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AIRCRAFT, MARITIME AND RAILWAY ACCIDENT INVESTIGATION UNIT DIRECTORATE

(AMRAIUD)

FINAL REPORT

On

Technical investigation of railway accident – derailment of freight train No 10530 during transit passing along third track of Todor Kableshkov station on 28.03.2014

October 2014

APPROVE:

TO
MRS. NIKOLINA ANGELKOVA
MINISTER OF TRANSPORT,
INFORMATION TECHNOLOGY AND COMMUNICATIONS

FINAL REPORT

Subject: *Technical investigation of railway accident – derailment of five wagons from freight train No 10530 during transit passing along third track in Todor Kableshkov station on 28.03.2014.*

DEAR MRS. ANGELKOVA,

The investigation commission preformed several inspections on the accident site; it carried out a confrontation with the persons involved in the accident and with eyewitnesses as well. In order to clarify timely and to ascertain the circumstances and causes that led to the accident occurrence, two independent experts were appointed to the Commission for technical investigation as well. In the course of investigation were analysed the report, finding records and other documents and materials, collected and submitted by the Task Force. The Commission took away material evidences and based on them decided independent laboratories to prepare a technical expertise of the locomotive speedometer tape for determining the train speed and a technical expertise of the broken right rail thread of the third track in Todor Kableshkov station that was to include metallographic and spectrometric analysis of the composition for determining the structure and factography and hardness measurement of a sample of the broken rail. Discussed and accepted were the statements of the independent experts who participated in the Commission.

1. Ascertained facts and circumstances in the course of investigation.

On 26.03.2014 from Lyubenovo-predavatelna station to Bobov dol station was composed train No 83698 running as per the Timetable in Lyubenovo-predavatelna – Stara Zagora – Plovdiv-marshalling yard direction in composition of 24 wagons, loaded with coals (briquettes), 96 axles, 1758 tons, which departed at 11:50 p.m. and arrived in Stara Zagora station at 04:35 a.m. on 27.03.2014. The same composition departed from Stara Zagora station on 27.03.2014 at 08:36 p.m. and arrived in Plovdiv-marshalling yard at 11:25 p.m., where a Technician-mechanic wagon inspector (TMWI) performed technical inspection of it.

On 28.03.2014 the same train with changed No 10530 and the same composition of 24 wagons loaded with coals (briquettes), 96 axles, 1758 tons, dragged by electrical locomotive No 46033.7, serviced by locomotive brigade – loco driver and assistant loco driver was running under the Schedule in Plovidv-marshalling yard – Plovdiv – Sofia - Bobov dol direction.

At 08:09 a.m., the train departed from Plovdiv station, which is evident from the technical expertise of the electrical locomotive speedometer tape. After the train departure, there was an acceleration of the speed up to 55 km/h, followed by reduction down to 48 km/h, again acceleration to 55 km/h, running with permanent speed and a new acceleration to 60 km/h. at a 5, 7 km distance from Plovdiv station. Two activations of the automatic train brake were carried out as the last was performed at 90 m before the speed reduction signal and the train entered Todor Kableshkov station area with 21 km/h. In relation to the implementation of project „Modernization of Septemvri-Plovdiv rail section, part of the Trans-European rail

network, Position 3: Modernisation of Stambolyiski – Plovdiv rail section“, a speed limitation of 25 km/h was imposed due to undone station signalling installation. The running of all trains and vehicles was assured using a temporary control board.

At 08:14 a.m., the duty Traffic manager at Todor Kableshkov station ordered by a telephone telegram the switchmen at the two points to accept the train in the station on third unoccupied acceptance-dispatching track without stopping. At 08:17 a.m., the switchmen reported on the route preparation along the third track and on the level-crossing safety. At 08:20 a.m., the train passed on transit along third track under an order given with the order disk by the duty traffic manager. During the train passing through the station filler neck, the switchman/level-crossing guard at point No 1, Plovdiv side, did not notice any irregularities. After the passing of the last train wagon past the duty traffic manager, he also did not notice any irregularity and went back to his office in order to exchange with Plovdiv station a telephone telegram Form 4, ,,train No 10530 entire here“ and an approval for acceptance of fast train No 8640.

During the train acceptance before the cabin of point No 2, Stambolyiski side, the switchman/level-crossing guard noticed a cloud of dust in the first part of the train and gave signal “Stop” immediately, under which command the loco driver undertook promptly stopping with the train brake. The train stopped at 08:22 a.m. at the exit switches of third track on km 146+440, the pressure in the main air conduit of the locomotive lowered down to the environmental pressure and the speed went down to 0 km/h. After stopping, the locomotive brigade inspected the train and found five wagons derailed and laid to the left and right sides of the track and the train split between fifth and sixth wagons. Immediately after, they informed interested authorities accordingly to the established procedure.

During the inspection on site, the investigation commission found as follows:

- The fifth wagon No 84520677364-8 derailed with the two bogies to the left on the train running direction and the loosed left rail tongue of switch No 24 cut into and twisted in the wagon;
- The sixth wagon No 84520677302-8 derailed to the left with the two bogies, laid to the left and with spilled freight of coal;
- The seventh wagon No 84526666007-3 derailed to the right with the two bogies, laid to the right with spilled freight consisting of coal;
- The eight wagon No 84526651100-3 derailed to the right with the two bogies and slightly bended to the right;
- The ninth wagon No 84526651309-0 was coupled on the buffers of the eight wagon and with the first bogie derailed.

After the additional inspection performed at 10:26 a. m. it was given permission for the first four wagons to depart with the train locomotive for Stambolyiski station and for the rest fifteen not derailed wagons to be transported in Plovdiv station.

On the accident site arrived investigation police officers from Transport Police, Regional Division – Plovdiv, who performed procedural-investigative actions in parallel with the inspections conducted by the Technical Investigation Commission at the Ministry of Transport, Information Technology and Communications (MTITC). After that, a written permission was given for commencement of emergency restoration work to the National Railway Infrastructure Company (NRIC).

On the accident site arrived specialized UNIMOG automobile from Plovdiv and at 05:03 p.m. two rehabilitation cranes from Sofia of NRIC’s property arrived in order to lift the derailed wagons. The derailed wagons were lifted and parked on the first track in the station, and then rehabilitation of the permanent way on the third track started.

As a result from the derailment, the gauge clearance of the fifth track was closed and the train movement from Plovdiv station to Stambolyiski station was interrupted from 8:20 a.m. on 28.03.2014 to 12:58 on 29.03.2014.

After repair-rehabilitation works on the third track were performed, the movement of trains in Todor Kableshkov station was restored at 12:58 hours on 29.03.2014.

2. Officials involved in the case.

2.1 Locomotive crew:

2.1.1. „Loco driver" of electrical locomotive No 46033.7 from Stara Zagora locomotive depot, „BDZ – Cargo" Ltd. - 4 years of work experience;

2.1.2. "Assistant loco driver" of electrical locomotive No 46033.7 from Stara Zagora locomotive depot, „BDZ Cargo" Ltd. - 7 years of work experience;

2.2. Station officers:

2.2.1. „Traffic manager" Todor Kableshkov station – employee at Train operation and Station activity management Division (TOSAMD) – Plovdiv, NRIC - 35 years of work experience;

2.2.2. „Switchman/level-crossing guard" Todor Kableshkov station – employee at TOSAMD – Plovdiv, NRIC - 26 years of work experience;

2.2.3. „Switchman/level-crossing guard" Todor Kableshkov station – employee at TOSAMD – Plovdiv, NRIC – 3 months of work experience;

2.3. Other employees

2.3.1. „Permanent way man" – Plovdiv rail section, NRIC - 32 years of work experience;

2.3.2. „Technician mechanic wagon inspector" (TMWI) – Freight Traffic Division (FTD) Plovdiv - 15 years of work experience;

2.3.3. TMWI – FTD Plovdiv - 31 years of work experience;

2.3.4. TMWI – FTD Plovdiv - 29 years of work experience.

3. Physical condition of the officials involved in the accident.

To all the officials, involved in the accident was assured the necessary duration of rest before starting work as required by the Labour Code and Ordinance No 50 of 28.12.2001 on the Working time of the management and executive personnel, involved in the provision of passenger and freight rail transport.

To all the officials, involved in the accident was performed pre-travel (pre-shift) instruction and they were declared to be alerted, rested and that did not drink any alcohol and other drugs.

The officials, involved in the accident possessed valid certificates of psychological examination.

4. Documents, certifying work qualification and exercise of work position.

All the officials, involved in the accident, possessed the necessary work and professional qualifications for the respective work position and a certificate for its execution.

5. Activities of the officials before and during the accident.

All the officials acted, immediately prior and during the accident, in accordance with the established regulations and internal rules, which regulate the rail transport safety.

6. Circumstances, preceding the accident in terms of track, signalling equipment, catenary, rolling stock and others.

Meteorological weather data, which had impact on the visibility of signals:

- air temperature - +14 °C;
- in the daylight hours;
- Good visibility.

Whether the train acceptance at the station plan was respected: yes

Permanent way: documentary in order.

Condition of the station and interstation signalling and its status before the accident: interstation signalling was in order, the train traffic was ensured by means of telephone method, the station was without centralization of the switches and with telephone connection with the switchmen on point duty and a „Temporary control board" of the entry and warning semaphores (TCB).

Whether the switches were equipped with locker type (hook bolt) and whether they were locked: locked.

Catenary: regular, irrelevant to the occurred rail accident.

Train composition station: Lyubenovo – handing over.

Communication equipment and telecommunication connections: technically regular.

Rolling stock:

Electrical locomotive No 46033.7 was technically functioning with regular draft gear, brake system, light and acoustic signals as per the technical standards and requirements which is evident from the records in the respective diaries, presented in the Task Force report.

Wagons series – „Fals", open wagons for transport of bulk freight: technically in order.

7. Fulfilment of the working procedures and technologies within the system of the SE National Railway Infrastructure Company before and during the accident.

The working procedures and technologies before and during the accident at the Train Operation and Station Activity Management Division – Plovdiv, part of the SE NRIC structure, were complied with. All that was evident from the Task Force report and its appendixes as well as from the performed confrontations on-site of the staff and witnesses involved directly or indirectly in the accident.

8. Fulfilment of the procedures and technologies for rolling stock service within the railway undertaking system before and during the accident.

The freight train No 10530 was composed in Lyubenovo station – Handing over, provided with the necessary brake mass and train documents. The locomotive brigade (crew) staff were provided with a business mobile phone.

Within the review of the technical documentation of locomotive No 46033.7, there were not ascertained and recorded any infringements of the Rules for factory and depot repair and maintenance of electrical locomotives in force as well as of the technology of the organisation and operation related to the derailment.

During the carried out review of the technical documentation of the derailed wagons, owned by „TEC Bobov dol" EAD with numbers: 84520677364-8, 84520677302-8, 84526666007-3, 84526651100-3, 84526651309-0, the following was found:

- They were not entered into the „National vehicles register" maintained by the Railway Administration Executive Agency at the time of the rail accident;

- There was no certified entity in charge of the wagons maintenance – in relation to art. 5 of Regulation (EU) № 445/2011 of the Commission dated 10 May 2011 on the certification of the entities in charge of cargo wagons maintenance.

9. Railway infrastructure and rolling stock status before, during and after the accident.

In a Protocol dated 20.03.2014, prepared by the Commission for monthly technical inspection of the rail structures and devices at Todor Kableshkov station as per art. 400 from „Rules for technical operation of the rail infrastructure" of NRIC the following results were written:

9.1. Tracks

- track No 3 – technically regular;

- track No 5 – technically regular;

- tracks No I, II, 4, 6, 7, UR, 1-st R, 2-nd R – handed over to the company, contractor of the construction - „PORR BAU";

- sidings No 1 and 2 – dismantled;

- main tracks No I, II – handed over to „PORR BAU"

9.2. Switches

- Switch No 1 – for measurement and levelling – head of section, 17.04.14, 18.03.14, signature;
- Switch No 9 – technically regular;
- Switch No 11 – for tightening – head of section, 17.04.14;
- Switch No 23 – technically regular;
- Switch No 14 – technically regular;
- Switch No 18 – for tightening – head of section, 17.04.14;
- Switch No 24 – technically regular;
- Switch No 28 – for tamping tongue part – head of section, 17.04.14;
- Switches No No 3, 5, 7, 13, 17, 19, 21, 25, 27, 29, 8, 10, 12, 16, 20, 22, 26, 30, derailing block DB- I – delivered to "PORR BAU";
- Switch No 6 – dismantled.
- Protocol from preliminarily performed hand measurements of switches and tracks and that they complied with the technical standards – 19.03.2014, signature;

9.3. Signalling

- Route relay interlocking (RRI) – switched off from action;
- Shunting board (SB) – switched off from activity;
- Signalling device (SD) – switched off from activity;
- Temporary control board (TCB) – point No 1 – regular;
- Temporary control board (TCB) – point No 21 – regular.

On 26.03.2014 a crack test was performed on third track from km 146+596 to km 146+664, as per "Methods of organization for non- destructive control on rails, railway switches, welded junctions and for rehabilitated through piling permanent way components".

There was found that the railway infrastructure was well functioning as per documents before and during the accident.

As a result from the accident many damages to the track were found, which were described in details 10.4

Before the accident, the electrical locomotive No 44085.9 and the wagons of freight train No 10530 were technically in order.

As a result from the accident there were found technical damages caused to the derailed wagons with numbers: 84520677364-8, 84520677302-8, 84526666007-3, 84526651100-3, 84526651309-0, which are described in details in point 10.3

10. Consequences from the accident.

10.1. Fatalities – none;

10.2. Seriously injured - none;

10.3. Failures and damages to the railway rolling stock:

10.3.1. Wagons:

- wagon No 84520677364-8, type Fals, property of TEC Bobov dol Ltd.;
- wagon No 84520677302-8, type Fals, property of TEC Bobov dol Ltd.;
- wagon No 84526666007-3, type Fals, property of TEC Bobov dol Ltd.;
- wagon No 84526651100-3, type Fals, property of TEC Bobov dol Ltd.;
- wagon No 84526651309-0, type Fals, property of TEC Bobov dol Ltd.;

Accordingly to the preliminary estimate for the revision of vehicles for the damage caused including check of the frame parameters, revision of the braking system, inspection and stand test with the drag bar and breaker equipment, inspection and check of the body shell geometry, unloading mechanism, mechanical and pneumatic part, brake test and balancing, delivery and installation of elements for the braking system completion and unloading mechanism and power cylinders, amount to a total of 146 830,00 BGN without VAT.

10.3.2. Electrical locomotive:

Electrical locomotive No 46033.7 – property of „BDZ – Cargo" Ltd.: None.

10.4. Failures and damages to the rail infrastructure:

10.4.1. Permanent way and structures:

The costs for rehabilitation of the permanent way on third track and switch No 24 amounted to 21 908,63 BGN without VAT.

The expenditures for lifting the derailed wagons on a track in the station and train movement recovery amounted to 14 433,16 BGN without VAT.

10.4.2. Signalling and communications, radio connections, power supply: there were no any damages.

10.4.3. Catenary: there were no any damages

The costs of the Regional division – Section Energy at NRIC for ensuring safety and participation in the rehabilitation works after the derailment amounted to 9 000 BGN without VAT.

10.4.4. Other failures and damages: none.

10.5 Damages and spill of freights, baggage and parcels:

The freight of three of the derailed wagons of TEC Bobov dol EAD property (84526666007-3, 84520677302-8 and 84526651100-3) was spilled over (coal briquettes).

The costs incurred by TBL Ltd. to guard and transport of coal are 6 497, 07 BGN without VAT.

The costs incurred by TEC Bobov dol Ltd. for coal loading are 3 721, 72 BGN without VAT.

10.6. Train circulation interruption:

Due to the derailment of freight train No 10530 in Todor Kableshkov station on third acceptance-departure track and the closure of the fifth track clearance gauge, the train movement between Stambolyiski-Todor Kableshkov-Plovdiv stations was interrupted for 28 hours and 38 minutes - from 08:20 a.m. on 28.03.2014 to 12:58 on 29.03.2014.

10.7. Caused train delay:

10.7.1. Delayed trains:

10.7.1.1 Passenger trains

- Train No 8692 - 28.03.2014 - „BDZ PS“ Ltd. - 8 min.;
- Train No 10112 - 28.03.2014 - „BDZ PS“ Ltd. - 34 min.;
- Train No 1624 - 28.03.2014 - „BDZ PS“ Ltd. - 42 min.;
- Train No 10114 - 28.03.2014 - „BDZ PS“ Ltd. - 50 min.;
- Train No 10112 - 28.03.2014 - „BDZ PS“ Ltd. - 49 min.;
- Train No 8601 - 28.03.2014 - „BDZ PS“ Ltd. - 28 min.;
- Train No 8613 - 28.03.2014 - „BDZ PS“ Ltd. - 15 min.;
- Train No 3624 - 28/29.03.2014 - „BDZ PS“ Ltd. - 40 min.;
- Train No 30115 - 28/29.03.2014 - „BDZ PS“ Ltd. - 20 min.;
- Train No 5625 - 28/29.03.2014 - „BDZ PS“ Ltd. – 8 min.;
- Train No 50134 - 28/29.03.2014 - „BDZ PS“ Ltd. - 10 min.;
- Train No 1626 - 28/29.03.2014 - „BDZ PS“ Ltd. - 28 min.;
- Train No 10234 - 28/29.03.2014 - „BDZ PS“ Ltd. - 39 min.;
- Train No 1620 - 29.03.2014 - „BDZ PS“ Ltd. - 17 min.;
- Train No 1622 - 29.03.2014 - „BDZ PS“ Ltd. - 15 min.;
- Train No 8692 - 29.03.2014 - „BDZ PS“ Ltd. - 26 min.;
- Train No 10112 - 29.03.2014 - „BDZ PS“ Ltd. - 35 min.;
- Train No 8692 - 29.03.2014 - „BDZ PS“ Ltd. - 26 min.;
- Train No 10230 - 29.03.2014 - „BDZ PS“ Ltd. - 15 min.;
- Train No 8610 - 29.03.2014 - „BDZ PS“ Ltd. - 11 min.;

Total delay of passenger trains – 06 hours and 11 minutes.

10.7.2. Cancelled trains

- Train No 10720 - 28.03.2014 – from Por to Sp - „BDZ PS“ Ltd.;
- Train No 10721 - 28.03.2014 – from Sp to Por - „BDZ PS“ Ltd.;
- Train No 8611 - 28.03.2014 – from Stm to Dnz - „BDZ PS“ Ltd.;
- Train No 8640 - 28.03.2014 – from Por to Sf - „BDZ PS“ Ltd.;
- Train No 10111 - 28.03.2014 – from Stm to Po - „BDZ PS“ Ltd.;
- Train No 10112 - 28.03.2014 – from Po to Stm - „BDZ PS“ Ltd.;
- Train No 8610 - 28.03.2014 – from Po to Sf - „BDZ PS“ Ltd.;
- Train No 8601 - 28.03.2014 – from Stm to Va - „BDZ PS“ Ltd.;

- Train No 1621 - 28.03.2014 – from Stm to Po - „BDZ PS“ Ltd.;
- Train No 1624 - 28.03.2014 – from Po to Stm - „BDZ PS“ Ltd.;
- Train No 18203 - 28.03.2014 - from Stm to Po - „BDZ PS“ Ltd.;
- Train No 10235 - 28.03.2014 - from Stm to Po - „BDZ PS“ Ltd.;
- Train No 10690 - 28.03.2014 – from Por to Pi – BRC JSC;
- Train No 10603 - 28.03.2014 – from Ik to Por - „BDZ PS“ Ltd.;
- Train No 1625 - 28.03.2014 - from Stm to Po - „BDZ PS“ Ltd.;
- Train No 1623 - 28.03.2014 - from Stm to Po - „BDZ PS“ Ltd.;
- Train No 8613 - 28.03.2014 – from Stm to Bs - „BDZ PS“ Ltd.;
- Train No 8641 - 28.03.2014 – from Stm to Sz - „BDZ PS“ Ltd.;
- Train No 10113 - 28.03.2014 – from Stm to Po - „BDZ PS“ Ltd.;
- Train No 10116 - 28.03.2014 – from Po to Stm - „BDZ PS“ Ltd.;
- Train No 8602 - 28.03.2014 – from Po to Sf - „BDZ PS“ Ltd.;
- Train No 8612 - 28.03.2014 - from Po to Sf - „BDZ PS“ Ltd.;
- Train No 44155 - 28.03.2014 – from Pzk to Kk - „BDZ PS“ Ltd.;
- Train No 10720 - 28.03.2014 – from Por to Sp - „BDZ Cargo“ Ltd.;
- Train No 8627 – 28/29.03.2014 – from Kz to Tl - „BDZ PS“ Ltd.;
- Train No 493 – 28/29.03.2014 – from Stm to Dgs - „BDZ PS“ Ltd.;
- Train No 10232 – 28/29.03.2014 – from Stm to Sp - „BDZ PS“ Ltd.;
- Train No 40838 – 28/29.03.2014 – from Por to Dzhs - „BDZ Cargo“ Ltd.;
- Train No 1620 – 28/29.03.2014 – from Po to Stm - „BDZ PS“ Ltd.;
- Train No 1622 – 28/29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;
- Train No 1622 – 28/29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;
- Train No 10230 – 28/29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;
- Train No 18202 – 28/29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;
- Train No 18201 – 28/29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;
- Train No 10131 – 28/29.03.2014 – from Stm to Prm - „BDZ PS“ Ltd.;
- Train No 10231 – 28/29.03.2014 – from Stm to Po - „BDZ PS“ Ltd.;
- Train No 80311 – 28/29.03.2014 – from P to Chp - „BDZ PS“ Ltd.;
- Train No 8611 – 29.03.2014 – from Stm to Dnz - „BDZ PS“ Ltd.;
- Train No 8640 – 29.03.2014 – from Po to Sf - „BDZ PS“ Ltd.;
- Train No 10112 – 29.03.2014 – from Po to Stm - „BDZ PS“ Ltd.;
- Train No 86111 – 29.03.2014 - from Stm to Po - „BDZ PS“ Ltd.;
- Train No 1621 – 29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;
- Train No 10235 – 29.03.2014 - from Stm to Po - „BDZ PS“ Ltd.;
- Train No 10114 – 29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;
- Train No 1624 – 29.03.2014 - from Po to Stm - „BDZ PS“ Ltd.;

10.7.3. Appointed trains

- Train No 8692 – 28.03.2014 – from Stm to Sf - „BDZ PS“ Ltd.;
- Train No 8681 – 28.03.2014 – from Po to Dnz - „BDZ PS“ Ltd.;
- Train No 8690 – 28.03.2014 – from Stm to Sf - „BDZ PS“ Ltd.;
- Train No 8683 – 28.03.2014 – from Po to Va - „BDZ PS“ Ltd.;
- Train No 82998 – 28.03.2014 – from Por to Pi – BRC JSC;
- Train No 8680 – 28.03.2014 – from Stm to Sf - „BDZ PS“ Ltd.;
- Train No 8682 – 28.03.2014 – from Po to Va - „BDZ PS“ Ltd.;
- Train No 8687 – 28.03.2014 – from Po to Sz - „BDZ PS“ Ltd.;
- Train No 8697 – 28/29.03.2014 – from Po to Tl - „BDZ PS“ Ltd.;
- Train No 8677 – 28/29.03.2014 – from Sf to Stm - „BDZ PS“ Ltd.;
- Train No 495 – 28/29.03.2014 – from Po to Dgs - „BDZ PS“ Ltd.;
- Train No 30681 – 28/29.03.2014 – from SfnordSb to Por - „BDZ PS“ Ltd.;
- Train No 8676 – 28/29.03.2014 – from Stm to Sf - „BDZ PS“ Ltd.;
- Train No 10191 – 28/29.03.2014 – from Po to Prm - „BDZ PS“ Ltd.;
- Train No 8681 – 29.03.2014 – from Po to Dnz - „BDZ PS“ Ltd.;
- Train No 8692 – 29.03.2014 – from Stm to Sf - „BDZ PS“ Ltd.;

10.7.4. Deviated trains
- Train No 46870 – 28.03.2014 – from Por to Sb-Kz - „BDZ Cargo“ Ltd.;
- Train No 40770 – 28.03.2014 – from Por to Sb-Dzhs - „BDZ Cargo“ Ltd.;
- Train No 46774 – 28/29.03.2014 - from Por to Sb-Dzhs - „BDZ Cargo“ Ltd.;
- Train No 40839 – 28/29.03.2014 – from Kz to Sb-Kk - „BDZ Cargo“ Ltd.;
- Train No 10602 – 28/29.03.2014 – from Por to Kv-Ik - „BDZ Cargo“ Ltd.;
- Train No 46870 – 28/29.03.2014 – from Por to Kv-Dzhs - „BDZ Cargo“ Ltd.;
- Train No 8626 – 28/29.03.2014 – from Po to Kv-Sf - „BDZ PS“ Ltd.;
- Train No 8627 – 28/29.03.2014 – from Sf to Kv-Tl - „BDZ PS“ Ltd.;
10.7.5. Delay of Train No 10530 on 28.03.2014 - „BDZ Cargo“ Ltd. -165 min.;
10.7.6. Costs of modifying the Train circulation schedule:
10.7.6.1 „BDZ – Passenger Services“ Ltd. – 36 102,31 BGN, without VAT.
10.7.6.2 „BDZ – Cargo“ Ltd. – 27 644,34 BGN, without VAT.

10.8. Rehabilitation vehicles circulation:

10.8.1. Rehabilitation train:

At 5:03 p.m. on 28.03.2014, train No 10431 in composition of two rehabilitation cranes of NRIC property arrived on the accident site from Sofia station for lifting the derailed wagons.

10.8.2. Other rehabilitation means:

After the derailment on 28.03.2014, a specialized automobile „UNIMOG“ of NRIC was sent from Plovdiv station to the accident site for lifting the wagons as well.

11. Analysis of the causes for the railway accident.

From the performed inspections, the additionally required materials and performed measurements of the track and derailed wagons by the commission for technical investigation it was established that:

- The derailment of five wagons of the freight train No 10530 happened at 08:22 a.m. at km 146+535,54 (at a distance of 40,54 m before the beginning of switch No 24) while passing transit along the third acceptance-departure track of Todor Kableshkov station towards Stambolyiski station;

- The derailment happened in a period when construction and rehabilitation works were on in Todor Kableshkov station that have been implemented to the present. They have been carried out under the agreed and approved sub site part of the "Temporary variant of track No 3" of the "Modernization of Septemvri – Plovdiv railway section as part of the Trans - European Network” project, Position 3: “Modernization of Stambolyiski – Plovdiv railway section". This subproject implementation is aimed to provide the necessary for the vehicles clearance gauge in the station, as shifting of the third track was performed with 1.80 m from the axis through a curve, reverse curve and intermediate straight line. In result from shifting the tracks in the station, the mainstream of passenger and freight trains has been directed towards third track (electrified) and fifth track (non-electrified) due to interruption of the movement on main tracks I and II.

- The derailment happened in a section with horizontal circular curve with radius of R=300 m, elevation H=0 mm and allowed speed of V_{max} = 25 km/h, due to loosed signalling installation;

- The train speed at the time of derailment was 21 km/h, which was less than the limit for the section;

- On the accident site was found the right rail broken in the area of the rail joint. The rail was produced in Azovsk in May 1960 (AV-1960-S-49, S - 49). The location of the fracture was between the sleepers and there was ascertained the presence of a defect (burn from welding) caused by poor technological effect (old welding of contact wire) on the rail heel. On the left side was found an old crack with a length of 30 mm along the entire section of the rail heel and on the right side there was a newly born crack of 45 mm length and 3 mm depth at the base of the rail heel. The morphology of the destroyed surface was evaluated visually

and by means of microscopic techniques (optical microscopy). There was performed visual observation of samples on the right rail thread. On the upper part of the samples were found (demolished working part of the railhead) tamped areas. Significant corrosion damages were observed at the lower side of the base as a result from retained moisture within the operation with depth not exceeding two mm. There were not found any slag inclusions or other visible defects.

The concentration of tensions created during the removal of a piece of the material (defect) of the rail, resulting in the formation of a crack in the heel and subsequently to a complete destruction of the rail. The dense oxide layer covered completely the morphology of the initial development of the crack. The change in the density of the layer observed showed the development of the process of crack enlargement.

The tamped areas (dents) observed on the head of the rail in the rupture area are a consequence from the destruction and not a cause of it.

During the operation of the track, the rails are subject to high loads of the rolling stock. To ensure the safety of traffic, it is necessary with the aid of appropriate methods for non-destructive testing to timely detect and evaluate the defects occurred. For this purpose the ultrasonic flaw detection is used, which allows to detect and evaluate defects on the surface as well as inside the rail. As a part of the railroad superstructure, the rails are under intense impact of dynamic loading from the trains, as well as of the surrounding environment and climate. These factors determine and lead to the formation and development of various defects that threaten the safe operation of the rolling stock. Defects of rails are characterized by distortions of their shape, size, parameters, quality of the metal under the influence of the rolling load and natural climatic factors. During the track operation under the impact of the dynamic rolling stock load and natural and climatic factors, in the rails appear defects, deformations and material fatigue. The solution of the problem is achieved by modern physical methods of non-destructive control (NDC). The experience shows that good organization and the skilful use of the method and the rational combination of these methods make it possible to assess the reliability of the recording of dangerous defects. Faults in rail elements according to the "Classification of defects of rails" of the track is classified as a number consisting of three digits. The first digit characterizes the type and the defect location (in the head, neck or heel). The second digit indicates the cause of damage to the rail and the third - the location of the defect in the length of the rail.

On 26.03.2014, a non-destructive testing was carried out with an equipment of RDM-3 type (No 219) of the rail threads on the third and fifth tracks at Todor Kableshkov station. It was done accordingly to the "Rules for non-destructive control of rails, railway switches, welded joints and recovered by layering elements of the track" of 12/03/2014, as evidenced by the ,, Working diary of the group for non-destructive testing"(Appendix No 3 to art. 22, i. 9, letter "a") at Plovdiv railway section. Due to the limited technical capabilities of fault detection equipment used for carrying out the NDC, there were no failures found in the rail threads that correspond to the "Catalogue of rail faults recorded by the methods of non-destructive testing", approved by the Director General of State Enterprise NRIC. Completion of preventive NDT with this type of ultrasonic flaw detector cannot trace the whole rail profile. Non-destructive testing equipment with advanced capabilities is necessary to be purchased to check the rail profile for ensuring the quality of the performed flaw detection and increasing the traffic safety on the rail track.

The general technical condition of the third railway track in the station, excluding the above quoted defect of the destroyed rail and mainly taking into account the section outside the accident area, could not be assessed as good. Despite that, it was not the cause of the accident and it had no impact on the nature and extent of the damages and consequences caused.

Due to the complete destruction of the railway superstructure in result of the derailment, there are missing data on technical measurements expressed in the Task Force written statement on the track.

Before the right rail fracture on (km 146 + 535.54) and before the occurrence of cross and vertical displacement between the two parts of the rail thread, there passed the wheels of the locomotive and the first four wagons. Following their impact, the displacement increased dramatically and reached a critical state of derailment. When derailed, the train was torn between the fifth and sixth wagon with a distance of around 4-meters from each other. First derailed with the two bogies to the left the fifth wagon (No 8452067364-8) in the row of the composition of the train. By that, the wagon dragged behind the sixth wagon, which deviated and laid to the left, the seventh deviated and laid to the right, the eight derailed to the right and the ninth wagon derailed with the first bogie. In consequence of the laid wagons and the freight spilled, the clearance gauge of the fifth track was closed.

On 31.03.2014, the commission for technical investigation performed measurements for establishing the technical condition parameters of the wagon No 84520677364-8, of "Fals" type, in Septemvri locomotive depot and on 01.04.2014 in „Wagon repair factory" („VRZ – 99" JSC – Septemvri), and found the following:

- Mid repair of wagon No 84520677364-8 was implemented on 30.11.2009;
- Distance between the inner head surfaces of the wheels:

No measurement	Subject of measurement – distance between the inner head surfaces of the wheels, mm.			
	First bogie		Second bogie	
	Axle-bushes with numbers 1 and 2	Axle-bushes with numbers 3 and 4	Axle-bushes with numbers 5 and 6	Axle-bushes with numbers 7 and 8
1	1359	1359	1359	1359
2	1359	1359	1359	1359
3	1359	1359	1359	1359

- The diameters of the wheels in the circle of rolling:

Subject of measurement – wheels at axle-bushes with numbers, mm							
1	2	3	4	5	6	7	8
900	900	900	900	910	910	910	910

- Parameters of the flanges:

Parameter type	Subject of measurement – wheel flange at axle-bushes with number							
	1	2	3	4	5	6	7	
Thickness mm	28	29	29	30	28	31	27	30
Height mm	29	29	29	28	31	29	30	29
Vertical cut-mm	8	9	9	9	8,5	9,5	8	9

The parameters of wagon No 84520677364-8 measured and reflected in the tables are within the prescribed limits and in accordance with the requirements of the Ordinance No 58 of 2 August 2006 on the rules of technical operation, the movement of trains and railway signalling and "Instruction on the wheel sets of the wagons."

- Other bogies findings: springs - uniform, mechanic valve KE-1 – switched on and regular, blocks - properly bedded, draw gears – regular, load - uniformly distributed.

The damages found to the bogie and the body shell of the wagon were caused in result of the accident occurred.

The parameters of the other wagons of type "Fals" measured and reflected in the written protocols were within prescribed limits and in accordance with the requirements of Ordinance No 58 dated 2 August 2006 on the rules of technical operation, the movement of trains and railway signalling and "Instruction on wagons wheel sets."

12. Causes for the accident.

After repeated inspections and measurements of the wagons performed in the Septemvri locomotive depot and in "VRZ - 99" JSC, the analysis made of the materials and documents collected, the report of the Task Force and from the technical expertise for decoding the speedometer tape of locomotive 46033.7 and the technical expertise for metallographic analysis, spectrometric analysis for the composition, factography and measurement of the hardness of the sample from the right rail thread performed additionally, the statements of the external experts presented, the investigation Commission considers that:

Immediate technical cause of the occurred accident - derailment of five wagons from freight train No 10530 in transit on third track in the Todor Kableshkov station on 28/03/2014 **was the cross destruction of the right rail thread at km 146 + 535 54 occurred in the lower part of the heel, due to the created tension concentrator (burn of welding).** The destruction evolved exponentially in the direction from the heel towards the head of the rail. The location of the defect found in the rail heel was in a free longitudinal position between the railway sleepers, which was a prerequisite to the spatial displacement caused.

Within the constant corrosive impact of the moisture and cyclic dynamic loading, it started development of cracks that merged and led to the full destruction. The destruction occurred transversely to the length and over the entire section of the rail in the place of defect found (burn of welding) on the lower edge of the rail heel. Following the repeated loads of passing trains and vehicles the occurred crack developed and reached the critical section of the rail (possibly increased dynamic impact - overload). As a result from the intensification of the train traffic on third track an avalanche type of destruction of the rail occurred. Based on the macro graphic observation of the destroyed surface it was found that the destruction happened under the impact of tensions applied on the rail thread.

13. Recommendations and suggestions for preventing events against other similar accidents.

In order to prevent the occurrence of similar accidents in the future and with reference to the requirements of art. 94, par. 1 of Ordinance No 59 from 5.12.2006 on the management of railway safety of the Minister of Transport, the Railway Administration Executive Agency shall order to SE NRIC to implement the following safety recommendations.

1. To conduct a study for delivery of a non-destructive control equipment with better capacity and functions in order a more precise detection of rail profile, switches and other track elements defects;

2. The SE NRIC Director General to order increased control and punctuality in the work of the staff members involved in the non-destructive control tests (NDT) of welded components and rehabilitated through layering elements in the rail track and preventive NDC of rails and switch elements laid in the rail track.

3. In carrying out construction-repair works for rehabilitation and modernization of rail infrastructure, to be carried out continuous control of the rail infrastructure and facilities for temporary construction and operation to it for the quality of materials intended for re-use accordingly to the requirements of the normative acts concerning maintenance of track.

With reference to the requirements of art. 94, par. 3 of Ordinance No 59 of 5.12.2006 on the management of railway safety of the Minister of Transport, the Railway Administration Executive Agency and the SE NRIC shall notify in writing the AMRAIU Directorate at MTITC not later than 28.11.2014 on the appropriate actions undertaken for implementation of the recommendations given.

Appendix: *1. Photos – 6.*

2. CD with photos from the accident.

Chairperson:

……..... (Boycho Skrobanski)
State Expert at AMRAIUD, at MTITC

Members:

1. ……..... (Boyko Stoilov)
Chief Inspector at AMRAIUD, MTITC

2. ……..... (Dimitar Iotov)
Inspector at AMRAIUD, MTITC

3. …… (Nina Postolova)
Independent external expert

4. ……..…. (Tsviatko Penchev)
Independent external expert