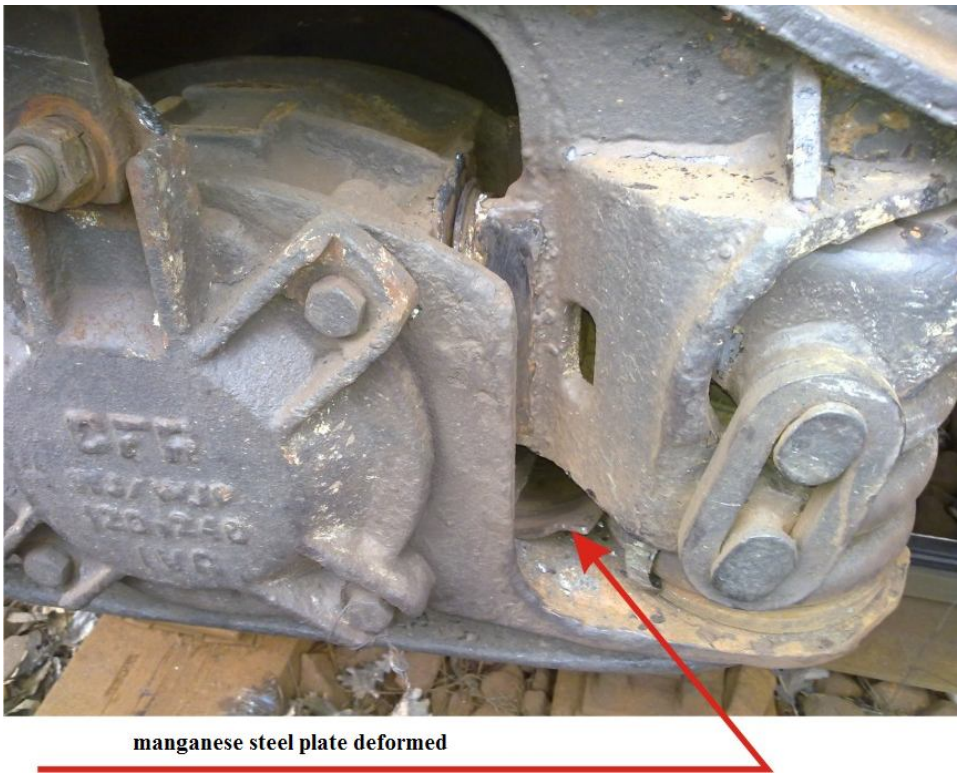

photo 2

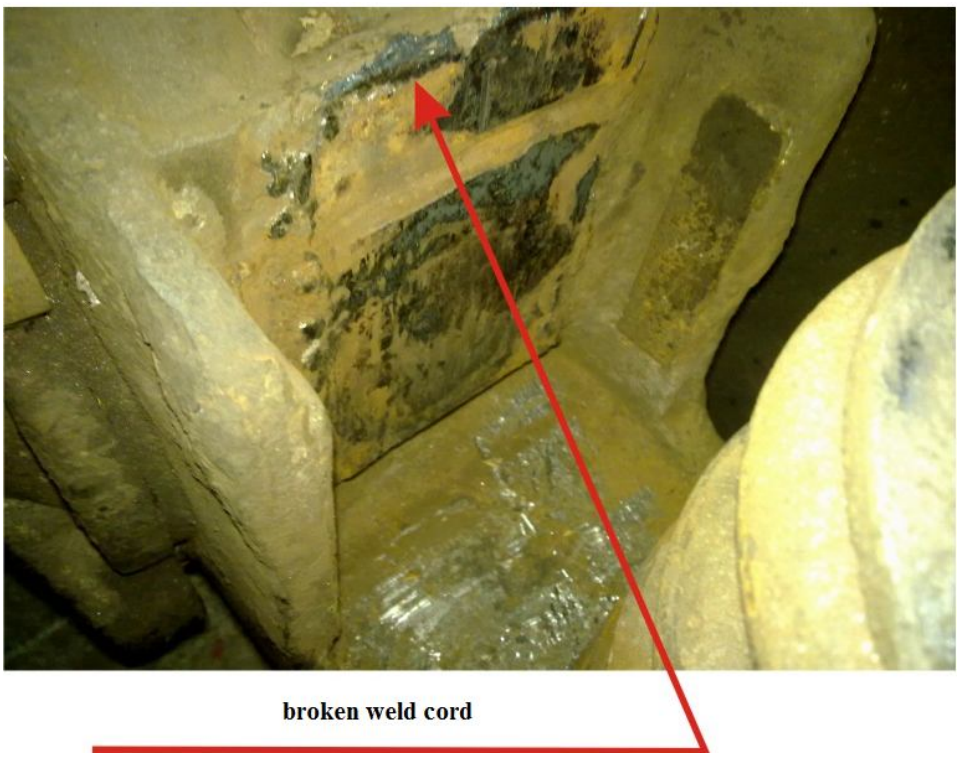

photo 3

- two fixing screws of the pad box on the front sleeper broken;

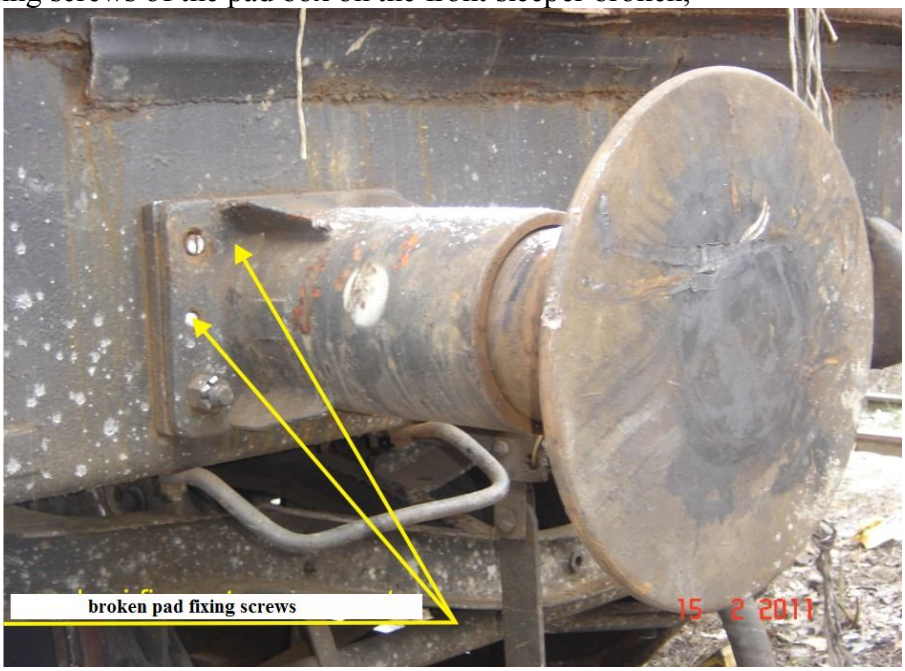

photo 4

- the safety limiters (T parts) associated to the axle boxes no. 7 and 8 were deformed;
- the bandages associated to the wheels no. 5, 6, 7, 8, had hits at the bandages rims on the running area and on the front side;
- the general air pipeline was broken behind the front sleeper (the break was 100% new);
- the air front valve type AK was broken;
- the support of the general air pipeline was broken.

B.4. External circumstances

On the 15th of February 2011, between 5.00 a.m.-6.00 a.m. the visibility was good, overcast sky, the air temperature -2ºC.

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

The locomotive driver of the locomotive EA 088, which towed the freight train no. 91797 stated as follows:

- he took over the locomotive EA 088 on the 14th of February 2011 in Craiova Locomotives Depot and came out in the railway station C.F. Craiova at 11.20 p.m.;
- after performing the complete test he leaves from the railway station C.F. Craiova on the 15th of February 2011, at 2.12 a.m.;
- he arrives in the railway station C.F. Prunisor at 4.20 a.m. where was attached the pushing locomotive EA 625;
- he leaves from the railway station C.F. Balota at 5.15 a.m.;
- he performed the effectiveness test and the train was normal;
- the train was scrolled by the IDM of the H.m. Valea Alba;
- the output signal from the H.m. Valea Alba had permissive indication, green – yellow;

- around 5.30 a.m. the air pressure in the general pipeline decreases suddenly and the train stopped;
- he sent the driver assistant on spot;
- the driver assistant announced by telephone that the 17th wagon by locomotive derailed.

The driver assistant of the locomotive EA 088, which towed the freight train no. 91797 stated as follows:
- he took over the locomotive EA 088 on the 14th of February 2011 in Craiova Locomotives Depot and came out in the railway station C.F. Craiova at 11.20 p.m.;
- after performing the complete test he leaves from the railway station C.F. Craiova on the 15th of February 2011, at 2.12 a.m.;
- he arrives in the railway station C.F. Prunisor at 4.20 a.m. where was attached the pushing locomotive EA 625;
- he leaves from the railway station C.F. Balota at 5.15 a.m.;
- the train had command of passing through the H.m. Valea Alba;
- the train was scrolled by the IDM of the H.m. Valea Alba;
- the output signal from the H.m. Valea Alba had permissive indication, green – yellow;
- around 5.30 a.m. the air pressure in the general pipeline decreases suddenly and the train stopped;
- he went on spot where he found that the 17th wagon by locomotive was derailed;
- he announced this by telephone to the locomotive driver;
- he tightened the hand brakes of the wagons in the composition of the train.

The locomotive driver of the pushing locomotive EA 625 stated as follows:
- he was directed from the railway station C.F. Drobeta Turnu Severin to the railway station C.F. Prunisor as train 97460;
- on the distance between the railway stations C.F. Prunisor – Balota, the locomotive EA 625 ran linked at the train and brake pushing the train 91797;
- he left from the railway station C.F. Balota at 5.15 a.m., the locomotive EA 625 remaining linked at the train and brake;
- the train was scrolled by the IDM of the H.m. Valea Alba;
- around 5.27 a.m. the air pressure in the general pipeline decreases suddenly and the train stopped;
- after about 10 minutes the driver of the locomotive EA 088 announces that a wagon derailed by a bogie.

The driver assistant of the pushing locomotive EA 625 stated as follows:
- the air pressure in the general pipeline decreases suddenly and the train stopped;
- on the distance between the railway stations C.F. Prunisor – Balota, the locomotive EA 625 ran linked at the train and brake pushing the train 91797;
- he left from the railway station C.F. Balota at 5.15 a.m., the locomotive EA 625 remaining linked at the train and brake;
- around 5.27 a.m. the air pressure in the general pipeline decreases suddenly and the train stopped;
- after about 10 minutes the driver of the locomotive EA 088 announces that a wagon derailed by a bogie;
- he tightened the hand brakes of the wagons in the composition of the train.

The IDM on duty in the flag station Valea Alba stated as follows:
- he performed passing path on block on the direct line II for the train 91797;
- after the train 91797 passed over the input signal X he went to scroll the train;
- he came back in the movement office;
- he finds on the lumino-scheme that the switch 2/8 lost control under the train;

- he contacted the locomotive driver who communicates that the train does not supply;
- he communicates to the train driver that the switch 2/8 remained without control;
- he leaves on spot to check the switch;
- he meets the driver assistant from the EA 088 who communicates that a wagon derailed;
- he comes back at the movement office and notifies verbally the occurrence of the railway accident to the operator RC and to the head of station.

The technical inspector of wagons who technically prepared the train no. 91797 on the 15th of February 2011 at direction on the side of the railway station C.F. Craiova, stated as follows:
- after linking at 0.30 a.m. the towing locomotive at the train and brake he waited the increase of the pressure in the general air pipeline and after the stabilization of the pressure in the general air pipeline of the train no. 91797 at the value of 5 bars he blew the dust separators from the first 3 wagons with the automatic brake active in the head of the train;
- he inspected each wagon, he blew the general air pipeline of the train on groups of 5 wagons, he repaired the damages and the air leaks found, he closed the drain traps at 2 wagons series Uagps;
- he performed the technical inspection at formation on the side of the railway station C.F. Craiova (on the left in the running direction);
- at the wagon no. 31535481610-2 he did not find any defect to endanger the railway traffic safety;
- he checked the insurance against fall of the 2 pads from the end of the last wagon in the train (the pad on the left in the running direction);
- he went at the towing locomotive of the train and he asked the locomotive driver to supply the general air pipeline at the regime pressure of 5 bars then he asked to be performed the complete test at the train no. 91797;
- he found a number of 7 wagons with the automatic brake defect and a number of 4 wagons with the hand brake defect that he recorded in the form "Note of brakes" no. 21/115;
- he met the team mate at the wagon series Uagps no. 31539339213-1;
- after checking the tightening of the automatic brakes he gave the signal "weaken the automatic brake" to the locomotive driver and he went towards the locomotive checking the brakes weakening by removing the shoes from the running surfaces of the wheels;
- he prepared and gave over under signature to the transit staff the form "Note of brakes" at 1.20 a.m.;
- he gave the brake test appropriate, he signed the roadmap of the locomotive and he supervised by scrolling on the side of the railway station the train no. 91797 at sending from the railway station C.F. Craiova .

The technical inspector of wagons who technically prepared the train no. 91797 on the 15th of February 2011 at direction on the opposite side of the railway station C.F. Craiova, stated as follows:
- he inspected each wagon, he blew the general air pipeline of the train on groups of 5 wagons, he repaired the damages and the air leaks found, he closed the drain traps at 2 wagons series Uagps;
- he performed the technical inspection at formation on the opposite side of the railway station C.F. Craiova (on the right in the running direction);
- at the wagon no. 31535481610-2 he did not find any defect to endanger the railway safety;
- he checked the insurance against fall of the 2 pads from the end of the last wagon in the train;
- he found a number of 7 wagons with the automatic brake defect and a number of 4 wagons with the hand brake defect that he transmitted to his colleague who prepared the form "Note of brakes" no. 21/115;
- he met the team mate at the wagon series Uagps no. 31539339213-1;
- he checked the pressure in the general pipeline of the train with the control manometer and it had the value of 5 bars;

- after checking the tightening of the automatic brakes he went to the last wagon checking the weakening of the brakes by removing the shoes from the running surfaces of the wheels;
- he gave the brake test appropriate and he supervised by scrolling on the opposite side of the railway station the train no. 91797 at sending from the railway station C.F. Craiova.

The head of lines district no. 4 Balota - Section L4 Drobeta Turnu Severin stated as follows:
During the period 15.08.2010 - 15.02.2011 on the line section from the input signal X end of the H.m. Valea Alba, the km 348+100 to the km 349+000 (the place of the derailment) were performed the following works:
On the 10th of September 2010
- biannual inspection and check of the hidden sides (VPA) at the switches no. 1 and 3 in the X end of the H.m. Valea Alba;

On the 24th of September 2010
- the direct line II in the H.m. Valea Alba, replaced wooden sleepers 2, 60 with new ones, 6 pieces on the area of the km. 348+900 - 348+920;
- the direct line II in the H.m. Valea Alba, level rectified by stuffing joints, 33 sleepers pieces area km 348+900 - 349+000;

On the 20 of October 2010
- km 348+100 to 348+200 panel 3 left replaced defect rail, 1x30 m with type 49;

On the 21st of October 2010
- km 348+130 to 348+140, level rectified by stuffing, 14 sleepers pieces;

On the 22nd of October 2010
- km 348+450, 465, 480 level rectified by stuffing at joints, 18 sleepers pieces;
- level rectified by stuffing linking rails switch no. 1 Valea Alba X end, 24 sleepers pieces;

On the 23rd of December 2010
- km 348+900 to 349+000 panel 1 left replaced defect rail 1x30 m type 49;
- line II Valea Alba 348+960 to 349+020 regulated expansion joints 60 linear meters, left wire;

La data de 05.01.2011
- km 348+200 to 348+290 regulated expansion joints, 90 linear meters, left wire.

B.5.2. Safety management system
At the moment of the railway accident occurrence, CNCF "CFR" SA as manager of the railway infrastructure had implemented its own railway safety management system, according to the provision 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 the possession of the Safety Authorization - Part A with the identification no. ASA 09002 – through which the Romanian Railway Safety Authority from AFER confirms the acceptance of the safety management system of railway infrastructure manager;

At the moment of the railway accident occurrence, SNTFM "CFR Marfa" SA Bucharest 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 Transport Minister no. 535/2007 on granting the safety certificate to perform railway transport services on Romanian railways.
On the 10th of November 2009 the railway transport undertaking was in the possession of the following documents on its own railway safety management system:

- Safety certificate - Part A with the identification no. CSA 0021 – 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 0021 – 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 applicable national legislation.

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

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

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;
- Instruction for setting terms and order for the rail inspections no. 305 approved by OMT no. 71 on the 17th of February 1997;
- Instruction for the lineman head of district for the rail maintenance no. 323/1965;
- Instruction for the activity of the foreman for the maintenance of the line no. 322/1972;
- Instruction for the flagmen and rail or dangerous points inspectors no. 321/1972;
- Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989;
- Instructions for the census of the bad sleepers in the path, planning and monitoring their replacement no. 316/1963;
- Instruction for the use of rail measuring wagons no. 329/1995
- Instructions for the diagnosis of the rail and of the contact line made with the TMC motorailer approved by the Order of the Minister of Transport, Constructions and tourism no. 2256/27.11.2006
- Railway Technical Norm no. 57-001/2006
- Railway Technical Norm no. 81-005/2006
- Instruction no. 936/1991

sources and references

- copies of the documents submitted as annexes to the investigation file prepared by the investigation commission appointed through the decision of the director of Craiova Regional Branch no. 4/1/3/406 from the 18th of March 2010;
- photos taken immediately after the railway accident by the members of the investigation commission;
- photos taken at the wagon involved in the railway accident in the H.m. Valea Alba
- 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 wagons;
- inspection and interpretation of the technical condition of the elements involved in the accident: infrastructure, railway installations and train;
- questioning of the staff involved in the occurrence of the railway accident;

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

B.5.4.1. Data found on the line

Technical condition of the line before the occurrence of the railway accident

The line II in the H.m. Valea Alba is located in mixed profile, in curve with right deviation and slope of 21.6 ‰ (gradient).
The derailment occurred don an area of circular curve with radius **R**=200 m, over-enlargement **s**=20 mm, over-elevation **h**=80 mm, right deviation, superstructure type 49, normal wooden sleepers, indirect clamping type K and SKL 14.

Findings and measurements performed at the line after the occurrence of the derailment and the lift of the wagons
The derailment occurred on the circular curve with right deviation of the line II at the km 349+000 by the escalation of the rail head associated to the rail of the outer wire of the curve with the bandage rim of the wheel on the left of the first axle in the running direction and, after running of about 80 cm on the rail head occurred the fall of the wheel outside the rail followed by the derailment of the second axle of the first bogie.
The small metallic fixing material was complete and active, the prism of broken stone was complete and compacted, the wooden sleepers were in proper condition.
After the check of the gauge (E) and of the cross level (N) in points having the equidistance of 2.5 m and also of the arrows (f) measured in the middle of the cord of 10 m, of the vertical and side wear of the rails (Uv; Uo) measured in the same points, was found that the line is appropriate from the point of view of the tolerances provided in the Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989.

B.5.4.2. Data found on the work of the rolling stock and of its technical installations

Findings performed at the wagons in the composition of the train in the H.m. Valea Alba
The regime exchangers freight-passenger (G-P) and empty-loaded (G-I) were found in appropriate position for the wagons condition, respectively the positions “freight” and “loaded”; the train had in composition seven wagons with the automatic brake isolated.

At the brake test (the complete test) performed at the wagons in the composition of the train no. 91797 the tightening and weakening times were appropriate and also at the tightness test of the general air pipeline were found air leaks with values within the limits admitted by the provisions of the instructions no. 250/2005.

B.6. <u>Analysis and conclusions</u>

B.6.1. Conclusions on the technical condition of the railway superstructure
The values of the gauge and of the cross level on the area before the first sign of derailment were within the maximum limits admitted by the Instruction of standards and tolerances for the construction and maintenance of the rail - standard gauge lines no. 314/1989, corresponding to the maximum speed admitted in the area of the derailment occurrence.

B.6.2. Conclusions on the technical condition of the wagons in the composition of the train
After derailed by the axles with the wheels no. 5, 6, 7, 8 the wagon series Eacs no. 31535481610-2 ran on a distance of about 485 meters hitting with the wheels the coach screws and the sleepers, which led to the braking of the weld cord insuring the fixing of the manganese plate on the axle box corresponding to the wheel no. 7, the destruction of the fix assembly between the manganese plate and the axle box and also the deformation of the manganese plate. After the lift of the wagon from the bogies, at the inspection of the axle box of the wheel no. 7, were found:

- the weld cord was broken on the entire perimeter of the wear plate of manganese steel. The break was new;
- the operation surface of the pressure part had hits and signs of overheating (bluish).

As consequence of the manganese plate displacement, occurred the work perturbation of the damper Lenoir,

photo no. 5

so that the pressure part (the piston) did not act anymore on the manganese plate. After the inclination of the piston a pronounced friction occurred, which led to the deformation of the manganese steel plate. After the measurements performed at the bogies type Y25Cs from the wagon series Eacs no. 31535481610-2 resulted that the amounted stroke between the friction stones (sliding) on the diagonal of the wagon right front – left back has the value 0, contrary to the provisions of the point 6.4.16 of the railway Technical Norm no. 57-001/2006 and to the provisions of the points 2.3, letter f) of the Instruction no. 936/1991.

At the lift of the wagon series Eacs no. 31535481610-2 (which was the 17th by locomotive in the composition of the train no. 91797 on the 15th of February 2011) from the bogies, at the pallet assembly from the bogie equipped with the axles with the wheels no. 5,6,7,8, the first in the running direction, were found the following:

- the two bogies that equip the wagon are type Y25Cs with the numbers 07029 (the bogie with the wheels no. 1,2,3,4) and 07028 (the bogie with the wheels no. 5,6,7,8 that derailed, the first in the running direction) and are equipped with pallets spherical type of cast steel, provided with wear plate of graphite polyamide;
- the shoulder of the bottom pallet has pronounced signs of friction (wear) with the depth of about 4-5 mm and a deformation on the right in the running direction of about 6 mm due to the friction in the top pallet;
- wear of about 2-3 mm and hit marks with depth of 3 mm at the top pallet;
- the pallets top and bottom have signs of contact (pronounced signs of friction) on 1/3 of the surface due to the missing of a piece with the dimensions of about 180x150 mm from the outer margin, right side in the running direction, of the wear plate;
- on the contact surface the wear plate has crushing with the depth of 4 mm;
- the marks of pronounced friction with the depth of about 3 mm at the friction stones associates to the wheels no. 6 and 8;
- the bogies frames and the chassis of the wagon series Eacs no. 31535481610-2 had no deformation;
- the devices of traction-linking and impact were in appropriate condition, without defects.

The amount of the wears on both pallets Uci + Ucs = about 6-7 mm, contrary to the provisions of the point 2.4.3, letter a) of the Railway Technical Norm no. 81-005/2006 (it is admitted that the amount of the wears on both sides does not exceed 4 mm).
At the pallet assembly from the 2nd bogie (equipped with the axles with the wheels no. 1, 2, 3, 4) in the running direction, were found the following:

- the pallets top and bottom show a contact surface with pronounced friction signs due to the missing of a piece with the dimensions of about 120x160 mm from the outer margin, right side in the running direction, of the wear plate;
- the shoulder of the bottom pallet has pronounced signs of friction (wear) with the depth of about 3-4 mm and a deformation of about 3 mm due to the friction in the top pallet.

Conclusions on the technical condition of the wagon series Eacs no. 31535481610-2:

- missing of some pieces from the wear plates found at the pallet assembly led to the occurrence of a dry friction between the two parties of this assembly. This led to the increase of the friction forces and implicitly to the very strong increase of the friction moment;
- at the bogie equipped with the axles with the wheels no. 5, 6, 7, 8, the first in the running direction the amount of the wears on both pallets Uci + Ucs = about 6-7 mm was bigger than the provisions of the point 2.4.3, letter a) of the Railway Technical Norm no. 81-005/2006 and the provisions of the point 2.3, letter c) of the Instruction no. 936/1991 ;
- the amounted stroke between the friction stones (sliding) on the diagonal of the wagon right front – left back had the value 0, contrary to the provisions of the point 6.4.16 of the Railway Technical norm no. 57-001/2006 and the provisions of the point 2.3, letter f) of the Instruction no. 936/1991.
- the inexistence of the strokes at the friction stones on the diagonal of the wagon contributed to the difficulty of the wagon to enter the curve.

All these non-compliances led to the situation in which the rotation moment of the bogie no. 07028 (equipped with the wheels no. 5, 6, 7, 8, the first in the running direction) increased (led to the difficulty to rotate of the bogie and to enter the curve) and implicitly increased the guiding force that acted on the wheel on the left in the running direction of the appeal wheel at the contact between this wheel and the rail of the outer wire (on the left) of the curve with right deviation of the direct line no. II in the H.m. Valea Alba.

B.6.3. Analysis and conclusions on the occurrence of the train derailment

From the analysis of the findings at the place of the railway accident, of the technical condition of the derailed wagon, of the photos taken at the place of the derailment and also of the statements of the involved employees, one could conclude that the derailment had the following dynamic of occurrence:

- under the conditions of missing of some pieces from the wear plates placed between the top pallet and the bottom one at the first bogie in the running direction, led to the occurrence of a dry friction and implicitly to the very strong increase of the friction moment between two parties of this assembly;
- consequence of the increase of the guiding force at the contact between this wheel and the rail while running on the right circular curve of the line no. II, the ratio between this force and the load on the appeal wheel (wheel 7) exceeded the value of the stability limit at derailment;
- due to the exceeding of the stability limit at derailment, the appeal wheel no. 7 (on the left in the running direction) escalated the outer rail at the km 349+000, being favored by the strong load discharge of the axle with the wheels 7, 8 (appeal axle);
- after the escalation of the rail head of the outer wire by the bandage rim of the wheel no. 7 (on the left in the running direction) from the appeal wheel, this ran with this wheel on the head of the outer rail and with the wheel no. 8 on the rail about 80 cm;

- from this kilometric position, the wheel no. 7 which was running on the head of the outer rail left the rolling surface of this rail head, fell outside the rail and hit the fixing elements of the rail on the sleepers.
- Simultaneously with the fall of the wheel no. 7 outside the path occurred also the fall of the wheel no. 8, (on the right in the running direction) inside the path, hitting the fixing elements of the rail on the sleepers, from inside the curve on a distance of about 356 m.
- After the fall outside the path of the wheel no. 7, the appeal axle started to roll tangent at the curve of the path and involved in the derailment also the second axle of the bogie (the axle with the wheels no. 5, 6).

The wagon Eacs no. 31535481610-2 placed the 17th by locomotive in the composition of the train no. 91797, ran with the wheels 5, 6, 7, 8 derailed a distance of 485 m on an area in curve stopping at about 28 meters from the top of the switch no. 2.

Due to running of the wagon in derailed condition occurred reactions in the train body, which led to the breaking of the front air valve type AK of 5 bars and the breaking of the general air pipeline behind the front sleeper from the wagon series Eacs no. 31535481953-6, RP 30.08.05 TMS (6), placed in the composition of the train before the derailed one.

As consequence of the breaking of the air valve from the wagon no. 31535481953-6, the air pressure in the general air pipeline of the train decreased suddenly, that led to the emergency braking of the train and its stop at the km 349+485. After the train stopped the wagon series Eacs no. 31535481610-2 was with the wheels no. 5, 6, 7, 8 derailed at a distance of about 30 cm from rail head.

B.7. Causes of the accident

B.7.1. The direct cause of the occurrence of this accident is the escalation of the wire on the left, in the running direction, by the appeal wheel of the axle no. 4 from the bogie no. 2 (the first in the running direction) of the wagon no. 31535481610-2 (the 17th in the composition of the freight train no. 91797), as consequence of the exceeding of the safety limit at derailment caused by the increase of the guiding force while rolling on the circular curve (with right deviation) of the direct line II from the H.m. Valea Alba at the contact between this wheel and the left wire of the direct line no. II located on an area in curve. The increase of the guiding force occurred as consequence of the increase of the friction forces between the two parts of the pallet assembly from the first bogie in the running direction of the wagon no. 31535481610-2 (caused by the missing of some pieces from the wear plate placed between the top pallet and the bottom one) and also by the missing of the stroke at the friction stones measured on the wagon diagonal.

B.7.2. Underlying causes
None.

B.7.3. Root causes
None.

C. Safety recommendations
None.

This Investigating Report will be sent to Romanian Railway Safety Authority, to the manager of public railway infrastructure CNCF "CFR" SA and to the freight railway undertaking SNTFM CFR MARFA S.A.

Members of the investigation commission:

- Popescu Nicolae main investigator
- Scăunaşu Fredi member
- Brînzan Marius member

- Dorobanţu Ion member
- Angelescu Marian member
- Condel Miron member