



REPUBLIC OF BULGARIA

**MINISTRY OF TRANSPORT, INFORMATION TECHNOLOGY
AND COMMUNICATIONS**

Directorate for Aircraft, Maritime and Railway Accident Investigation

Railway Accident and Incident Investigation Unit

ANNUAL REPORT



2009



TABLE OF CONTENTS

1. Introduction.....	2
2. List of abbreviations	3
3. Summary.....	10
4. Investigating authority	10
5. Activity performed by the Railway Accident and Incident Investigation Unit in 2009	13
6. Investigation process.....	16
6.1 Occurrences subject to investigation	16
7. Investigations	16
7.1 Overview of completed investigations	17
7.2 Summary of investigations	17
7.3 Investigations completed and initiated in 2009	17
7.4 Investigations which were initiated but not carried on in 2009.....	17
7.5 Accidents and incidents during the last four years (2006–2009)	21
8. Recommendations for organizational and technical and other measures aimed at preventing this type of accidents	21



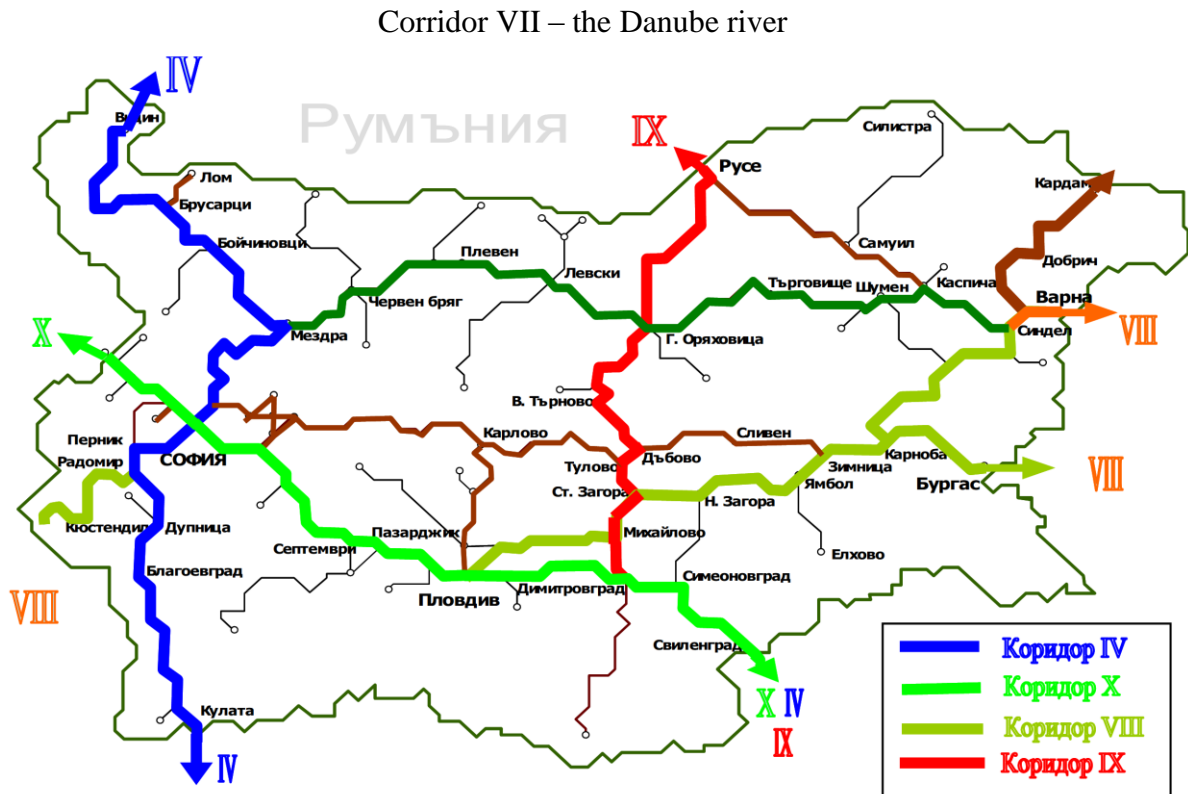
List of abbreviations

1. MTITC – Ministry of Transport, Information Technology and Communications
2. DAMRAI – Directorate for Aircraft, Maritime and Railway Accident Investigation at the Ministry of Transport, Information Technologies and Communications
3. RAIIU – Railway Accident and Incident Investigation Unit(at Directorate for Aircraft, Maritime and Railway Accident Investigation at the Ministry of Transport, Information Technology and Communications)
4. MoI – Ministry of Interior (the bodies and the laboratories involved in railway accident investigation)
5. RAEA – “Railway Administration” Executive Agency (national authority on safety in rail transport)
6. NRIC – National Railway Infrastructure Company (state-owned company)
7. BDZ EAD – Bulgarian State Railways EAD.
2. BRC AD – Bulgarian Railway Company AD
3. RTA – Rail Transport Act
4. TINA – EU TINA project (for the construction of integrated trans-European transport system with the participation of all countries which have applied for full membership in the EU structures)
5. TRASECA – the TRASECA Intergovernmental Committee (for Europe-Caucasus-Asia transport corridor)
6. TLT – total length of track
7. Todor Kableshkov HST – Todor Kableshkov Higher School of Transport
8. TRI – Transport Research Institute EOD
9. spec. labs – specialized laboratories s
10. RW – railway
11. PRS – Powered Rolling Stock
12. HR – Hoist-assisted repair
13. MLR – Mid-life repair
14. MR – Major repair
15. RPTC – Regional Passenger Transport Center
22. ERA – European Railway Agency
23. RWRS – railway rolling stock
24. OS – Operations site
25. SR – System regulations
26. NA – National Assembly
27. ATSA – Air Traffic Services Authority (state-owned company)
28. CRD – car repair depot
29. SPR – Small Periodic Repair



1. Introduction

Five Pan-European transport corridors cross the territory of the Republic of Bulgaria: IV, VII, VIII, IX and X.



Pan-European transport corridors covering the railway network of the Republic of Bulgaria

- The corridors crossing the territory of the Republic of Bulgaria (extensions of the trans-European transport network and its connection with the neighboring states and regions) are the priority axes for the development of the railway infrastructure. These include the routes:
 - Pan-European transport corridor IV: Vidin – Sofia – Kulata;
 - Pan-European transport corridor VII: the Danube river railway connections;
 - Pan-European transport corridor X: Belgrade – Nis – Sofia – Plovdiv – Svilengrad – Istanbul (TRASECA);
 - Pan-European transport corridor VIII: Durres – Trana – Skopje – София – Plovdiv – Burgas/Varna

Sea transportation routes: the connections between the ports of Varna and Burgas and the railway networks of Ukraine, Russia, Georgia and Turkey.

Corridor IX (Bucharest – Ruse – Dimitrovgrad – Alexandroupolis) is a pan-European transport corridor which is not covered by the major axes.



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The additional connections of the TINA network include:

- Mezdra – Pleven – Gorna Oryahovitsa railway section;
- Ruse – Kaspichan – Sindel railway section ;

The railway network of the Republic of Bulgaria includes the following transborder railway sections:

- to Turkey: the Svilengrad – Kapikule transborder section,
- to Greece: the Svilengrad – Dikea and Kulata – Promahonas transborder railway sections
- to Serbia and Montenegro: the Dragoman – Dimitrovgrad transborder railway section
- to Romania: the bridge over the Danube river (Ruse – Giurgiu) and the inland Kardam – Negru Voda section

The Varna Rail Ferry Complex allows the transportation of railway cars via the Black Sea to the railway networks of other countries in the Black Sea region.

There is no railway connection to Macedonia via Gyueshevo (Corridor VIII), although the railway section in the Bulgarian territory has already been constructed.



Map of the railway network of the Republic of Bulgaria

Main characteristics of the railway network:

As of the beginning of 2010, the total length of track (TLT) of the railway network was 6 859 km, including 6 701 km (97,7% of the TLT) of normal gage (1 435 mm), including:



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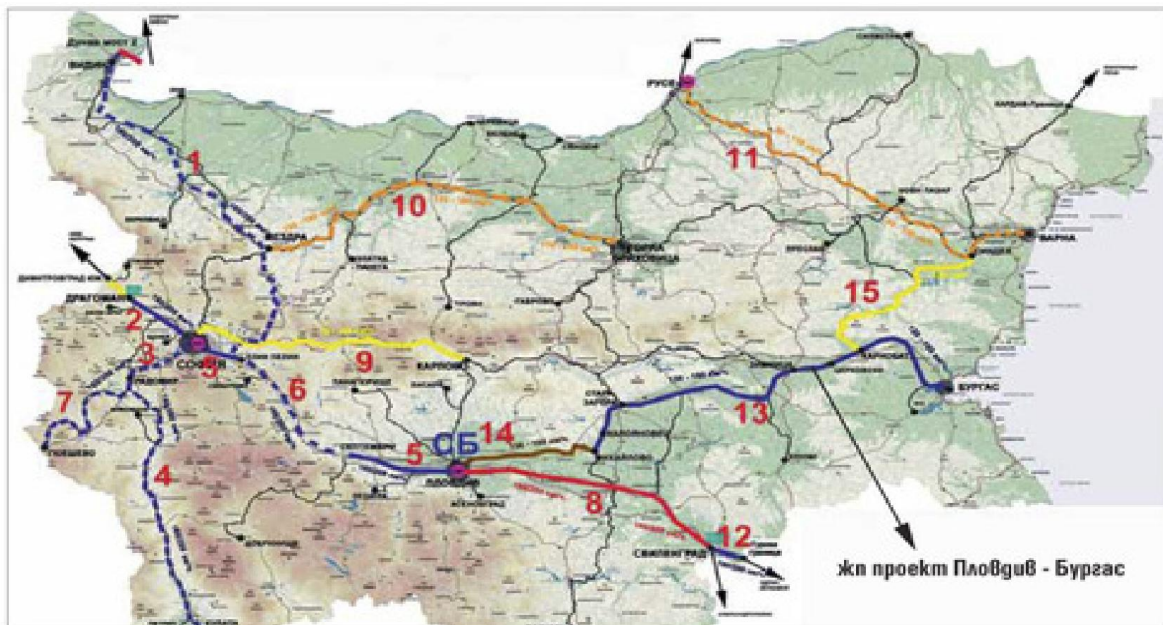
- Length of open normal gage tracks: 4 025 km, or 58,7% of TLT;
- Length railway station tracks: 1705 km, or 24,8% of TLT;
- Number of railway switches: 7 580;
- Number of railway crossings: 819;
- Number of railway bridges: 982, with total length of 41,4 km;
incl.:
 - with steel structure – 305, with total length of 14,2 kmm;
 - with ferro-concrete structure – 677, with total length of 25,7 km;
- Number of tunnels: 180, with total length of 47,54 km;
- Continuous railway tracks: with total length of 1 765 km, or 25,7% of TLT;

Railway structure

- The activities, relations and functions of the parties involved in the railway transport have been arranged in accordance with the provisions of the EU legislation and on the grounds of the national legislation.
- The **railway infrastructure** of the Republic of Bulgaria is state-owned and is managed by the **state-owned National Railway Infrastructure Company**.

Steps have been taken to improve the technical condition of the company in view of its integration into the EU railway system and with the aim of preserving and strengthening the railway position in the transport market.

Priority investment projects of the National Railway Infrastructure Company



- Modernization for 160/200 km/h financed by ISPA/EIB/state budget, construction in progress
- Modernization/Rehabilitation/Renewal, the construction being financed under Operational Programme "Transport" 2007-2013
- Modernization/Rehabilitation/Renewal, the construction to be financed under Operational Programme "Transport" 2014-2020
- Modernization/Rehabilitation – the construction design has been prepared, the construction to be financed via a loan from the World Bank
- Rehabilitation/Renewal – construction design to be ready in 2010, no financing arrangements have been made, however
- Rehabilitation/Renewal – the construction design has been fully prepared, and the construction of the sections is financed via the state budget



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Republic of Bulgaria**

Railway carriers holding railway transport licenses:

- State carrier – BDZ EAD - along with its subsidiary companies, viz. BDZ – Freight Transport EOOD, BDZ – Passenger Transport EOOD, and BDZ – Powered Rolling Stock (locomotives)” EOOD
- Private carriers BRC AD, Bulmarket-DM OOD, Gastrade AD, Unitranscom AD, DB Schenker Rail Bulgaria EOOD, and Express Service OOD.

Carrier	Date of issue of license	Scope of license
Bulgarian State Railways EAD (BDZ EAD)	01/04/04 National BG 10.01.2007 European EU	Passenger and freight transport
Bulgarian Railways Company AD	15.04.2005 BG 10.01.2007 EU	Freight transport
Bulmarket-DM OOD	24.10.2005 BG 10.01.2007 EU	Freight transport
BDZ – Freight Transport EOOD	31.01.2008 EU	Freight transport
BDZ – Passenger Transport EOOD	31.01.2008 EU	Passenger transport
BDZ – Powered Rolling Stock (locomotives)” EOOD	31.01.2008 EU	Passenger and freight transport
Gastrade AD	01.10.2008 EU	Freight transport
Unitranscom AD	01.10.2008 EU	Freight transport
DB Schenker Rail Bulgaria EOOD	13.05.2010 EU	Freight transport
Express Service OOD	10.06.2010 EU	Freight transport

- The average age of the locomotives and railway cars owned by the state carrier BDZ EAD is up to and above 25 years. Exception to the above are the passenger cars which have been recycled under the rehabilitation programme financed by the World Bank and the European Bank for Reconstruction and Development with the aim of modernizing the RWRS.

RWRS fleet owned by BDZ EAD – Breakdown by age

Type of RWRS	5 years or less		5-10 years		10-20 years		20-30 years		30-40 years	
	number	%	number	%	number	%	number	%	number	%
Locomotives	6	1.00%	20	3.30%	76	12.60%	321	53.30%	179	29.70%
Electrically powered trains	0	0.00%	0	0.00%	6	8.10%	35	47.30%	33	44.6%
Passenger cars	2	0.10%	50	3.40%	332	22.90%	386	26.60%	682	47.0%
Freight cars	0	0.00%	149	0.70%	8607	41.70%	9344	45.30%	2522	12.20%



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- 25 new „Desiro – Classic” diesel-powered trains (produced by Siemens) were acquired in the period 2005 – 2006, as well as 25 new electrically-powered trains „Desiro” in the period 2007 – 2008.
- BDZ EAD has developed a programme for passenger car renewal aimed at enhancing the service quality, under which 20 recycled sleeping cars and 3 bistro-type cars were put into operation in June 2009.

Another 18 sleeping cars and 2 bistro-type cars are also expected to be put into operation. The above railway cars have been imported from Germany and meet the EU operational compatibility standards (TSI).

Railway accidents

In 2009 there were 1679 occurrences registered in accordance with the statutory provisions. Their classification by type is given in the following table:

#	Type of occurrence	Total number
1	Cut railway switch	10
2	Train admitted to an occupied track with subsequent collision	1
3	Missed train	1
4	Fire in railway rolling stock fire, cargo, etc.	33
5	Collision at a crossing	24
6	Persons killed or injured	87
7	Train admitted to an occupied track without collision	0
8	Train dispatched without approval from the net station	0
9	Closure signal disregarded	3
10	Train dispatched to an occupied inter-station section or in the wrong direction	11
11	Movement at a railway crossing without activating the manual barriers	4
12	Train with insufficient braking weight	0
13	Railway rolling stock left without identified distance	0
14	Railway rolling stock fault – carrier	384
15	Railway rolling stock fault – infrastructure	10
16	Railway fault	6
17	Safety equipment fault	41
18	Contact network fault	99
19	Wrong or uncoordinated operations at the OS	9
20	Traffic interruption due to natural disasters, etc.	53
21	Abandoned train	489



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Republic of Bulgaria

#	Type of occurrence	Total number
22	Detached railroad car	142
23	Untimely slot respond	22
24	Animals run over	73
25	Objects placed on the tracks	26
26	Objects thrown at rolling stock or other ill-intentioned actions	119
27	Train detachment	32
	TOTAL	1679

The following table shows a breakdown of accidents by type, and damages.

Type of accident		2007		2008		2009	
		number	Damages (BGN)	number	Damages (BGN)	number	Damages (BGN)
1	Derailment or collision	84	56 562	83	385 192	34	101 221
2	Setting on fire / Fire	16	6 665	21	1 337	23	62 856
3	RWRS fault	318	54 565	287	35 713	263	38 712
4	Abandoned train	533	32 612	560	58 526	84	56 562
5	Cut railway switch	13	0	16	0	4	210
6	Detached rain car	71	2 049	89	3 447	74	2 077
7	Intentional placement of object on the tracks	34	12 739	29	6	23	163
8	Throwing objects and other actions causing the RWRS to stop	216	131 303	155	44 218	127	61 566
9	Train detachment	28	516	27	1 417	16	3 283
	TOTAL	1313	387011	1267	529856	1016	302 064

Out of a total of 1798 occurrences:
 230 (13%) are related with NRIC
 1074 (16%) are related with the carriers
 970 (54%) are related with BDZ EAD
 493 (27%) are related with external reasons.

Accidents with damages incurred

Damages (BGN) in 2007 as compared with 2006: + BGN 17 572 (+ EUR 9 011)
 Damages (BGN) in 2008 as compared with 2007: + BGN 232 845 (+ EUR 119 412)
 Damages (BGN) in 2009 as compared with 2008:– BGN 227 792 (- EUR 116 816)

As seen from the above table, in terms of percentage, the damages caused by fire in RWRS were the largest in 2009:



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- BDZ EAD has incurred damages amounting to BGN 61 519 (EUR 31 548) as a result of a total of 23 registered and investigated fires in RWRS
- BDZ EAD has incurred damages amounting to BGN 101 221 (EUR 51 908) as a result of a total of 23 registered and investigated accidents involving RWRS
- The damages caused by train derailment have considerably decreased as compared with 2008 (by BGN 283 971 (EUR 145 626))

In view of the above, the accidents, although leading to train derailment or collision, or fire in RWRS, have caused small damages and consequences, and therefore they have not been subject of investigation by the RAIU..

2. Summary

The activities and relations between the parties in the rail transport sector have been arranged in accordance with the provisions of the national legislation.

The functions of national regulatory and control body are being performed by RAEA (“Railway Administration” Executive Agency) which is also the national authority on safety in rail transport.

3. Investigating authority

The functions of national investigating authority are being performed by the Railway Accident and Incident Investigation Unit within the Directorate for Aircraft, Maritime and Railway Accident Investigation” at the Ministry of Transport, Information Technology and Communications.

- The Railway Accident and Incident Investigation Unit was established by Decree No. 250 (25.11.2005) of the Council of Ministers of the Republic of Bulgaria, Section IIIg, Art. 30D of the Organization regulations of the Ministry of Transport, adopted by Decree No. 4 (2000) of the Council of Ministers, and in relation with Directive 2004/49/EC of the European Parliament and the Council (dated 29.04.2004) concerning railway safety in the Community.
- The Rail Transport Act has been amended and supplemented, effective since 14.11.2006, and Art. 115i and Art. 115k have been added to regulate by law the establishment of Railway Accident and Incident Investigation Unit at the Ministry of Transport.
- A structural reorganization was initiated on 01.08.2008, in accordance with Decree No. 185 (28.07.2008) of the Council of Ministers of the Republic of Bulgaria, and the individual national independent investigating bodies – the specialized units for aircraft, maritime and railway accident investigation, were united within Directorate „Unit for Aircraft, Maritime and Railway Accident Investigation” at the Ministry of Transport.
- By Decree No. 232 (28.09.2009) of the Council of Ministers of the Republic of Bulgaria, promulgated in State Gazette No. 78 of 02.10.2009, effective as of 10.10.2009, amended and supplemented as promulgated in State Gazette in No. 15 of 23.02.2010, Directorate „Aircraft, Maritime and Railway Accident Investigation” at the Ministry of Transport was transformed into Directorate „Unit for Aircraft, Maritime and Railway Accident Investigation” at the Ministry of Transport, Information Technologies and Communications.



Specialized Unit for Railway Accident and Incident Investigation Republic of Bulgaria

- The RAIU investigates severe railway accidents, accidents and incidents which under different circumstances would have resulted in severe railway accidents, and specific accidents and incidents specified by the Minister of Transport, Information Technologies and Communications.
- The RAIU is an independent body in terms of internal organization, legislative structure and the decisions made by the railway infrastructure and carrier operators, and is also independent of the national authority on safety in the making of decisions for the investigation of severe railway accidents and incidents, and carries out the functions and tasks set out below.

Main functions

1. Maintains a system for mandatory and voluntary reporting of accidents and incidents;
2. Organizes and technically controls the investigation of accidents and incidents and assists the work of the commissions established for that purpose;
3. During the investigation of railway accidents, the RAIU analyzes the actions of individuals and legal entities involved in the operation of the railway transport, the railway rolling stock and the infrastructure sites and equipment related to the accident;
4. Maintains records of the investigations and a data base on accidents and incidents;
5. Prepares and publishes information bulletins;
6. Prepares annual reports on its activity;
7. Maintains contact with the authorities investigating railway accidents in foreign countries for the use of their experts in case of severe railway accidents.

Main tasks

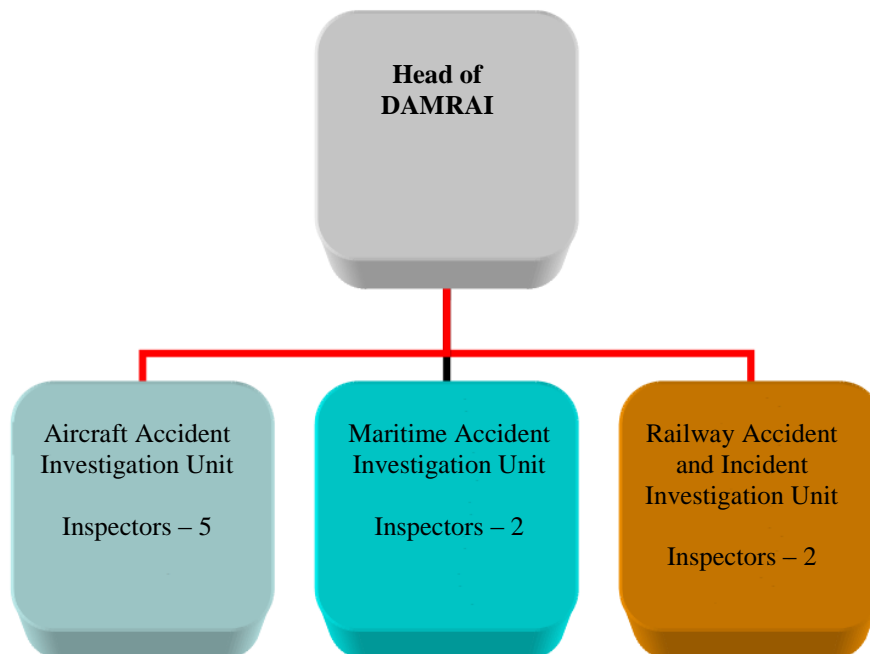
1. Investigation of severe railway accidents and incidents which under slightly different circumstances would have resulted in severe railway accidents, and provision of safety recommendations.
2. Chairs the commissions investigating severe railway accidents and incidents in the territory of the Republic of Bulgaria and in the transborder sections.
3. At its discretion, the specialized unit may take over the investigation of severe railway accidents and incidents which under different circumstances would have resulted in severe railway accidents.
4. Informs the Head of the Directorate about the progress of the technical investigation.
5. Reports drawn up by persons authorized by the head of the investigating commission shall be prepared for each investigation and sent to the Minister, along with recommendations on safety.
6. The RAIU shall participate in working groups and commissions for the preparation of regulations related to the improvement of the technical investigation.
 - The RAIU investigates railway accidents and incidents on the ground of Directive 2004/49/EC concerning railway safety, the Rail Transport Act, Regulation No. 59 on the management of rail transport safety, Regulation No. N-32 for coordination of actions and exchange of information during railway accident and incident investigations.



Directorate for Aircraft, Maritime and Railway Accident Investigation

- Ensures the coordination between the institutions and the legal entities involved in the investigation of aircraft occurrences, maritime and waterway accidents, as well as rail transport accidents and incidents;
- Organizes and participates in international meetings related with the investigation of aircraft occurrences, maritime and waterway accidents, as well as the investigation of rail transport accidents and incidents;
- Maintains contact with the authorities investigating railway accidents in foreign countries for the use of their experts in case of severe railway accidents;

Structure of DAMRAI



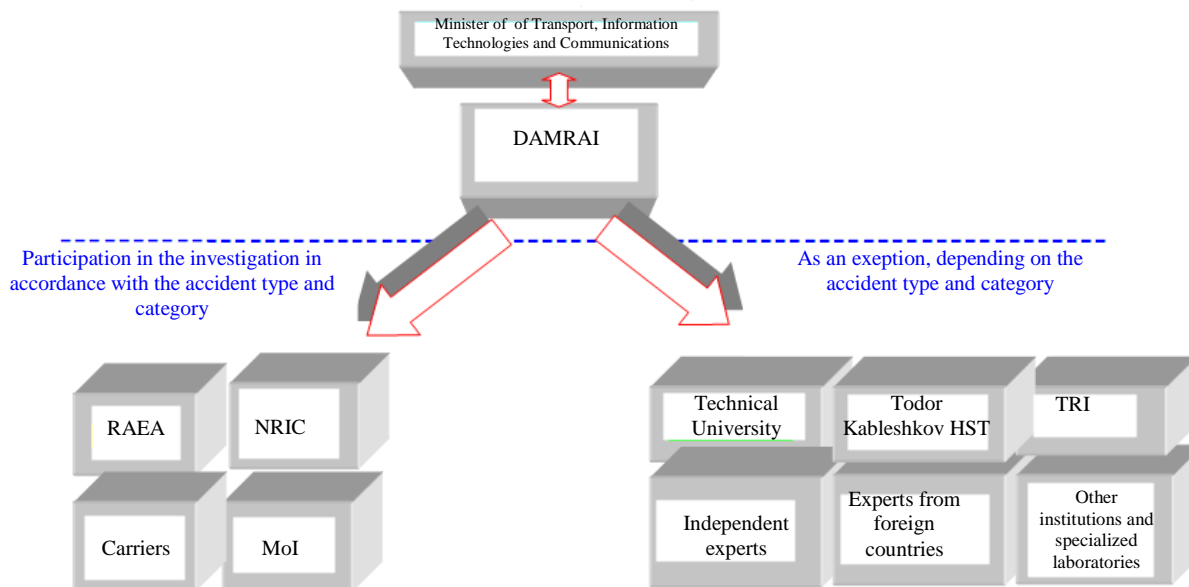
- Each investigation shall be completed with a report to the Minister, along with recommendations on safety.
- The head of the Directorate shall provide the Minister with annual reports on the measures taken and the addressees of the recommendations set out in the reports.
- The inspectors at the Directorate shall have inspector ID cards and passes in the specified form, as approved by the Minister.
- The head of the Directorate shall report to the Minister.
- Directorate for Aircraft, Maritime and Railway Accident Investigation is directly subordinated to the Minister of Transport, Information Technology and Communications.
- The reports on the technical investigations prepared by Directorate UAMRAI shall be published in the website of the MTITC, thus ensuring their publicity and accessibility.



INSTITUTIONS INVOLVED IN THE INVESTIGATION OF RAILWAY ACCIDENTS AND INCIDENTS

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Ministry of Transport, Information Technology and Communications



4. Activity performed by the Railway Accident and Incident Investigation Unit in 2009

- Technical investigation of railway accident: fire in electric locomotive No. 45-167.4 of train composition No. 3601 Sofia – Burgas at 142+580 km, in the Stamboliiski-Todor Kableshkov inter-station section, on road No. 1, which occurred at around 17:55 on 30.11.2009

Locomotive No. 45-167.4 is shown in Figure 1



Figure 1



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- Collection of additional evidences related with the accident of 30.11.2009 and holding of working meetings with the commission for the technical investigation of the accident, and preparation for drawing up the final report on the railway accident investigation, as regulated by Order of the Minister of Transport, Information Technology and Communications (dated 02.12.2009).
- Investigation of the railway accident which occurred on 07.08.2009, at around 13:15 h, at OS Kaspichan. A child climbed to the roof of the isolated locomotive No. 07.74 without permission and supervision. The child moved close to the contact network and was injured, without threat to the life of the child.
- Preparation and participation in a working meeting with RAEA and the company KEMA which has been authorized by the European Commission in connection with the implementation of Directive 2004/49/EC concerning railway safety.
- Explanation of the occurrence of smoke in rail car No. 505229741713 of train composition No. 8626 during travel, which happened on 04.02.2009, at around 22:33 h. The car was detached from the train. It was found that there was a damaged rubber jacket between the electric motor and the turbine causing the gas mixture to enter the car.
- Organization of working meetings with the Commission for the technical investigation of the accident and preparation for drawing up the final report on the railway accident investigation, as regulated by Order of the Minister of Transport, Information Technology and Communications (dated 02.12.2009).
- Preparation and participation in a working meeting with RAEA and the company KEMA which has been authorized by the European Commission in connection with the implementation of Directive 2004/49/EC concerning railway safety.
- During the period April-October 2009, the RAIU inspectors took part in joint comprehensive inspections together with the Regional Railway Inspections Offices of the “Railway Administration” Executive Agency and BDZ EAD in the divisions of the railway company, which resulted in the preparation of respective rail transport safety instructions.
- Working meetings between the DAMRAI inspectors and the managers and transport safety officers of NRIC were held in April 2009 for familiarization with the company's means of objective control and for discussing transport safety issues.
- The final report intended for the Minister of Transport, Information Technology and Communications and concerning the technical investigation of a severe railway accident – fire in train No. 2637 Sofia-Kardam at 137+950 km, in the Kunino-Cherven Bryag inter-station section, which occurred at around 23:20, on 28.02.2008 – was prepared in August 2009. The above report, which conforms with the provisions of Annex V to Directive 2004/49/EC, was sent to the European Railway Agency (ERA). In 2008 the RAIU carried out technical investigation, and 5 (five) interim reports to the Minister of Transport have been drawn up following numerous additional experiments and meetings held by the investigation commission. On the grounds of Art. 8(2), Art. 8(3) and Art. 8(4) of Regulations N-32, the MTITC requested the necessary information and the results of the experts' technical examination of the fire from the Ministry of Interior (MoI), but due to the prejudicial inquiry being carried out by the Regional Prosecutor's Office of the city of Pleven at that time, the above data was not provided. For that reason, the final report was not completed by the end of 2008. Following the receipt of the above data on July 20th, 2009, the final report to the Minister of Transport, Information Technology and Communications was drawn up in August 2009.



Figure 2 shows the couchette-car after the fire



Figure 2

- In May 2009, working meetings were held between DAMRAI inspectors and the transport safety officers of BDZ EAD for familiarization with the company's means of objective control and for discussing transport safety issues.
- In June 2009, working meetings were held between DAMRAI inspectors and the ATSA management and transport safety officers with the aim of exchange of experience.
- Working meetings with the commission members, where, based on an analysis, a joint report intended for the Minister of Transport, Information Technology and Communications was drawn up on the grounds of Order dated 01.12.2009, specifying urgent measures for improving the technical condition of the RWRS and the BDZ EAD rolling-stock safety.
- Participation in an inter-institutional working group together with representatives of MTITC, MoI, RAEA, NRIC and BDZ EAD with the aim of cooperation in railway investigations; the working group has made proposals for legislative amendments.
- Participation in a working group together with representatives of MTITC, RAEA, NRIC and BDZ EAD on the amendment of Regulations Nos. 46, 58 and 59.
- Review and analysis of the railway accidents and incidents occurring at NRIC and the carriers have been performed on a monthly basis.
- Participation of RAIU inspectors in the meetings and workshops of national independent bodies investigating railway accidents in the EU member-states, at the European Railway Agency in Lille, France.
- Participation in the process of defining the internal rules of DAMRAI.
- Daily identification, analysis and clarification of information on railway accidents and incidents.
- In September 2009, in accordance with Art. 23(3) of Directive 2004/49/EC, the 2008 annual report of RAIU (within Directorate for Aircraft, Maritime and Railway Accident Investigation at the Ministry of Transport, Information Technology and Communication) was drawn up and sent to the European Railway Agency.
- Participation (without being members of the technical investigation commission) in the investigation of the accident which occurred on 20.10.2009, at around 18:00 h, involving train No. 50506, powered by locomotive No. 06 – 065, in the inter-station section Kalotina-Stanyantsi, resulting from fire in the locomotive. The accident was caused by fire in the fourth and fifth driving engines of the locomotive. The damages incurred amounted to BGN 53 543 (EUR 27 387.7).



Locomotive No. 06-065 is shown in Figure 5 and Figure 6



Figure 5

Figure 6

- Analysis of the railway accident which occurred on 24.08.2009, at around 20:25 h, in the Katunitsa-Popovitsa inter-station section, as a result of a fire in the sixth driving engine of diesel locomotive No. 10245 of train No. 10245, without participation in the technical investigation commission.
- Daily identification, analysis and clarification of information on the accidents and incidents in the national railway network.
- In September 2009, in accordance with Art. 23(3) of Directive 2004/49/EC, the 2008 annual report of RAIU (within Directorate for Aircraft, Maritime and Railway Accident Investigation at the Ministry of Transport, Information Technology and Communication) was drawn up and sent to the European Railway Agency (ERA).

5. Investigation process

5.1 Occurrences subject to investigation

Mandatory in the meaning of Art. 19, point 1 and non-mandatory in the meaning of Art. 19, point 2 of Directive 2004/49/EC concerning railway safety:

- mandatory – investigation of severe railway accident – fire in train No. 2637 from Sofia to Kardam, with fatalities.

- non-mandatory – investigation of railway accident – fire in electric locomotive No. 45-167.4 hauling train composition No. 3601 from Sofia to Burgas.

6. Investigations

6.1. Overview of completed investigations



Fire in train No. 2637 Sofia-Kardam at 137+950 km, in the Kunino-Cherven Bryag inter-station section, which occurred at around 23:20, on 28.02.2008, which caused 9 fatalities as well as slight injuries to ten persons. There were also material damages. Due to the severity of the accident and the numerous expert examinations, the investigation was not completed until August 2009.

Type of the accidents being investigated (2008-2009)	Number of accidents	Injuries and fatalities		Damages in EUR (approximate) - material
		Fatalities	Serious injuries	
Severe railway accident - fire in RWRS	1	9	no	50 623

6.2 Investigations completed and initiated in 2009

6.3 Investigations completed in 2009

Date of the occurrence	Brief description of the investigation (Type of occurrence, location)	Legal grounds	Completed on ... (date)
28.02.2008	Technical investigation of a severe railway accident – fire in train No. 2637 Sofia-Kardam at 137+950 km, in the Kunino-Cherven Bryag inter-station section (between the warning and traffic lights of Cherven Bryag railway station), which occurred at around 23:20, on 28.02.2008	Orders by the Minister of Transport, Information Technology and Communication. On the grounds of Art.5, point 6 of the RTA, Art. 76, point 1 and Art. 79 of Regulation No. 59	August 2009

6.2 Investigations initiated in 2009

Date of the occurrence	Brief description of the investigation (Type of occurrence, location)	Legal grounds
30.11.2009	Technical investigation of railway accident: fire in electric locomotive No. 45-167.4 hauling train composition No. 3601 Sofia – Burgas at 142+580 km, in the Stamboliiski-Todor Kableshkov inter-station section, on road No. 1, which occurred at around 17:55 h on 30.11.2009	Order by the Minister of Transport, Information Technologies and Communication. On the grounds of Art.5, point 6 of the RTA, Art. 76, point 1 and Art. 79 of Regulation No. 59 and Art. 16 of the SR of MTITC

6.3 Summary of 2009 investigations



Specialized Unit for Railway Accident and Incident Investigation Republic of Bulgaria

Technical investigation of railway accident: fire in electric locomotive No. 45-167.4 of train composition No. 3601 Sofia – Burgas at 142+580 km, in the Stamboliiski-Todor Kableshev inter-station section, on road No. 1, which occurred at around 17:55 h on 30.11.2009.

Locomotive No. 45-167.4 is shown in Figure 7



Figure 7

On 30.11.2009, high-speed fast train No 3601 Sofia – Burgas departed from Sofia station at 16:00 on a regular schedule, the train consisting of 9 coaches, with total weight of 422 t, powered by electric locomotive No. 45-167.4, with engine-driver No. 1 and engine-driver No. 2, both from the Plovdiv locomotive depot, and a trainmaster and a car attendant, both from the Sofia Regional Center for Passenger Transport. No peculiarities in the train composition were noticed by the train operations officer and the switchmen on duty at 17:53, while the train was passing through the Stamboliiski station without stopping. After transiting through the Stamboliiski station at a speed of 98 km/h, on road No. 1, in the Stamboliiski – Todor Kableshev inter-station section, and passing by the station traffic signal installations for the reverse direction, specific smell of burning insulation was felt in the engine-driver's cabin. The engine-drivers looked through the windows of the doors of the engine compartment, but they did not notice any irregularities. Then engine-driver No. 2 stuck his head out of the right side window, looked back towards the train and noticed flame coming from beneath the locomotive and immediately initiated emergency breaking, causing the train to finally stop at 142+580 km at 17:55 h...

Compliance with the operating procedures and technologies in the carrier's rolling-stock system prior to and during the accident.

Train No. 3601 had the required breaking mass and had been furnished with the necessary train documentation and train navigation radio communication system, and the locomotive and train service team members had GSM mobile phones provided by the company.

As a result of the analysis of the collected documents certifying the technical condition of locomotive No. 45-167.4, the scheduled repairs and inspections performed, and the



Specialized Unit for Railway Accident and Incident Investigation Republic of Bulgaria

explanations provided by the personnel involved in the accident, it was found that there were no violations of the operating organization, procedures and technologies.

Locomotive No. 45-167.4 was produced and supplied in 1982. Its book value as of 31.10.2009 was BGN 293 377,65. At the time of the accident, the distances run by the locomotive since the last scheduled repairs and inspections were as follows:

Type of repair	Date of release from repair	Distance run since the respective repair
Major repair (MR)	01.08.1994	1 988 068 km
Mid-life repair (MLR)	01.12.2001	1 002 608 km
Hoist-assisted repair (HR)	27.02.2008	318 540 km
Small periodic repair (SPRP)	11.08.2009	54 000 km
Technical inspection (TI)	20.11.2009	6 040 km

The last operating inspection of the locomotive was carried out in the Plovdiv locomotive depot, at 08:00 on 29.11.2009.

There is a test protocol (dated 28.01.2008) on the electrical insulation strength, the insulation resistance and the grounding resistance of the rectifier cabinet, in accordance with the rules of factory repair, as well as 5 more protocols concerning the electric equipment of the locomotive, all of them confirming the compliance with the standards and requirements.

All repairs of the locomotive have been carried out in accordance with the established repair cycle and the applicable regulations.

The examination of the entries in the log-book and the repair inventory shows that the faults noted in the act orders had been rectified on a timely basis. No information about faults in the electric equipment of the locomotive that could have caused the fire were found in the locomotive passport.

Condition of the railway infrastructure and the rolling stock prior to, during and after the accident

The railway infrastructure was in good working order prior to the incident.

The railway section at 142+580 km forms a horizontal curve with $R = 1800$ m, with rise $H = 65$ mm and slope of 3‰ in the forward direction.

No damages to the railway infrastructure elements were found after the accident.

The rolling stock was in good working order prior to the accident.

The accident has caused damages to locomotive No. 45-167.4 – fire in the first horizontal fan and the engine compartment.

Causes of the accident

As a result of the examinations carried out after the fire, the collected protocols on scheduled repairs and inspections, protocols on the measurements performed, other documentation relating to this case, as well as the explanations taken from the locomotive and train crews and the employees involved, **the investigation commission concluded that:**



- the reason for the fire in Locomotive No. 45-167.4 cannot be unambiguously determined; it can be clearly seen, however, that the lower section of the rectifier unit of Group 1 of the first horizontal fan – the section accommodating the rectifiers for the auxiliary equipment – was most severely affected by the fire, and on this grounds it can be assumed that **the fire in the locomotive was most probably caused by a breakdown of a capacitor of the R-C groups used to protect the auxiliary 220V rectifier from internal commutation over-voltage.** The over-voltage occurring during switching of the rectifiers is generated concurrently with the transition of the P-N junctions of silicon elements (diodes and transistors) from ON to OFF state as a result of the negative bias (U_{rev}) of the sinusoidal voltage wave (i.e., regular switching). The circuit contains a R-C group (capacitor and resistor in series) connected in parallel with each semiconductor rectifier. The capacitor is charged during the half wave causing negative bias voltage at the rectifier P-N junction, which is followed by a period of discharging via the resistor (during which energy is transformed into heat) while there is a conducting bias voltage applied at the rectifier (ON state of the rectifier). During the past 27 years of continuous operation, the nominal performance (capacitance) of the of the capacitors have gradually deteriorated as a result of aging, which is a reason to conclude, with high degree of probability, **that at a certain unpredictable moment there was an explosion (blow-up) of a capacitor caused by an over-voltage pulse, and the resulting sparks caused self-ignition of the capacitor electrolyte. The compact size of the rectifier cabinet (small spacing between the elements) created conditions for a process of avalanche expansion of the fire and ignition of the cables within the rectifier unit, thus causing subsequent blow-up of adjacent capacitors.** The confined design of the rectifier cabinet and the cooling method based on the generation of negative pressure in the air duct by the under-basket fan caused the air to be sucked into the engine department, flowing through the heat sinks of the semiconductor rectifiers and R-C groups in the downward direction to the area under the locomotive. This is the reason why the engine-drivers did not see fire and smoke in the engine department. Then the fire expanded from the rectifier cabinet to the fan via the air duct, causing ignition of its power supply cables, and this was the fire first seen by engine-driver No. 2 when he stuck his head out of the side window and looked back. While the efforts of the locomotive crew were directed at putting out the fire under the locomotive, the fans were put out of operation, as a result of the disconnection of the main air-break disconnecter and the power supply, and the fire expanded inside the engine compartment, filling it with thick asphyxiating smoke from the burning insulation and capacitor electrolyte. This also explains why the engine-drivers' efforts to take out the handheld CO₂ fire extinguishers were unsuccessful. The rapid intensification of the fire and its spreading to the oil-cooling system (oil cooler, pump and oil tubes) of the power transformer and the subsequent melting and burning of the rubber fixtures and seals caused leakage of oil with ignition temperature of 135°C. The ignition of the oil, rubber seals, cable insulation and insulating boards in the rectifier unit under the conditions of intense flow of air caused a rapid rise of the temperature in the engine compartment and intense release of smoke. The breaking of the side windows with the aim of putting the water hoses inside the engine compartment caused inflow of oxygen and subsequent intensification of the fire in the interior.

This fire was not caused by violations or omissions in the maintenance (performance of scheduled and emergency repairs) or operation (depot inspections, etc.) of the locomotive, or deviation from the regulatory provisions concerning the condition of the electric circuits (control measurements), or improper actions of employees.

The damage incurred by the locomotive amounted to around BGN 240 000 (EUR 127 000).



6.4 Investigations which were initiated but not carried on in 2009 – none

6.5 Accidents and incidents during the last four years (2006–2009)

Technical investigations in the period 2006 – 2009

Investigations		2006	2007	2008	2009	
Serious accidents (Art. 19, 1 + 2 of Directive 2004/49/EC)	Collision between trains					0
	Train collision with obstacle					0
	Train derailment	1			1	1
	Accidents at railway crossing	1				1
	Accidents involving persons and caused by moving rolling stock					0
	Fire in rolling stock			1	1	2
	Accidents related with hazardous cargo					0
Others under Art. 21.6	None					0
Incidents					1	1
TOTAL		2		1	1	4

7. Recommendations for organizational and technical and other measures aimed at preventing this type of accidents

The following recommendations have been given in the Final Report on the completed investigation of the accident of 30.11.2009:

Regarding the accident of 30.11.2009 with a final report completed in March 2009.

Proposals (recommendations) for organizational, technical and other measures aimed at preventing this type of accidents.

1. BDZ EAD shall give directions to the competent departments to reconsider the location of the CO₂ fire extinguishers in the engine compartments of all locomotives being currently used, in view of their possible relocation to a suitable place for easier and unobstructed access in case of their use by the engine-drivers.

2. BDZ EAD shall give directions for inspection of the condition of the fire-alarm and fire-extinguishing systems of all electric locomotives being currently used, and find a



technical solution to ensure safer and more efficient way of their activation from the standard places.

3. BDZ EAD shall give directions for the provision of new type of fire-safe dry capacitors for the R-C over-voltage protection units of the rectifiers, in view of their replacement during the next scheduled repairs (hoist-assisted repair, mid-life repair, major repair).

4. A special briefing on fire and accident safety and the actions of the locomotive crews in case of fire in the powered rolling stock shall be conducted by 31.01.2010.

5. By 31.03.2010, BDZ EAD shall notify the chairman of the investigation commission of the measures undertaken with the aim of fulfilling the proposals under the above points 1-4.

The following recommendations have been given in the Final Report on the completed investigation of the accident of 28.02.2008:

1. BDZ EAD shall review and update its regulations regarding fire safety, and specify and submit up-to-date measures for operative control of their fulfillment. BDZ EAD shall notify in writing the Directorate for Aircraft, Maritime and Railway Accident Investigation (DAMRAI) in the Ministry of Transport of the specified measures and their implementation.

2. BDZ EAD shall conduct additional training of the staff for practical familiarization with the operation of various types of fire extinguishers.

3. BDZ EAD shall ensure permanent availability of the necessary operative anti-fire equipment in the trains, and maintain the electric installations of the rolling stock in good working order.

4. "Railway Administration" Executive Agency, in its capacity of a national authority on safety, based on a thorough analysis of the circumstances relating to the case, shall draw up additional proposals for organizational and technical measures to ensure the necessary level of safety, and prescribe them to the railway carriers providing passenger transport services, and provide preventive control for their implementation through General Directorate "Railway Inspection" and its regional railway inspection bodies.

Recommendations based on the analysis of the railway accident which occurred on 24.08.2009, at around 20:25 h, in the Katunitsa-Popovitsa inter-station section, as a result of a fire in the sixth driving engine of diesel locomotive No. 10245 of train No. 10245, without participation in the technical investigation commission:

1. "Railway Administration" Executive Agency (RAEA) shall provide information about the number of locomotives and cars (both passenger and freight) in its fleet which comply with the EU safety standards of operation.

2. RAEA shall inspect the functionality and operational efficiency of the systems for safety control and management used by the railway operators – infrastructure and carriers.

3. RAEA, in its capacity of a national authority on safety, shall present a report on the safety organization, control and management measures it has taken in respect of the railway operators' (infrastructure and carriers) systems and organization for railway safety control and management.



4. RAEA shall prepare a report on the condition and management of railway safety, specifying efficient measures for improvement and ensuring the organization and control of their implementation.

5. RAEA shall provide DUAMRAI with a report on the implementation of the measures specified in the above points 2, 3 and 4.

6. The National Railway Infrastructure Company (NRIC) shall present a report on the condition of the unsafe sections of the railway infrastructure which endanger transport safety and are subject to immediate improvement.

By Order (dated 01.12.2009) of the Minister of Transport, DAMRAI was established with the aim of analyzing the technical and operational condition of the BDZ EAD rolling stock, locomotives and cars. On the basis of the above analysis, the following measures were specified:

- Measures for enhancing the operational safety of the PRS:
 1. BDZ EAD shall develop a plan for phased issuing of safety certificates for HRS with expired certificates;
 2. Enhancement of the quality of the repairs performed at the locomotive depots;
 3. Reduction of locomotive repair-related downtime;
 4. Specialization of the repair depots for specific PRS series;
 5. Fast modernization of specific PRS series;
 6. Renewal of the rolling stock by acquisition of new RHS.
- Measures for enhancing the technical condition and safety of the railway car fleet:
 1. BDZ EAD shall develop a plan for phased issuing of safety certificates for railway cars with expired certificates;
 2. Development of a long-term programme for:
 - enhancement of the repair quality criteria;
 - certification of car repair depots and the personnel carrying out car repair;
 - provision of modern equipment for the car repair depots and introduction of new repair technologies;
 3. Initiation of a procedure for the provision of new passenger cars;
 4. Carrying on and further development of the car recycling activities throughout the country;
 6. Restoration of the automatic locking systems of the entrance doors;
 7. Provision of bogies which are suitable for the conditions in our country in order to prevent the fast wearing out of the wheel rims.
- Due to the considerably deteriorated technical condition of the nonoperational RWRS, locomotives and cars for which there are no plans and no financial and material resources for repair, BDZ EAD suggests that there should be stepwise rejection and liquidation of RWRS.
- Based on the examination, findings and the decisions made, the Commission suggests that BDZ EAD should develop a programme for timely liquidation and release of the nonoperational RWRS and its optimization with the specified time limits of the phases of implementation, with the aim of enhancing the throughput of the railway infrastructure in the locomotive and car depot areas.



Specialized Unit for Railway Accident and Incident Investigation
Republic of Bulgaria

Phase No. 1: 01 .01. 2010 – 31 .03. 2010

Phase No. 2: 01 .04. 2010 – 31 .07. 2010

Recommendations for the period 2006 – 2009

Recommendations		Status of implementation of the recommendations		
		Implemented	In the process of implementation	Not implemented
Year	Number	Number	Number	Number
2006	4	4	-	-
2007	65*	65*	-	-
2008	4+3*-	4+3*-	-	-
2009	39	10	29	-
TOTAL	47+68*	18+68*	29	-

* recommendations based on the planned comprehensive inspections