



MINISTERUL TRANSPORTURILOR SI INFRASTRUCTURII
AUTORITATEA FERROVIARA ROMANA - AFER

ORGANISMUL DE INVESTIGARE FERROVIAR ROMAN



INVESTIGATING REPORT

on the derailment, of two wagons from the passenger train composition no. 4485
owned by SNTFC “CFR Călători” SA, manufactured in the railway station Mogoșeni
on 07th of April 2010



Final Edition

August 17, 2010

NOTICE

As regards the railway incident occurred on 07th of April 2010 during the running of the passenger train no. 4485, on the activity area of Railway District CFR Cluj, railway station Mogoșeni, by derailment of one bogie of each of the two wagons, the Romanian Railway Investigating Body developed an investigating action according to the provisions of the accidents and incidents investigation Regulation, of development and improvement of railway safety on the Romanian railways and metro transport network approved by GD no. 117/2010. By this investigating action, were collected and analyzed information on the railway accident occurrence and also were established the conditions and was determined the cause.

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

The Romanian Railway Investigating Body considers necessary that one took corrective measures in order to improve the railway safety and to prevent accidents, as to which, in this report were given a series of safety recommendations.

Bucharest, 17 august 2010

I give my positive opinion

Director
Dragoș FLOROIU

I find the observance of the legal provisions on the development of the investigating action and drawing the present investigating report that i'm proposing for approval.

Chief Investigator
Sorin CONSTANTINESCU

The present Notice is a part of the Report for investigating the railway accident occurred on 07th of August 2010 during the running of the passenger train no. 4485, owned by SNTFC “CFR Călători”, railway station Mogoșeni, on the activity area of Railway District CFR Cluj.

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I. PREAMBLE

I.1. Introduction

As regards the railway incident occurred on 07th of April 2010 during the running of the passenger train no. 4485, by derailment of one bogie of each of the two wagons, on the activity area of Railway District CFR Cluj, railway station Mogoșeni, the Romanian Railway Investigating Body, permanent and independent body within the Romanian Railway Authority – AFER, hereinafter referred as OIFR, developed an investigating action in order to prevent accidents with similar causes, by establishing the conditions, determining the causes and issue safety recommendations.

By this investigating action, were collected and analyzed information on the railway accident occurrence and also were established the conditions and was determined the cause.

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

I.2. The investigation process

Immediately after this accident occurrence the Romanian Railway Investigating Body was verbally notified and by written procedure by the Romanian Railway Safety Authority, body within the Romanian Railway Authority – AFER, about the railway accident occurrence in which the passenger train no.4485 was involved. Also the Romanian Railway Investigatin Body took notice about the followings:

- the passenger no. 4485 was stopped on deflecting section 1 of the railway station Mogoșeni having the wagon no. 505320476896, the second from the locomotive, derailed with the second bogie, with the left wheels fallen between the rails of line 1 and the right wheels fallen between line no.1 and line no.0;
- the wagon no. 505320576026 (the 3rd and also the last in the train composition) had the first boghie in the running direction derailed. The left wheels of this bogie were at 10-15 cm from the right rail of line no.1, and the right wheels were between line no.1 and line no.0 next to the sleepers end of line no.0;
- line no. 1 and track connection no. 5/7 between line no.1 and line no.0 were buckled;

Following this accident there were no victims or injured.

At the place of the accident were present representatives of: Police of Railway Transport, Romanian Railway Safety Authority, Public Railway Infrastructure Manager - CNCF „CFR” SA, Public Railway Undertaking - SNTFC „CFR Călători” SA.

By decision nr. 18 of 09.04.2010, of OIFR's director, according to the provisions of art. 19 paragraph 2 of the Law no.55/2006 on the railway safety, was appointed an inquiry commission composed of:

- | | |
|------------------------------------|---------------------|
| • Eduard STOIAN – head of service | - main investigator |
| • Dumitru SFÂRLOS – investigator | - member |
| • Marian ZAMFIRACHE – investigator | - member |

A. SUMMARY OF THE ACCIDENT

A.1. Short description

On 07.04.2010 the passenger train no. 4485, was running between Ilva Mică - Dej Călători. According to the train diagram, the train was dispatched from the railway station Nimigea towards the railway station Mogoșeni at 17:23 o'clock. In the railway station Mogoșeni the train was to be stabled on the deflecting section no.1.

On 07.04.2010 the passenger train no. 4485, was hauled by the locomotive EA 924 (belonging to CFR Cluj engine shed) and composed of 3 wagons, 12 axles, 147 tons, automatically braked 125 tons, actually 192 tons, additional 67 tons against the timetable, hauled by the locomotive EA 924 from the Cluj engine shed, in one man driving, was dispatched from the railway station Nimigea towards the railway station Mogoșeni at 17.23 o'clock on the basis of BLA without observations.

At 17:31 o'clock when stabling the passenger train no. 4485 on the deflecting section no.1 of the railway station Mogoșeni, when passing on the deflecting section over the switch no.5, the wagon no. 505320476896 derailed (the 2nd from the locomotive), with the second bogie and the wagon no. 505320576026 (the 3rd from the locomotive), with the first bogie.

The railway accident occurred in the X end of the railway station Mogoșeni on the connecting rail on the deflecting section of switch no.5. The gradient where the railway accident occurred is 3‰.

The area where the railway accident occurred is on the Beclean pe Someș – Salva running section, owned by CNCF „CFR” SA – Cluj railway regional branch.

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

A.2.1. Direct cause

The direct cause of the accident was the left wheel of the first axle, in the running direction, of wagon no. 505320476896 (the 2nd from the locomotive) get into the space between the lateral surface of the curve stock rail head and the lateral surface of the connecting rail from the left side of the direct line of switch no.5 due to the yielding of the metal plate welding seam, its penetration and lateral movement into the sleeper body, together with the deformation of the coach screws for fixing the metal plate on the sleeper, followed by this wheel falling inside the rail.

Contributed factors

Metal plate breakage due to the welding seam yielding due to the guidance force on the first axle, at running in curve, together with the vertical fastening yielding of the metal plate on the timber sleeper.

The increase of the guidance force (horizontal) occur due to the train braking to enter the deflecting section of switch no 5;

The yielding of the vertical fastening in the sleeper body occur due to:

- the welding seam yielding from the sleeper construction, the welding seam was under the bottom of the curved stock rail
- decreasing the lateral resistance exerted by the metal plate shims on the timber sleeper, as a result of cutting the plate.

A.2.2. Underlying cause

2.2.1. The execution of a wrong welding at the metal plate construction for fixing on the timber sleeper the curved stock rail and right point switch in the joint area of the curved stock rail.

2.2.2. Exceeding the instructional period for replacing the non-adequate special sleepers from points and crossing.

2.2.3. The non-adequate impregnation of timber sleepers with the non-observance of reception conditions of the railway critical product of impregnation.

A.3. Severity level

According to the provision of article 3, letter l of Law no. 55/2006 on railway safety and of article 7, paragraph (1), letter. b of the Investigation regulation for accidents and incidents, development and improvement of railway safety on railways and on metro transport network in Romania, approved by GD 117/2010, this railway event is qualified as railway accident.

A.4 Safety recommendations

The recipient of the safety recommendations is CNCF „CFR ”SA, as public railway infrastructure administrator, the Romanian Railway Notified Body as body that authorizes, homologates and grant agreements to the supplier manufacturers and railway critical products/services and the Romanian Railway Safety Authority as authority that periodically checks through state inspections/controls the railway supplier quality of the white sleepers manufacturers and of the railway critical service supplier of sleepers impregnation.

The recommendations resume and complete the situations with the occasion of an accident occurred in similar conditions in May 2008 in the railway station Mogoşeni over the same switch and are guided to resolve the followings:

1. Checking during the VPA works and of the constructive welding integrity of the special metal plates for fixing the points switch and stocks rail;
2. For the cases in which the instruction time for replacing the inadequate reviewed sleepers in points and crossing is not respected, the management of the Regional Branch CF Cluj with one accord with Lines Department within CNCF „CFR” SA will establish the running conditions for each case.
3. The Romanian Railway Safety Authority shall check by state inspection actions the way that the railway critical service suppliers „wood products treatment with chemicals (sleepers and sleeper plugs)” meet the technological processes of preparation for preservation (impregnation), preservation and checking the preserved sleepers quality.

After completion of the action, the Romanian Railway Safety Authority will transmit to the Romanian Railway Notified Body the report on the non-conformities found and the measures disposed to be taken to remove those.

4. CNCF "CFR" SA will organise trainings for the personnel with competences on ways of assessing the sleepers defects and the way of conducting the census of inadequate sleepers.
5. CNCF „CFR” SA will asses the reception mode of the preserved timber sleepers and the management of the documentation on the quality certification of the supplied materials, documents that must accompany the product until the direct user, the maintenance lines district.
6. The Romanian Railway Notified Body shall check by state inspection actions the compliance by the railway critical service providers of protection with chemicals of the timber sleepers of the norms and technical and technological prescriptions mandatory for this railway critical service.

After the action end, the Romanian Railway Notified Body will transmit to the Romanian Railway Investigating Body a report on the non-conformities found and the measures disposed to be taken to remove those.

The present investigating report will be transmitted to the Romanian Railway Safety Authority, CNCF "CFR" SA, National Railway Passenger Company "CFR Calatori" – SA and to the Romanian Railway Notified Body.

According to the provisions of the Law no.55/2006 on railway safety and of the Investigating Regulation of accidents and incidents, development and improvement of railway safety on the railways and on the metro transport network in Romania approved by GD no. 117/2010, the Romanian Railway Safety Authority will survey the way of implementation of these recommendations.

B. INVESTIGATING REPORT

B.1. Description of the accident

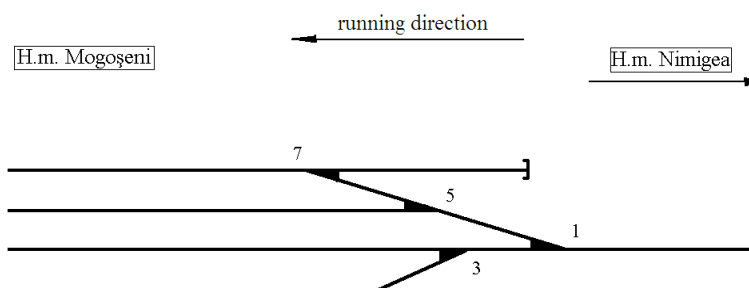
On 07.04.2010 the passenger train no. 4485, that was running between Ilva Mică - Dej Călători departure from the railway station Nimigea at 17:23 o'clock to the railway station Mogoșeni where it should be stabled at line no.1 to meet the train no. 1943-2 passing on direct line II from the railway station Mogoșeni.



Foto 1: The geographical position of the accident

At 17:31 during the parking of the passenger train no. 4485 at the deflecting section no.1, when passing the switch no.5 with deflecting route, the wagon no. 505320476896 (the 2nd from the locomotive) derailed, with the second bogie and the wagon no. 505320576026 (the 3rd from the locomotive) with the first bogie.

The derailment started from a distance of 80 cm from the right point switch heel (the 14th sleeper), the left wheel of the first axle, in the running direction, of wagon no. 505320476896, the 2nd from the locomotive, get into the space between the lateral surface of the curved stock rail head and the lateral surface of the connecting band from the left side of the direct line of switch no.5 due to the sleeper suddenly yielding on which the metal plate was situated from which the curved stock rail is fixing and the connecting band from the left side of the direct line of switch no.5, followed by the breaking and deformation of the coach screws.



the railway station Mogoșeni scheme, in the area where the accident occurred photo no.2



point 0

photo no.3

The complete fall of the wheel from the left side occurred within the connecting band (after the curved stock rail heel) in the space between the connecting band from the left side of the switch direct line and the connecting band of the switch no.5 deflecting line, at a distance of 3,0 m after the joint of the curved rail stock heel, the wheel was running and forcing the metal plates shims of the sleepers.

This wheel fall right next to the 20th sleeper from the top joint of switch no.5, at a speed of 24 km/h



the sleeper no.20

photo no.4

From the fall of the left wheel, the right wheels had run another 2,0 m on the connecting rail on the deflecting section from the right side (the track corresponding to the exterior track of the switch curve), after which the flange of wheel climb over the head of rail falling between the head of rail and the connecting rail from the right side corresponding to the direct line of the switch (between the 23rd and 24th sleepers) and then ran on the metallic elements for fastening of the rail to the metal plates and fastening of the metal plates to the sleepers.



the area of the 23rd and 24th sleepers

photo no.5

The derailment of the first axle in the running direction had caused the total derailment of the second bogie of the wagon no. 505320476896 (the 2nd in the train composition) and then to the derailment of the first bogie of the wagon no. 505320576026 (the 3rd in the train composition).

From point “o” the first derailed bogie had run 35 m on the switch sleepers, running with the right wheels on the direct line of the switch no. 5 and with the left wheels on the deflecting section of the same switch. As a consequence of this route was the breaking of the lignofolium fishplates from the section or isolated of the switch no.7 heel, buckling of connecting rail 5-7 and of line 1 as

weel as the sleepers deterioration from the connecting rail 5-7 and the first panel after the heel joint of the switch no.5 center.



the connecting rail 5-7

photo no.6

The passenger train no. 4485, had in its composition the locomotive EA 924 and 3 passenger cars, all owned by SNTFC „CFR Călători” SA.

There weren't any injured persons.

There were damages to the line and to the two derailed bogies.

B.2. The accident circumstances

B.2.1. Involved parties

- 16.1. The involved personnel is employed by CNCF „CFR” SA – Branch of the Railway County C.F. Cluj- Cluj Lines Department and SNTFC „C.F.R. Călători”- S.A, Passenger Railway County Cluj.
- 16.2. The involved wagons are property of SNTFC „C.F.R. Călători”- S.A. Passenger Railway County Cluj and under maintenance by Cluj Multimodal Terminal.
- 16.3. The railway infrastructure involved, the lines from the railway station Mogoșeni, are in the management of CN CF „CFR” SA – Branch of the Railway County CF Cluj and under maintenance by the personnel of the Section L8 Bistrița, District 5 Năsăud, crew 13 Nimigea.

The interlocking systems (SCB) between the railway stations Nimigea and Mogoșeni are in the management of CNCF „CFR” SA and under maintenance by the personnel of the Branch of the Railway County CF Cluj.

The railway communication equipment in the railway station Mogoșeni is under the management of CNCF „CFR” S.A. and under maintenance by the personnel of SC TELECOMUNICAȚII CFR S.A.

The force and electric traction equipment (IFTE) is under the management of CNCF „CFR” SA and under maintenance by the personnel of SC ELECTRIFICARE CFR SA.

The railway communication equipment onboard the involved locomotive is property of SNTFC „CFR Călători” SA and under maintenance by its employees.

The passengers cars in the forming of the train involved in the accident are property of SNTFC „CFR Călători” SA and under maintenance by its employees, the repairs are performed by the authorised railway suppliers economic agents.

The inquiry commission questioned the employees involved in the infrastructure maintenance and operation and the employees involved in the locomotive driving and the train staff.

The inquiry commission questioned two passengers as witnesses at the accident occurrence because this was necessary to establish the real causes of the accident.

B.2.2. Composition and equipments of the train

The train was composed from 3 wagons, 12 axles, 147 tones, automatic braked 125 t, actually 192 t, additional 67 against the timetable, hauled by the locomotive EA 924 from the Cluj depot, in one man driving.

The locomotive and the 3 wagons belongs to the railway operator SNTFC „CFR Călători” SA.

The safety and automatic warning systems (DSV), the equipment for the punctual control of the speed and autostop (INDUSI) from the endowment of the locomotive were active and operated in accordance with the instructions and with the handbrake active.

B.2.3. Railway equipments

Track route description

The involved railway infrastructure, the lines and switches from the railway station Mogoşeni, is under the management of CNCF „CFR” SA – Branch of the Railway County CF Cluj, being under the maintenance of Lines District no.5 Năsăud, crew 13 Nimigea within the section L8 Bistriţa.

The track superstructure of the current line between the railway stations Mogoşeni and Nimigea is made from rail type 49, concrete sleepers T13, indirect fastening type K.

The access to the railway station Mogoşeni (X end) from the railway station Nimigea is made by a circular curve right deviation, of radius $R = 900$ m, track deflection $f = 55$ mm, widening of the gauge $s = 0$ mm and cant of track $h = 55$ mm. The connection of the constant-radius curve to the adjacent straight line is made by two parabolic curves.

The switches 1, 3, 5, 7 from the railway station Mogoşeni (X end) and line 1 are situated in down-grade (in the running direction of the railway station Nimigea to the railway station Mogoşeni) having the gradient 3‰.

The deflecting section 1 is in a straight line and it's lay out with rail type 49, on reinforced-concrete sleepers T13.

The switch no. 5 is type 49 and has the following characteristics: radius $R = 190$ m, tangent $tg = 1:9$, left deviation, joint point switch (Aa), track gauge 1435 mm, timber sleepers, indirect fastening type K.

The current line Nimigea-Mogoşeni and direct line II , 1 and 3 from the railway station Mogoşeni are electrified.

B.2.4. Means of communications

The link between the locomotive driver and the movement inspectors and between the locomotive driver and the train crew was assured through radiotelephone equipment.

B.2.5. Launching the railway emergency plan

As soon as the railway incident happened, starting the intervention plan in order to remove the damages and the trains traffic was re-established by the information flow stipulated in the annex 2 from the Instructions for the prevention and inquiry of railway accidents and events – no. 003/2000, after which the representatives of CNCF „CFR” SA – public railway infrastructure manager, SNTFC „CFR Călători” SA, and of Romanian Railway Authority – AFER and of Railway Transport Police were presented.

B.3. The consequences of the accident

B.3.1. Lost of human life and injured people

Following this accident there weren't any injured or victims.

B.3.2. Material damages

- rolling stock - no damages;
- tracks - according to the estimation no :840/41/2010 of CNCF „CFR” SA – Branch of Railway County CFR Cluj – Track division – 340,53 lei ;
- equipments - according to the estimation no :1162/41/2010 of CNCF „CFR” SA – Branch of Railway County CFR Cluj – Track division – 95,84 lei;
- environment - no damages;
- means of intervention costs - no damages
- Total 436,37 lei

B.3.3. The accident consequences on the railway traffic

Closed tracks: On 07.04.2010 the railway traffic on direct line II and on the deflecting sections no.1 and no.3 of the railway station Mogoșeni was stopped between 17:33 o'clock and 18:14 o'clock.

Delayed trains: 22 passenger trains with a total of 264 minutes

B.4. External circumstances

On 07.04.2010, at the hour when the railway accident occurred, the visibility was good, clear sky, no wind and the air temperature was about 12⁰ C.

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

B.5. The investigation development

B.5.1. The summary of the testimonies of the railway personnel

The summary of the personnel testimonies employed by the railway transport operator and of the public railway infrastructure manager

The engine driver of the passenger train no. 4485, on 07.04.2010, stated the followings:

- the train had run in normal conditions on the route Dej - Ilva Mică - Mogoșeni;
- at the entry into the railway station Mogoșeni on the deflecting section 1 the train had the speed of 26 km/h;
- at the entry on line no.1 he felt a sudden movement in the train and then he immediately took braking measures;
- after the train and locomotive were stopped and blocked, he let down the pantograph and notified the conductor about the derailment of the two bogies;
- he notified by radiophone the movement inspector about the ones found out;
- at the arrival in the depot, on 08.04.2010 he draw up the event report no. 135 concerning the unscheduled stop of the train between the railway stations Mititei and Nimigea, on the bridge over the Someș river, due to the switch disconnection, event stipulated in the given statement on 07.04.2010 .

The chief conductor of the passenger train no. 4485, on 07.04.2010 stated the followings:

- he was in charge of the train on the route Ilva Mică-Dej Călători;
- when the train derailed, he was in the 1st wagon from the locomotive
- at the entry on the deflecting section he noticed a shock in the train composition;
- after the train stopped he notice the derailment of the 2nd bogie from the 2nd wagon and the 1st bogie from the 3rd wagon, in the running direction;
- he contact the movement inspector on duty, the stationmaster and the traffic controller.

The conductor of the passenger train no. 4485, on 07.04.2010 stated the followings:

- he was onboard the train on the route Ilva Mică-Dej Călători;
- after the derailment, he checked and noticed the passengers on what happened.

The two inspectors with supervision functions, employed by SNTFC „CFR Călători”, that on 07.04.2010 were exercising their service duties on the passenger train no. 4485, stated the followings:

- they heard no noises or suspicious knocking at the wagons in the train composition;
- they didn't guide the passengers to other wagons in the train composition from the wagon no.2;

The movement inspector on duty in the railway station Mogoșeni on 07.04.2010 stated the followings:

- after receiving the departure order from the railway station Nimigea he performed entry route of the train 4485 on the deflecting section 1;
- he left the train-service office to guide the train for stabling;
- he heard a loud noise and he notice that the train 4485 is stopped an the X end on the deflecting section 1;
- he went to the train where he noticed the derailments of the 2nd bogie from the 2nd wagon and the 1st bogie from the 3rd wagon;
- he noticed that the fouling point with direct line 2 was open;
- he went to the train-service office where he noticed the stationmaster and the traffic controller then he accept the passenger train no. 1943-2, at line 3, with calling-on signal because the isolated section 1-5 was busy.

The district inspector from District 5 Năsăud stated the followings:

- on 09.02.2010 he took for maintenance the lines from the railway station Mogoșeni from District 2 Beclean
- at the reception one measured the switch no. 5 the values were in tolerance

- the last inspection at half a month with measurement of the switch no. 5 he performed on 29.03.2010

The district inspector from District 2 Beclean stated the followings:

- on 09.02.2010 he gave for maintenance the lines from the railway station Mogoşeni to District 5 Năsăud
- the last special timber sleepers were replaced between 26-31 May 2008 following the derailment on 25 May 2008
- on the switch no. 5 in 2008, 11 sleepers were replaced between the joint from the heel of the switch to the switch diamond

The ganger on duty from 07.04.2010 stated the followings:

- in the inspection distance the railway station Mogoşeni is included
- the last inspection at line 1 was performed on 06.04.2010
- on 08.04.2010 when replacing the sleeper from the curved stock rail one found the metal plate for fastening broken under the stock rail

Section head assistant-Section L8 Bistriţa

- due to the scheduled inspections and performed at District 2 Beclean he didn't find any special deficiencies at the switch no.5 from the railway station Mogoşeni;
- in 2008 due to the census on the point and crossing sleepers, on the switch no. 5 were reviewed as inappropriate a number of 5 sleepers, and in 2009 were reviewed as inappropriate a number of 2 sleepers

Section head of L8 Bistriţa

- in 2008 and 2009 Section L8 Bistriţa wasn't supplied with special timber sleepers with length of 3,3 m, 4,5 m and 4,8 m;
- the deflecting section 0 from the railway station Mogoşeni was never been used in shunting activity of the railway station Mogoşeni.

SCB electromechanic on duty on 07.04.2010 stated the followings:

- he was notified by the stationmaster about the derailment of the train no. 4485;
- the interior and exterior SCB equipment were according to the standing instructions
- in the area where the derailment occurred the electromechanism no.5 was operated and locked on the „+” position of access to line 1;
- the peg and the impedance bond of the isolated section 1-5 - 1C were broken and the SCB cables were turned out.

The summary of the passenger staff testimonies onboard the train and some persons who assist when the train no.4485 passed on the route Ilva Mică-Mogoşeni

One passenger from the train no. 4485 on 07.04.2010 stated in writing, on 20.04.2010 the followings:

- she was travelling with her mother from Ilva Mică to Cluj in wagon no.2 in the running direction;

- during the journey she heard noises coming from the wagon wheels and asked the conductor what is the cause of the noises, the conductor suggest them to move in the first wagon;
- between Năsăud and Nimigea the train stopped uncheduled on the bridge over the Someș river;
- when entering the railway station Mogoșeni the train derailed and the passenger continued their journey with an accelerat train.

A **person** who assisted on 07.04.2010 from the personal car, when the train no. 4485 passed over the level track crossing before the railway bridge over the Someș river, stated in writting on 20.04.2010 the followings:

- was travelling with the personal car towards Beclean and stopped at level crossing so that the passenger train no .4485 could pass;
- when the train was passing, one observed sparks from the wheels of the last two wagons;
- the train stopped on the bridge over the Someș river.

B.5.2. Safety management system

Carrying out its responsibilities and duties, the public railway infrastructure manager - CNCF „CFR” SA, and the railway transport operator SNTFC „CFR Călători” SA had implemented its own safety management systsem.

In this context, CNCF „CFR” SA, and SNTFC „CFR Călători” SA ensure the risks control for the manager and transport operator activity.

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

When investigating the railway accidents the followings were taken into account:

norms and regulations

- Instructions on the technical inspection and wagon maintenance into operation no.250 approved by Minister of Transports, Construction and Tourism Order no. 1817 from 26.10.2005;
- Instruction for setting the limits and the order in which the track inspection need to be made no. 305 approved by Minister of Transports Order no. 71 from 17.02.1997;
- Norms and tolerance instruction for constructions and maintenance of track with normal space between rails no. 314/1989;
- Instruction for the lineman chief of the district for track maintenance no. 323/1965;
- Instruction for the foreman ganger activity no.322/1972;
- Instruction for lengthman and gangers or danger points no. 321/1972;

sources and references

- documents copies added as annexes to the inspection file draw up by the inquiry commission appointed by the Railway County Cluj Director’s Decision no. 42/A1/1/2010 from 26.04.2010;
- the photos taken by the investigation commission members, immediately after the accidents;
- the photos taken by the inquiry commission members, immediately after the accidents;
- documents on the track maintenance placed at disposal by the reponsible for their maintenance;

- the measurement results performed immediately after the railway accident at the track surface and at the derailed wagons;
- examination and interpretation of the technical state of the elements involved in the accident: infrastructure, railway equipment and train;
- questioning the employees involved in the railway accident;
- the statements of the passengers onboard the train or of the witnesses;
- the reports and measurements performed immediately after the railway accidents by the investigation commission and inquiry commission members;
- documents on the track maintenance placed at disposal by the responsible for their maintenance;
- the examination and interpretation on the technical state of the elements involved in the accident: (switch and wagons);
- the questionnaires of operation and maintenance staff of rolling stock, tracks and involved equipment;

B.5.4. Technical equipment, infrastructure and rolling stock operation

B.5.4.1. Data on the line

The track technical state before the railway accident

The last maintenance work on the switch no. 5 was performed in May 2008 and it consists in replacing 11 special timber sleepers and redrawing the switch curve by restoring the designed values of geometric coordinates.

Findings and measures performed at the line immediately after the derailment and wagon lifting

After re-railing the derailed wagons on 07.04.2010 checkings were performed with the measure gauge and cross level in the switch points, starting from the derailment point in the opposite direction of the train traffic direction.

Table 1

pct.	1 pj	2 vf	3 cd	4 ca	5 o	6 cm
E (mm)	12	24	8	8	23	-
N (mm)	8	9	10	12	9	-

note: **pj** - first joint; **ca** - deflecting heel
 vf - switch peak; **cm** - the middle of the switch curve;

c. d - direct heel of the switch; „o” - derailment spot

There were examined, also, the vertically and horizontally wears in point „o” of curved stock rail and right point switch resulting in a vertical wear of 1mm and horizontal wear of 0.

When checking the switch sleepers one found out that the sleeper no.14 in front of point „o” is rotten inside and on the fastening area of the metal plate of the curved stock and the connecting band, on the deflecting section left side, is damaged and the plate is pierced in the sleeper body.

Ordered assembly of the deflecting section curve according to the assembling plan from the switch project type 49, 190, 1/9, Aa, Stg. Measurements were measured from 2 to 2 meters, the first measuring point was at 2 m from the point switch heel.

point no.	1	2	3	4	5	6
Measured Y (mm)	132	228	341	476	634	805
Projected Y APCAROM (mm)	141	229	338	468	619	791

Data resulted from the inspections performed on the spot by the inquiry commision on 20.04.2010

- in the railway station Mogoseni the railway traffic over the switch no. 5 on the direct and deflecting section was closed from 07.04.2010 at 17:33 o'clock, the railway traffic was performed only on direct line II and on the deflecting section 3;
- within the switch no. 5, 14 special timber sleepers were replaced and other 5 were in process of replacing;



replaced sleepers

photo no.7

- when replacing the sleeper no. 14 within the switch no. 5 corresponding to point „o” one found out that the common metal plate for fastening on the sleeper of the curved stock rail and the connecting band on the left side was broken. The fracture occurred through the wealding seam, which in constructive terms was situated under the curved stock rail base;



broken metal plate

photo no.8



broken welding seam

photo no.9

- when replacing the sleepers no. 14, 15, 17, 18, 19 and 20 one found out that some coach screws had the thread rod bended and others had the thread rod broken in the first third;



broken and bended coach screws

photo no.10

- following the investigation of the new timber sleepers mounted on the switch no.5 one found out that their impregnation was superficial performed, the antiseptic liquid penetration depth is of 1-2 mm on the entire length of the sleeper. STAS 9302/5-90 stipulates that the penetration depth of the impregnation solution for normal sleepers to be of minimum 30 mm at the end and of minimum 10 mm in the middle. Also, some sleepers had cracks on the extremities, reason for which they were tied with wire;



how to impregnate new sleepers mounted at the switch no.5

photo no.11

Data resulted from the analysis of the files from the railway infrastructure manager

1. On 09.02.2010 the lines within the railway station Mogoşeni were transferred from District L2 Beclean evidence to District L5 Năsăud evidence.
2. The District 5 Năsăud evidences were checked, resulting that the last check by measuring the gauge and the transversal level of the switch no. 5, and record the measurements in the points and crossing register, was performed on 29.03.2010.
3. The section L8 Bistriţa evidences were checked concerning the programming inspection works on the hidden parts of the points and crossing, resulting that the switch no. 5 from the railway station Mogoşeni (switch on arrival-dispatching track) was programmed and checked on 12.05.2009 according to the provisions of the Instruction no. 314/1989 of norms and tolerances for constructions and line maintenance – lines with normal gauge stipulating that points and crossing on the arrival-dispatching track to be checked once a year.
4. According to the writings in the points and crossing inspection records from the district, one have performed annually a minimum of 3 measures at the switch no.5 level and gauge and according to the writings within the points and crossing inspection records from the crew, one performed fortnightly measures.
5. From the measurements analysis performed at the last hidden parts checking, when one gave and one took the tracks in the railway station Mogoşeni and at the last fortnightly measurement one found out that the gauge values measured in the points of tongue (1), heel of the switch on deflecting (2) and middle curve (3) are in tolerances, except two values measured at VPA so:

Table 4

Measuring date	The point in which the measurement occurred	Point of switch tongue	deflecting stock rail	Middle curve
12.05.2009 after hidden parts checking	measured value	1449	1451	1448
	tolerance	1442-1449	1438-1446	1438-1446

12.02.2010	measured value	1449	1443	1446
handing of line	tolerance	1442-1449	1438-1447	1438-1446
29.03.2010	measured value	1449	1443	1445
last measurement before the derailment date	tolerance	1442-1449	1438-1447	1438-1446

6. According to the section posts, the foreman ganger post at the Mogoşeni crew at the district 2 Beclean, during 2008-2010 was vacant, the post was occupied on 12.02.2010 by assignment the tracks in the railway station Mogoşeni to District L5 Năsăud, crew 13 Nimigea that has a foreman ganger.
7. According to the points and crossing sleepers counting performed on 2009, 5 sleepers were reviewed as inappropriate, and for 2010, 2 sleepers were reviewed as inappropriate.
8. Sleeper no 14 proper to curved stock rail heel wasn't reviewed as inappropriate for 2010;
9. From the analysis of the measurements performed on the switch no. 5 at the works of VPA on 12.05.2009 writed in the daily sheet part II and points and crossing inspection book of district, one found out that when closing the works the deviations from tolerances level and gauge weren't remedied, the inappropriate sleepers weren't replaced.

Analisis and interpretation of measurements of the line

1. The measurement performed after the derailment (on 07.04.2010 by the inquiry commision) according to table no. 1 in point **vf** (point of switch tongue) is E /N=24/9 (approved value 11/5) and shows an exceeding of the tolerances limits at gauge of 10 mm and at transversal level of 4 mm. The provisions of article 19 points 2 and 6 and the values in table no. 17 from the Instruction no.314/1989 norms and tolerances for constructions and line maintenance - lines with normal gauge, weren't observed.
2. The measurement performed after the derailment (on 07.04.2010 by the inquiry commision) according to table no. 1 in point **ca** (heel of blade on deflecting section) is E /N=8/12 (approved value 11/5 shows an exceeding of the tolerances limits at transversal level of 7 mm. The provisions of article 19 points 2 and 6 and the values in table no. 17 from the Instruction no.314/1989 norms and tolerances for constructions and line maintenance - lines with normal gauge, weren't observed.
3. The measurement performed after the derailment (on 07.04.2010 by the inquiry commision) according to table no. 2 in the points corresponding with the 10 sleepers (from 14 to 23) shows an exceeding of the tolerances limits at transversal level with values between 4 and 12 mm. The provisions of article 19 point. 6 and the values in table no. 17 from the Instruction no.314/1989 norms and tolerances for constructions and line maintenance - lines with normal gauge, weren't observed.
4. At the last hidden parts check (VPA) performed on 12.05.2009, according to the writings in the daily sheet part II and points and crossing inspection book after works completion, 2 gauge measurements performed in the specific points exceeds the tolerances admitted with values between +2 mm and +5 mm. The technological process within the Order 33/34 – 1978 of DLI Bucureşti annex 2 that at the preparatory works provides the correction of the points and crossing position, supplementing and replacing the inappropriate screws.

5. When the derailment occurred on the switch no.5 were inappropriate sleepers on the connecting band area and web of the rail area that didn't ensure the fastening and in total, on the switch were at least 7 inappropriate sleepers reviewed. The provisions of article 15 point. 11 from the Instruction no.314/1989 norms and tolerances for constructions and line maintenance - lines with normal gauge, stipulating „Within the points and crossing, inappropriate, curved or distorted sleepers” weren't observed.
6. On the entire length of the curve to the deflecting section of switch no.5 the metal plate fastenings on the sleepers have the coach screws, in most cases, inclined to right (curve exterior) indicating load supplement by the derailment of the left wheel of the first derailed axle.
7. The sleeper from the joint of the curved stock rail heel, the 14th pf the switch no. 5 was rotten in the metal plate fastening area and it wasn't point out in the last reviewed. The provisions of article 15 point. 11 from the Instruction no.314/1989 norms and tolerances for constructions and line maintenance - lines with normal gauge, stipulating „Within the points and crossing, inappropriate, curved or distorted sleepers” weren't observed.
8. All the measurements were performed after the derailment. The irregularities found out after the measuring point of the point switch heel may be a consequence of derailment;
9. The new sleepers fitted in the track after derailment aren't imbued with antiseptic substances, favoring rapid deterioration by rotting. The provisions of point 4.4.1. - STAS 9302/5-74 Wood- Impregnation with oily antiseptic and OMT 290/2000

Conclusions

- The gauge and transversal level values resulted from the inspection performed with track measure in the characteristic points, in the derailment area, were situated in the permitted tolerances according to article 1 and article 7 on the Norms and tolerances instruction for track construction and maintenance – lines with normal gauge no. 314/1989 excepting the transversal level of the first 5 measuring point where the 5 mm tolerance at the prescribed transversal level was exceeded with values between 3 mm and 7 mm.

On the entire measured distance, tolerances at track torsion stipulated in article 7 from the Instruction of norms and tolerances for constructions and line maintenance - lines with normal gauge no. 314/1989, were not exceeded.

The deviations of the measured values of transversal level in the 5 point couldn't influence the climb of the connecting band on the right side by the right wheel of the first axle, because this occur at a distance of 5 m from the last deflectin section from the transversal profile.

- The interpretation of appropriate measures of track vertical and side usages on the curve exterior stretch of rail according to Technical Regulations on measuring track vertical and side usages – 1987 edition, points to vertical usages of 1-2 mm and side usages of 3 - 5 mm. The measured values were integrated in permitted tolerances by the provisions of tables 24 and 25 from the Instruction of norms and tolerances for constructions and line maintenance - lines with normal gauge no. 314/1989.

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

At the locomotive

The train automatic brake was active, the safety and vigilance devices (DSV), the INDUSI installation from the traction locomotive's endowment were active and were functioning according to the instructions.

Following the interpretation of the IVMS equipment records onboard the locomotive EA 924, that hauled the passenger train no. 4485 resulted that the train had a single uncheduled stop at 17:16:36 o' clock on the bridge over the Someș river at km 13+335 because of a technical flaw at the increase/decrease circuit for the locomotive power (lever control circuit), followed by the disconnection through the feeding voltage cut-out switch from the catenary-type overhead contact line.

At the involved wagons

Wagons technical characteristics

- wagon design series B;
- construction year both derailed wagons - 1969;
- empty wagon weight 41,2 tones;
- wagon length 24,5 m;
- distance between bogie pins 17,2 m;
- buffing gears large capacity cylindrical buffers;
- draft gear discontinuous type;
- bogies Minden – Deutz type;
- bogie pitch 2,5 m;
- pairs of wheels equipped with tired wheels;
- automatic brake KE - GPR;

Inspections and repairs performed on the involved wagons

1. Wagon no. 50532047689-6 (the 2nd from the locomotive – the 1st derailed):
 - periodically repair type RP on 05.03.2008 at SC ATELIERELE GRIVIȚA SA București;
 - intermediate inspection type RTI 1 and RTI 2 at Jibou inspection point;
 - intermediate inspection type RTI 3 valid until 05.09.2010 at Cluj-Napoca technical inspection department.
2. Wagon no. 50532057602-6 (the 3rd from the locomotive – the 2nd derailed):
 - full repair type RK in 1984 at SC ATELIERELE GRIVIȚA SA București;
 - general repair type RG in 1998 at SC ATELIERELE GRIVIȚA SA București;
 - periodically repair type RP on 25.06.2008 at SC ATELIERELE GRIVIȚA SA București;
 - intermediate inspection type RTI 1 at Cluj-Napoca technical inspection department;
 - intermediate inspection type RTI 2 at Jibou inspection point valid until 25.06.2010.

Findings at the involved wagons with the checks performed after the accident

After the railway accident, checkings of the wheel geometry from the derailed bogies were performed at the two wagons involved and the height between the center of the buffers and the upper level of the tracks was measured.

The values resulted from this checkings are:

1. Wagon no. 50532047689-6 (the 2nd from the locomotive – the 1st derailed):

Measured elements	wheel no. 1	wheel no. 2	wheel no. 3	wheel no. 4
lip of tyre width (mm)	28,5	31	28,5	32
lip of tyre height (mm)	30	30	30	30

q _r dimension (mm)	9,5	11	8,5	11,5
Distance between inner surfaces measured in 3 points situated at 120° (mm)	1360,05 / 1360 / 1359,95		1359,75 / 1359,7 / 1359,95	
the height between the center of the buffers and the upper level of the tracks (mm)	1035	1040		

2. Wagon no. 50532057602-6 (the 3rd from the locomotive – the 2nd derailed):

Measured elements	wheel no. 1	wheel no. 2	wheel no. 3	wheel no. 4
lip of tyre width (mm)	31	31,5	29	31,5
lip of tyre height (mm)	30	30	29	29,5
q _r dimension (mm)	10,5	11,5	11,5	11
Distance between inner surfaces measured in 3 points situated at 120° (mm)	1359 / 1359 / 1359		1358,8 / 1358,8 / 1358,77	

B.6. Previous events with similar charater

On may 2008 in the railway station Mogoşeni over the switch no.9 there has been recorded another railway accident made by the derailment of the locomotive EA 826 hauling the passenger train no.4483 owned by SNTFC “CFR Călători” SA, accident after which an investigation report was drawn up and one issued a series of safety recommendations, for which the implementing measures weren't reported.

In the investigation report drawn up at that moment one issued the following safety recommendations, to prevent other accidents in similar conditions:

- Re-viewing the sleepers review to draw up a replace plan for the inappropriate sleepers and establishing the traffic condition imposed.
- Perform of an analysis (audit) on dynamic degradation of sleepers state on points and crossing within 5 years together with the dynamic supply and replacement of sleepers in track for point and crossing in curent lines, direct and arrival-dispatch track.
- Perform of an analysis on the dynamics of reduce traffic speeds, on points and crossing area, by weighting all causes.
- Perform of an analysis on preservation and improvement of technical and practical abilities of the managing, maintenance and repair personnel of points and crossing, by boarding school staff training and specialised institutions.
- The analysis of an audit performed on the romanian railway network condition.

The Romanian Railway Safety Authority performed inspections to check the safety measures taken by the infrastructure manager for the implementation of these recommendations, but there weren't identified concrete measures, except administrative sanctions for staff.

B.7. Analysis and conclusions

B.7.1. Conclusions on the technical state of track superstructure

- the welding seam break under the curved stock rail heel corroborated with the guiding force increase (horizontal) had determined the falling of the left wheel of the first axle, in the running direction, of the wagon no. 505320476896 (the 2nd from the locomotive) between the lateral surface of the curve stock rail and the lateral surface of the connecting rail from the left side of the direct line of switch no.5;
- the measured values of the track gauge and transversal level to the derailment point couldn't influence the climbing of the right wheel of the first axle of wagon no. 505320476896.

B.7.2. Conclusions on the technical state of wagons in the train composition

- the measured values at the wheel geometry from the derailed bogies of the involved wagons, respectively the flange of wheel thickness, flange of wheel height and q_R dimension, and the distance between the inner surfaces of the wheels are in the permitted limits by the Instructions on technical inspection and operating wagons maintenance no. 250 approved by Ministry of Transport, Constructions and Tourism Order no. 1817 from 26.10.2005;
- the height of the center of the buffers against the upper level of the tracks are in the permitted limits by the Instructions on technical inspection and operating wagons maintenance no. 250 approved by Ministry of Transport, Constructions and Tourism Order no. 1817 from 26.10.2005;
- during the traffic, as a result of running passenger cars in current line and over points and crossing, noises may appear stronger, noises from the wagons running part and the from their braking equipment, without these noises to related as defects in these equipments;
- also, at the passenger cars equipped with metal brake block, during braking sparks can occur in the form of a so-called „ring of fire”, sparks that are caused by the application of the brake block on the wheels and their friction with the bearing surface, without this phenomenon might be caused by a malfunction at the brake equipment.

From the analysis of the ones mentioned above one can conclude that the derailment of the two wagons wasn't caused or influenced by their technical state, the measured values at the wheel geometry of the derailed bogies were in the values permitted in the Regulation for Railway Technical Operation no.002/2001.

B.8. The incident causes

B.8.1. Direct cause

The direct cause of the accident was the left wheel of the first axle, in the running direction, of wagon no. 505320476896 (the 2nd from the locomotive) get into the space between the lateral surface of the curve stock rail and the lateral surface of the connecting rail from the left side of the direct line of switch no.5 due to the yielding of the metal plate welding seam, its penetration and lateral movement into the sleeper body, together with the deformation of the coach screws for fixing the metal plate on the sleeper, followed by this wheel falling inside the rail.

Contributed factors

Metal plate breakage due to the welding seam yielding due to the guidance force on the first axle, at running in curve, together with vertical fastening of the metal plate on the timber sleeper.

The increase of the guidance force (horizontal) occur due to the train braking to enter the deflecting section of switch no 5;

The yielding of the vertical fastening in the sleeper body occur due to:

- the welding seam yielding from the sleeper construction, the welding seam was situated under the curved stock rail
- decreasing the lateral resistance exerted by the shims of the metal plate on the timber sleeper, as a result of the cutting of the plate.

B.8.2. Underlying causes

8.2.1. The execution of a wrong welding at the metal plate construction for fixing on the timber sleeper the curved stock rail and right point switch in the joint area of the curved stock rail.

8.2.2. Exceeding the instructional period for replacing the non-adequate special sleepers from points and crossing.

8.2.3. The non-adequate impregnation of timber sleepers with the non-observance of reception conditions of the railway critical product of impregnation.

C. Safety recommendations

The recipient of the safety recommendations is CNCF „CFR ”SA, as public railway infrastructure administrator, the Romanian Railway Notified Body as body that authorizes, homologates and grant agreements to the supplier manufacturers and railway critical products/services and the Romanian Railway Safety Authority as authority that periodically checks through state inspections/controls the railway supplier quality of the white sleepers manufacturers and of the railway critical service supplier of impregnation of sleepers.

The recommendations are guided to resolve the followings:

1. Checking the VPA works and the constructive welding integrity of the special metal plates for fixing the point switch and stock rail;
2. For the cases in which the instruction time for replacing the inadequate reviewed sleepers in points and crossing is not respected, the management of the Regional Branch CF Cluj with one accord with Lines Department within CNCF „CFR” SA will establish the running conditions for each case.
3. The Romanian Railway Safety Authority shall check by state inspection actions the way that the railway critical service suppliers „wood products treatment with chemicals (sleepers and sleeper plugs)” meet the technological processes of preparation for preservation (impregnation), preservation and of checking for the preserved sleepers quality.
After the action end, the Romanian Railway Safety Authority will transmit to the Romanian Railway Notified Body the report on the non-conformities found and the measures disposed to be taken to remove those.
4. CNCF ”CFR” SA will organise trainings for the personnel with competences on ways of assessing the sleepers defects and the way of conducting the census of inadequate sleepers.
5. CNCF „CFR” SA will assess the reception mode of the preserved timber sleepers and the management of the documentation on the quality certification of the supplied materials, documents that must accompany the product until the direct user, the maintenance lines district.
6. The Romanian Railway Notified Body shall check by state inspection actions by the railway critical service providers of protection with chemicals of the timber sleepers of norms and technical and technological prescriptions mandatory for this railway critical service.

The present investigating report will be transmitted to the Romanian Railway Safety Authority, CNCF “CFR” SA, National Railway Passenger Company “CFR Calatori” – SA and to the Romanian Railway Notified Body.

According to the provisions of the Law no.55/2006 on railway safety and of the Investigating Regulation of accidents and incidents, development and improvement of railway safety on the railways and on the metro transport network in Romania approved by GD no. 117/2010, the Romanian Railway Safety Authority will survey the way of implementation of these recommendations.

Membrii comisiei de investigare:

- | | | |
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