MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY

INVESTIGATING REPORT

of the railway accident occurred on the 29th of July 2010,
in the railway station Palas

Final edition
the 20th of October 2010

NOTICE

With reference to the railway accident occurred on the 29th of July 2010, in the Branch of the Railway County Constanta, railway station Constanta, consisting in the derailment of two loaded wagons, belonging to the freight train no. 93590, Romanian Railway Investigating Body carried out an investigation, according to the provisions of the Regulations for the investigation of the accidents and incidents, for the development and improvement of the safety on Romanian railway and subway network, approved by Government Decision no. 117/2010. Through the investigation, the information on the respective accident was gathered and analyzed, the conditions were established and the causes determined.

Romanian Railway Investigating Body investigation did not aim to establish the guilty or the responsibility in this situation.
Romanian Railway Investigating Body considers necessary that the corrective measures be taken in order to improve the railway safety and to prevent the accidents, so it included in the report a series of safety recommendations

Bucharest, the 20th of Octomber 2010

Approved by,
Dragos Floroiu
director

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

Chief Investigator
Sorin Constantinescu

This approval is part of the Report for the investigation of the accident occurred on the 29th of July 2010, in the running of the freight train no. 93590, belonging to SNTFM "CFR Marfa", in the Branch of the Railway County Constanta, railway station Constanta.

CONTENT

I. PREAMBLE

I.1 Introduction

Concerning the railway accident happened on the 29th of July 2010, at 18,45 hour, in the **Branch of the Railway County Constanta,** track section Constanta – Medgidia (double electrified line), in the running of the freight train no. 93590 (belonging to the railway undertaking SNTFM "CFR Marfa" SA), at its exit from the line no. 7A of the railway station Palas, consisting in the derailment of the wagon no. 31534542088-1 (loaded with containers, the 21st in the running direction) and the derailment of the first bogie of the wagon no. 31534542083-2 (loaded with containers, the 22nd in the running direction) Romanian Railway Investigating Body carried out an investigation, according to the provisions of the Government Decision no. 117/2010, in order to prevent some accidents with similar causes, establishing the conditions and determining the causes.

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

I.2 Investigation process

Taking into account the approval of the General Inspectorate for the Traffic Safety from CNCF "CFR" SA , concerning the railway accident occurred on the 29th of July 2010, at 18,45 hour, in the Branch of the Railway County Constanta, railway station Palas, in the running of the freight train no. 93590 (belonging to the railway undertaking SNTFM "CFR Marfa" SA), consisting in the derailment of the wagon no. 31534542088-1 (loaded with containers, the 21st in the running direction) and the derailment of the first bogie of the wagon no. 31534542083-2 (loaded with containers, the 22nd in the running direction) and considering that the railway event is categorized as accident, according to art 7(1), point b) of the Regulations for the investigation of the accidents and incidents, for the improvement of the safety on Romanian railway and subway network.
According to the art. 19, paragraph (2) of the Law 55/2006 on the railway safety, corroborated with the art. 48(1) of the Regulations for the investigation of the accidents and incidents, for the development and improvement of the safety on Romanian railway and subway network, approved by the Government Decision 117/2010, Romanian Railway Investigating Body director decided to start an investigation.

So, through the Decision of OIFR director, no. 27 from the 30th of July 2010, the investigation commission was appointed, consisting in:

- Stoian Eduard - investigator in charge
- Burlea Sorin - investigator
- Tena Lucian - investigator
- Dobre Florin - investigator
- Anton Radu - head of Safety Traffic Inspectorate, Branch of the Railway County Constanta
- Batranoiu Stefan - head of the Department for the Control of the Protection, Prevention and Emergency Situations, Freight Railway Branch Constanta

A. ACCIDENT RESUME

A.1 Brief presentation

On the 29th of July 2010, the freight train no. 93590, consisting in 32 wagons (loaded with containers) 128 axles, 2463 gross tonnage, 1768 net tonnage, 678 m length, hauling locomotive EA 088 and banking locomotive EA 911, with SNTFM "CFR Marfa" SA staff, was dispatched from the railway station Constanta Port Zone B, at 17,55 hour, and arrived in the railway station Palas at 18,05 hour, being stabled on the line 7A. At 18,42 hour, after uncoupling of the banking locomotive and performing the continuity test, the train 93950 was dispatched to Valul lui Traian. After the train starting to run, enter on the insulated track section no. 061A and running about 570 m, at crossing over the switches (double-slip points) no. 85/77, two wagons derailed as follows:

- the both bogies of the wagon no. 31534542088-1 derailed, the 21st in the train running direction;
- the first bogie of the wagon no. 31534542083-2 derailed, the 22nd in the train running direction;

The freight train no. 93590, consisting in 32 wagons loaded with containers, 28 axles, 2463 gross tonnage, 1768 net tonnage, length 678 m, hauling locomotive EA 088 and banking locomotive EA 911 (all belonging to the railway undertaking SNTFM "CFR Marfa" SA), with SNTFM "CFR Marfa" SA staff, run between Constanta Port Zone B and Targoviste, the wagons being loaded with ceramics plates from SC CMA CGM Romania, for SC Halofin Prod SRL.
Following this accident, the traffic and shunting by the end X of the lines 5-9 from the fan of sidings A were closed.
No damages either at the hauling locomotive of the train or at the railway equipments.

No deaths or injuries.

A.2 Direct cause, contributing factors and root causes

A.2.1 Direct cause

The direct cause of the accident is the derailment of the first axle of the second bogie from the wagon no. 31534542088-1 (the 21st of the freight train no. 93590) on the switch no. 85 from the double slip points no. 77/85, because of lack of fastening of the goods in the container no. CLHU 28395-5, it leading to a load transfer on the bogie wheels, by the loading of the left wheels and the downloading with the same laod of the right wheels in the running direction. The container no. CLHU 28395-5 was loaded with ceramics plates and situated on the end of the wagong, corresponding to the second bogie in the running direction.

Contributing factors were:

- lack of fastening of the goods against the cross diplacement in the container no. CLNU 28395-5, loaded on the end of the wagon, corresponding to the second bogie in the running direction;
- exceeding of the wagon loading limit at the letter C of the frame ABC, corresponding to the wagon running on the lines type C and speed class S.

A.2.3 Underlying cause

The underlying cause of this accident is the lack of goods fastening in the container.

A.4 Safety recommendations

The addressee of the safety recommendations is Romanian Railway Safety Authority, the safety recommendations aiming to solve the next issue:

1.drawing up of some regulations that stipulate the fastening way of the goods loaded in containers, so they be safely placed, longitudinally and crossly ensured against falls, displacements, slipping and overturning.

This investigation report will be sent to Romanian Railway Safety Authority , to the public railway infrastructure manager CNCF „CFR" SA and to the railway undertaking SNTFM „CFR Marfa" SA.

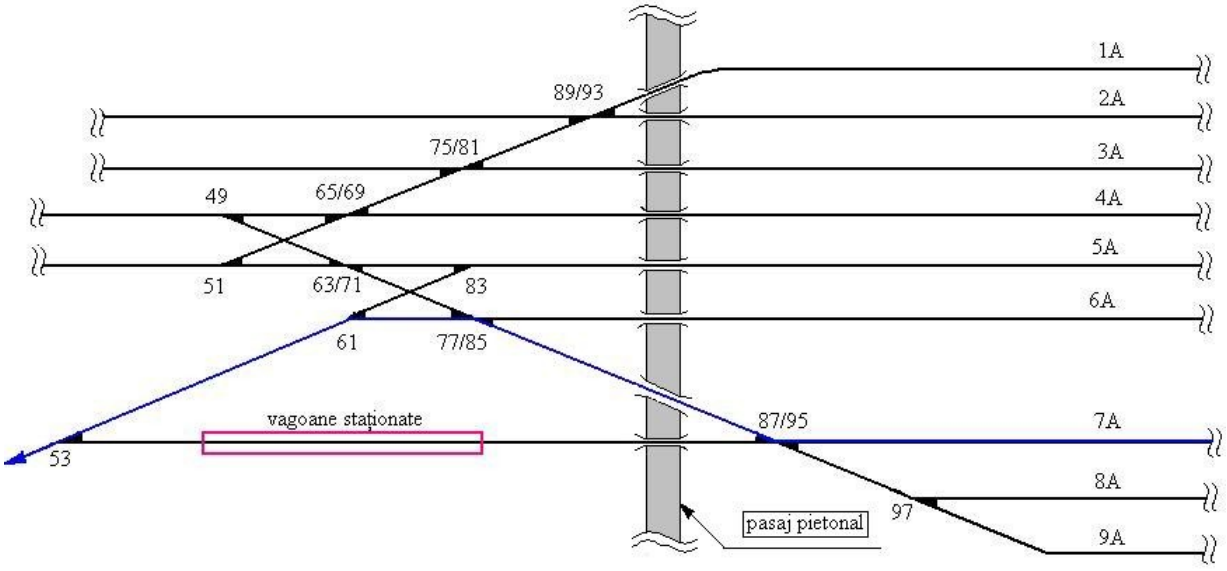
B. INVESTIGATING REPORT

B.1. Accident presentation

On the 29th of July 2010, the freight train no. 93590, consisting in 32 wagons loaded with containers, 28 axles, 2463 gross tonnage, 1768 net tonnage, hauling locomotive EA 088 and banking locomotive EA 911, all belonging and with staff from the railway undertaking SNTFM „CFR Marfa" SA, was dispatched from the railway station Constanta Port Zone B (consignor CMA CGM Romania) at 17,55 to the railway station Targoviste Sud (consignee SC Halofin Prod SRL). The train arrived in the railway station Palas at 18,05 hour, stabling on the line 7A. At 18,42 hour, after uncoupling the banking locomotive and performing the continuity test, the train was dispatched from the railway station Palas to the railway station Valul lui Traian.

After the train starting to run from the line 7A and its access on the insulated track section no. 061A and running of about 570 m, at the passing over a double slip points no. 85/77, both bogies of the wagon no. 31534542088-1, loaded with containers (the 21st in the running direction) and the first bogie of the wagon no. 31534542083-2, loaded with 2 containers (the 22nd in the running direction of the train) derailed.

Within the distance from the railway station Palas and the derailment place, the train run with 14 km/h maximum speed.



THE RAILWAY STATION PALAS ZONE A

The containers from the derailed wagons were loaded with ceramics plates.
The members of the investigation commission found out on the spot:
findings at the wagons

- both bogies of the wagon no. 31534542088-1 (the 21st from the locomotive) derailed and was tilted to left (about 45^0) in the train running direction);
  technical characteristics of the wagon
  - wagon series Sgs;
  - type of automatic brake KE-GP;
  - type of bogies Y25Cs;
  - type of automatic brake-rod adjuster DRV 2AT-600;
  - wheel base of the wagon 14,6 m;
  - length over buffers 19,64 m;
  - the date of the last planned repair (RP) the 7th of July 2010 SPC
  - the deadline for inspection 6 years.

  The wagon was loaded with 2 containers, as follows:
  - container ECMU no. 194613-4 was on the end of the wagon from the locomotive;
  - the container CLHU no. 283951-5 was on the end from the railway station Palas.

  Following the derailment, the back right buffer (type 105-A), in the running direction, was pulled from the screws for its fastening on the wagon head stock and the front air cock turn from open to close position (off), following its impact with the pulled buffer.

  The air front cocks were on open position an there were found no wheel flat and material deposit on the wheels running surfaces.

  Coupling of the wagon in the train, at the front and back wagons, (whose derailment generated) was made according to the instructions.

  The wagon run in derailed condition about 80 m.
- the first bogie of the wagon no. 31534542083-2 (the 22nd from the locomotive) derailed in the running direction and with the derailed wheels at about 50 cm leftmost from the rail head in the train running direction:
  the technical characteristics of the wagon
  - wagon series Sgs;
  - type of automatic brake KE-GP;
  - type of bogies Y25Cs;
  - type of automatic brake-rod adjuster DRV 2AT-600;
  - wheel base of the wagon 14,6 m;
  - length over buffers 19,64 m;
  - the date of the last planned repair (RP) the 7th of July 2010 SPC
  - the deadline for inspection 6 years.

  The wagon was loaded with 2 containers, as follows:
  - container BMOU no. 217092-3 was on the end of the wagon from the locomotive;
  - the container GSTU no. 347968-0 was on the end from the railway station Palas.

The containers were properly placed and fastened in the pins.
The handle of the brake isolating valve was on open position.
There were no wheel flat and material deposit on the wheels running surfaces
The wagon was derailed by the wagon no. 31534542088-1.

findings at the line

The first derailment trace (fall of right wheels between the tracks, in the running direction) was found at the point of switch tongue from the direction I, at the passing over the switches of the double slip points TDJ 85/77, trace situated at 1240 mm, measured from the tip joint of the switch no. 85 to the heel of blade. At this trace, on the left side, in the running direction of the train, on the left lateral surface of the curved stock rail (lateral surface from the outside of the track) there was found a trace of left wheels fall.

Within the double-slip points no. 85/77, both between the tracks and out of it, there were found traces left by the wheel tyres running on the fastening elements of the metallic parts on the sleepers corresponding to the points and switches.

After passing over the common crossing of the switch no. 77, the derailment traces exist up to the train stop, both between and out of the tracks (on the left side in the running direction).

When the train stopped, the wagon no. 31534542083-2 had the second bogie, in the running direction, on the rail and the first derailed bogie, with the right wheels between the tracks. This wagon was derailed on the switch no. 61, with the first bogie derailed at the point machine.

When the train stopped, the wagon no. 31534542088-1 was derailed and titled to the left, in the running direction, on the track panel situated in front of the switch no. 61, the left rail, in the running direction, being between the right wheel of the second axle from the second bogie and the right wheel of the first axle from the same bogie, in the running direction.
At about 1 m before de tip fishplates of the switch no. 61, on the right stock rail, on the lateral surface of the stock rail head, there were found traces of right wheels fall.
On the whole line where happened the derailment and its effect, the track superstructure consists in rail type 49, wooden sleepers with indirect fastening type K.
The fastening elements of the metallic plates on the sleepers and of the rails and metallic parts of the double-slip points no. 85/77 on the metallic plates were active.
The track bed from the route run by the train had some areas with chocked broke stone.

B.2 Accident circumstances

B.2.1 Involved parties

The track section where the railway accident occurred is administrated by CNCF „CFR" SA and maintained by its employees.
The track infrastructure and superstructure are administrated by CNCF "CFR" SA and maintained by the employees of the District 2 Medeea from the Track Section L1 Constanta, Branch of the Railway County Constanta.
The interlocking system from the railway station Palas are administrated by CNCF "CFR" SA and maintained by the employees of the Track Section CT 1 Constanta, Branch of the Railway County Constanta.
The communication equipment from the railway station Palas is administrated by CNCF "CFR" SA and maintained by the employees of SC TELECOMUNICATII CFR SA.
The power and electric traction equipment (IFTE) is administrated by CNCF "CFR" SA and maintained by the employees of SC ELECTRIFICARE CFR SA.
The locomotive communication equipment is owned by the railway undertaking SC UNIFERTRANS SA and maintained by its employees.
The locomotive and wagons of the train no. 93590 are owned by the railway undertaking SNTFM "CFR Marfa" SA and maintained and inspected during the route by its employees, the repairs are made by the economic agents authorized as railway suppliers.

B.2.2 Train forming and equipments

The freight train no. 93590, consisting in 32 wagons loaded with containers, 28 axles, 2463 gross tonnage, 1768 net tonnage, length 678 m, with hauling locomotive EA 088 and banking locomotive EA 911, all belonging to the railway undertaking SNTFM "CFR Marfa" SA.

The automatic brakes of the wagons was in service, excepting 3 wagons with the handbrake off, respectively: the wagon no. 31533560651-5 (the 10^{th} from the locomotive), the wagon no. 31534673030-4 (the 26^{th} from the locomotive) and the wagon no. 31534770013-2 (the 27^{th} from the locomotive), the safety and vigilance equipments (DSV), the equipment for the punctual control of the speed and train protection system (INDUSI) of the hauling locomotive were in service and worked according to the instructions.

B.2.3 Railway equipments

Route presentation

From the dispatching railway station and up to the derailment place, the train run about 14 km, the track alignment consisting in a series of curves and straight tracks, the rays between 205 – 1900 m.
The longitudinal section of the track consists in a series or gradients (slopes in the running direction) and levels, the values of the gradients being between 7,00‰ and 10,46‰.

Superstructure presentation

In the derailment area, the track superstructure consists in lines with switches type 49, wooden sleepers, indirect fastening type K.
The derailment occurred on the double-slip points 85/77, with the next characteristics: type 49, radius R=190 m, tangent = 1:9, jointed point, gauge E_c =1435 mm.

Presentation of the safety equipments for the traffic management

The railway station Palas is endowed with interlocking system type CR 3, with automatic electric block system.

Presentation of the power and energy supply equipment
The contact wire, part of the power and energy supply equipment, consists in the catenary suspension and its supporting system on reinforced concrete poles.

B.2.4 Communication means
The communication between the driver and the movements inspectors, as well as between the driver and the train crew was ensured through radio-telephone equipments.

B.2.5 Start of the railway emergency plan
Soon after the railway accident, the intervention plan for the removal the damages and re-starting the trains traffic was made in accordance with the information flow stipulated in the annex 2 of the Instructions for the prevention and inquiry of the railway accidents and events – no. 003/2000.
Following of these, the representatives of the railway infrastructure administrator CNCF „CFR" SA, of the railway undertaking SNTFM "CFR Marfa" SA, of Romanian Railway Authority – AFER and of the Operative Department of the Railway Police came at the accident place.
In order to re-rail the derailed rolling-stock, there was asked and routed the specialized sequence of operations endowed with crane 125 tf, belonging to the Track Section L1 Constanta.

B.3 Accident consequences

B.3.1 Losses and casualties
None

B.3.2 Material damages
The value of the material damages, according to the estimations drawn up by the owner of the rolling stock, intervention equipments and public railway infrastructure administrator, is:

- **at the locomotive EA 088** **none**;
- **at the wagons** according to the estimations no. 2178/07/09/2010 and 2177/07/09/2010 of SC IRV SA Constanta 6825,24 lei;
- **at the lines** according to the estimation no. 4.1/1/2853/03.2010 of the Track Section L1 Constanta 16090,82 lei
- **at the equipments** according to the estimation no. 5.1/1/2911/05.08.2010 17770,48 lei
- **at the intervention equipments** according to the estimation no. 4.1/2842/03.08.2010 of the Track Section L1 Constanta 13927,56 lei

B.3.3 Accident consequences for the railway traffic
None

B.4 External circumstances
On the 29th of July 2010, between the hours 18,00 and 19,00, the visibility was good, the temperature was about $+26^0$ C.

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

B.5 Investigation course

B.5.1 Summary of the involved staff testimonies

The driver of the hauling locomotive of the freight train no. 93590 stated:

- leaving the railway station Palas, group A line 7A, at 18,39 hour, the position of the signal Y7A, two yellow lights on (the access on the connection line track II Palas-Valul lui Traian);
- at 18,43 hour, he received from the movements inspector on duty, by radio-telephone equipment, the order to stop the train;
- he took soon measures for the train stop;
- after the train stop, the movements inspector on duty notified him, by radio-telephone equipment, that a wagon from the second part of the train derailed;
- when the train stopped, he felt a light shock, and after stop, the air pressure in the train brake pipe decreased suddenly;
- after the train stop, he observed that the wagons 21 and 22 from the locomotive derailed;
- when he received the order to stop, the registered speed by the locomotive speed recorder was about 13-14 km/h.

The driver assistant of the locomotive EA 088, hauling the freight train no. 93590 stated:

- leaving left the railway station Palas, group A line 7A, at 18,39 hour, the position of the signal Y7A, two yellow lights on (the access on the connecting line track II Palas-Valul lui Traian);
- at 18,43 hour, he received, by radio-telephone equipment, the order to stop the train leaving the line 7A;
- he took measures for the train stop;
- the movements inspector on duty notified him by radio-telephone equipment that a wagon derailed;
- during the train stop, he felt a light shock;
- after the train stop, he observed that the wagons 21 and 22 from the locomotive derailed;
- the running speed before the train stop was about 13-14 km/h.

The examiner of the railway undertaking SC GFR SA, on duty on the 29th of July 2010 in the railway station Palas, stated:

- at about 18,45 hour he was in front of the box, when a freight train, belonging to SNTFM "CFR Marfa" SA left the line 7A for Valul lui Traian;
- after the leaving of about 3 quarters of the train length, he observed that both axles of the bogie from the city, of a wagon Rgs, loaded with containers, derailed, the bogie running on the sleepers in front of the box;
- he asked, by radio-telephone equipment, the movements inspector on duty in the railway station Palas to order the stop of the freight train leaving the line 7A and the movements inspector did it;
- during the surveillance of the train that left the line 7A, he heard, before the derailment, when it passed over the level crossing, a noise like vibrations, then he observed the that the wagon Rgs derailed;
- up to the order of the movements inspector on duty in the railway station Palas to stop the train, the second bogie of this wagon derailed to Valul lui Traian.

The disposing station movements inspector on duty in the railway station Palas on the 29th of July 2010 stated:

- he received at 17,55 hour, from the railway station Constanta Oras departure notification for the freight train no. 93590 with banking locomotive EA 911;
- at 18,25 hour the freight train no. 93950 was ready for dispatching in the safety traffic conditions by the traffic controller;
- at 18,42 he gave the order from the line 7A for the freight train;
- at 18,43 hour, the freight train no. 93950 was dispatched from the line no. 7A and he send the departure notification to the railway station Valul lui Traian;
- at 18,45 hour he observed that the switch no. 77/95 did not work under the train and started to ring the alarm bells;
- at 18,45 hour, the freight train no. 93950 was held in the railway station Palas and notified the competent bodies.

The external station movements inspector on duty in the railway station Palas on the 29th of July 2010 stated:

- the freight train no. 93950 stabled at 18,05 hour, the banking locomotive being uncoupled after stabling;
- after the performance of the continuity brake test, the train was ready for the safety dispatching by the movements inspector ;
- at 18,42 hour the train was dispatched from the line 7A, from the signal Y7A up to the signal YPA, notifying also the running conditions;
- the train left at 18,43 hour and at a moment the switch no. 77/85 could not be controlled, the trailing bells started to ring, then the driver received the order, was notified, through radio-telephone equipment, by the movements inspector, to stop the train;
- the train was held in the railway station.

B.5.2 Safety management system

At the moment of the accident, CNCF "CFR" SA, as manager of the railway infrastructure, had implemented its own railway safety management, according to the provisions of the Law no. 55/2006 on the railway safety and of the Minister of Transports Order no. 101/2008 on the granting of the safety authorization to Romanian railway infrastructure administrator/manager, getting**:**

- Safety Authorization – Part A, identification number ASA 09002 – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER agrees the acceptance of the safety management of the railway infrastructure manager;
- Safety Authorization – Part B, identification number ASB 9007 – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER agrees the acceptance of the dispositions taken by railway infrastructure manager in order to comply with the specific requirements necessary to assure the railway infrastructure safety, in the designing, maintenance and operation, including if case, maintenance and operation of the system for the traffic control and signalling.

At the moment of the accident, SNTFM "CFR Marfa"SA, as railway undertaking had implemented its own railway safety management, according to the provisions of the Law no. 55/2006 on the railway safety and of the Minister of Transports Order no. 535/2007 concerning the approval of the norms for the granting of the railway licence and of the safety certificates in order to perform railway transport on Romanian railways, got:

- Safety Certificate – Part A, identification number RO1120090021 – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER confirms the acceptance of the safety management system of the railway undertaking in accordance with the national legislation;
- Safety Certificate – Part B, identification number RO1120090189 – by which Romanian Railway Safety Authority, from Romanian Railway Authority – AFER confirms the acceptance of the dispositions taken by the railway company in order to

comply with the specific requirements necessary for the safety operation on the relevant network, in accordance with the national legislation.

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

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

rules and regulations

- instructios on the technical inspection and maintenance of the wagons in operation no. 250 approved by Minister of Transports, Constructions and Tourism Order no. 1817 from the 26th of October 2005;
- annex II of the Regulations for the mutual use of the wagons in the international traffic RIV;
- instructions on the establishment of the deadlines and order for the track inspections no. 305, approved by Order of Minister of Transports no. 71 from the 17th of February 1997;
- Instruction for the head permanent way inspector of the district for the track maintenance no. 323/1965;
- Instruction for the activity of the track maintenance gange foreman no. 322/1972;
- Instruction for lengthmen and gangers or dangerous points no. 321/1972;
- Instruction of norms and tolerances for the track construction and maintenance – lines with standard gauge no. 314/1989;

sources and references

- copies of the documents enclosed to the investigation file;
- photos taken soon after the railway accident by the members of the investigation commission;
- photos of the load disposition and fastening in containers;
- photos of the wagons involved in the railway accident in the railway station Palas, as well as at the headquarters of SC „CFR – IRV" Constanta – Section IRV Oradea;
- documents on the lines maintenance, supplied by the persons in charge with their maintenance;
- results of the measurements performed soon after the railway accident at the track suprastructure and derailed wagon;
- inspection and interpretation of the technical condition of the elements involved in the accident: infrastructure, railway equipments and train;
- questionning of the employees involved in the railway accident.

B.5.4 Functioning of the technical equipments, infrastructure and rolling stock

B.5.4.1 Data found out at the lines

Technical condition of the line before the railway accident

The lines and the switches from the railway accident area consist in rail type 49, wooden sleepers, indirect fastening type K.

The fastening elements of the rails and metallic parts of the switches on the sleepers were active, ensuring their proper fastening.

On the 28th of July 2010 there were performed some griding works of the points and stock rails at 7 switches, through which also the double-slip points no. 85/77, after this works the profile of all these grinded parts was proper at the checking with ORE tamplate.

Findings and measurements at the line after the wagons derailment and lift

a) *the place of the first trace where happened the leaving of the running surface of the rail corresponding to the curve outsiderail of the double-slip points no. 85/77.*

- the first derailment trace was found on the right side, on the lateral surface, between the rails of the curved points, corresponding to the direction (I-IV), at 1240 mm from the joint of the switch tongue point;
- on the left side of the curved stock rail, corresponding to the direction (I-IV), at the first derailment trace, on its lateral surface from the outside of the track, there was found a trace of a left wheel fall;
- there were found no climbing specific traces on the curved stock rail surface, left by the wheel flange ;
- on the whole surface on which the derailed wagons run up to the train stop, on the left side in the running direction,the specific derailment traces from the sleepers and fastening elements of their metallic parts were hardly visible;
- from the first derailment trace, oposite the train running, there were performed, with the template, checking at the gauge (Ec) and at the track cross section (N), in points with the equidistance of 2,5 m, their values being:

Peg no.	1	2	3	4	5	6	7	8
Gauge (Ec)	12	3	0	-1	8	10	12	9
Cross section (N)	-2	1	8	10	8	10	2	-2

- The measured values are according to the tolerances stipulated by the Instructions of norms and tolerances for track construction and maintenance – lines with standard gauge no. 314/1989.

B.5.4.2 Data found out on the work of the rolling stock and its technical equipments.
Findings at the train wagons;

- The lever„Freight-Passengers" and „Empty-Loaded" were on the right positions correponding to the wagons condition, that is on „Freight" and „Loaded".
- the train had 3 wagons with the automatic brake isolated, that is the wagons no. 31533560651-5 (the 10th from the locomotive), 31534673030-4 (the 26th from the locomotive) and 31534770013-2, (the 27th from the locomotive).
- the coupling of the wagons was proper;
- the working coupler of the draft gear was fastened correponding to the freight trains;
- there was found no piece non-ensured, that can put in danger the traffic safety

Findings at the wagons of the train no. 93590 performed at SC „CFR-IRV" Constanta SA-Section IRV Palas

The findings at those two derailed wagons, performed by the authorized staff of the Section IRV Palas, surveilled by the members of the railway accident investigation commission, both through the visual inspection and the size control (through checking and measurements with the control and measurement equipments) put in evidence the technical condition of the wagons after their derailment, the found failures were not before the accident.

- **At the wagon no. 31534542088-1, first with both bogies derailed** (the 21st after the locomotive)
  the first bogie involved in derailment (the second bogie of the wagon in the running direction of the train), having the wheels no.5-8:

- the bogie frame deformed, with recent impacts, following the derailments;

- deformations at the bogie front bolster, on about 80 mm, following the contact with the central solebar of the wagon;
- slight deformations following the contact between the fixed point for the brake rigging and the central solebar of the wagon;
- triangular axis distorted;
- 6 safety stirrup-pieces distorted
- coupling hook distorted;
- screw of the coupler distorted;
- corner stairs distorted
- collar distorted
- material displacement from the lateral parts of the tyres of the wheels no. 5,6,7,8

the third bogie involved in derailment (the first bogie of the wagon in the running direction of the train) having the wheels no.1-4:

- cross beam distorted with material displacement on 100 mm;
- cross-over for the sleepers bracing distorted and broken;
- front bolster distorted in the area for the buffing gear coupling;
- the bogie frame distorted, with recent impacts following the derailments;
- distortions on both lateral solebars on 1600 mm, at the bogie with the wheels 1,2,3,4, respectively the area for the lifting with the crane;
- there was checked the aspect of the lubrication at the axle boxes with the wheels no. 7, 8 at which there was founf no change of the characteristic colour and properties.

  Following the measurements performed according to the Instructions no. 250/2005, tabel 1, there was found that the axle with the wheels 7 and 8 was distorted, measuring the distance between the inner surfaces there was got the next values: 1353 mm, 1360,30 mm, 1367 mm.

  The frame of the bogie no. 2 was checked, from the sizes point of view, on the testing bench of the bogies Y25 CS, being found distortions over the limits accepted by the instructions for repairs, as follows;
    - deviation from the vertical collinearity of the holes centers of the suspension brackets , on the same side of the bogie frame – quota a: 934 mm, against 928,5 mm and tolerance +2/-1;
    - the difference between the diagonals D1- D2, measured between the middles of the suspension brackets pairs (in the longitudinal axis of the springs) – quota i=D1-D2=2816-2800=16 mm against the accepted value of 4mm;
    - the twist of the bogie frame at the level of the solebars low flange, at the outside limits of the horizontal part of the flanges - quota q=6 mm against the accepted value of 5 mm;
    - the deviation of the center of the center casting against the longitudinal axis of the bogie – S_L =3 mm against the accepted value of 2 mm;
    - the deviation of the center of the center casting against the cross axis of the bogie – S_T = 3 mm against the accepted value of 2mm;

- **At the wagon no. 31534542083-2, the second with a bogie derailed** (the 22nd after the locomotive)

the second bogie involved in derailment (the first bogie of the wagon in the running direction of the train)

- at the bogie with the wheels no. 5-8, the first derailed bogie in the running direction;
- coupling hook distorted;
- coupling gear damaged, corner stairs broken, and a part of the screews missing;
- front bolster distorted at the holes for the fastening of the buffing gear.

Following the checking of the other subsets of the wagon there was found no wear or failure over the accepted limits.

The measurements were performed by the authorized staff of the Section IRV Palas, surveilled by the members of the accident investigation commission.

B.6 Analysis and conclusions

B.6.1 Conclusions on the technical condition of the track superstructure

The technical condition of the lines and switches superstructure could not influence the wagons condition.

B.6.2 Conclusions on the technical condition of the train wagons

Concerning the running gears of the derailed wagons bogies, there were found no failure, that could be before the train dispatching from the railway station Palas and that could lead to taking out of the wagons from the train.

B.6.3 Analysis and conclusions on the train derailment occurrence

After the analysis of the findings from the railway accident place, of the technical condition of the train wagons, of the photos taken from the derailment place, as well as of the statements of the involved employees, one can drawn that the dynamic of the derailment was as follows:

- after running about 570 m from the railway station Palas and entering of the train on the insulated track section no. 061A, the wagon no. 31534542088-1, loaded with containers, the 21st in the train running direction, had the second bogie in the running direction, bogie with the wheels 5,6,7,8, on which the transcontainer CLHU 28395-5 was loaded – over the double-slip points no. 85/77 in the area of the switch tongue point from the direction I, when the axles 5 – 7 and 6-8 were under a strong download from the right wheels in the running direction to the left ones.
  It generated:
  - appearance of some upper guiding forces of the left wheels of this bogie versus the right wheels and implicitly versus the guiding capacity of the rail;
  - fall of the wheels no. 6 and 8 (right wheels of the bogie) between the rails, in the area of the switch tongue point from the direction I, at 1240 mm, measured from the tip joint of the switch no. 85 to the heel of blades;
  - climbing of the rail by the left wheels (wheels no. 5 and 7), on the lateral surface from the left side of the curved stock rail (the lateral surface from the outside track);
  - the derailment of the first bogie of the next wagon no. 31534542083-2, the 22nd in the train running direction, with the right wheels (no. 2 and 4) between the rails, at the point machine of the switch no. 61.
- after running in these conditions about 80 m, the train stopped and the wagon no. 31534542088-1 had both bogies derailed and tilted to the left in the running direction about 45^{0} on the track length in front of the switch no. 61, the left rail being between the right wheels of the second wagon bogie.
- the appearance of the previous download was possible because:
  - comparing the load resulted after weighing the wagon 31534542088-1 in the railway station Palas, with the maximum loading limit written down on the wagon in the frame ABC, at the letter C, results an exceeding with: 59530-59300=230 kg of this loading limit; in the same way for the wagon no. 31534542083-2 resuls an exceeding with 59400-59100=300 kg.
  Corroborating the sizes of the pallets of the container CLHU 28395-5 – respectively 102x119x112 mm-with the inside sizes of the same container-respectively 587x233x235-as well as with the number of the pallets loaded in this container, and with their weight, according to the statement of the good supplier (SC HALOFIN PROD SRL Targoviste) and those resulted from the weighing of the wagons in the railway station Palas and with the enclosed photos, results that the pallets were loaded on those two decks of the container, in accordance with the situation presented in the image no. 1, and the mass exceeding, respectively of the loading limit mass (letter C) are according to the bellow tabel.

Wagon number	Mass (kg)			Letter C (kg)		
	supplier	real	difference	Written down	real	difference
31534542083-2	55744	59400	3656	59100	59400	+300
3154542088-1	56522	59350	2778	59300	59530	+230

According to the annex no. II RIV, point 5.4, in order to ensure the goods against the displacement, longitudinally and crosswise, there are 2 loading ways:
- compact – when the goods are loaded without intermediate spaces;
- rigid – by individual fastening or in lots.
According to the provisions of point 5.4.1 of the annex no. II RIV, for the goods that can move crosswise, in direct contact with the walls or stanchions, this distance has not to be over 10 cm.
From the checking perform on spot, as well as from the analysis of the photos taken after the accident, resulted that the goods were not ensured crosswise either by the insertion of partition walls or by the stiffening of the pallets by horizontal and vertical encirclements with stretching stress resistant. It permitted to those 4 pallets, A, B, C and D from the image 1 to move independently, not being one unit with the center of gravity G on the wagon longitudinal axis.
So, the upper pallets C and D with the gravity centers at 168 cm from the container floor and at 51 cm as against the wagon longitudinal axis – by comparison with the maximum accepted offset of the center of gravity, 10 cm – could move independently one side of the longitudinal axis.
Taking into account that on the left lateral wall of the container there are 5 pallets type C, that because of lack of fastening and inherent running vibrations, generated both by the rai land by the wagon suspension, tend to move crosswise, it has as result that the left lateral wall of the container, in the running direction, was stressed by the horizontal component of the those 5 pallets when the wagon run in curve. This non balanced component generated a torsional moment in relation to the longitudinal axis of the container, leading to the serious tilt of the container to left side, in the running direction, and implicitly the tilt of the wagon on which it was loaded, and finallz to the derailment of the bogie and of the wagon, that then generated the derailment of the first bogie of the next wagon no. 31534542083-2 (the 22nd from the locomotive), in the running direction.

B.7 Accident cause

B.7.1 Direct cause

The direct cause of the accident is the derailment of the first axle of the second bogie from the wagon no. 31534542088-1 (the 21st of the freight train no. 93590) on the switch no. 85 from the double slip points no. 77/85, because of lack of fastening of the goods in the container no. CLHU 28395-5, it leading to a load transfer on the bogie wheels, by the loading of the left wheels and the downloading with the same laod of the right wheels in the running direction. The container no. CLHU 28395-5 was loaded with ceramics plates and situated on the end of the wagong, corresponding to the second bogie in the running direction.

Contributing factors were:

- lack of fastening of the goods against the cross diplacement in the container no. CLNU 28395-5, loaded on the end of the wagon, corresponding to the second bogie in the running direction;
- exceeding of the wagon loading limit at the letter C of the frame ABC, corresponding to the wagon running on the lines type C and speed class S.

B.7.2 Underlying cause

The underlying cause of this accident is the lack of goods fastening in the container.

C. Safety recommendations

The addressee of the safety recommendations is Romanian Railway Safety Authority, the safety recommendations aiming to solve the next issue:

1.drawing up of some regulations that stipulate the fastening way of the goods loaded in containers, so they be safely placed, longitudinally and crossly ensured against falls, displacements, slipping and overturning.

This investigation report will be sent to Romanian Railway Safety Authority , to the public railway infrastructure manager CNCF „CFR" SA and to the railway undertaking SNTFM „CFR Marfa" SA.

Members of the investigation commission:

- Stoian Eduard - investigator in charge
- Burlea Sorin - investigator
- Tena Lucian - investigator
- Dobre Florin - investigator
- Anton Radu - head of Safety Traffic Inspectorate, Branch of the Railway County Constanta
- Batranoiu Stefan - head of the Department for the Control of the Protection, Prevention and Emergency Situations, Freight Railway Branch Constanta