THE MINISTRY OF TRANSPORTS
THE ROMANIAN RAILWAY AUTHORITY – AFER
THE ROMANIAN RAILWAY INVESTIGATING BODY

INVESTIGATION REPORT

of the derailment of the freight train no. 60373 on February 22, 2007 to H.m Cricov railway station, that belongs to the RAILWAY TRANSPORT COMPANY SA

Final report

February 12, 2008

1. Short description

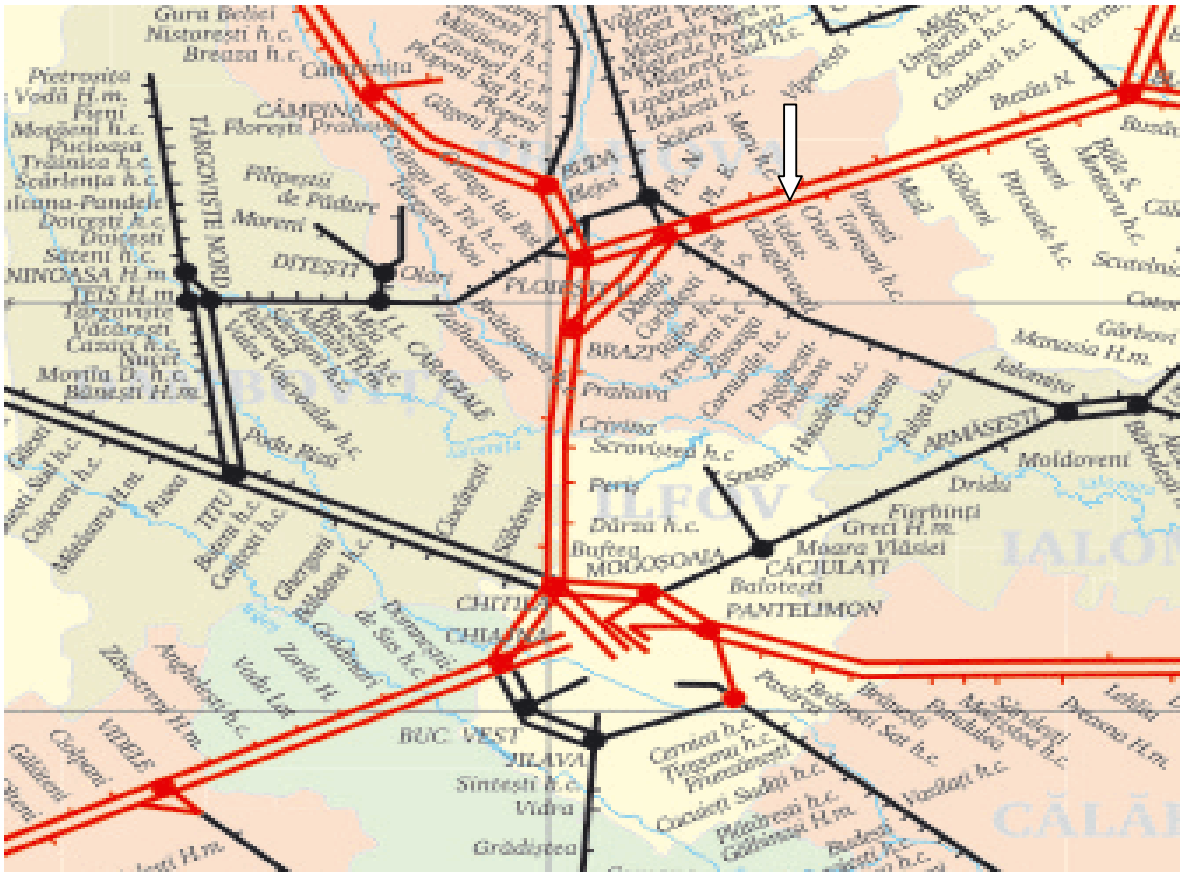
1.1. On February 22, 2007 the freight train no. 60373 that belongs to the RAILWAY TRANSPORT COMPANY OF BUCHAREST SA was sent from CFR Ploiesti Triaj railway station to Catusa railway station at 17.40. After the train stopped for two minutes to the CFR Ploiesti Sud railway station, the train run non-stop until H.m Cricov railway station, at 18.26 when passing to the third straight line, the last two wagons of the train derailed. The axle no. 3 (corresponding to wheels no. 5-6) of the last but one wagon (no. 88536657717-3) was found at 60 metres behind the last wagon, the wheel no.5 having the tyre axial displaced from the rim, into an oblical position.

1.2. According to the provisions of the Law no. 55/2006, article no. 3 the derailment of the freight train no. 60373 represents a railway accident.

1.3. The main reason of the railway accident was identified as being the change of the fitted axle gauge as result of the transversal displacement of the wheel tyre no. 5 of the wagon no 88536657717-3 (the last but one wagon) leading to the derailment of that axle on the point switch no. 9 of H.m Cricov railway station.

1.4. It could not be established an estimation of the time when the tyre started to rotate on the wheel rim as he began to slack.

Figure no.1 - geographical localization of the railway event



5. The legal frame in developing an investigation by the Romanian Railway Investigating Body

5.2. According to the provisions of the Law no. 55/2006, article no.19 was set up the Romanian Railway Investigating Body, an independent and permanent body within the Romanian Railway Authority- AFER, which develops the investigation of the serious railway events, his objective being to improve the railway safety and to prevent the railway events. More, the Romanian Railway Investigating Body can investigate also those railway events and incidents that in different conditions could led to serious railway events, including the technical defects of the structural subsystems or of the interoperability constituents of the railway systems of high speed or European conventional.

5.3. Taking into account that on February 22, 2007 a railway accident occurred, by the means of the Law no. 55/2006 on the railway safety, by derailment of the two wagons of the freight train no. 60373, the Romanian Railway Investigating Body decided to make an investigation of this railway event, the investigating commission being composed of:

- Marian Zamfirache - investigator in charge
- Eugeniu Ciobanu - investigator
- Mircea Nicolescu - investigator

5.4. The investigation objective is not to establish the guilt or the responsibility, the investigation being developed simultaneous with other operations, including those operations developed by the responsible authorities for judicial investigation (if such investigation is necessary).

5.5. The investigation is openly performed so that all parts can be listen and have access to the results. The railway infrastructure manager and the railway undertakings involved, the Romanian Railway Safety Authority, the victims and their relatives, the owners of the damaged goods, the manufacturers, the emergency services and the reprezentatives of the staff are regularly informed with regard to the progress of the investigation, allowing, at their request, the possibility to express their opinions related to the investigation and to make remarks on the reports informations.

6. Description of the railway event

The railway event occurred owing to the following circumstances:

- on February 22, 2007 the freight train no. 60373 composed by 27 empty wagons, having a gross wagon tonnage of 651 tons, automatic brake 673 tons with a surplus of 380 tons from the timetable , hauled by the locomotive DA 058 , that had a hauled vehicle (the first in the train composition) the locomotive DA 01B, was dispatched from CFR Ploiesti Triaj railway station to Catusa railway station at 17:50.
- The train and his operating staff are belonging to THE RAILWAY TRANSPORT COMPANY OF BUCHAREST SA, named CTF;
- The inspection on the train composition was made by two employees (examiners) of the SC SEFER SA BRAZI on the basis of a contract concluded with CTF;
- After 2 minutes of standstill to CFR Ploiesti Sud railway station , the train run non-stop until h.m Cricov railway station; at 18:26 passing to the third straight line, when the movements inspector observed that the wagon no. 88536657717-3 (the last but one

of the train composition) was derailed by a bogie, flashed stop signals and informed the mechanic using the radio signal station in order to stop the train;

- When the mechanic heard the movements inspector through the radio signal station and in the same time observing the reduction of the air pressure in the main brake pipe, he stopped the train using the emergency brake;
- When the train stopped and the driver's assistant made the inspection, he established the following:
    - the wagon no. 88536657717-3 (the last but one wagon of the train composition) has derailed on all axles and was inclined to the second running line and the axle no. 3 (corresponding to wheels no 5-6) was found at 60 metres behind the last wagon , the wheel no.5 had the tyre axial displaced from the rim, into an oblique position, having contact with the rim in two points diametrically opposed;
    - the wagon no. 88536656880-0 (the last wagon of the train composition) has derailed by axles no. 1,3 and 4 and was inclined to the second running line and the axle no.2 remained on the rail;

Figure no.2 – the wheel no.5 of the wagon no. 88536657717-3 having the tyre displaced from the rim

7. Consequences

7.2. **Victims and injured persons** no dates were found regarding dead or injured persons

7.3. **Material damages**

-	*of the wagons*	6.755 lei representing the repair of the two damaged wagons,
-	*of the rail*	279.727,92 lei representing the replacement of the small iron fittings of catching the third line and the replacement of the point switches and of the helping devices of shunting type DAMA,
-	*of the installations*	5846,35 lei representing the point motors, impedance bonds, inductors, equiped pickets , attachment and connecting elements.
	Total	**312.316,69 Lei**

8. Tehnical considerations – the measuring results, inspections, tests

5.1 **The results of the inspections performed on the wagon no. 88536657717-3 in the period February 23- March 12, 2007**:

- the wagon no. 88536657717-3 is a wagon type Fals for transporting coal and other minerals, having bogies type Y25 Cs II and equiped with a brake unit type KE GP and unloading installation by gravity;
- the owner of the wagon no. 88536657717-3 is SC TRANSFEROVIAR SA Cluj Napoca, being bought from SC Matizol SA Ploiesti on July 27,2006 and rented to SC ROM RAIL TRANSPORT SRL Bucharest on November 30, 2006 and then rented by this economic agent to SC CTF SA Bucharest on the same date;
- the wagon changed the registration number from 84536657717-7 to 88536657717-3 on October 26, 2006 when the wagon was registrated by the Romanian Railway Authority- AFER;
- the last periodical inspection of the wagon was carry out on November 11, 2003 by SC UMERVA SA Ploiesti (with this occasion all axles were changed);
- the inspection of the bogie and the intermediate inspection of the brake were made in August 2006 to SC CFR SIRV Brasov SA;
- under the wagon were found traces of new impacts, that indicates that the wagon crossed over the axle no.3 (corresponding to wheels no 5-6) , running out of the bogie frame as result of the impacts received during the distance that the train was running with derailed wagons;
- the axle corresponding to wheels no. 5-6 (the second in the traffic direction) is an axle type OR 1 and on her surface were found the following dates: fabrication no. 3407007, charge no. 33793-IUGP/1976;
- to wheel no. 5 were identified the following dates:
  - on the tyre : V 8 11 75 OM 6948 300090;
  - on the rim: 57747 CSR;
- the axle no. 3407007 was fitted on the wagon no. 88536657717-3 with the occasion of the wagon periodical inspection on November 4, 2003;
- the concerned axle showed traces of new impacts and as regards the wheel no. 5 (on the left side of the traffic direction), the tyre is axial displaced from the rim, into an oblique position, having contact with the rim in two points diametrically opposed;

- on the wheel tyre no.5 it can be seen traces of heat density (colour changed to blue) as result of the temperatures used during the fastening ring grinding of the wheel rim.

Figure no.3 – the mark of the wheel tyre no. 5

The results of the inspections carried out to SC UMERVA SA:

- first, the axle no. 3407007 went into circulation on the wagon no. 82536650477-7 owned by SNTFM " CFR MARFĂ" and previously he was fitted in 2003 on the wagon no. 88536657717-3 ;
- the wagon no. 82536650477-7 was repaired in November 30, 1999 to SC UMERVA SA Ploiesti;
- during this period (1999-2003) were not performed any operations of changing the tyres of the wheel rim no. 3407007;

- from the informations obtained with the occasion of the documentation visit and from the SC UMERVA SA Ploiesti staff, resulted that there is no document within the unit archive as regards the route to follow of the axle no. 3407007 before his fitting on the wagon no. 82536650477-7 in 1999;
- as result of the visual examinations carried out on the axle no. 3511680 (axle no. 4 – corresponding to wheels no.7-8 of the wagon no. 88536657717-3) it was established that the tyres of both wheels were switched from the rim (the control marks used to fit the tyres were changed with 3-5 centimetres one from another);
- also, for the wheel tyres no.7-8 of the wagon 88536657717-3 are available two mechanical control marks – see figure no.4. According to the article no. 29 of the " Instruction no.931" on the repair of the fitted axles of the railway vehicles, this type of stamps are given once with the occasion of fitting the tyre on the wheel rim.
- the wheel tyre no.5 was removed from the axle no. 3407007, a piece of 50 centimetres being cutted from this and being deposited to the bogie section.

Figure no. 4 – the changed marks of the tyre and the wheel rim no.7

Figure no.5 – the wheel tyre no.5 removed from the wheel rim

Specific dimensions of the bogie axles no. 2 (fabrication no. 1416) of the wagon no. 88536657717-3, measured after derailment

	The axle with wheels no. 5-6		The axle with wheels no. 7-8	
	Measured value (mm)	Allowed value (mm)	Measured value (mm)	Allowed value (mm)
The distance between the inside surfaces of the tyres measured at 120 degrees in three points	-	1360 +/-3	1359 1360 1360	1360 +/-3

	The axle with wheels no. 5-6			
	Wheel no. 5		Wheel no. 6	
	Measured Value (mm)	Allowed value (mm)	Measured Value (mm)	Allowed value (mm)
The tyre's width	54	30	54	30
Qr	7,5	>6,5	7	>6,5
The height of the tyre's lip	29	≤36	29	≤36
The width of the tyre's lip	29	>22	29	>22

	The axle with wheels no. 7-8			
	Wheel no. 7		Wheel no. 8	
	Measured Value (mm)	Allowed value (mm)	Measured Value (mm)	Allowed value (mm)
The tyre's width	55	30	55	30
Qr	7	>6,5	7	>6,5
The height of the tyre's lip	28	≤36	28	≤36
The width of the tyre's lip	29	>22	28	>22

5.2. Data collected from the involved railway staff:

- on February 22, 2007 the technical inspection and the full brake test of the train no. 60373 were carried out by two examiners between 16:10-17:05 o'clock, employees of the SC SEFER SA Brazi;
- with the occasion of the technical inspection, the examiners didn't find out nothing special as regards the axles of the last but one wagon of the train, the only inconvenience recorded being the absence of the marks on the outside of the wheel with tyre, being placed at 90 degrees one from another. This fact is confirmed also by the photos concerning the axle;
- contrary to the provisions of the *Instructions on the tehnical inspection and the maintenance of the operating wagons – no. 250*, approved by the Order of the Ministry of Transports, Constructions and Tourism no. 1817/26.10.2005, the railway staff didn't repaired the marks on the spot and didn't informed anyone in order to guide the wagon to a workshop wagon maintenance depot;
- according to what an examiner said, the management of SC SEFER Brazi didn't allowed to the examiners to remove the empty wagons from the circulation, these wagons presenting a defect "the absence of the marks on the outside of the wheel with tyre, being placed at 90 degrees one from another" and didn't supplied Ploieşti working point with all necessary materials in order to repair this marks.

6. Interpreting the results

of the wagon:

- the marks of the wheel no. 5 indicate that:

- the tyre was manufactured on November 8, 1975 by Reşita Integrated Iron and Steel Works (CSR) from "wagon steel" produced in furnance type Martin;
- the tyre is a component of melting charge no. 300090, having a serial number 6948;
- the rim was manufactured in 1975 by Reşita Integrated Iron and Steel Works (CSR) being a component of the melting charge no. 57747;

- the specific dimensions of the bogie axles, measured after derailment, were identified as admissible values, according to article no. 87, chart no.1 of the *Instructions on the technical inspection and the maintenance of the operating wagons - no. 250*, approved by the Order of the Ministry of Transports, Constructions and Tourism no. 1817/ 26.10.2005;
- the existence of double mechanical marks on the wheels tyres no. 7-8 indicates the rotation of those during their operation, a new mark being realized previous to the tyre's fitting on the rim, that is contrary to the repair instructions;
- based on current information, the route to follow by the axle no. 3407007 couldn't be established after he was fitted on the wagon no. 88536657717-3 (the axle wasn't neither new or recent fitting the tyre on the wheel rim) so that it can be determined the date on which the tyre no. 6948/1975 was fitted on this axle.

7. Conclusions

7.1. The direct cause

- the change of the fitted axle track gauge as result of the transversal displacement of the wheel tyre no. 5 of the wagon no. 88536657717-3 (the last but one wagon) led to the derailment of the respective axle on the point switch no. 9 of H.m Cricov railway station.

7.2. Underlying causes

- the loosening of the wheel tyre no. 5 of the wagon no. 88536657717-3 (the last but one wagon) having as result his rotation on the wheel rim and the grinding of the rails;
- when the technical inspections were performed, they didn't comply with the regulations in force, so that the railway staff didn't repaired the marks on the outside of the wheel with tyre, being placed in four points at 90 degrees one from another, respectively they didn't removed the wagon from running, taking into consideration that Ploiesti working point was not equipped as appropriate.

7.3. Contributory factors

- the reduction in time of the clamping forces between the tyre and the wheel rim as result of crushing the irregularities on those two contact areas due to the heat and mechanical impact that appeared during the axle operating (the axle has 31 years ancient);
- the heat impacts exercised on the wheel rim as result of the breakings during the wagon operating.

8. Other issues identified during the investigations

The non-observance of the provisions referring to the mark of the tyre position of the wheel rim, when the repairs were done - a fact established to the axle corresponding to wheels no. 7 - 8, the stamping being performed twice (the axle that was equipping the bogie with that who produced the derailment) - represents a irregularity that might be a possible factor for the tyre detachment from the wheel. The second stamping was made after the tyre was rotated on the rim and when the wagon was repaired he was running with a "turning round tyre" – fact that acts contrary to the *Instructions on the technical inspection and the maintenance of the operating wagons - no. 250/2005*, which on article no. 87 – chart no.1- current no.10 provides that:

- if the tyre is „turning round ":

  I. The empty wagon is detached from the train and is guided to a workshop wagon maintenance depot, the automatic brake being isolated;

  II. A tyre is considered weak, if at least one of the conditions of below is fulfilled:

  a. vague sound when blow-off the hammer;

  b. loosening of the fastening ring;

  c. the existence of the rust between the tyre and the wheel rim on a section bigger than 1/3 of the circumference;

  d. **the control marks of the tyre and of the wheel rim changed by rotation one from another**.

9. The accomplishment of the proposed objectives by the intermediary report

9.1 Performing a technical investigation which:

- will determine the phases to follow by the wheel with weak tyre until the tyre detachment from the wheel rim;
- will determine the time and the distance (connected with the speed and the brake) in which a tyre is moving from the wheel rim;
- will establish potential elements that led to the lost of the tightening and the tyre movement on the rim, in conditions of running with functional automatic brake.

From the discussions had with the rolling stock and metallurgy experts, the conclusion was that due to many factors involved in the process of loosening the tightening and the displacement of the tyre on the wheel rim, his study involves a high complexity and a large duration of this expertise.

Taking into account these aspects, the expertise has become very expensive by comparison with the results and informations that could have been obtained from this.

Because the OIFR funds didn't covered the estimated costs of this expertise and taking into consideration all the above, the OIFR management decided that this expertise don't performe anymore.

9.2. The establishment of the route to follow by the axle no. 3407007, previous his fitting on the wagon no. 88536657717-3 in order to determine the date when the tyre no. 6948/1975 was fitted. The results were included to the present report.

9.3. The questioning of the railway staff that performed the railway inspections to the trains on which the wagon no. 88536657717-3 was attached and also the questioning of the SC SEFER SA Brazi and SC CTF SA Ploiesti training, guidance and control staff, in order to determin:

- the way to apply the instructions, the operating norms and specific proceedings of the tehnical inspections and of the maintenance of the operating wagons;

- the examination method and the internal audit of the technical inspections activities and of the operating wagons maintenance;

The results were included to the present report.

10. Safety recommendations

10.1 On the next period will be scheduled an inspection within the freight railway undertakings, being examined the method of organizing the inspection of the freight trains. If, as result of this inspection the specialized personnel could not trace all cases of the wheel with weak tyre or rotated from the rim and to resolve these cases according to the regulations in force (*Instructions on the technical inspection and the maintenance of the operating wagons - no.250*, approved by the Order of the Ministry of Transports, Constructions and Tourism no. 1817/26.10.2005) will ask this railway undertakings to change the organizing method of the train inspection activity in order to trace all freight wagons that have this defect.

10.2 The analysis of the possibility to restrict the use of the axles equipped with wheel and tyres which are fitted to a number of spells between two periodical repairs of this wagons.

10.3 The legislation in force concerning the repairing and maintenance of the fitted axles equipped with wheels having tyres on it, will be completed by a tracking methodology of the fitted axles when operating and also to the maintenance, repairing centres so that we can find out the date and the centre when the tyre was fitted on the wheel.

10.4 The freight railway undertakings will check if the wagons have a double mark of the tyre position from the wheel rim by stamping, being removed from the circulation in order to replace the respective axles.