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

IVESTIGATION REPORT

concerning the derailment of the freight train no. 50366, belonging to S.C. UNIFERTRANS S.A., at km 586+ 310, between the railway stations Milova and Conop, on the 15th of December 2007

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1. Brief presentation – step 1 of the investigation

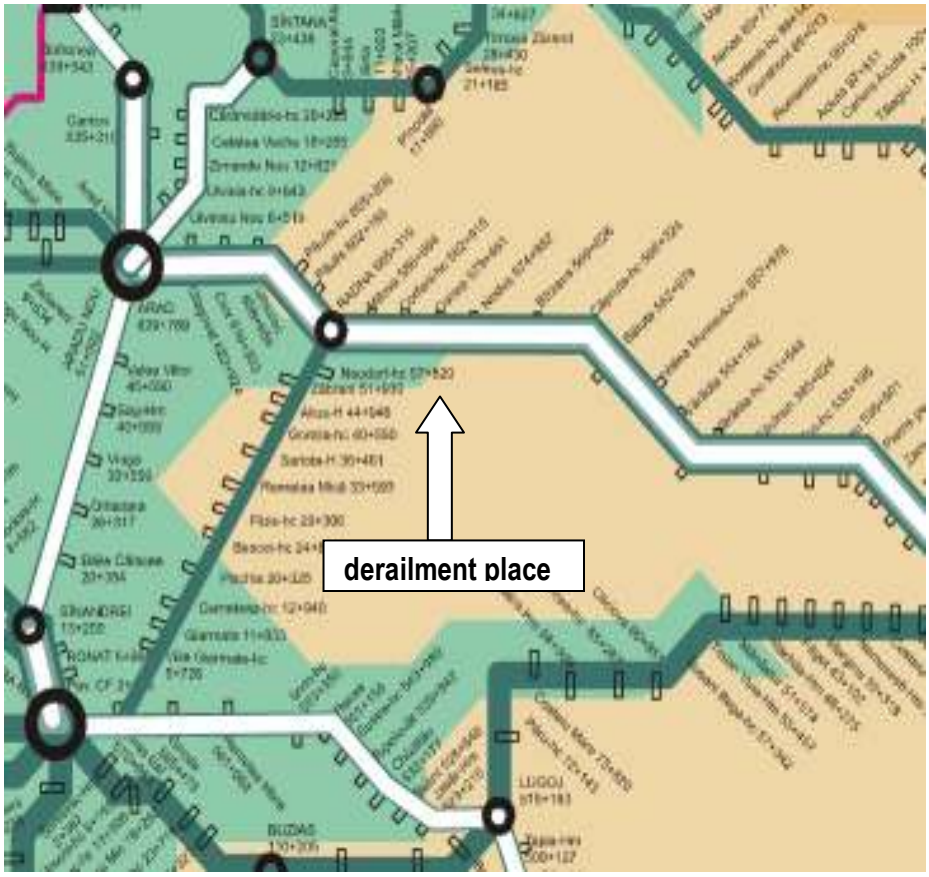
1.1 On the 15th of December 2007, the freight train no. 50366, belonging to the railway undertaking S.C. UNIFERTRANS S.A. was dispatched from the railway station Episcopia Bihorului to the destination railway station Plopsoru at 14,30 o'clock. The train ran without problems to the railway station Utvinisul Nou where it was inspected, in transit, from the technical point of view and the hauling vehicle was changed. At 20,05 o'clock the train was dispatched to the railway station Plopsoru and ran without other problems between Utvinisul Nou – Milova (where it crossed at 21,14 o'clock). Between the railway station Milova and the halt Conop, on the track section 1AD of the railway station Milova, line II, at the km 585+500, the driver of the train 50369 that ran from opposite direction noticed at the train 50366 a derailed wagon and sparks at the running gear. The driver of the train no. 50369 informed, by radio station, the service official from the railway station Milova and the driver of the train 50366, who stopped the train. When the driver's assistant performed the checking, after the train stop on open line, he noticed that at the km 585+210 the axle corresponding to the wheels 1-2 of wagon 8853 6656 718-2 (the 9th from the locomotive) derailed, the tyre of the wheel 2 being cross displaced on the wheel rim and oblique against the running tread plan.

1.2 According to the provisions of the art. 3 of the Law no. 55/2006, the event, respectively the derailment of the freight train no. 50366 is a railway accident.

1.3 The main cause of the railway accident occurance , respectively the change of the wheel set gauge following the tyre lateral displacement of the wheel no. 2 of the wagon no. 88536656718-2, leading to the respective axle derailment at the km 586+ 310.

1.4 One could not establish, on clear basis, if the interval of time after that the tyre began to turn round on the wheel rim from the moment of its loosing can be estimated.

Figure 1 – geographical position of the event



2. Legal framework for the investigation process of the Romanian Railway Investigating Body.

2.1 According to the provisions of the art. 19 of the law no. 55/2006 was set up the Romanian Railway Investigating Body, permanent and independent body of the Romanian Railway Authority – AFER, that caries on the investigation of the serious railway accidents, its objective being to improve the railway safety and to prevent the accidents. The Romanian Railway Investigating Body can investigate, besides the serious accidents, those accidents and incidents, that in little different conditions could lead to serious accidents, including technical failures of the structural subsystems or of the interoperability constituents of the European high speed or conventional railway systems.

2.2 Taking into account that on the 15th of December 2007 occurred a railway accident according to the Law no. 55/2006 concerning the railway safety, consisting in the derailment of a wagon belonging to the freight train no. 50366, the Romanian Railway Investigating Body decided to investigate this railway event, the investigation commission consisting from:

- Eduard Stoian – main investigator
- Marian Zamfirache – investigator
- Eugeniu Ciobanu – investigator
- Mircea Nicolescu – investigator
- Florin Dobre – investigator

2.3 The investigation does not aim to establish the guilt or the responsibility and is carried on simultaneous with other investigating processes, including those carried on by the authorities responsible with the judicial inquiries (if in the case of a such inquiry).

2.4 The investigation is carried on as open as possible, as all the parties be listened to and have access to the results. The infrastructure manager and the involved railway undertakings, Romanian Railway Safety Authority, victims and their relatives, the owner of the deteriorated goods, the producers, the involved emergency services and the staff representatives and the users are regularly informed about the investigation and its course, giving, at their request, the possibility to present their opinions on the investigation and having the possibility, at request, to comment upon the information from the reports projects .

3. Railway accident description

3.1 The railway accident occurred in the following circumstances:

- on the 15th of December 2007, the freight train no. 50366 consisting from 25 empty wagons, of 620 gross tonnage, automatic broken 310 tons, actually 588 tons over the timetable, hauled by the locomotive DA 1255, was dispatched at 15,00 o'clock from the railway station Episcopia Bihor to the destination railway station Plopsoru;
- the train and the train crew belonged to the railway undertaking SC UNIFERTRANS SA;
- the technical inspection at the freight train forming no.50366 was performed in the railway station Episcopia Bihor by an examiner from the SC UNIFERTRANS SA, called herein after examiner (**RTV 1**);
- the wagon 88536656718-2, at witch the tyre detached from the wheel rim (the 9th wagon from the locomotive), reached the railway station Episcopia Bihor on the 14th/15th of December 2007, in the freight train no. 50369, this train inspected from the technical point of view by an examiner from the SC UNIFERTRANS SA, called herein after generically examiner (**RTV 2**);
- the train no. 50366 was dispatched from the railway station Episcopia Bihor with automatic brake "off " at 4 wagons from the train, respectively 8853 6656 620 – 0, 88536656645-7, 88536657856-9 and **88536656718-2** ,wagon that led to the train derailment;

- the train ran without other problems to the railway station Utvinişu Nou, where was performed the technical inspection in transit by an examiner from SC UNIFERTRANS SA, called herein after generically examiner (**RTV 3**) and the hauling locomotive was changed with EA 212;
- from the railway station Utvinişu Nou the train no. 50366 was dispatched to the railway station Plopsoru at 20,05 o'clock. Between Utvinişu Nou – Milova, the train ran without problems. After passing through the railway station Milova, on the track section 1AD, between the railway stations Milova and Conop, at the km 585+500, the driver of the train 50369, that ran from the opposite direction noticed at the train no. 50366 a derailed wagon between the lines I and II of the track and at which there were sparks at the running gear. The driver of the train no. 50369 contacted, by radio station, the driver of the train no. 50366 and the service official from the railway station Milova, informing them about he noticed. Following this notification, the driver of the train 50366 broke the train and stopped it on running line at 21,20 o'clock. At the train inspection performed by the driver's assistant was found out that at the km 585+210 one axle of the wagon no. 88536656718-2 (the ninth wagon from the locomotive) derailed – the last in the running direction – due to the tyre displacement of the wheel no. 2 on the wheel rim.

Figure 2 – Wheel no. 2 of the wagon no. 8853 6656 620-0 with the tyre dispatched from the wheel rim

4. Consequences

4.1 Victims and casualties none

4.2 Material damages

- at the wagons 1800 lei for repairs of the derailed wagon
- at the track 22553,46 lei for the replacement of the small fastening units of the running line II between the railway station Milova and the halt Conop
- at the railway equipments 2677,01 lei for the replacement of the inductor of 500 Hz from the signal XF in the railway station Milova
- the cost of the intervention means 9232,11 lei for the breakdown wagon movement and intervention in the derailment field
- TOTAL 36262,58 lei

5. Technical issues – the results of measurements, controls, performed tests

Wagons

5.1 The results of the controls performed between the 15th of December 2007 and the 2nd of April 2008 at the wagon no. 8853 6656 718-2:

- the wagon no. 8853 6656 718-2 is Fals type, self discharging wagon for coal transportation and other ores, equipped with bogies type Y25 Cs and with braking device KE GP;
- the wagon no. 8853 6656 718-2 is owned by SC UNIFERTRANS SA;
- one performed the last repair type " reconstruction and reconditioning" at the wagon on the 31st of August 2006 by SC TRANSWAGONB Burgas Bulgaria;
- the axle corresponding to the wheels 1-2 (the last in the movement direction) is type OR1, and on its surface were found out the next data: manufacture number 3494398, charge number 33793 – IUGP/1978;
    - on the tyre: N 50 1183 9 77 ZB BV2
    - on the wheel rim: 11478 CSR 28647;

- the axle no. 3494398 was fitted up on the wagon no. 88536656718-2 at the moment of the repair, performed on the 31st of August by SC TRANSWAGON Burgas, the nominal diameter of the running tread of the pair of wheels at repair end being 843 mm given the accepted minimum diameter of 840 mm;

- the tyre of the wheel 2 has an axial displacement on the wheel rim, the paint coat deteriorated following the thermic stresses resulted from grinding of the fastening ring by the wheel rim and following the friction forces resulted from the axial displacement of the tyre;

Dimensions specific to the wagon axles no. 8853 6656 718-2, measured after the derailment:

	Distance between the inside surfaces of the tyre	Height of the wheel lip measured from the running tread	Thickness of the wheel lip measured at the 10 mm over the running tread	Dimension qR	Tyre thickness
Accepted values	1357-1363	< 36	≥22	>6,5	≥30
Wheel 1	Deteriorated wheel	30	31,5	8.9	39
Wheel 2		31	27	7	34
Wheel 3	1360,1	32,5	29	12	41
Wheel 4		30,5	30,5	10	41
Wheel 5	1360	30,5	30,5	10	39
Wheel 6		32	30	9	39
Wheel 7	1360,1	33	31	9	40
Wheel 8		29	31,5	10	40

5.2 The data got from the involved railway staff statements:

- The data resulted from the questionnaire examiner (RTV 1) who performed the technical inspection at the arrival:

- the wagon no. 8853 6656 718-2 reached the railway station Episcopia Bihor on the 15th December 2007 in the freight train 50369, being technical inspected at the arrival between 3,30 and 4,10 o'clock
- the wagon arrived with the automatic brake "off", with 2 brake shoes missing, without notification and without label type R1
- at the moment of the controls performed during the technical inspection at the arrival one did not find out at the wagon signs that indicate that it should have the tyre loosed
- examiner (RTV1) too stated that at this wagon there were no control marks on the tyre and on the wheel rim and he did not try to make these

again because of the lack of the necessary materials, contrary to the Instruction no. 250/2005 concerning the technical inspection an maintenance of the operated wagons. One points out that in the axle photos made after that the marking on the wheel rim in all 4 points and on the tyre in 3 points is visible.

- Data resulted from the questionnaire examiner (RTV2) who performed the technical inspection at the train forming:

- the wagon was dispatched from the railway station Episcopia Bihor on the 15th of December 2007 in the freight train 50366, being submitted to the technical inspection at the train forming between 13,00 and 14,20 o'clock.
- at the moment of the controls performed during the technical inspection at the train forming one did not find out at the wagons signs that show that the tyre was loosed
- at the moment of controls performed during the technical inspection at the train forming, at the wagon no. 8853 6656 718-2 was found out 2 brake shoes missing and the automatic brake "off";
- contrary to the instructions provisions concerning the technical inspection and the maintenance of the operated wagons – no. 250/2005 approved by Ministry of Transports , Constructions and Tourism's Order no. 1817/26.10.2005 the missing parts were not replaced and the wagon was not notified;
- examiner (RTV2) does not know if the automatic brake at the wagon no. 8853 6656 718-2 operated at that time;
- at the moment above mentioned the working point from the railway station Episcopia Bihor did not have braking shoes.

- Data resulted from the questionnaire examiner (RTV3) who performed the technical inspection in transit:

- the transit technical inspection of the train no. 50366, in which forming was also the wagon 8853 6656 718-2 was performed on the 15th/16th of December 2008 between 20,00 and 2,30 o'clock in the railway station Utvinişu Nou;
- at the moment of controls performed during the technical inspection at the arrival one did not find out at the wagon signs that indicate that it should have the tyre loosed
- 2 braking shoes were missing but the wagon was not notified and the 2 missing parts were not replaced
- at the working point from the Utvinişu Nou there was no diagram of the technical inspections that have to be performed at the trains belonging SC UNIFERTRANS

- the technical inspection of the trains is performed by one examiner (RTV)
- the replacement of the missing parts at the wagon no. 8853 6656 718-2 was not done because the insufficient staff.

Tracks

5.3 Data from the records and from the controls carried on at the Tracks Maintenance Section L8 Arad
- alignment geometry between the railway stations Milova – Conop line II consists of 3 single curves placed between straight track zones
- according to the study carried on according to the art. 2 from the Instruction no. 314/1989 regarding the establishing of the track sections, the distance between the railway stations Milova and Conop line II is part of the track section Batuta and Radna;
- in this track section between the railway stations Milova and Conop,line II, there are 3 single curves consisting of constant radius curves that join to the adjacent straight tracks through parabolic curves. The geometry elements of these curves comply with the provisions of the art. 2 and art. 3 from the Instruction no. 314/1989;
This curves are characterized through follows elements:

Curve				R(m)	S(mm)	h(mm)	f(mm)	V (km/h)	V_{lim}(km/h)
AR	RC	CR	RA						
585+650	585+760	586+140	586+250	485	0	120	103	100	85
584+900	584+980	585+060	585+120	2174	0	40	23	100	-
580+390	580+480	580+900	581+010	459	0	110	109	100	85

- in the curves km 580+390-581+010 and km 585+650 – 586+250 the running maximum speed is limited to 85km/h because of the geometric element of these curves
- in the derailment area the maximum grade is 1,03‰
- the track in the derailment area is type 49, welded rail, concrete sleepers type T13
- following the controls of the last 3 tapes with the failures record provided by the testing and recording wagon, respectively at the measurements performed on the 24th of September 2007, 25th of October 2007 and 28th of March 2008, was found out that the derailment area, namely km 586+000 – 587+000, received the qualificative " very good" , the registered scores were:

- at the measurement from the 24th of September 2007 – 45 points

- at the measurement from the 25th of October 2007 – 0 points
- at the measurement from the 28th of March 2007 – 45 points

- following the control of the rail defects record was found out that, at the moment of the derailment in the area of the km 586+000-587+000 there were no rails with failures in the records of the Track Section L8 Arad
- between 2005 -2006 on the running line II Milova – Conop were performed replacement works of all wearied rails of the curves, so at the moment of the derailment on the entire distance there were no rails with lateral and vertical wears over the accepted tolerances from the Instruction no. 314/1989 (the values of these wears were between 1-3 mm)
- during 2007 in the derailment area (km 586+310), respectively km 586+300-586+400, before the derailment occurrence there was no need to perform maintenance works;

6. Analysis of the resulted elements

At the wagon
- the existing marks on the respective wheel (no. 2) show that:
  - the tyre was manufactured in September 1997 by the company ZDB Bohumin (nowadays Bonatrans company) from steel type BV2;
  - the tyre belongs to the charge no. 1183, its order number in this charge is 50;
  - the wheel rim was manufactured in 1978 by Iron Works Resita (CSR) and belongs to the charge no. 28647, lot number 11;

- the characteristic dimensions measured after the derailment at the axles of the axle journals 3-4, 5-6, 7-8 are in the accepted values according to the art. 87, table 1 from the Instruction concerning the operated wagons technical inspection and maintenance – no. 250 approved by Ministry of Transports, Constructions and Tourism's Order no. 1817/26.10.2005;
- according to the present data, the route of the axle no. 3494398 before its assembling on the wagon no. C (the axle was neither new nor again retyred) could not be establish, so that the assembling data of the tyre no. 50 from the charge 1183 on this axle be established.

At the tracks
-from the data analysis results that the alignment of the line, through its geometric characteristics, could not produce big stress.

7. Conclusions

7.1 Direct cause:

- the change of the pair of wheels gauge, following the cross displacement of the tyre of the wheel no. 2 belonging to the wagon no. 8853 6656 718-2,led to the respective axle derailment between the railway stations Milova and Conop, at the km 586+310.

7.2 Subsidiary causes

- the loosening of the tire of the wheel no. 2 at the wagon no. 8853 6656 718-2 (the 9th wagon after the locomotive) led to its turning round the wheel rim and to the grinding of the fastening ring;

7.3 Elements that had contribution:

- reduction during the time of the fastening forces between the tire and the wheel rim following the crushing of the irregularities from the 2 contact surfaces following the thermic and mechanical stresses appeared in the axle operation (the axle is 30 years old);
- thermic forcee introduced in the tyre following the braking actions occurred in the respective wagon operation;
- at the moment of the technical inspections , at the train forming and arrival, the specific regulations in force were not observed , so that the railway staff did not replace the missing parts and did not notify the wagon.

9. Safety recommendations

9.1 Romanian Railway Safety Authority – ASFR will planned in the next time a control action at the freight undertakings when it will control the organizing way of the technical inspection of the freight trains.
If it will find out that, the organizing of the train inspection does not allow to the undertakings staff to discover all the wheels with the loosening tyre or turning against the wheel rim and to analyse these situations according to the specific regulations in force (Instructions concerning the technical inspection and maintenance of the operated wagons – no. 250, approved by the Ministry of Transports, Constructions and Tourism's Order no. 1817/26.10.2005), it will ask these railway undertakings to reexamine the organizing of the trains inspection, so that this activity allow to find out all the freight wagons that have this failure.

9.2 Romanian Railway Safety Authority – ASFR, together with the Romanian Railway Notified Body – ONFR, rolling stock manufacturers or repairing companies and with the rolling stock owners will analyse the

possibilities to limit the use of the pairs of wheels equipped with wheels with tyre at a couple of years that does not exceed the wagon length of life (20 years).

9.3 Romanian Railway Safety Authority – ASFR will analyse the present regulations concerning the repairing and the maintenance of the pairs of wheels equipped with wheels with tyre and will complete the survey methodology of these axles, both in operation and in the maintenance and repairing points during all the operation period, so that one can know every moment the date and the place where the tyre was assemblyed on the wheel.

Romanian Railway Safety Authority will look after the observance of these recommendations.