MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY

INVESTIGATING REPORT

on the railway accident
between the railway stations Lehliu - Săruleşti,
km. 66+100, on 17.10.2009

Final edition
23.02.2010

NOTICE

Concerning the railway accident, happened on the 17th of October 2009, at 03:50**,** on Constanta Railway County, Pasarea – Ciulnita running section (double-track line, electrified railway line), between the railway stations Lehliu – Săruleşti, km. 66+100, on open line II, by reaching and hitting the freight train no. 93402 by the freight train no. 93400, Romanian Railway Investigating Body performed an investigation, according to the provisions of the Law 55/2006 on railway safety.
Through the performed investigation, the information concerning the occurrence of this accident were gathered and analyzed, the conditions were established and the causes determined.
The investigation of Romanian Railway Investigating Body does not aim to establish the guilty or the responsibility in this case.
Romanian Railway Investigating Body considers as necessary to take some corrective measures, in order to improve the railway safety and to prevent the accidents, and accordingly it made some recommendations this report.

Bucharest, the 23rd of February 2010

I ascertain the compliance with the legal provisions concerning the conduct of the investigation and the drawing up of this investigating report that **I consider positive**

Director,
Dragoş FLOROIU

This notice is part of the report for the investigation of the railway accident happened on the 17th of October 2009, at 03:50, on Constanța Railway County, Pasărea – Ciulnița running section (double-track line, electrified railway line), between the railway stations Lehliu – Săruleşti, km. 66+100, on open line II, the freight train no. 93402 has been caught up and hit by the freight train no. 93400.

I. PREAMBLE

I.1. Introduction

Concerning the railway accident, happened on the **17th of October 2009**, at **03:50,** on Constanța Railway County, Pasărea – Ciulnița running section (double-track line, electrified railway line), between the railway stations Lehliu – Săruleşti, km. 66+100, on open line II, by reaching and hitting the freight train no. 93402 by the freight train no. 93400, Romanian Railway Investigating Body, hereinafter referred as OIFR, performed an investigation in order to prevent some accidents with similar causes, establishing the conditions, determining the causes and issuing safety recommendations.

The investigation of Romanian Railway Investigating Body does not aim to establish the guilty or the responsibility, its objective being the improvement of the railway safety and the prevention of the railway accidents and incidents.

I.2. Investigation process

On the 17th of October 2009, OIFR was notified by Romanian Railway Safety Authority about the railway accident occurrence on Constanța Railway County. At the railway accident place, specialists within OIFR were displaced and found out that between the railway stations Lehliu – Săruleşti, km. 66+100, in the freight train no.93400 movement, on open line II, happened the collision with the freight train no.93402 by reaching it.

At the railway accident place, specialists within the Romanian Railway Safety Authority were displaced, as well as representatives of the public railway infrastructure manager, including the representatives of SC Intervenții Feroviare SA, of the involved railway operator, respectively SNTFM „CFR Marfă" SA, of Railway Transport Police and Romanian Gendarmerie, as well as Ialomița şi Călăraşi Prefectures Representatives, respectively of local public administration.

Taking into account that the occurred facts represents a collision between two freight trains, were ranked as railway accident, in accordance with article 19(2) of the Law 55/2006 concerning the railway safety, therefore OIFR director decided to perform an investigation. So, through the decision of OIFR director no. 13 from the 19th of October 2009, one established an investigation commission, consisting in:

- OLARU Mihai – investigator in charge,
- ZAMFIRACHE Marian – investigator;
- TOADER Doru Cătălin – investigator;
- DRĂGHICI Marin – investigator.

A. ACCIDENT BRIEF PRESENTATION

A.1 Brief presentation

On the **17th of October 2009**, at **03:50,** on Constanța Railway County, Pasărea – Ciulnița running section (double-track line, electrified railway line), between the railway stations Lehliu – Săruleşti, km. 66+100, on open line II, the freight train no. 93400 reach and hit the freight train no. 93402.

Following the collision, the following occurred:

- at the freight train no. 93402 (first in the traffic direction):
    - the derailment, overturning and serious damage of the wagon no. 31534673034-6 (rear wagon);
    - the damage of the wagons no. 31534673040-3 and no. 31534770020-7 (the 2nd and the 3rd wagon from the rear of the train);
    - coupling breaking between wagons no. 31534673063-5 (the 9th wagon from rear of the train) and wagon no. 31534673019-7 (the 8th wagon from the rear of the train);
- at the freight train no. 93400 (2nd in the traffic direction):
    - hauling locomotive EA 040-187-1 derailment and damage;
    - slight damage of the wagon no. 31535483285-1 (buffer wagon).

The freight train no. 93400, composed of 27 wagons, 108 axles, 2051 tones, 440 meters, hauled with the locomotive EA 040-187-1 (belonging to Palas engine shed) was running on the Constanța Port – Fieni route, loaded with coal from Constanța Port Mol 5 railway station to Fieni railway station.

The freight train no. 93402, composed of 27 wagons, 108 axles, 1949 tones, 428 meters, hauled with the locomotive EA 060-225-9 (belonging to Bucureşti Triaj engine shed) was running on the Constanța Port – Călineşti route, loaded with metal plate rolls.

In the above train composition, the wagons were not loaded with dangerous goods.

The train no. 93400 arrived at Feteşti railway station at 01:42 o'clock, where the locomotive staff was replaced, after which it was send to Lehliu at 01:53 o'clock.

Starting from Feteşti railway station the freight train no. 93400 was running without stopping on the basis of the color-light signals till the signal BL 212 wich was turned off on open line II, between the railway stations Lehliu – Săruleşti, exceeding it without observing the specific regulations, gradually increasing the speed from approximately 36 km/h to approximately 45 km/h at km. 66+100, where, at 03:50 o'clock, it was reached and hit the freight train no. 93402.

Following this accident it was not recorded any victims or injured people.

A.2. Direct causes, underlying causes and root causes

A.2.1. Direct causes

The direct cause of the accident – the collision occurred because of non-regulating exceeding of the signal Bl 212 turned off that in these conditions was indicating the stop, by the freight train no.93400 followed by the increase of the train's speed to 45 km/hour, fact that led to the reaching from behind and the hitting the freight train no.93402.

The irregular exceeding of the signal Bl 212 turned off by the freight train no. 93400 was based on a human error because:

- the freight train no.93400 had to stop in the front of the signal Bl 212 that was turned off and that in these conditions was showing the stop, without exceeding it, according to the provisions of article 89, paragraph 1 corroborated with article 93, paragraph 1 of the Signaling Regulation no.004/2006, respectively according to the provisions of article 129, paragraph 3 and 4 of the Instructions for the activity of the driving staff in the railway transport no.201/2007;
- in case of stopping in front of the signal Bl 212, situation that was described above, the engine driver had to wait a time necessary to release the brake and in this time the indication doesn't change , he had to convince that the identification mark had white color and was rectangular, after which he was going to drive the train with a speed of maximum 20 km/hour until the next signal according to the provisions of article 89, paragraph 2 of the Signaling Regulation no.004/2006, respectively according to the provisions of article 132, item b of the Instructions for the activity of the driving staff in the railway transport no.201/2007;
- on the conditions mentioned above , the engine driver had to safely drive the train, to permanently survey the line and to adjust the speed depending on the visibility distance so that to immediately stop in case that the line is busy or is noticing the signals of the rear of the train according to the provisions of article 28, paragraph 9 of the Signaling Regulation no.004/2006;
- the button "ordered exceeding" of the speed punctual control installation wasn't properly handled according to the provisions of chapter V of the Order 17DA/610, col.1987 "Instructions on the functioning, operation and maintenance of the vigilance and safety devices and of the speed punctual control installations (INDUSI), respectively according to the provisions of article 9, paragraph 1, item o from the Instructions for the activity of the driving staff in the railway transport no. 201/2007.

A.2.2 Underlying causes

There weren't identified underlying causes of this railway accident

A.2.3 Root causes

There weren't identified root causes of this railway accident

A.3. Severity level

According to the provisions of article 3, item l of the Law no.55/2006 on the railway safety, the event is qualified as railway accident.

A.4. Safety recommendations

There weren't identified safety recommendations.

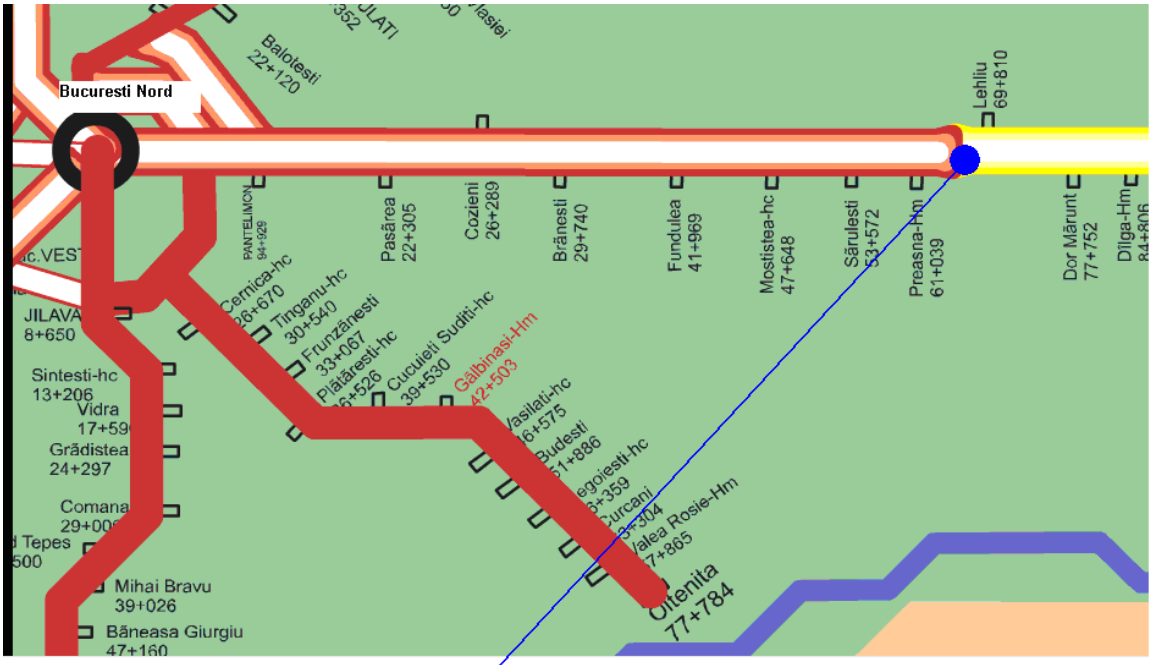
The present Investigating Report will be transmitted to the manager of the public railway infrastructure, licensed railway undertakings and to the Romanian Railway Safety Authority.

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

B. THE INVESTIGATION REPORT

B.1 Accident presentation

On the 17th of October 2009, at about 3:50 hour, in the Railway County Constanta, track section Pasărea – Ciulnița, (double track line, electrified), between the railway stations Lehliu – Săruleşti, at the km 66+100, on the open line II, occurred reaching and hitting of the freight train no. 93402 by the freight train no. 93400.



Picture 1 – Geographical location of the accident.

The freight train no. 93400, consisting in 27 wagons, 108 axles, 2051t, 440 m, hauled by the locomotive EA 040 - 187 – 1 (belonging to the running shed Palas) run between Constanta Seaport – Fieni, charged with coal from the railway station Constanta Seaport Mol 5 for the railway station Fieni.

The freight train no. 93402, consisting in 27 wagons, 108 axles, 1949 t, 428 m, hauled by the locomotive EA 060 – 225 – 9 (belonging to the running shed Bucuresti Marshaling Yard) run between Constanta Seaport – Călineşti, charged with sheet rolls.

In the composition of the above trains there were no wagons charged with dangerous goods.

The train no. 93400 arrived in the railway station Feteşti at 1:42 hour, where was made the driver change, after that it was dispatched to Lehliu, at 1:53 hour.

From the railway station Feteşti, the freight train no. 93400 run without stop, according to the color – light signals up to the closed section block BL 212, from the open line II, between the railway stations Lehliu – Săruleşti, passing beyond it without observing the provisions of the

specific regulations, increasing progressively the speed from about 36 km/h in front of the signal up to about 45 km/h at the km 66+100, where, at 3:50 hour reached and hit the freight train no. 93402.

At the accident place, **the situation of the rolling stock from those two freight trains composition** was, as follows:

- the locomotive EA 040-187-1 (being hauled by the train no. 93400) with all axle derailed , with the driver cab II climbed on the under-frame of the wagon no. 31534673040-3 (the last but one from the composition of the train no. 93402) with active pantograph completely broken, the bogies, the buffing and coupling gears, brake rigging as well as the suspension affected;

- the wagon no. 31534673034-6, the last in the composition of the train no. 93402, derailed and overturned on the right side in the traffic direction, and its axles and bogies caught under the locomotive EA 040-0187-1;

- the wagon no. 31534673040-3, the last but one from the composition of the train no. 93402, with the tarpaulin, the tarpaulin fastening system and end walls seriously damaged;

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- the wagon no. 31534770020-7, the third from the end of the train no. 93402 with the buffers and the end wall from the rear of the train damaged;

- the coupling of the wagon no. 31534673063-5, being the 9th from the rear of the train no. 93402, that ensured the coupling between this wagon and the wagon no. 31534673019-7 (the 8th from the rear of the train) was broken, end the general air pipe of the train was interrupted between these two wagons;

- the wagon no. 31535483285-1 the first from the locomotive in the composition of the train no. 93400 had the buffers from the locomotive damaged and the head bar bent.

From this accident did not result any losses and casualties.

Also, following the accident, it happened the disconnection of the contact line power supply, as well as the damage of 23 concrete sleepers belonging to the open line II.
The open line I Săruleşti – Lehliu, was closed for modernization works from the pan-European Corridor IV.

The track section Pasărea – Ciulnița was closed between the hours 3:50 – 18:41, the passenger and freight traffic being transfered on the deviation Mogoşoaia – Urziceni – Slobozia – Ciulnița.

B.2 The background to the occurrence

B.2.1 Parties involved

The track section where happened the railway accident is under the management of CNCF „CFR" SA and maintained by its employees.

The power and electric traction equipment (IFTE) is under the management of CNCF „CFR" SA is maintained by the employees of SC ELECTRIFICARE CFR SA – Constanta Railway County.

The railway communications equipment from the locomotive is owned by SNTFM „CFR Marfa" SA is maintained by its employees.

The locomotive and the wagons from the composition of those two trains involved in the accident are owned by SNTFM „CFR Marfa" SA and are maintained and inspected in the route by its employees and the repairs are performed by the economic agents authorized as rail suppliers.

The investigation commission questioned the employees involved in the accident, respectively drivers, driver's assistant, movement inspector on duty in the railway station Lehliu.

B.2.2 Composition and the equipments of the train

The freight train no. 93400, consisting in 27 wagons, 108 axles, 2051 t, 440 m, hauled by the locomotive EA 040-187-1 (belonging to the running shed Palas) run between Constanta Seaport – Fieni, charged with coal from the railway station Constanta Sea Port Mol 5 for the railway station Fieni.

The freight train no. 93402, consisting in 27 wagons, 108 axles, 1949 t, 428 m, hauled by the locomotive EA 060-225-9 (belonging to the running shed Bucuresti Marshaling Yard) run between Constanta Seaport – Călineşti, charged with sheet rolls.

The safety and automatic warning systems (DSV), the equipment for the punctual control of the speed and autostop (INDUSI) from those 2 locomotives were active and operated in accordance with the instructions and with the handbrake active.

B.2.3 Railway equipments

Open line I Săruleşti- Lehliu closed because of the rehabilitation works.

Open line II Lehliu – Săruleşti opened for traffic.

The railway stations from the track section Pasărea – Ciulnița are endowed with interlocking systems type CR and the traffic between the railway stations is made in accordance with the automatic block. The automatic control of the train speed on the whole track section is made with the equipment type INDUSI that controls the speed in the points.

The communications system is made by:

1. telecommunication equipments for the traffic safety and train running management consisting in:
   - equipments for the traffic control center;
   - equipments for free pass system.
2. duplex radio traffic equipments.

The track section Pasărea – Ciulnița is electrified.

B.2.4 Communication facilities

The communication between the drivers and the movements inspectors was ensured by duplex radio traffic equipments**.**

B.2.5 Starting of the railway emergency plan

As soon as the railway incident happened, it was necessary to start the intervention plan in order to remove the damages and to restart the traffic, the railway accident being notified by the information flow stipulated in the annex 2 from the Instructions for the prevention and inquiry of the railway accidents and events – no. 003/2000.

Following the notification at the accident place presented the representatives of the National Railways Company „CFR" SA – railway infrastructure manager, National Railway Freight Company „CFR Marfa" SA – railway undertaking, Romanian Railway Safety Authority, Romanian Railway Investigating Body and of the Transports Policy from Calarasi.

The restarting of the traffic was made by SC Interventii Feroviare (Railway Intervantions) SA.

B.3 Accident consequences

B.3.1 Fatalities and injuries

The railway accident did not generate deaths or injuries.

B.3.2 Material damages

The values of the material damages, according to the estimates drawn up by holder of the rolling stock, intervention equipments and by the public railway infrastructure administrator, are follows:

- **at the locomotive EA 040-187-1**, according to the estimate of the CFR IRLU SA Branch Palas – Constanta, no. 392/26.10.2009 = **108484.89 lei;**
- **at the wagon no. 31534673034-6**, according to the estimate of CFR IRV SA Constanta no. 2839/2009 = **45233.84 lei**;
- **at the wagon no. 31534673040-3**, according to the estimate of CFR IRV SA Constanta no. 2838/2009 = **26793.50 lei**;
- **at the wagon no. 31534770020-7,** according to the estimate of CFR IRV SA Constanta no. 2840/2009 = **18824.32 lei;**
- **at the wagon no. 31534673063-5**, according to the estimate of Wagon Inspection Fetesti no. VF2/463/2009 = **94.82 lei**;

- **at the wagon no. 31535483285-1,** according to the estimate of Wagon Inspection Fetesti no. VF2/463/2009 = **306.78 lei**;
- **the tariff for the use of the breakdown train of 125 tf**, according to the estimate of the track section L1 Constanta no. 4.1/1/3819/23.10.2009 = **6355.16 lei**;
- **the tariff for the use of the breakdown train of 250 tf**, according to the estimate of the Track Division Bucuresti no. L4/110/12.11.2009 = **15091.33 lei**;
- **at the catenary,** according to the estimate of the Electrification Center Fetesti no. 2/8/2/1827/02.11.209 = **4740.28 lei**;
- **the cost of the additional works performed by RTFC Constanta**, according to the estimate of the Depot Medgidia no. 5/76/20.10.2009 = **9589 lei**;
- **at the environment** – none.

TOTAL = 235513.92 lei

The railway accident generated the displacement and overturning of 5 sheet rolls from the wagons involved in the collision, one of these sheet rolls remaining fixed on the wagon no. 31534673040-3. These were taken back from the accident place and handed to the transport beneficiary.

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

The traffic was closed on the 17th of October 2009, between 3:32 and 18:51 hours on the open line II Lehliu-Săruleşti.

This is the cause that led to the cancellation of the next passenger trains on the 17th of October 2009:

- the trains no. 8011, 1822-1, 1636-1, 13032-1, 8013 between Bucuresti Obor – Ciulnita;
- the trains no. 681, 8033, 8015 between Bucuresti Obor – Lehliu;
- the train no. 8032 between Dor Marunt – Bucuresti Obor;
- the trains no. 14033-2, 8016 between Lehliu – Bucuresti Obor.

Also the passenger trains no. 8032 and 680 from the 18th of October 2009 were canceled.

The following trains were transferred on detouring route:

- the train no. 1822-1 running on the route Bucuresti N – Lehliu – Fetesti – Constanta as train no. 13991 on the route Bucuresti – Ploiesti – Tandarei – Constanta;
- the train no. 1636-1 running on the route Bucuresti N – Lehliu – Fetesti – Constanta as train no. 13993 on the route Bucuresti – Slobozia – Ciulnita – Constanta;
- the train no. 680 running on the route Constanta – Fetesti - Lehliu – Bucuresti N as train no. 13992 on the route Ciulnita – Brosteni – Bucuresti ;
- the train no. 684 running on the route Constanta – Fetesti - Lehliu – Bucuresti N as train no. 13994 on the route Fetesti – Tandarei – Bucuresti;
- the train no. 1635-2 running on the route Constanta – Fetesti - Lehliu – Bucuresti N as train no. 13996 on the route Fetesti – Tandarei – Bucuresti;

The freight trains no. 83530-1, 83533, 81747 and 83534-1 were canceled.

B.4 External circumstances

According to address of the Meteorology Direction, from the 17th of October 2009, at the meteorology point Slobozia, situated at about 45 km from the collision place, between the hours 3 and 5 in the morning, the visibility was good (10 km), the air temperature was about 16^0 C, cloudless sky, wind speed between 1 m/s and 3 m/s, low luminosity during the night.

In the railway accident area the line is straight and gradient zero.

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

B.5 Investigation process

B.5.1 Brief presentation of the involved staff testimonies

From the statement of the **locomotive driver of the freight train no. 93400** from the 17th of October 2009, we can retain the following:

- the movements inspector from the railway station Lehliu notified him that it would be possibble to stop them on the direct line, because he had some problems at the automatic block track sections.
- at the entrance in the railway station Lehliu the position of the entry signal was green, when the movements inspector notified him about exit signal with yellow colour at signal light; up to the passing beyond the exit signal, it changed several times the position from yellow to green;
- he pushed the attention button in front of the exit signal, the light came on and then followed the insulated section;
- in the insulated section one respected the procedures for connecting and disconnecting the circuit breaker, specific to the insulated sections;
- after passing beyond the insulated section, the line being between forests, it entered an area with mist and fog;
- after the exit from the foggy area of the forest, the identification peg Bl 212 (white strip) was shortly observed, and at the signal no light unit operated, neither that for breakdown;
- shortly he observed the next BLA signal on yellow;
- taking into account the mentions of the movements inspector and seeing the another signal with permissive light, he considered that the extinguished signal was on green;
- taking into account that between the railway stations Lehliu – Sarulesti there are many times problems with the track magnets and signals from the beginning of the rehabilitation works, and on the basis of the movements inspector's mentions, he pushed the button for ordered passing, in order to avoid a brake and because the train had 2005 t and not generate its breaking;
- after a few minutes at about 200 m he observed the tail disc;
- he stopped immediately the train, operating the automatic brake, putting the cock KD2 on the sharp braking position;
- because of the wet line and of the train tonnage he observed that the braking was not proper in order to avoid the collision with the front train;
- concerning the acting way after passing beyond the exit signal in the railway station Lehliu, on yellow position, he stated that he had to run with low speed, with the central

light turn on during the night, following continuously the line and the next signal, being prepared to stop at once if the next signal was on stop or if on the line was an obstacle;

- after passing beyond the insulated section he increased the speed from 30 km/h to 36 km/h, that being a foggy area, he observed the yellow permissive position of the next block signal after Bl 212, mistaking it with this because the signal Bl 212 was extinguished;
- he knew the acting way if Bl 212 was extinguished, that he had to stop before the signal without passing it, waiting for the braking time of the train, in this time making sure about the identification peg and if the line is not seen occupied or if he is not notified about the occupied line, he would continue tor un with a maximum speed 20 km/h up to the next signal;
- passing the extinguished signal Bl 212, the driver assistant communicated that it is extinguished and he had to stop;
- after passing the signal Bl 212 he increased the train speed because the next signal was on permissive position and he considered that the block section is free;
- before to begin the work he had no additional stress.

From the statement of the **driver's assistant of the freight train no. 93400** from the 17th of October 2009, we can retain the following:

- he was notified by the movements inspector, through the radio station, that there are some problems with the equipments and it would be possible to stop him on the direct line, after that he was notified about the running on yellow position at the exit;
- up to the exit signal passing, he observed some fluctuations by the color change in green after appearing again yellow, remaining on this position up to its passing by the locomotive;
- he informed the driver that the exit signal is on yellow position and the position of next signal is stop;
- the driver pushed the button attention, the yellow light came on and they run to the insulated section;
- the weather was bad, with thick fog in the forest after the insulated section and mist that made difficult the visibility;
- after the insulated section he performed a partial inspection at the room of the engine;
- he observed the identification peg of the signal Bl 212, that was extinguished without any indication;
- he informed the driver that the signal Bl 212 is extinguished and then he heard that the driver had at once pushed the „ordered passing";
- he communicated to the engine driver to stop the train;
- immediately after he saw a yellow light and the engine driver communicated that they have open position for running and taking into consideration that the movements inspector told them about the problems of the section from that area and the fluctuation of the exit signal, he thought that the yellow light was for them and therefore they continued the running;
- due to the reduced visibility he noticed the red disc at approximately 200 meters;
- the engine driver took measures of fast breaking but the impact wasn't avoided;
- knows the way of proceeding in case that the exit signal had the yellow signal.

From the statement of the **movements inspector** on duty to **Lehliu railway station** on October 17, 2009 we can retain the following:

- the freight train no.93400 passed through the railway station at 3:45 with the signal Y2 having the yellow signal ;
- in order to perform the passing route first it was performed the entry route and then the exit route;
- the engine driver of the freight train no.93400 was noticed through the radio station that he must be careful to the inductor of 500Hz from the exit signal Y2 that brakes at all indications and that he's running according to the position of the automatic block signal .

From the statement of the **engine driver** of the **freight train no. 93402** of October 17, 2009 we can retain the following:

- he heard through the radio station that the movements inspector on duty of Lehliu railway station informed the engine driver of the freight train no.93400 that is passing on yellow signal and that he must be careful at the exit to the inductor of 500 Hz that brakes at any indication and is going to run according to the position of the automatic block signal after the freight train no. 93400;
- the entry signal and the exit signal from Lehliu railway station and also the block signal B1 212 had the green signal;
- the train circulated without stopping till the signal B1 210 where he noticed that he has a strange signal ("the yellow color was red");
- he stopped the train in front of the signal B1 212 in order to be convinced of the signal position that was yellow;
- he contacted the engine driver of the freight train no. 94790; he communicated that he was located at the entrance on restriction of 15 km/hour between Preasna railway station and Sarulesti railway station;
- after the brake release he felt a strong kick back, the voltage from the contact line dropped and the pressure from the main pipe decreased to 0.

From the statement of **the Chief of the District CED Lehliu** we can retain the following:

- the automatic block installation Lehliu- Sarulesti was taken over by SC IMSAT SA and put into function in April, 2009 and since then there weren't any interruptions to the signal Bl 212 or its inductors;
- in this period it wasn't scheduled annual inspection to the signal;
- the last inspection performed to red signal light and to spare red signal light from the signal Bl 212 was performed on September 24, 2009;
- according to the registrations from RRISC and from book of the box Pr XF/Bl 212 these were functioning;
- the burned lamps from the red signal light and the spare red signal light cannot be signaled by the engine drivers as interruptions.

B.5.2. Safety management system

In performing these tasks and responsibilities, SNTFM "CFR Marfã" SA established its own safety management system.

When the railway incident took place, CNCF "CFR" SA didn't establish its own safety management system. The safety management system was issued and transmitted to the

Romanian Railway Safety Authority on December 21, 2009 when was granted the safety authorization part A.

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

At the railway accident investigation were taken into account the following:

- the investigating file no. F 31/25/2008 of the railway accident drawn up by the inquiry commission named according to the provisions of the Instructions for preventing and investigating the railway events and accidents no.003/2000;
- images taken immediately after the railway accident occurrence performed by the members of the inquiry commission and by the members of the investigating commission;
- documents on the process of leading and regulating the trains circulation;
- results of the measurements performed immediately after the railway incident occurrence to the automatic line block installation;
- questioning the involved employees;
- the signaling regulation no.004/2006;
- Instructions for the activity of the locomotive's staff the railway transport no.201/2007;
- the order 17DA/610 col.1987 "Instructions on the functioning, maintenance of the safety and vigilance devices and of the punctual control installation of the speed (INDUSI)".

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

B.5.4.1. Data found on the installations

The control panel of the interlocking system type CR 3 from Lehliu railway station:

- the sections XF-1AD available and XF-2AD busy;
- the line block oriented on dispatching BE, LCO busy, BP with intact seals, BILC with intact seals;
- the key and the door of the relays hall with intact seals.

The automatic lines block installation on the distance Lehliu- Sarulesti on the open line I:

- the signal Y2 displayed red signal and the static values of the inductor of 1000/2000 Hz for the red color were of 78/12 divisions and for the yellow color were of 22/80 divisions;
- the signal Bl 212 having the seals intact to fires and inductors was turned off (the lamp from the red unit of light signal had imperfect contact within the unit due to the fact that the two contact plates had different thicknesses and the lamp from the spare red unit of light signal was burnt) and the static values of the inductor of 1000/2000 Hz were of 88/10 divisions and of the inductor of 500 Hz were of 28 divisions; after replacing the lamps the following values were found: UbRr=10,7 V and UbR=10,2 V, the signal displaying red position;
- the signal Pr XF was turned off (the lamp from the red unit of light signal was burnt and the lamp from the spare red unit of light signal was burnt);

- the signal Bl 211 was turned off (the lamp from the red unit of light signal was burnt and the lamp from the spare red unit of light signal was burnt);
- the signal Bl 210 was displaying yellow light signal (the lamp from the green unit of light signal was burnt) and the static values of the inductor of 1000/2000 Hz were 12/78 divisions and of the inductor of 500 Hz were of 78 divisions;
- the lamps from the spare red units of light from the block signals couldn't be replaced due to the lack of lamps.

B.5.4.2. Data on lines

The open line II Lehliu – Sarulesti has the superstructure with rail type 60, concrete sleepers T17, indirect fastening type K.

B.5.4.3. Data found to the functioning of the rolling stock and its technical installations

The locomotive of the freight train no.93400: EA 040-187-1

The state of the pneumatic brake installation:	deteriorated as result of collision.
The state of the manual brake installation:	deteriorated as result of collision.
The state of the air compressor:	good.
The state of the air manometers:	good.
The state of the safety and vigilance installation:	deteriorated as result of collision and sealed.
The state of the speed punctual control installation:	deteriorated as result of collision and sealed.
The state of the IVMS-Softronic:	deteriorated as result of collision and sealed.
The state of the buffing and coupling gears:	deteriorated as result of collision.
The state of the RTF railway station:	good.

The wagons from the composition of the freight train no.93400.

The changeover braking devices, "empty-loaded" and "freight-passengers" were in a corresponding position.

The frontal valves were opened on one row except the last from the rear of the train that was turned off.

The automatic brakes were in action according to the state of the wagons.

From **the minute** of reading the records of the installation IVMS no.487/TF 12/19.10.2009 of the locomotive EA 040-187-1 of the freight train no. **93400** results the following:

At 3:45:44 o'clock the freight train no.93400 passes through CFR Lehliu railway station with a speed of 29 km/hour.

At 3:46:31 o'clock the train passes the exit signal of CFR Lehliu railway station with a speed of 21 km/hour, the engine driver pushing the button" Attention INDUSI" of the INDUSI installation.

From 3:46:31 o'clock to 3:47:01 o'clock it runs with a speed of 21 km/hour on a distance of 177 meters.

From 3:47:01 o'clock to 3:48:32 o'clock the speed increases to 34 km/hour on a distance of 708 meters.

From 3:48:32 o'clock to 3:49:59 o'clock the speed decreases to 30 km/hour on a distance of 767 meters (neutral area Lehliu-Sarulesti).

From 3:49:59 o'clock the speed increases progressively on a distance of 472 meters to 36 km/hour, at 3:50:50 o'clock when the train passes the signal Bl 212 the engine driver pushing the button "Ordered exceeding" of INDUSI installation.

Before the signal Bl 212, at 3:50:26 o'clock it is noticed the influence of the inductor of 500 Hz on the band.

After passing the signal Bl 212, at 3:52:43 o'clock the speed increases to 45 km/hour on a distance of 1298 meters.

From 3:52:43 o'clock (from 45 km/hour), the speed suddenly decreases to zero at 3:52:57.

The INDUSI installation was in function.

There weren't found sliding and braking of INDUSI installation and of the locomotive.

From **the minute** of reading the records of the installation IVMS no.486/TF 12/17.10.2009 of the locomotive EA 060-225-9 of the freight train no. **93402** results the following:

At 3:35:29 o'clock, the freight train no.93402 passes through the station with a speed of 30 km/hour.

The speed decreases on a distance of 767 meters to 26 km/hour at 3:37:08 o'clock.

Starting with this hour the speed increases to 35 km/hour on a distance of 708 meters, then from 3:38:32 o'clock the speed decreases to 33 km/hour on a distance of 531 meters at 3:39:28 o'clock (the neutral area Lehliu-Sarulesti).

From 3:39:28 o'clock the speed increases to 43 km/hour on a distance of 1593 meters until 3:42:00 o'clock. From this hour the speed decreases progressively to zero km/hour on a distance of 738 meters, the train stopping at 3:43:52 o'clock.

The train stops for 7 minutes and 38 seconds until 3:51:30 o'clock when the speed slightly increases from 0 km/hour to 3 km/hour, then decreasing to 0 at 3:51:43 o'clock.

From the exit of Lehliu railway station and until stopping before the signal Bl 210, on the band doesn't appear any influence of the inductor.

There weren't found sliding of the locomotive and braking of INDUSI installation.

The INDUSI installation was functioning.

B.5.5. The man-machine interface

The circulation on the fourth corridor is carried out in special conditions determined by the modernization works of the railway infrastructure which implies the circulation on a single running line and frequent confrontation with situations in which the signaling installation doesn't work under the required parameters. In this context a series of new stimulus appear that modify common situations and require increased vigilance and more involvement in the decisions concerning the rules appliance. In these conditions, the engine drivers usually are receiving running orders that are signaling speed restrictions and defects to the signaling system. Beside these, are done verbal notifications relating to the situations of the route through radiophone installation by the movements inspector.

The engine driver of the train no. 93400 was notified by running order that the inductor of 500 Hz afferent to the exit signal X II Lehliu is damaged and active to all indications; also he received information from the movements inspector that the exit signal from the railway station will be surpassed on yellow color.

The engine driver didn't notice on time the signal BLA 212 to which no light unit was functioning. Being put in the situation to decide if it brakes he pushed the button "Ordered exceeding" to not allow the INDUSI installation to brake the train.

This decision was supported by the fact that he saw the yellow light of the next signal and he interpreted that the defect signal was displaying green color. The wrong decision was influenced by the general context that involves the frequent existence of some interruptions to the interlocking system on the fourth corridor but also by the previous situation that the engine driver has confronted at the exit from Lehliu railway station (the engine driver claimed that the movements inspector informed him that he was having problems with the block sections).

These made him to hesitate and induced him the doubt relating to the general signals functioning, the only information that he considered that he can count on being the light position of the next signal. Beside this, the hesitation of the engine driver to brake when noticing with delay the signal BLA 212 can be explained through the fact that he wanted to avoid the sanctions for emergency braking because during 2009 he received a warning and then he was sanctioned for emergency braking. After he took the wrong decision to surpass the signal Bl 212, the engine driver didn't took in consideration the warning of the engine driver's assistant to stop the train because he strongly believed that the defect signal was displaying green light, as demonstrated by the speed increase.

In this context it is necessary to take into account that the power of a rule is determined by its frequent and successfully application. As the conditions for application of a rule are imperfect or only a part of them are proper for the application as the probability of wrong application/ violation of the rule is bigger. This is how is happened in case of the engine driver that took into account the notifications received concerning the interruptions existent to the installations from the area and misunderstood the lack of the light signal to BLA 212. This situation frequently encountered to operate depending on the field interruptions determined that operating method by exception from the rule, in time to be strengthened and valued as an action rule. The cognitive system of the human operator is sensitive when applying an "internal rule" but in this case a wrong rule that led to a wrong decision.

B.6. Analysis and Conclusions

B.6.1. Analysis on the functioning of the automatic control installation of trains speed in the period 01.01.2009-17.10.2009

Following the railway accident occurred on October 2009 between Lehliu- Sarulesti railway stations, open line II km 66+100, 3:50 o'clock on the running section Bucuresti-Constanta was requested to the Regional County Constanta by document no. 4120/484 of October 28, 2009, the situation of the failures of auto stop installation from the section Sarulesti Constanta.

From the total of 59 cases declared as defective, manifested by emergency braking of trains following the analysis of the evidences were found the following:

- **4 cases** of damages which cause was the breaking of the cables between the inductors and the signal box , as ASTALDI declared, 2 damages being to inductors of 500 Hz located at approximately 250 meters from the signal and 2 cases to the inductors of 1000/2000 Hz. From these only 2 defects weren't remedied, the inductors of 500 Hz remaining "active", cases that require the operating of the button for " ordered exceeding" by the engine driver;
- **2 cases** of damages due to the intrusion of non-authorized persons that were totally remedied in time;
- **8 cases of damages** due to track installation, from which one case remained unsolved being necessary that the engine driver to push the button for ordered exceeding;
- **45 cases of damages**, the railway infrastructure administrator qualifying as damages caused by the locomotive's installation. This qualification was made only on the basis of the employee's report that examined the auto stop installation but not as result of a confrontation as mentioned in the legislation that rules the method of surveying, analysis and treating the emergency brakes.

At the end of the analyzed period on the running section Constanta- Sarulesti a number of 6 inductors were active to which was necessary the pushing of the button of ordered exceeding by the engine driver. Three cases were solved by repairing the damaged cables, the time assigned for this being in the limits (maximum 5 days).

The analysis of the cases of the number of defects can lead to the following:

1. it doesn't justify a wrong working method of the engine driver due to the need of pushing the button for ordered exceeding.
2. it can't be concluded that the damages du to the auto stop installation of the locomotive are exclusively due to this installation due to absence of a confrontation of interruptions data between the public railway infrastructure manager and the railway undertakings that own the locomotives by non-observing the provisions of the Order of the Ministry of Transports, Telecommunications and Constructions no.1634/26.12.1983.

B.6.2. Interpretation of the data found

It can't be supported the affirmation of the engine driver and of the engine driver's assistant of the freight train no.93400 referring to the fact that by the moment of exceeding the exit signal he noticed some fluctuations by color changes to green then appeared yellow as it wasn't found anomalies to the interlocking system of Lehliu railway station. In the same

time the train's speed in the right of the exit signal Y2 was of 21 km/ hour, so in accordance with the indication of the exit signal Y2.

The communication of the movements inspector from Lehliu railway station to the engine driver of the freight train no.93400 concerning some problems to the installation isn't confirmed by the engine driver of the freight train no.93402 that heard the conversation through the radio station.

The reduced visibility from the area of the signal Bl 212 didn't have any influence in perceiving the signal as the engine driver of the freight train no. 93400 pushed the button for ordered exceeding before exceeding the signal Bl 212.

The exceeding of the signal out Bl 212 can't be justified by noticing the yellow indication of the signal Bl 210 that shows the fact that the block section after the signal Bl 212 was free.

The engine driver of the freight train no. 93400 knew the fact that after exceeding the exit signal of Lehliu railway station with indication yellow had to circulate with reduced speed with the central lamp lightened during night , continuously surveying the line and the next signal, being prepared to stop immediately if the next signal was ordering the stop or if on line was an obstacle.

The engine driver of the freight train no. 93400 knew the proceeding in case that Bl 212 was turned off meaning that it had to stop before the signal without exceeding it, waiting the time of the brake of the train, while he's convincing of the identification peg of the signal and if doesn't see the line busy or if he isn't informed that the line is busy he will continue the running with maximum 20 km/hour until the next signal.

The engine driver's assistant of the freight train no. 93400 communicated to the engine driver that the exit signal Y2 had yellow color.

The engine driver's assistant of the freight train no.93400 communicated to the engine driver that the signal Bl 212 is turned off, then he heard that the engine driver pushed the button "ordered exceeding". Then he communicated to the engine driver to stop the train. Following this he didn't take any measure although he found that the specific regulations were violated.

Unjustified parking of the freight train no.93402 for 7 minutes and 38 seconds led to the occupation of the section 2 AD.

B.7. Accident causes

B.7.1. Direct cause

The direct cause of the accident – the collision occurred because of non-regulating exceeding of the signal Bl 212 turned off that in these conditions was indicating the stop, by the freight train no.93400 followed by the increase of the train's speed to 45 km/hour, fact that led to the reaching from behind and the hitting the freight train no.93402.

The irregular exceeding of the signal Bl 212 turned off by the freight train no. 93400 was based on a human error because:

- the freight train no.93400 had to stop in the front of the signal Bl 212 that was turned off and that in these conditions was showing the stop, without exceeding it, according to the provisions of article 89, paragraph 1 corroborated with article 93, paragraph 1 of the Signaling Regulation no.004/2006, respectively according to the provisions of article 129, paragraph 3 and 4 of the Instructions for the activity of the driving staff in the railway transport no.201/2007;
- in case of stopping in front of the signal Bl 212, situation that was described above, the engine driver had to wait a time necessary to release the brake and in this time the indication doesn't change , he had to convince that the identification mark had white color and was rectangular, after which he was going to drive the train with a speed of maximum 20 km/hour until the next signal according to the provisions of article 89, paragraph 2 of the Signaling Regulation no.004/2006, respectively according to the provisions of article 132, item b of the Instructions for the activity of the driving staff in the railway transport no.201/2007;
- on the conditions mentioned above , the engine driver had to safely drive the train, to permanently survey the line and to adjust the speed depending on the visibility distance so that to immediately stop in case that the line is busy or is noticing the signals of the rear of the train according to the provisions of article 28, paragraph 9 of the Signaling Regulation no.004/2006;
- the button "ordered exceeding" of the speed punctual control installation wasn't properly handled according to the provisions of chapter V of the Order 17DA/610, col.1987 "Instructions on the functioning, operation and maintenance of the vigilance and safety devices and of the speed punctual control installations (INDUSI), respectively according to the provisions of article 9, paragraph 1, item o from the Instructions for the activity of the driving staff in the railway transport no. 201/2007.

B.7.2. Underlying causes

It weren't identified underlying causes of this railway accident.

B.7.3. Root causes

It weren't identified underlying causes of this railway accident.

C. SAFETY RECOMMENDATIONS

It weren't identified elements that could lead to the issuing of safety recommendations.

The present investigating report will be transmitted to the public railway infrastructure manager, licensed railway undertakings and to the Romanian Railway Safety Authority.

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

Members of the investigating commission:

- Olaru Mihai – investigator in charge
- Zamfirache Marian – investigator
- Toader Doru Catalin – investigator
- Draghici Marin - investigator