Ministry for Infrastructure and Transport

DIRECTORATE-GENERAL OF THE ITALIAN RAILWAY INVESTIGATION BODY

Annual Report
2013

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ITALY

Foreword by the Director General

The annual report on the activities of the Directorate General of the Italian Railway Investigation Body, which performs the Investigating Body functions stipulated in Directive 2004/49/EC of the European Parliament and the Council and in Legislative Decree 162 of 10 August 2007, is published each year in accordance with these regulations and summarises the activities performed in the previous year.

During 2013, the Directorate General was confirmed in its opinion about the need to publicise investigation results internationally and within the EU.

It is fully aware that the specific institutional task of implementing the recommendations issued by the investigation body following rail accidents - translating them into more specific technical or regulatory actions - is the responsibility of the direct recipients of these recommendations.

However, and as it has already done previously, the Directorate General has not restricted itself to waiting for the processes started to follow their natural course as a result of actions undertaken by parties like the ANSF [Italian National Safety Authority], the departments in the Ministry for Transport, etc. but has got directly involved in the work of disseminating investigation results by speaking at conferences, bilateral meetings and national and international working groups to clarify the nature, technical details, scope and wider purposes of the recommendations.

It often does this specifically to support the action undertaken by the prime recipients which frequently explicitly ask the investigating body for technical support.

Bilateral meetings were held with more than one EU institution - and also with bodies like OTIF [Intergovernmental Organisation for International Carriage by Rail] - and continued in 2013 with the aim of better clarifying, publicising and defending general and detailed topics that emerged more clearly as a result of the railway investigations.

I wish to give two examples of the above: the investigation into the Viareggio accident and the investigations into the accidents at level crossings in 2012 and 2013.

For the first point, I recall that the issues that primarily characterised our activities in 2012 concerned the conclusions of the investigation into the Viareggio accident in 2009. These clearly showed that the cause of the accident was the lack of proper maintenance of one of the train's freight cars. Shortcomings in maintenance were the cause of failure of one of the car axles due to fatigue. The broken axle caused the derailment of the train carrying liquid gas with disastrous consequences.

Foreword by the Director General

The Directorate General used the recommendations issued in 2012 to illustrate a clear structural deficiency in the European regulatory framework regarding maintenance regulations and the traceability of the maintenance of wagons and critical safety components. (At the time of writing this report, current maintenance regulations still require quality control of industrial processes on a voluntary basis only with regard to the technical details).

The event that occurred at Viareggio highlighted situations where there were serious shortcomings in maintenance of rolling stock. These were also a consequence of the processes for decentralising the activities, making them hard to monitor, especially because of the misguided lack of a core of common regulatory protocols - at least in Europe.

The current European regulatory framework delegates the activities to parties known as ECMs (Entities in Charge of Maintenance) and sets out a long formal chain of control (limited in effect only and at most to process control).

No account is taken, even in a conceptual way, of the fact that for some railway undertakings, seeking cost reductions is a 'must' that takes precedence over every other factor, in its production balance sheet. They clearly do not manage to escape from this, as they ought, by constantly seeking to achieve the highest possible levels of safety.

Consequently, some Undertakings choose outsourced operators simply on the basis that they are certified for maintenance activities.

For these Railway Undertakings, the issue of prior checks on the actual technical reliability and effectiveness of the maintenance activities of the chosen ECM cannot be the deciding factor, as the certification process intervenes to relieve them of their direct responsibility for maintenance. We continue to harbour strong doubts about this system and if the Viareggio accident were not enough, many other accidents since have shown, very clearly, the ineffectiveness of the current system of responsibilities.

These accidents have occurred for reasons that are very similar to the causes of the Viareggio accident, especially with regard to the lack of common regulations across the EU and internationally on systems for maintaining those parts of rolling stock that are more exposed to wear and repeated stress cycles. The most recent derailment at Bressanone stands out as a paradigm of the ineffectiveness of the system of assigning maintenance contracts to ECMs simply on the basis of 'certification'. The cause and dynamics of this derailment are very serious.

Only mere chance prevented the event from having the most serious consequences which could have occurred in only slightly different circumstances of time and place.

Foreword by the Director General

Until the space occupied by chance, understood as the unfathomable and unquantifiable unexpected, can be much more significantly reduced, we consider that the Directorate General should continue to seek support for the idea that maintenance activities on the most safety-critical parts of rolling stock should, mandatorily, have at least common roots in basic regulations, which should be applied at least at EU level.

To give a bit of recent history, we should say that since 2012 we have embarked on a comprehensive programme to publicise the findings from the 2009 Viareggio accident investigations, the recommendations and the reasons for issuing them, both in Italy and, most importantly, throughout Europe (European Commission and European Railway Agency). Our aim in doing this is to prompt the drafting of legal and regulatory acts, applicable not just in Italy but throughout Europe.

In 2013, we still found resistance to accepting the two principles that sum up the spirit of the recommendations, namely the requirement for mandatory basic maintenance processes of railway wagons transporting hazardous materials and the crucial topic of the traceability of maintenance processes and safety-critical components.

In 2013, the concept of 'quality by certification' for maintenance activity was still being strenuously defended, in spite of repeated accidents caused specifically by poor maintenance by certified ECMs.

It has often been the same maintenance body or the same workshop appointed to undertake the work that has been involved in several accidents or in events where there has been a potential risk.

The Directorate General, and especially its international and institutional affairs division, has taken the opportunity of the revision of the package of EU directives on the railways to seek to overcome this resistance, which has prevented - for example - the introduction of the necessary changes to application regulations such as the Technical Specifications for Interoperability (TSI).

We therefore played an active part in 2013 in the technical panels of the Expert Group on Land Transport Security (LANDSEC) in Brussels as part of the Council's activities on the fourth rail package which began in 2013.

Thanks also to interaction with national organisations in other countries some initial amendments partly agreeing in content with the Recommendations now appear in the versions of the 'Safety' and 'Interoperability' directives licensed at the end of 2013 by the Council.

Foreword by the Director General

But it is the European Parliament that has been most receptive in its amendments at the start of 2014 to the directives as debated by the investigating body in international fora during 2012 and 2013.

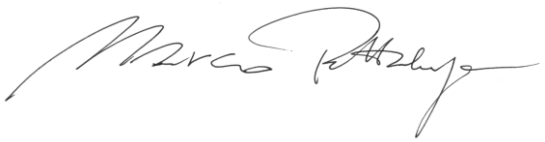
While waiting for the imminent tripartite meeting on the directives by the European Council, Parliament and Commission, we expect that a few fundamental principles on maintenance will finally be recognised in primary EU regulations.

I repeat again, in this report which refers to 2013, that these recommendations are addressed to a railway world that is increasingly more integrated in organisational as well as technical terms. Interoperability between European networks and the cross-border usage of rolling stock both continue to increase. There is a continuing increase in the decentralisation and fragmentation of maintenance activities on rolling stock. This process is probably inevitable with regard to industrial policies but, specifically because it is inevitable, it requires a few, fundamental corrective elements.

Secondly, I would like to refer briefly to the level crossing investigations.

The result of the investigations is encouraging. This is thanks to the practical involvement of the relevant Ministry departments and changes to the Highway Code of a technical nature but also which refer to instructions about behaviour. It has also made possible - at UNECE (United Nations Economic Commission for Europe) level - the direct involvement of the director responsible for international affairs in a special work group on level crossings. This has made it possible to propose content from the work done for a wider regulatory context such as the Vienna Conventions.

Marco Pittaluga



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1. The Directorate General of the Italian Railway Investigation Body

1.1. Regulatory Framework

Legislative Decree No 162 of 10 August 2007, which implements the content of Directive 2004/49/EC, provides for the establishment of the Directorate General of the Italian Railway Investigation Body (DGIF) within the Ministry for Infrastructure and Transport. This provision was implemented by Presidential Decree No 211 of 3 December 2008 (Regulation on the reorganisation of the Ministry for Infrastructure and Transport) and amended by Ministerial Decree No 307 of 2 April 2009.

The amendment to the decree had already entered into effect as of the date of this report's publication, bringing it into line with EU law on the joint nature of investigating actions and judiciary activities.

1.2. Mission and role of the Directorate General

The primary objective of the activities of the Directorate General of the Italian Railway Investigation Body is the improvement of railway safety.

The pursuit of this objective entails the determination of the causes of operating accidents and incidents and the definition of any safety recommendations that might be needed.

Investigations that are initiated in response to railway accidents or incidents (and conducted by the Directorate General's own employees or using outside investigators) set out to identify direct and indirect causes and the causes leading up to the event. The purpose, therefore, is not just to analyse the technical aspects that resulted in the event, but to extend the analysis even further to check for errors and shortcomings in the relevant procedures and regulations.

The final investigation reports include the safety recommendations proposed by the investigating committee or the appointed investigator.

On the basis of the causes that are identified, the Directorate General sets out the official recommendations (derived directly from the ones found in the final investigation report) and transmits them to the interested parties (ANSF, Infrastructure Manager, Railway Undertakings, etc.) and to the ERA (European Railway Agency) together with the report itself. It is important to emphasise that the investigations are not in any way concerned with the determination of civil or criminal liability. These matters are the exclusive responsibility of the judiciary.

It is the recommendations themselves that constitute the core business of the Directorate General. Issue of the recommendations starts a safety improvement process where the recommendations are shared at EU level with partner National Investigation Bodies of other EU member states through the offices of the European Railway Agency.

1.3. Organisation

Ministerial Decree No 167 of 29 April 2011, organises the Directorate General into two divisions:

- *Division 1* - Institutional and international relations, Safety database
- *Division 2* - Investigations into railway accidents

Responsibilities of *Division 1*:

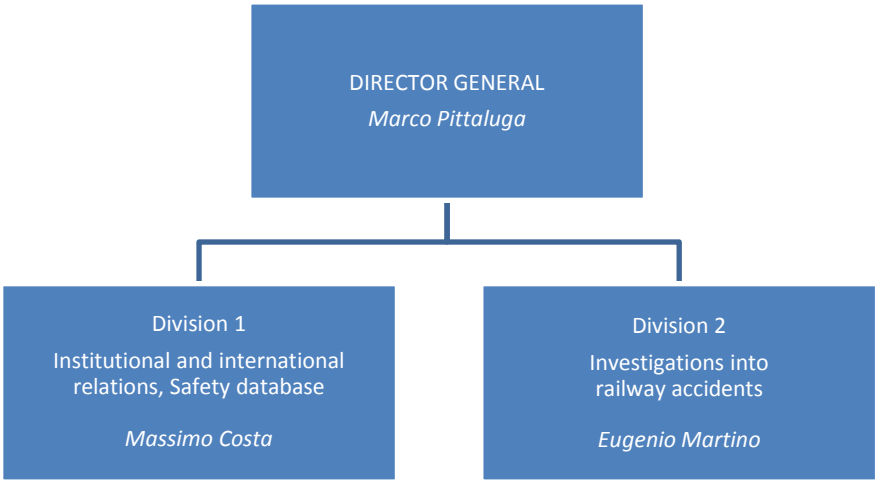
- Relations with the European Railway Agency

1. The Directorate General of the Italian Railway Investigation Body

- Relations with the National Railway Safety Authority
- Relations with the Infrastructure Managers and Railway Undertakings
- Relations with other investigating bodies of the EU
- Relations and conventions with outside entities (Railway Police, Civil Protection, etc.)
- Processing, management and updating of the safety database
- Drafting of the annual report.

Responsibilities of *Division 2*:

- Setting up of Investigating Committees for railway accidents
- Coordination of investigations
- Performance of investigating procedures
- Investigations into operating accidents
- Preparation of safety recommendations pursuant to Article 24 of Legislative Decree No 162 of 2007
- Training of investigating staff
- Preparation, management and updating of a register of experts for appointment to investigating roles.



2. The investigating process and the safety regime

2.1. When investigations are started

The Directorate General of the Italian Railway Investigation Body (DGIF) performs the role stipulated in Directive 2004/49/EC and is tasked with conducting investigations:

- Following serious railway accidents
- Following accidents and incidents that could have resulted in a serious accident (e.g. technical failures in structural subsystems or railway system components) under other conditions.

Investigations are conducted in compliance with EU and national laws and regulations in order to provide recommendations for improving railway safety and accident prevention in Italy as well as other EU member states.

The activities of the various investigating bodies in the EU are framed within a mutual learning process of best practices and an ongoing harmonisation of investigation methods and procedures. There is specific provision for mutual exchanges of the best investigating practices applied by different states in a variety of sectors of relevance to railway operations and railway safety, with the overall system being understood to consist of a variety of different components.

More specifically, it should be noted that for cases in which the opening of a formal investigation is not explicitly required by law, an investigation can be opened by the DGIF on the basis of broader parameters and by the Directorate General, at its own discretion, in the following cases:

- If the event forms part of a series of accidents or incidents of pertinence to the system as a whole
- If the event has a potential impact on railway safety across the EU
- If the media coverage of the event could serve as the preferred channel for publicising the recommendations that follow the investigations
- If requests are submitted by infrastructure managers, railway undertakings or the Italian National Safety Authority.

The Directorate General also considers the key lessons for safety improvement that it wishes to draw from the accident or incident when determining the extent of the investigations and related procedures.

As already mentioned, the law forbids investigations from apportioning blame or liability in any way, and provides that, in the interest of a more effective process, any recommendations must be formulated with clarity and detail but without forgoing the due level of generality in terms of its field of application, as required in the interests of accident prevention.

2.2. Institutions involved in investigations

Investigating activities conducted in 2012 saw the involvement, in various capacities, of the following institutional players:

- The Italian National Safety Authority (ANSF), which is the primary recipient of safety recommendations as provided by Article 21 of Legislative Decree No 162 of 10 August 2007.
- The European Railway Agency (ERA), which is notified of every investigation that is initiated and, in regard to the Viareggio accident, is the recipient of nearly all the recommendations in its capacity as the coordinating body for national agencies.

Its direct involvement was needed to encourage the EU and other international entities (including the OTIF, another addressee of the recommendations) to commit to a re-analysis of the regulatory framework on the two topics already cited above: the traceability of rolling stock and maintenance schedules and the need to define the

2. The investigating process and the safety regime

maintenance operations for safety-critical components of these vehicles and to make these operations mandatory.

- The Ministry for Infrastructure and Transport, which was presented with the recommendation to endeavour to promote the actions described above in the Italian context, especially by virtue of its participation in the RISC (Railway Interoperability and Safety Committee) committee.

2.3. The investigation process and the strategy of the Directorate General

Since 2008, the Directorate General and the national Infrastructure Manager have agreed a notification protocol for accidents and incidents and defined the types of events that must be reported immediately to the Directorate General.

The lines of communication remain open 24 hours a day.

After receiving notification of an event, the Directorate General gathers additional information about the occurrence, if necessary, and decides whether to start an on-site investigation.

If the Directorate General decides to visit the site of the event, all interested parties are informed immediately and action is agreed with the judicial authorities, where the judiciary is involved. The Directorate General and the judiciary act independently for their particular spheres of responsibility.

The investigation thus begins with an initial verification of certain specific conditions:

- Proper functioning of all railway subsystems
- Adequacy and correct application of all safety measures.

Preliminary information is also gathered from the Police, the Infrastructure Manager and Railway Undertakings.

After the preliminary operations have been concluded, the Directorate General collects any information that may help in reconstructing events; this information includes:

- Witness statements
- Operating standards, rules and procedures
- Functioning of rolling stock and technical installations
- Documentation related to the traffic movements
- Human-machine interface
- Safety management system
- Any other elements deemed useful.

At this point analysis of the event begins. The objective of analysis is to clarify the reasons why the event occurred. In this stage, it may also become necessary to acquire additional information and the information collection process is repeated depending on the complexity of the event.

The analysis may also require the assistance of outside experts for specialist topics of particular complexity.

The analysis stage finishes with a reconstruction of the chain of events that took place and details the direct and indirect causes and the causes leading up to the accident or incident.

At this point the Directorate General, after analysis of the causes leading to the event, decides whether a safety recommendation designed to improve rail transport safety at the national and European levels should be issued.

Before the final investigation report and recommendations are published, all of the parties involved in the accident are given the opportunity to make technical contributions to the investigation.

2. The investigating process and the safety regime

All suggestions and observations formulated by consulted parties are limited to factual content and, when deemed pertinent, are taken into consideration by the Directorate General before the final investigation report is published.

3. Investigations in 2013

3.1. Presentation of the investigations into accidents

The Infrastructure Manager must report any accidents that happen on the national network, regardless of their consequences.

There are two types of event that will trigger investigations leading to proposals to improve rail traffic safety. Investigations are started in the event of particularly serious incidents or in the case of occurrences where a fortunate combination of circumstances meant that a potentially serious accident was avoided. Investigations are also started in the case of events that occur too frequently and which require investigation to establish their causes and critical factors.

Reports of accidents or incidents serve as reference points for acquiring the data used by the Directorate. The information is examined to develop a rapid, summary assessment of the occurrence and its severity level and this is then used as the basis for starting an investigation or not.

The types of events investigated in 2013 and their consequences are indicated in *Table 1*.

Table 1 - Events investigated in 2013

Type of event	***Number***	***Number of victims***	
		Deaths	***Serious injuries***
Derailments	2	0	0
Accidents at LXs	2	2	2
Accidents to individual persons caused by rolling stock in motion	3	3	0
Collisions with obstacles	1	2	0
Rolling stock fires	2	0	0
Incidents	0	0	0

3.2. Investigations completed and initiated in 2013

This activity continued in 2013 with the completion of many investigations that were launched in 2012 and the appointment of new Ministerial Committees and Investigating Officers (for details, see *Table 2*).

3. Investigations in 2013

Table 2 - Investigations which included investigative work during 2013

	Date of accident	Place	Incident	Date of conclusion of the investigation (delivery of the final report)
Closed at 31.12.2013	29.06.2009	Viareggio	Derailment of train carrying hazardous materials	31.05.2013
	since 21.04.2010	Miscellaneous	Problems with the operation of level crossings	07.11.2013
	27.02.2012	Bivio Chiusi	Detachment of an access door on train 9482 during travel	08.02.2013
	29.02.2012	Ravenna - Rimini line	Collision between regional train and motor car at level crossing	08.02.2013
	31.03.2012	Policastro, Battipaglia - Reggio Calabria line	Derailment of freight train due to overheating of axle-box	14.02.2013
	26.04.2012	Roma Termini	Derailment of HS train 9643 and collision with HS train 9558	30.05.2013
	14.07.2012	Lavino marshalling point	Derailment of regional train 2885	01.02.2013
	21.09.2012	Bari Parco Nord - Bari S. Spirito stretch	Collision between train 38793 (isolated locomotive) and bus at LX km 604+122	30.05.2013
	24.09.2012	Cisternino, Bari - Lecce line	Collision between HS train 9351 and motor vehicle at LX km 71+403	30.05.2013
	24.11.2012	Rossano - Mirto Crosia stretch	Collision between regional train 3753 and motor vehicle at LX km 155+849	30.05.2013
	18.02.2013	Sondrio - Tirano stretch, at Chiuro	Collision of regional train 5194 with an articulated lorry	02.12.2013
	27.03.2013	Florence - Empoli line, Firenze Cascine station	Fire in the locomotive of regional train 3024	30.07.2013
	12.05.2013	Castello di Godego	Collision of train 20825 with motor vehicle at LX km 37+474	14.10.2013
	31.05.2013	Sesto San Giovanni	Fatal collision with RFI technician during shunting	08.11.2013
Open at 31.12.2013	06.06.2012	Bressanone	Derailment of freight train 44213	*(Concluded on 14.05.2014)*
	07.01.2013	Arezzo - Olmo marshalling point	Fatal collision of train 3099 with a person on the line	*On-going*
	12.05.2013	Napoli Centrale station	Fatal collision with a shunter during a shunting operation	*(Concluded on 10.01.2014)*
	25.06.2013	Formia - Gaeta	Derailment of freight train 60629	*On-going*
	24.10.2013	Locate Triulzi - Milano Rogoredo stretch	Fire in the locomotive of train 50346	*(Concluded on 20.03.2014)*
	07.11.2013	Milan - Bergamo line, between Ambivere and	Collision between train 5036 and ambulance at LX km 16+279	*(Concluded on 28.04.2014)*
	01.12.2013	Foggia - Metaponto line, Cervaro marshalling point -	Derailment of regional train 3546	*(Concluded on 04.07.2014)*

3. Investigations in 2013

3.3. Study and analysis of railway accidents

As part of its efforts to improve railway safety, back in 2011 the Directorate General conducted several investigations into some of the worst problems with the national railway system in addition to other activities designed to lay a methodological foundation for the proactive and in-depth analytical examination of accident events.

All of the level crossing investigations in 2011, 2012 and more recently were thus able to benefit from this methodological foundation, leading to the issue of a comprehensive framework of recommendations on this matter in 2013.

Insufficient resources during 2012 prevented the continuation of this activity, which had laid some important groundwork in the form of a taxonomic classification that is particularly useful in regard to accidents at level crossings.

However, in 2013 it was possible to start a comparative investigation relating to the specific accident rate, characterised by derailments of rolling stock, as soon it was identified even though the funds required were only made available at the end of the year.

3.4. Account of the investigations completed or initiated in 2013

The following provides a detailed account of each individual event that was under investigation in 2013.

29.06.2009 Viareggio, derailment of train carrying hazardous materials

With regard to the accident at Viareggio, the complexity of the topic has been covered in detail in the introduction including, and especially, with regard to the delicate implications for regulatory processes.

An addition to the investigation, concerning the search for the possible cause of the perforation of the tank-wagon that overturned as a result of an axle breaking due to fatigue, was published on 31 May 2013.

Problems with the operation of level crossings at various locations since 21.04.2010

Investigations into operational problems with level crossings being opened wrongly during train transit were completed on 7 November 2013.

The Committee with the remit to ascertain the causes of the events indicated that the direct cause of all the events considered can be attributed to human error.

27.02.2012 Bivio Chiusi, detachment of an access door from HS train 9482 during travel

On 27 February 2012 HS train 9482 from Roma to Brescia was travelling on the line stretch between Bivio Chiusi Sud and Bivio Chiusi Nord. While passing HS train 9647 travelling in the opposite direction in the Casella tunnel of the Rome - Florence DD (express) line, at approximately 19:15, the train's foodservice staff heard an unusual noise while engaged in their work in passenger car 1.

Passing through the connection between passenger cars 1 and 2 and accessing the rear (in the train's direction of travel) entry vestibule of passenger car 2, the staff could see that the rear passenger boarding/alighting door on the right-hand side (in the train's direction of travel) of the

3. Investigations in 2013

passenger car, identified as door 3 of passenger car BB207, was missing.

The door, which had come out of its lower inset due to the breakage of the swivel plate housing the rollers, could no longer withstand the pressure and had detached from the body and pivoted approximately 180° around its point of attachment to the operator door, flying onto the roof and striking the pantograph housed on the roof of body structure 1 and bending its parallelogram. It then struck and destroyed the support rod located between the roof and the opposite side of the wagon, and finally hit the side at three points, damaging an underbody casing.

The direct cause of the event was the breakage of the adjustable roller lever in the guide part of the door.

The indirect cause was incorrect adjustment of the seal hook.

29.02.2012 Ravenna - Rimini line, regional train collision with motor car at level crossing

At approximately 22:00 on 29 February 2012, regional train 11611 from Ravenna to Rimini collided with a motor car that was on the railway track between the half-barriers (properly lowered) of the Automated Level Crossing (ALX) at km 73+423 of the Ferrara-Rimini line (Ravenna-Classe stretch).

The train, which had left Ravenna station at 21:58, reached the ALX at km 73+423 while travelling at approximately 84 km/h and struck the car without derailing, coming to a stop 294 metres past the point of impact.

The accident had the following consequences:

- The death of the motor car driver
- Serious injuries to the two passengers in the motor car
- Withdrawal of the train from service
- Approx. EUR 15 000 of damage to the infrastructure
- Approx. EUR 120 000 of damage to the rolling stock
- Interruption of train operation until 04:25 on 1 March 2012.

The accident's direct cause has been attributed to the unauthorised occupation of the railway track by the driver of the car that was struck by the train while the half-barriers of the ALX were properly closed. This unauthorised occupation of the railway track was the result of an attempt by the car driver to cross the ALX by intentionally executing a slalom manoeuvre around the half-barriers after committing other Highway Code violations.

31.03.2012 Policastro, Battipaglia - Reggio Calabria line, freight train derailment

At approximately 02:16 on 31 March 2013, freight train 57369 derailed in Policastro Bussentino Station while the train was braking to a stop on track II and came to a stop at km 96+229.

The train, which left Roccaravindola at 20:05 on 30 March 2012 heading for Villa S. Giovanni, came to a stop about 45 metres past the point of the derailment, which only involved the front set of wheels (relative to the train's direction of travel) of the second wagon, loaded with beverages.

The axle-box of the first set of wheels was found on the railway track at km 96+186 between the platform and the left-hand rail of the down-line through track. It had triggered the heat detector and absolute selective alarm of the HABD (hot axle box detector) system positioned at km 79+800 between Centola and Celle di Bulgheria stations. The down-line departure signal at Celle di Bulgheria station automatically signalled stop and at the same time the event report reached the control station located in the Sapri Traffic Controller centre.

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No one was injured during the event, which interfered with train operation and caused minor damage to the rolling stock and railway infrastructure involved.

The direct cause of the train derailment was the failure of the axle journal of the leading set of wheels on the left-hand side (relative to the train's direction of travel) of the train's second wagon as a result of the high temperatures that developed inside the axle-box and as a result of it seizing up. The detachment of the axle journal, including the axle-box that fell onto the railway track, removed the support point for the wagon chassis on the left-hand side (relative to the train's direction of travel) at the 15th axle, causing the corresponding left-hand wheel to climb the rail and the right-hand wheel to shift in the track.

The mechanical failure of a component of the rear bearing of left-hand axle-box 1 was a contributing factor. Due to the condition of the materials, however, which were severely compromised by the high temperatures involved, it was impossible to identify the exact starting point of the breakage or the technical cause that initiated the process that damaged the rear bearing. The development of the event also led to the seizing of the front bearing.

The indirect cause was the condition of the location by the down-line track departure signal at Celle di Bulgheria station (an inaccessible area with no footpath, covered with weeds and with low visibility) which prevented immediate detection of the alarm.

26.04.2012 Roma Termini, HS 9643 train derailment

HS train 9643 derailed at Roma Termini station at 18:57 on 26 April 2012. The event caused a collision with HS train 9558, which was in parallel run on an adjacent track at the moment when train 9643 derailed. The impact caused the second train to derail as well.

The direct causes of the derailment were traceable to excessive wear in a switch point at Roma Termini station.

The indirect causes were the failure to intensify inspections of the switch point, in particular the area where a raised section had developed due to the condition of the switch blade. This intensification of inspections should have begun as soon as the first sign of switch point wear was detected.

The accident did not result in any passenger injuries and no injuries to non-railway personnel were reported.

However, slight injuries to the Trenitalia drivers and crew and the foodservice staff on board the train were reported.

The Infrastructure Manager estimated the damage at EUR 1 119 056.00.

The Railway Undertaking estimated the damage to the rolling stock at EUR 2 082 000.00.

14.07.2012 Lavino Marshalling Point, derailment of regional train 2885

At 9:25 on 14 July 2012, Trenitalia regional train 2885, from Voghera to Rimini, while in transit on track II of the Lavino Marshalling Point, with line clear signals, derailed at a speed of 140 km/h at Lavino Marshalling Point switch point 09, which was set for the turnout instead of the correct route. The front of the train travelled about 800 metres before coming to a stop. The presence of maintenance technicians was detected near the switch point.

3. Investigations in 2013

The derailment resulted in extensive damage to the infrastructure and rolling stock. About 250 passengers were on board the train, 30 of whom reported injuries, 1 serious and 29 minor.

The direct cause of the incident was incorrect positioning of switch point 9 in relation to the signalling.

The indirect cause was the incorrect execution of maintenance in relation to current provisions. A description of the activities performed by the maintenance technicians made it clear that the cause of the derailment is attributable to the procedures by which this switch point work had been organised and executed and their non-compliance with the provisions on the execution of safety mechanism maintenance operations and repairs.

21.09.2012 Bari Parco Nord - Bari S. Spirito stretch, collision between isolated locomotive and bus at level crossing

At 7:06 on 21 September 2012, the isolated locomotive travelling as train 38793 collided with a city bus from the city of Bari that had become trapped between the barriers, which had closed properly, in the area of the automated level crossing (ALX) at km 640+122 of the Bari S. Spirito - Bari Parco Nord stretch on the Termoli - Bari Centrale line.

Train 38973 was approximately 250 metres from the LX and travelling at approximately 105 km/h when the driving crew realised that an obstruction, positioned parallel to and alongside the track in the LX area, was occupying the clearance gauge of the rolling stock. They activated the rapid braking system and the acoustic signal, but were unable to stop before reaching the obstruction. The train struck the bus and continued on without derailing, coming to a stop approximately 450 metres past the point of impact. The bus was dragged by the train and came to a stop against the equipment boxes of the ALX at km 640+122.

The two train drivers were injured in the collision and assisted by the emergency ambulance service. The bus driver was treated for shock. Two bus passengers had injuries, but these were not a result of the collision. They were the result of the sudden braking by the bus driver when the bus became trapped between the ALX barriers, which had already closed.

As a result of the collision there was damage to the locomotive (damage estimated at EUR 465 000), the railway infrastructure in the ALX area (EUR 26 000) and the bus.

The direct cause of the accident was the incorrect orientation of the colour-light signal, which was not visible while approaching and crossing the ALX and which does not allow for completion of the manoeuvre within the advance notice time (the period between the illumination of the red colour-light signal and the moment when the barriers start lowering) of the ALX system.

The contributory factors to the accident were:

- the inadequacy of the LX warning traffic signs (both horizontal and vertical) along the route taken by the bus;
- the signs authorising the bus manoeuvre, which was difficult in terms of the minimum requirements for curve negotiation by heavy vehicles as well as the high risk of entrapment;
- visibility problems for the driving crew of the train (who were unable to see the bus in the LX area with sufficient advance notice because it was lengthways to the track rather than crossways).

Paragraph 3, conditions which are also listed under point 4.24 of the Train Traffic Regulations issued by ANSF for the adoption of such devices due to the presence of a junction adjacent to the

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LX and the sharp bends in the approach from Via Macchie.

The causes leading to the accident are considered to be:

• The failure of the Infrastructure Manager to provide a procedure for the driver of the road vehicle to follow in emergency situations, such as the entrapment of a vehicle between properly closed barriers.

• The ineffectiveness of the analysis of potentially hazardous situations by the Infrastructure Manager with respect to past events that occurred under similar circumstances, such as the 12 July 2011 incident on the Vezzano - Parma line.

24.09.2012 Cisternino, train 9351 collision with motor vehicle at level crossing

At 13:33 on 24 September 2012, HS train 9351 was approaching the LX at km 710+403 of the Fasano - Ostuni stretch on the Bari Centrale - Lecce line, by Cisternino station, when it struck an articulated lorry that had been caught between the barriers that had been properly closed.

The impact resulted in:

• the death of the train driver;

• injuries to 20 passengers;

• extensive damage to the rolling stock (estimated by Trenitalia at approximately EUR 7 500 000) and the infrastructure (estimated by RFI at approximately EUR 650 000).

The driver of the heavy goods vehicle was uninjured having left the cab of the tractor unit prior to impact.

The first link in the chain of events leading up to the accident was the entrapment of the articulated lorry between the barriers.

The direct cause of the accident was the error by the articulated lorry's driver, who failed to complete the approach and crossing of the LX in the time allotted by the LX system. There is insufficient information to determine whether the error was a deliberate violation of the Highway Code (by intentionally crossing against a red colour-light signal) or an unintentional accident.

The contributory factors to the accident were:

• Visibility problems for the train driver due to the track layout (curve to the left, station track III, curve to the right just before the LX) and the presence of the platform roofing of track III

• The long distance between the barriers (about 24 metres) that, although in compliance with current regulations, lengthens the amount of time needed to cross the LX and increases the probability of being trapped between them.

The indirect causes of the accident are considered to be:

• The failure to adopt a TV viewing device despite the fact that the LX in question meets the conditions set forth in the IEPL [Level Crossing Operating Instructions] Article 9 paragraph 3, conditions which are also listed under point 4.24 of the Train Traffic Regulations issued by ANSF, for the adoption of such devices, and due to the presence of two road junctions adjacent to the LX and the unusually long distance (approximately 24 m) between the barriers.

The causes leading to the accident are considered to be:

• The failure of the Infrastructure Manager and the Highway Code to provide a procedure for emergency situations, such as the entrapment of a vehicle between properly closed barriers.

• The failure to complete the works needed to remove the LX at km 710+403, as had already been planned as a risk mitigation measure for this LX and approved by the Infrastructure Manager and the owner of the road, resulting in the persistence of the situation over time.

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24.11.2012 Rossano - Mirto Crosia stretch, regional train 3753 collision with motor vehicle at level crossing

At 17:12 on 24 November 2012, Trenitalia SpA regional train 3753 was passing an LX operated by private parties at km 155+849 on the Metaponto - Reggio Calabria line (Rossano - Mirto Crosia stretch) when it struck a motor vehicle with six farm workers on board.

The vehicle was destroyed in the tragic collision and none of its occupants survived.

The direct cause of the accident was the vehicle's presence on the railway track when the train was passing.

The following indirect causes were identified as:

• The absence of suitable protection systems, as required for all systems of this type, for the railway infrastructure side of the privately-operated LX

• the absence of visual/acoustic systems on the road side of the LX in question to signal the arrival of the train as required for all systems of this type and the absence of procedures for requesting informed consent to cross;

• the presence of uncut vegetation along the line and low visibility in the vicinity of the LX, worsened by the height of the crossing which rises and then dips in correspondence with the tracks.

18.02.2013 Sondrio - Tirano stretch, at Chiuro, collision of regional train 5194 with an articulated lorry

On 18 February 2013, on the Sondrio - Tirano stretch of the Lecco - Tirano line, at the km 10+200 marker, approximately 500 metres from Chiuro railway station (marker km 9+709), the through regional train 5194 from Sondrio to Tirano had a head-on collision with an articulated lorry which had come onto the railway track following a manoeuvre aimed at avoiding a road accident involving several vehicles on the adjacent trunk road SS38 of Stelvio.

The impact caused the articulated lorry to be violently turned 180 degrees around on itself towards the roadway, and many fragments of it were thrown onto the SS38 hitting the cars of passers-by that had in the meantime stopped.

The fragments of the heavy vehicle also hit and killed the lorry driver and a person at the scene of the accident. None of the train passengers or the driver was injured.

The direct cause that led to the accident was the manoeuvre of the articulated lorry which, after uprooting the barriers, plunged onto the railway track, remaining wedged on it, until the arrival of the regional train, which could not avoid hitting it even using its emergency braking system.

27.03.2013 Florence - Empoli line, Firenze Cascine station, fire in the locomotive of regional train 3024

On 27 March 2013, at approximately 07:50, there was a fire in locomotive D445.1039 pushing regional train 3024 from the back, on the Siena - Firenze S.M.N. railway line, near Firenze Cascine station.

Train 3024 stopped in Firenze Cascine station, on through track II, before the station departure signal.

The direct cause of the accident was the failure of the weld bead on the top part of the expansion joint of the hot gas exhaust flue from the turbine to the diesel engine set of wheels. The failure generated a 'shrinkage crack' between the inside and outside of the turbine exhaust flue, through which gas jets at very high temperatures escaped, hitting the equipment near the joint and causing the fire.

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The first indirect cause can be ascribed to the lack of integrity controls and to wear of the expansion joint, especially with regard to the thickness of the sheets and the state of the weld beads. The 1st level Maintenance Plans include only functional inspections and checks, whereas the 2nd level plans do not require integrity inspections and/or checks or substitutions.

A further indirect cause can be ascribed to the type of fire safety system on board locomotive D445. The system is 'semi-automatic' where an extinguisher agent is delivered following the activation of a specific command by the driving crew. This means that if a fire breaks out on board, it can quickly turn into a sizable fire in the (non-negligible) time between the alarm being activated and the intervention of the crew.

The hauled rolling stock (four carriages and one cab car) was not damaged and, after workshop checks performed by Trenitalia at the Florence Osmannoro IMC [Current Maintenance Facility], was put back into service. Locomotive D445.1039 suffered substantial damage from the fire and was initially taken to the Florence Osmannoro IMC before being transferred to the Siena IMC, its home depot.

12.05.2013 Castello di Godelo, collision of train 20825 with motor car at LX km 37+474

On 12 May 2013, at 06:15, regional train 20825 hit a car by the LX at km 37+474 by Castello di Godego station on the Bassano del Grappa - Venezia Mestre line. Even though the barriers had been properly closed and the colour-light signals on the road side were active, the car had knocked down the entry barrier to the LX, running onto the railway track a few seconds before the train, which had already entered the track circuit containing the LX, arrived.

The car driver was injured by the impact, with fractures to the jaw, tibia and nose, and there was minor damage to the rolling stock and infrastructure.

The motor car was dragged by the train for 80 metres and carried with the rear part onto the platform of track I of Castello di Godego station.

The car driver was found to have an alcohol level several times above the permitted limit.

The first and only event in the chain of events leading to the incident was the forcing of the LX entry barrier, which had been properly closed, by the car driver who had run onto the roadway of the LX shortly before the train passed.

The direct cause of the accident was the error committed by the car driver who did not stop at the properly closed LX, probably due to his high blood alcohol level.

31.05.2013 Sesto San Giovanni, fatal collision with RFI technician during shunting

On 31 May 2013, at approximately 13:15 at Sesto San Giovanni railway station, through regional train 10623 from Sesto San Giovanni to Brescia, made up of a locomotive and five carriages (one of which was a control car), fatally collided with a technician working for Rete Ferroviaria Italiana (Italian Railway Network), the infrastructure management company, while performing a shunting movement from track VIII to track V.

The technician died in the accident.

No damage was sustained by the infrastructure or rolling stock as a result of the collision.

The direct causes that led to the collision can be attributed to the actions of the driving crew, who performed the shunting movement of regional train 10623 from track VIII to track V at Sesto San Giovanni station from the front cab of the locomotive, without changing control desk before starting the reversing movement from the points area in the direction of track V, and without

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the intervention of the shunter. It can also be attributed to the unauthorised crossing of track V by the technician.

06.06.2012 Bressanone, derailment of freight train 44213

On 6 June 2012, at 11:56, freight train 44213, made up of 21 wagons transporting scrap metal, travelling from Brennero to Brescia depot, derailed by the entry points as it was passing through Bressanone station on track II. During the accident, the whole portion of the superstructure at the entrance to the station was torn off as was part of the electric power supply system.

The direct cause of the accident was the pressing out of the wheels of the 1st and 4th sets of wheels of the first wagon (relative to the train's direction of travel).

The indirect causes of the accident include non-compliance with the regulations on the assembly of wheels on the axles and with the instructions for maintenance and assembly of the sets of wheels provided by the company to its operators and to other operators.

07.01.2013 Arezzo - Olmo marshalling point, fatal collision of train 3099 with a person on the line

On 7 January 2013, Regional Train 3099, from Firenze S.M.N. to Chiusi Chianciano Terme, was running on the down-line track of the Florence - Rome LL (slow) line after the passenger service stop at Arezzo station.

At km 226+200 the driving crew of the regional train reported an impact perceived from the driver's cab. After activating the normal safety procedure and checking that there was no apparent damage, they continued the journey.

IC (Intercity) train 592, from Roma Termini to Trieste, stopped at the protective signal at Arezzo station which was in the stop position.

The accident can be attributed to the unauthorised opening of a door by a passenger, who then alighted. This passenger must have been on IC train 592 according to the ticket found by the Railway Police and cannot have realised, due to the thick fog in the area, that the IC train had not reached Arezzo station.

The passenger managed to alight while the IC train was stopped at the protective signal and, while it was still stopped or after it had departed, crossed the railway track where he was hit by regional train 3099.

The passenger died as a result of the impact.

The primary cause is a maintenance problem that led to the incorrect operation of the mechanical block of the upper pneumatic operator of the door of carriage 5. It closed the door but did not lock it, thus allowing the door to be opened.

The indirect cause was the incorrect behaviour of the conductor (CST) who did not comply with the requirements in DEIF [Railway Undertaking Operating Instructions] 4.4 and with Trenitalia procedures.

12.05.2013 Napoli Centrale, fatal collision with a shunter during a shunting operation

On 12 May 2013, shortly before 14:00, on the track called 'Extension 2 Turnout Track', part of the Napoli Centrale vehicle track set, a manoeuvre to remove a vehicle from a train was in progress.

As the vehicle to remove was the next to last - with respect to the locomotive - of the previous train composition identified as 24302, the last vehicle of the train was uncoupled. After it was uncoupled, the shunting locomotive advanced

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with the remaining coupled rolling stock. This left the uncoupled vehicle separated from the rest of the composition, so that the manoeuvre to reform the composition and remove the vehicle could continue.

The Area Manager then went to the back of the vehicle to be removed, which was still coupled at the front to the composition, to adjust a cable. At that point the vehicle that had just been uncoupled, and separated from the remaining rolling stock, moved along the track in the direction of the natural slope and hit the Area Manager.

Even though the emergency services arrived at approximately 14:00 and he was then taken to hospital, the Area Manager died.

The event did not cause damage to any other people or to the rolling stock.

The direct cause of the event was the sudden, unforeseen movement of the railway car which, after being isolated from the rest of the train, hit the Area Manager.

The indirect cause of the event was found to be the lack of several specific regulations governing the procedures for reforming trains.

25.06.2013 Formia-Gaeta, derailment of freight train 60629

On 25 June 2013, at 02:41, freight train 60629, made up of 17 wagons and drawn by an E652 locomotive, travelling from Torino Orbassano to Maddaloni Smistamento, which was running properly on a clear route, derailed on the fourth track (down-line through track) of Formia-Gaeta station with the last four wagons. The train stopped due to emergency braking as a result of the sudden emptying of the pipe.

The derailment began at the km 118+648 marker between Itri and Fondi-Sperlonga stations, in the Vivola tunnel, where signs of broken sleepers were found. Approximately 170 metres further on, the body of the axle-box belonging to the 1st axle on the right-hand side (relative to the train's direction of travel) of the 15th wagon in the composition and the corresponding right-hand leaf spring were found in the six-foot way.

The derailment was caused by the loss of the axle-box due to the excessive temperature that caused the fusion of the axle journal and the bearings and the resulting damage to the infrastructure for a distance of around 10 km.

The indirect causes of the accident were:

- The frequency of inspections of the axle-box required in the Maintenance Plan, in the case in question, was not adequate to prevent the event
- The faulty management of an advice of damage provided by the HABD (hot axle-box detection) system at Priverno-Fossanova station on 28 May 2013 which did not lead to the activation of the communication flows intended to report the damage to the system maintenance engineer and thus to its being put back into operation, something that would have allowed the train to be stopped at the Control Station and the removal of the wagon due to the abnormal axle-box temperature
- The layout of the Priverno-Fossanova control station proved to be inadequate for presenting advices of damage efficiently to the Traffic Manager.

24.10.2013 Locate Triulzi - Milano Rogoredo stretch, fire in the locomotive of train 50346

On 24 October 2013 at approximately 04:51, on the Milan - Tortona railway line, there was a fire in the locomotive drawing freight train 50346, in service on the Alessandria Smistamento - Chiassa Smistamento stretch.

The train stopped on open track on the up-line, in the Locate Triulzi - Milano Rogoredo stretch at Sesto Ulterano, at the km 5+072 marker.

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The direct cause of the accident was found to be the failure of insulating material inside the direct current filter condenser in the High Voltage Filter (HVF) cubicle at the entrance to the two ARSA static converters. The failure short-circuited the condenser plates and terminals, causing first the oil in the condenser to combust and then the condenser to explode, the content of which hit the equipment and caused the fire.

The first indirect cause was found to be the lack of specific controls of the HVF components, specifically the condenser and the discharge resistance, especially with regard to the presence of bulging, oil leaks, deformations in the insulator anchorage areas, traces of discharges or panelling; the 1st and 2nd level maintenance plans specify only checking the functioning of the power supply, cleaning the filters and visual inspections of the equipment and components.

A further indirect cause was found to be the lack of control desk signals about possible short--circuit conditions of electrical components in HV stations, with the corresponding procedures to follow in the event of the circuit breaker being opened due to a short circuit, and in the lack of HVF block systems.

07.11.2013 Milan - Bergamo line, Ambivere - Cisano Caprino stretch, collision between train 5036 and an ambulance at LX km 16+279

On 7 November 2013, at approximately 09:53, at the automatic level crossing (ALX) at km 16+279 on the Lecco – Brescia line, there was a collision between the locomotive of regional train 5036 and an ambulance crossing the LX in question with the barriers open.

The driving crew of train 5036, which had left Ambivere–Mapello station (km 11+572) at 9:47:45 with the departure signal properly indicating line clear and with the LX barriers properly closed, performed the passenger service at the subsequent station Pontida (km 14+766) and then set off again at 9:51:48 heading towards Cisano-Caprino Bergamasco. At approximately 88 m before the ALX at km 16+279 they saw the motor vehicle in the area of the LX (the barriers of which were improperly open) and activated the rapid braking system and acoustic warning but were unable to stop before the obstacle.

The train struck the ambulance and continued on without derailing, coming to a stop about 277 metres past the point of impact.

The ambulance was dragged several tens of metres and came to a stop on one side of the ballast.

The collision caused the death of two people on board the ambulance, serious injury to the ambulance driver, and minor injuries to the conductor and four passengers on the train that collided with the ambulance.

The collision also caused:

- damage to the rolling stock (especially to the control cab and the carriage) amounting to approx. EUR 206 000;
- damage to the infrastructure amounting to EUR 950;
- the destruction of the ambulance that was hit.

The direct cause of the accident can be attributed to human error (certainly unwitting) by the person who gave the unauthorised command to open the barriers without checking whether there was a train present on the stretch or not.

The contributory cause of the accident in question is the failure, by the TC (Traffic Controller) of Ambivere M, to comply with the provisions of Article 6.5 of the IEPL [Level Crossing Operating Instructions] and with those of Chapter III.1.B of the Ambivere RDS [Service Order Registers] M365. It is clear that if the Ambivere M TC had asked the Traffic Coordinator in good time for intervention by the signalling installation technicians after the first

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activation of the level crossing release lever (at 08:41:06.9), the reopening of the barriers at 09:52:54.9 would have happened, at best, with the LX manned, and thus, the accident would very likely not have happened.

01.12.2013 Foggia - Metaponto line, Cervaro Marshalling Point – Ordona stretch, derailment of regional train 3546

On 1 December 2013 regional train 3546 left Potenza at 21:05 heading for Foggia.

At 22:48, the power car, while travelling at approximately 90 km/h, reached a hydraulic divert located at the km 15+450 marker. It suddenly derailed here, because of the bowing of the superstructure caused by a stretch of the railway embankment below having been carried away due to flooding caused by the overflowing of the Carapelle torrent and the Ponte Rotto canal.

The driver and conductor were seriously injured in the accident. They received first aid and were taken to Foggia hospital.

The two passengers on board received minor injuries.

Material damage to the infrastructure was quantified at approximately EUR 1 400 000.

The rolling stock suffered less damage.

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3.5. Accidents and incidents investigated during the last five years (2009-2013)

Table 3 presents a summary of the different types of events investigated by the Directorate General since 2009.

Table 3 – Events investigated from 2009 to 2013

Events investigated		2009	2010	2011	2012	2013	TOT
Serious accidents	Collisions between trains	0	0	0	0	0	0
	Collisions with obstacles	0	0	0	0	1	1
	Derailments	3	0	1	3	1	8
	Accidents at LXs	0	0	1	3	1	5
	Accidents to individual persons caused by rolling stock in motion	1	0	1	0	3	5
	Rolling stock fires	0	0	1	0	0	1
	Hazardous materials	0	0	0	0	0	0
Other accidents	Collisions between trains	1	0	0	0	0	1
	Collisions with obstacles	0	0	1	0	0	1
	Derailments	1	0	2	1	1	5
	Accidents at LXs	0	0	1	1	1	3
	Accidents to individual persons caused by rolling stock in motion	0	0	0	0	0	0
	Rolling stock fires	0	0	0	0	2	2
	Hazardous materials	0	1	0	0	0	1
Incidents		1	3	2	1	0	7
TOTAL		7	4	10	9	10	40

4. Other activities of the Directorate General in 2013

In 2013, the Directorate General continued to engage in activities that are preparatory and complementary to the investigations.

As regards its international activities, we have already mentioned how the Directorate General continued to publicise the findings from the Viareggio investigation and the resulting recommendations, continuing a consistent dialogue with the European Commission and European Railway Agency.

These institutions have still not shown conclusive and convincing signs of agreeing with the general principles of making maintenance protocols on railway wagons mandatory.

The Directorate General engaged personally in the activity of amending EU directive 2004/49/EC on safety and railway interoperability directive 2008/57/EC, taking part in the work panel set up in Brussels in the Working Party on Land Transport at the Council.

Some initial results at least concerning the traceability of freight wagons and their maintenance activities seem to have been agreed by the European Commission but the topic of the principle of decreeing specific maintenance protocols is still open.

On the date of drafting this report, we are waiting for the work in Brussels to continue to achieve the result of having this principle - which is already in primary European regulations - confirmed, a position shared to date by the European Parliament.

The activity of publicising the results of the investigations into level crossings has seen significant successes in practical terms by the start of the introduction of the Directorate's recommendations, in the area strictly related to the railways and in the area of road traffic regulations.

The involvement in the WP1 work group panels on safe mobility, a group operating in the wider context of the Land Transport Committee of the UN Economic Commission for Europe, represents the best example of this publicising action.

5. Recommendations

5.1. Brief remarks and presentation of the Recommendations

Pursuant to Legislative Decree No 162/2007, the Directorate General uses the causes identified during investigations to define recommendations, which are then transmitted to the interested parties (ANSF, Infrastructure Manager, Railway Undertakings) and to the European Railway Agency (ERA).

As a result of the investigations completed in 2013, the investigating body issued a number of recommendations to the bodies responsible for safety.

5.2. Recommendations in 2013

Table 4 summarises the recommendations issued in 2013.

Table 4 - Recommendations issued by the Directorate General in 2013

Date of accident	*Place*	*Problem*	*Date of Recommendation*	*Recipient of Recommendation*	*#*	*Recommendation*
14/07/2012	Lavino marshalling point	Derailment of train 2885. 26 minor injuries, damage to rolling stock and infrastructure	28/02/2013	ANSF	1.	We recommend that the Italian National Safety Authority endeavours to ensure that RFI makes its own structures and employees concerned aware of the provisions on maintenance of field equipment, especially with regard, where necessary due to the special nature of the work, to halting operation on the stretch undergoing maintenance work and consequently that it instructs employees charged with maintenance work to follow strictly the maintenance management system. The latter should include operating methods that are consistent with the conditions of use of the infrastructure and systems and should make clear under what restrictions operations may continue in relation to the various types of maintenance. The aim of this is also to have evidence and traceability of the operating conditions under which each maintenance operation is performed.
				ANSF	2.	We recommend that the Italian National Safety Authority endeavours to ensure that RFI devises a procedure that is self-protecting and thus fail-safe, aimed at preventing employees performing maintenance operations from operating without the explicit consent of the Traffic Controller, with particular reference to unmanned operating posts.
27/02/2012	Bivio Chiusi	Detachment of access door ETR 485/36 (train 9482)	28/02/2013	ANSF	1.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertaking Trenitalia SpA reorganises its documentation management procedures, introducing a communications protocol for its suppliers to check that design and maintenance documents are updated and amended.
				ANSF	2.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertaking Trenitalia SpA implements an action to amend or improve its control system procedures, by means of which its technical staff check works on their completion, whether these checks are performed in-house or are outsourced. These procedures should include preparing and using a specific checklist.
				ANSF	3.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertaking Trenitalia SpA plans an action to reorganise archived technical documentation, especially with regard to documentation relating to the safety bodies.
				ANSF	4.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertaking Trenitalia SpA amends, quickly and in accordance with the existing orders or standards, the design of the door (which currently has a contact that detects the 98% closure of the door), ensuring that the centralised monitoring of the state of the doors also uses this information to give the signal that the doors have been locked on the train driver's control desk.
				ANSF	5.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertaking Trenitalia SpA ensures continuity in training and updating skills of train crews, with regard to the methods for the timely and immediately effective use of the devices provided to signal emergencies. This should be done ensuring updates are given promptly when orders are issued by the Infrastructure Manager regarding the use of the GSM-R (Global System for Mobile Communications - Railways) network.
				ANSF	6.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertaking Trenitalia SpA guarantees, when inspecting the

5. Recommendations

Date of accident	*Place*	*Problem*	*Date of Recommendation*	*Recipient of Recommendation*	*#*	*Recommendation*
						safety components, the use of original spare parts or parts equivalent to original spare parts as well as the regular use of qualified labour.
				ANSF	7.	We also recommend that the Italian National Safety Authority endeavours to ensure that the Infrastructure Manager prepares and implements a plan to measure and check the GSM-R coverage of the network and, where it proves necessary, prepares improvement actions, especially along stretches with tunnels.
31/03/2012	Battipaglia - Sapri line. Policastro	Derailment due to overheating of axle-box	05/04/2013	ANSF	1.	We recommend that the Italian National Safety Authority promotes activity by the Infrastructure Manager so that the areas identified where trains can stop in the event of a 'hot-axle box selective alarm' so that the driving crew can perform the technical investigations safely, are adequate in terms of size, establishing, where necessary, the minimum requirements for this purpose, including the accessibility of the location and the sufficient visibility conditions.
				ANSF	2.	We recommend that the Italian National Safety Authority promotes the following initiatives by the Infrastructure Manager and the Railway Undertakings, to ensure that the thermal state recorded when axle-boxes are monitored is as free as possible from subjective interpretation: • Continuity in the training and updating of skills of on-board staff charged with checking that the thermal state of the axle-boxes is recorded, concerning methods for performing the inspections, taking account of feedback from previous episodes • Amending of form M40 RTB, annexed to Order No 48/2001 concerning the 'Regulations for the operation of hot axle box detection (HABD) systems', inserting special boxes to record the temperatures recorded by the HABD system following an absolute and/or relative selective alarm (measurements made available to the Control Station) • Providing the driving crews of trains operating on railway lines equipped with HABD systems of appropriate heat detection instruments, which are necessary for judging objectively whether it is appropriate to allow the train to continue or not.
				ANSF	3.	We recommend that the Italian National Safety Authority raises the awareness of the Railway Undertakings so that they undertake to integrate appropriately the existing detailed procedures, issued pursuant to Article 1(8) of Order No 48/2001, so that the following can be shown unequivocally: • The technical instruments provided • The maximum temperatures, by type of material, beyond which the material concerned must be removed from operation.
				ANSF	4.	We recommend that the Italian National Safety Authority promotes specific measures, intended to check freight trains, to achieve a greater level of reliability concerning the actual weight of the freight load transported, including in relation to the maximum permissible axle load.
				ANSF	5.	We recommend that the Italian National Safety Authority calls for compliance with the orders regulating the methods for performing a shunting movement of a train without a conductor in an unmanned station managed remotely, as in the specific case of reversing movements. It should also assess any actions to improve the orders.
29/02/2012	Ravenna - Rimini	Collision between a passenger train and a motor car at the level crossing, 1 dead and 2 seriously injured	15/04/2013	ANSF	1.	We recommend that the Italian National Safety Authority requests the Infrastructure Manager RFI to perform the following assessments: 1) Whether it is worthwhile replacing the current system of half barriers at the LX where the incident took place, with a system with full barriers, to constitute a deterrent to the unsatisfactory behaviour of road users, in view of the high level of vehicle traffic in the area.
				ANSF	2.	We recommend that the Italian National Safety Authority requests the Infrastructure Manager RFI to perform the following assessments: 2) Extend this analysis to other LXs with half barriers still in operation for which similar considerations are valid.
12/07/2011	Parma - Vicofertile stretch	Collision with lorry at level crossing	02/05/2013	ANSF	2.	The Italian National Safety Authority endeavours to ensure that the Infrastructure Manager, in agreement with the individual departments responsible for managing roads with level crossings, adopts the possible measures for general improvement to the recognition and visibility of the level crossings, including by means of changes to local roads.
				MIT - DGSISTRA	3.	The Directorate General for Road Safety of the Ministry for Infrastructure and Transport should assess every appropriate action to undertake and propose to that department's Legislative Office amendments or improvements to the regulatory framework and/or implementing regulations, so that the recognition of level crossings on the road side is improved, increasing the effectiveness of the orientation and positioning of the visual signalling systems and providing for appropriate repetition of the road signs from all directions approaching the intersection, taking due account of the actual layout of the access roads to the LX.
				ANSF	4.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager informs road users of the behaviour referred to in Recommendation 4 below, by installing appropriate and effective signs and/or posters inside the level crossing, which are clearly visible - including from the

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Date of accident	*Place*	*Problem*	*Date of Recommendation*	*Recipient of Recommendation*	*#*	*Recommendation*
						driver's seat - by road users trapped within the level crossing itself, assessing the hypothesis of installing them on the inner side of the barriers as well.
				MIT - DGMOT	5.	Bearing in mind that Legislative Decree No 285 of 30 April 1992 'New Highway Code' as amended, states in Article 147 – 'Behaviour at level crossings' – paragraphs 4 and 5 that: c.4 'Road users must clear level crossings promptly. If the vehicle is forced to stop, the driver must try to move it off the tracks or, if that is physically impossible, must do everything possible to avoid any danger to people, and ensure that drivers of vehicles on the rails are notified in good time of the existence of the hazard' c.5 'Anyone who violates the provision in this article is liable to the administrative sanction of payment of an amount ranging from EUR 84.00 to EUR 335.00 The Directorate General for Motor Vehicles of the Ministry for Infrastructure and Transport should assess whether to undertake appropriate action and propose to that department's Legislative Office legislation to send to the Legislator, aimed at ensuring that amendments consistent with the legislative framework of the Highway Code and its implementing regulation can be accepted, aimed at explicitly highlighting that the driver of a vehicle trapped between the barriers of a level crossing after they close should force his way through the level crossing barriers, knocking them down, and that this behaviour meets the general tenor of paragraph 4 above and constitutes practice aimed at averting the condition of impending danger. Similarly, it should also be emphasised that, if a vehicle has stopped between closed barriers and can no longer be operated, then the road user's action of knocking down the barriers manually will activate the railway traffic control systems in many types of railway equipment, so this action will encourage arriving trains to be stopped, fulfilling the requirement of aforementioned paragraph 4. The Directorate General for Motor Vehicles therefore should assess appropriate actions to undertake to ensure that the previous fundamental concepts are included in the training of road drivers and form part of the process for issuing driving licenses.
				ANSF	6.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager increases the dissemination of devices to check whether it is safe to go across level crossings which are equivalent in effect to those defined in the RFI Level Crossing Operating Instructions. The Infrastructure Manager should adopt an implementation plan that considers as a priority the installation of the devices at level crossings identified as critical. This plan must also take account of the priority requirements indicated in point 4.24 of the ANSF 'Railway Traffic Regulations' and of the systems identified in chapter 2.3 of the analytic study on railway accident rates concerning level crossings, produced by this Directorate General.
				ANSF	7.	The Italian National Safety Authority should assess whether it is worthwhile for the Infrastructure Manager to plan the general installation at level crossings of information panels giving data identifying the level crossing and the telephone number to contact to report promptly and effectively to rail traffic control staff the presence of an obstacle on the railway track at the level crossing itself.
				MIT - DGSISTRA	8.	The Directorate General for Road Safety of the Ministry for Infrastructure and Transport should assess whether it should undertake an appropriate action and propose to that department's Legislative Office amendments or improvements to the regulatory framework and/or implementing regulations to send to the Legislator, so that it is possible for the departments owning the roads to install systems for automatic detection of road violations at level crossings, in order to discourage unlawful behaviour by road users.
				ANSF	9.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager undertakes to monitor the actual closure times of level crossings and adopts appropriate solutions to ensure that these times are generally restricted to a maximum time that will not lead road users to wrong and/or dangerous behaviour.
				ANSF	10.	The Italian National Safety Authority should assess whether it is worthwhile for the Infrastructure Manager to plan the general adoption of a suitable shape for barriers that is compatible with the existing facilities and constitutes a physical deterrent to pedestrians and cyclists passing under these barriers when they are lowered.
23/07/2011	Monza - Arcore stretch	Series of collisions at the level crossing	02/05/2013	ANSF	2.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager, in agreement with the individual departments responsible for managing roads with level crossings, adopts the possible measures for general improvement to the recognition and visibility of the level crossings, including by means of changes to local roads.
				MIT - DGSISTRA	3.	The Directorate General for Road Safety of the Ministry for Infrastructure and Transport should assess every appropriate action to undertake and propose to that department's Legislative Office amendments or improvements to the regulatory

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Date of accident	*Place*	*Problem*	*Date of Recommendation*	*Recipient of Recommendation*	*#*	*Recommendation*
						framework and/or implementing regulations, so that the recognition of level crossings on the road side is improved, increasing the effectiveness of the orientation and positioning of the visual signalling systems and providing for appropriate repetition of the road signs from all directions approaching the intersection, taking due account of the actual layout of the access roads to the LX.
				ANSF	4.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager informs road users of the behaviour referred to in Recommendation 4 below, by installing appropriate and effective signs and/or posters inside the level crossing, which are clearly visible - including from the driver's seat - by road users trapped within the level crossing itself, assessing the hypothesis of installing them on the inner side of the barriers as well.
				MIT - DGMOT	5.	Bearing in mind that Legislative Decree No 285 of 30 April 1992 'New Highway Code' as amended, states in Article 147 – 'Behaviour at level crossings' - paragraphs 4 and 5 that: c.4 'Road users must clear level crossings promptly. If the vehicle is forced to stop, the driver must try to move it off the tracks or, if that is physically impossible, must do everything possible to avoid any danger to people, and ensure that drivers of vehicles on the rails are notified in good time of the existence of the hazard' c.5 'Anyone who violates the provision in this article is liable to the administrative sanction of payment of an amount ranging from EUR 84.00 to EUR 335.00' The Directorate General for Motor Vehicles of the Ministry for Infrastructure and Transport should assess whether to undertake appropriate action and propose to that department's Legislative Office legislation to send to the Legislator, aimed at ensuring that amendments consistent with the legislative framework of the Highway Code and its implementing regulation can be accepted, aimed at explicitly highlighting that the driver of a vehicle trapped between the barriers of a level crossing after they close should force his way through the level crossing barriers, knocking them down, and that this behaviour meets the general tenor of paragraph 4 above and constitutes practice aimed at averting the condition of impending danger. Similarly, it should also be emphasised that, if a vehicle has stopped between closed barriers and can no longer be operated, then the road user's action of knocking down the barriers manually will activate the railway traffic control systems in many types of railway equipment, so this action will encourage arriving trains to be stopped, fulfilling the requirement of aforementioned paragraph 4. The Directorate General for Motor Vehicles therefore should assess appropriate actions to undertake to ensure that the previous fundamental concepts are included in the training of road drivers and form part of the process for issuing driving licenses.
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				ANSF	9.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager undertakes to monitor the actual closure times of level crossings and adopts appropriate solutions to ensure that these times are generally restricted to a maximum time that will not lead road users to wrong and/or dangerous behaviour.
				ANSF	10.	The Italian National Safety Authority should assess whether it is worthwhile for the Infrastructure Manager to plan the general adoption of a suitable shape for barriers that is compatible with the existing facilities and constitutes a physical deterrent to pedestrians and cyclists passing under these barriers when they are lowered.

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Date of accident	*Place*	*Problem*	*Date of Recommendation*	*Recipient of Recommendation*	*#*	*Recommendation*
29/06/2009	Viareggio	Derailment of freight train carrying hazardous materials	31/05/2013	ANSF	12.	ANSF should consider whether to require the Infrastructure Manager RFI either to: • Devise and implement a plan for the gradual removal of curve markers following a process starting from the most highly exposed sites, in terms of surrounding urbanisation, replacing them with systems for horizontal-vertical control of the geometrical stability of the curves characterised by a zero value with respect to the risk of establishing a cutting and/or tearing element • Start the gradual installation of systems for protection and confinement of the markers which annuls the intrinsic potential for becoming cutting and tearing elements, again following the principle of hierarchical primacy of the most highly exposed sites in terms of surrounding urbanisation.
				ANSF	13.	ANSF should consider whether it is worthwhile requesting RFI, the Infrastructure Manager, to perform an analysis and consequent overall assessment of the potential risk of equipment or infrastructure components constituting a cutting and/or tearing element if such equipment or infrastructure components can be technically eliminated or substituted in order to reduce the level of risk.
21/09/2012	Bari Parco Nord - Bari Santo Spirito section	Collision of Trenitalia train 38793 (isolated locomotive) with bus at ALX 604+122	29/07/2013	ANSF	2.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager (IM) assesses how to guarantee an advance notice period (time between the red light of the colour-light signal coming on and the barriers starting to lower) at level crossings, which takes account of: • Situations that might affect the movement of road vehicles (for example the presence of road junctions near the LXs) • The length of vehicles permitted on the roads • The actual distance between the entry and exit barriers calculated according to the direction of movement of the road vehicles. Considering the current criteria in use by the IM, we recommend that, for all LXs, a minimum advance notice period should be assessed of: • 5 seconds, for roads with a restriction on vehicles more than 11 metres long • 7 seconds for roads with no limit to the length of vehicles. We recommend that it assesses whether to increase these minimum times in specific cases (such as, for example, where the LXs are near road junctions and the approach speed might be very low because the road vehicle might start from a standstill to pass the junction by the LX or in cases where the LXs are habitually subject to heavy traffic so that road vehicles are forced to stop right next to the barriers and thus to start off from a standstill): merely as a hypothesis, which has not been analysed exhaustively and should be by the IM, the existing technical literature provides for respective increases of up to 10 seconds and up to 12 seconds for the two situations described above. We also recommend assessing further increases of these times of the order of 1 second for every 3 metres above the 15 metre length of the road crossing or actual distance between the barriers. In the case of a LX with single complete barriers, we recommend assessing the possibility of adding a final free time to the minimum advance notice time designed and defined above in order to ensure the crossing is cleared as the whole length of the vehicle must also pass the second barrier in the direction of travel. We suggest assessing a further 5 second delay as free time for this function.
				ANSF	3.	The Italian National Safety Authority should endeavour to ensure with regard to the IM that works aimed at removing LXs and already completed as in the specific case of the Cisternino LX, should be put into operation as quickly as possible with the resulting removal of the LX as soon as the administrative procedures have been completed.
24/09/2012	Cisternino, Bari - Lecce line	Collision of Trenitalia train 9351 (Frecciargento) with a motor vehicle at LX km 71+403	29/07/2013	ANSF	2.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager (IM) assesses how to guarantee an advance notice period (time between the red light of the colour-light signal coming on and the barriers starting to lower) at level crossings, which takes account of: • Situations that might affect the movement of road vehicles (for example the presence of road junctions near the LXs) • The length of vehicles permitted on the roads • The actual distance between the entry and exit barriers calculated according to the direction of movement of the road vehicles. Considering the current criteria in use by the IM, we recommend that, for all LXs, a minimum advance notice period should be assessed of: • 5 seconds, for roads with a restriction on vehicles more than 11 metres long • 7 seconds for roads with no limit to the length of vehicles. We recommend that it assesses whether to increase these minimum times in specific cases (such as, for example, where the LXs are near road junctions and the approach speed might be very low because the road vehicle might start from a standstill to pass the junction by the LX or in cases where the LXs are habitually subject to heavy traffic so that road vehicles are forced to stop right next to the barriers and thus to start off from a standstill): merely as a hypothesis, which has not been analysed exhaustively and should be by the IM, the existing technical literature provides for corresponding increases of up to 10 seconds and up to

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				ANSF	3.	The Italian National Safety Authority should endeavour to ensure with regard to the IM that works aimed at removing LXs and already completed as in the specific case of the Cisternino LX, should be put into operation as quickly as possible with the resulting removal of the LX as soon as the administrative procedures have been completed.
24/11/2012	Sibari - Reggio Calabria line, Rossano-Mirto Crosia stretch	Collision of Trenitalia train 3753 with a motor vehicle at the LX km 155+849	29/07/2013	ANSF	1.	The Italian National Safety Authority should endeavour to ensure that the Infrastructure Manager performs appropriate analysis, aimed at checking the conditions for the title of parties licensed to cross LXs for private use, arranging for the removal of the LX where it is found that the easement of necessity of the property has ceased or the private parties have no interest in crossing the railway line in order to reach the property and, therefore, there is the possibility of a performance agreement to remove those level crossings whose infrequent use makes it appropriate to remove them.
				ANSF	2.	The Italian National Safety Authority should ensure that the Infrastructure Manager endeavours to check, for the remaining level crossings in private use after the assessments and any subsequent actions arising from the analysis referred to in Recommendation 1 have been performed, the level of risk of their use in accordance with the parameters of visibility and maximum authorised speeds on the line stretch concerned. Following this analysis, the Manager should adopt appropriate measures to reduce the level of risk, consisting, either of: • Adopting protection devices similar to those adopted for public LXs • Adopting protection devices at least equivalent to those of public LXs in terms of type of road-side signals, subject to ensuring that the level of risk is comparable to the systems referred to in the previous point Even if it does not adopt protective devices, it should, in accordance with the previous points: • Define specifications for each individual crossing related to the clear sighting distance according to the speed of the train, aimed at defining the minimum time required to pass and clear the railway track, including methods and ways of implementing them in complete safety. RFI is responsible for analysing and defining these specifications correctly and they must be clearly indicated in the agreement between RFI and the owner of the property with the easement. The agreement must clearly indicate that the obligation to be fulfilled at the transit, in accordance with the conditions set out in the agreement, is the responsibility of the owner of the property or of the person appointed by that owner and that the obligation cannot be fulfilled by others not declared in the agreement itself. This possibility may be implemented only when there is a level of risk no higher than that which would exist if the protective devices referred to in the previous points were adopted. Whichever of the above provisions are adopted, even if they are different for each individual crossing, they must always be such as to substantially lower the hazard level in any weather and lighting conditions.
26/04/2012	Roma Termini station	Derailment of train 9643 and subsequent impact with train 9558	29/07/2013	ANSF	2.	We recommend that the Italian National Safety Authority endeavours to check that the Infrastructure Manager undertakes to complete the detailed analysis of the maintenance state of the entire infrastructure system of Roma Termini station to restore the optimal condition of the state of the superstructure as specified in the emergency recommendation issued on 30 April 2012, or to ascertain that the Infrastructure Manager has already implemented the requirement just described.
				ANSF	3.	We recommend that the Italian National Safety Authority checks what actions the Infrastructure Manager has taken, if already undertaken, to check the maintenance state of the entire national railway network.
				ANSF	4.	We recommend that the Italian National Safety Authority examines the effectiveness of the procedures implemented by RFI to perform exhaustive, systematic and traceable checks of the operational suitability of the track equipment and to check which procedures are being drawn up or have already been adopted to achieve the objective of ensuring implementation of traffic safety. The examination must be aimed in particular at checking the effectiveness of the scheduling procedures and subsequent performance of all the necessary interventions, including any substitution of the switch blade-stock rail mechanical pair where raised sections are found on these elements or other phenomena of wear on the points.
27/03/2013	Florence -	Fire in the	13/11/2013	ANSF	1.	We recommend that the Italian National Safety Authority endeavours to ensure

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Date of accident	*Place*	*Problem*	*Date of Recommendation*	*Recipient of Recommendation*	*#*	*Recommendation*
	Empoli line, Firenze Cascine station	locomotive of regional train 3024. Delays on the line.				that the Railway Undertaking Trenitalia SpA analyses and assesses the possibility of introducing changes to the Maintenance Plans, possibly requiring the performance of all the inspections needed to ensure the state of integrity and wear of the expansion joints of the hot gas exhaust flue of the turbines of D445 locomotives and, in general, the performance of specific inspections of all components for which only removal and refitting operations are required during periodic overhauls.
				ANSF	2.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertaking Trenitalia SpA analyses and assesses the possibility of introducing technical changes to components subject to particular and onerous thermal cycles and to loads that involve stress whenever it emerges during the performance of the inspections indicated in the previous recommendation that the necessary operating safety margins may not be guaranteed.
				ANSF	3.	We recommend that the Italian National Safety Authority endeavours to ensure that Railway Undertakings that have type D445 locomotives in their rolling stock should undertake, as quickly as possible, to perform a general campaign of thorough inspections of the expansion joints on all locomotives of this type, using both visual inspections and instrumental ones, provided they are non-destructive.
				ANSF	4.	We recommend that the Italian National Safety Authority endeavours to ensure that the Railway Undertakings that have type D445 locomotives in their rolling stock assess whether it is worthwhile amending the type of fire safety equipment, moving to an automatic system with a double intervention threshold of the sensors (1st threshold an acoustic and visual alarm, 2nd threshold automatic activation of extinguisher delivery), similar to the systems present in other types of rolling stock.

6. Conclusions

From what has been stated so far, the situation that emerges is that for rail accidents concerning 'typical' operating problems there is a positive trend towards the reduction of the more serious events, though this is a gradual trend. Nonetheless, overall the statistics described above show that several critical areas persist. These remain the subject of ongoing consideration by the Directorate General in order to develop the investigative activity.

'Typical' rail accidents, namely events such as collisions, rolling stock runaways, derailments or other events connected to irregularities in rail traffic management now represent an area that shows general signs of improvement.

The lower number of these types of incidents can certainly be attributed to the positive impact of all of the different innovative technologies that have been adopted in the field of rail traffic control.

Taking an overall view, we consider that we are seeing the effective safeguarding of rail traffic safety in operational terms by the National Railway Infrastructure Manager, RFI, in the context of the framework of guidelines promoted by the Italian National Safety Authority.

In this regard, this investigative activity has led to an improvement, in terms of the context where it is able to operate, thanks also to reorganising of the railway traffic safety regulations carried out by the Italian National Safety Authority (ANSF).

This was started by ANSF in 2009 and has been consolidated in the years that followed.

In addition to the planned alignment of national regulations with the principles of the EU directives, the regulatory reorganisation has conveniently resulted in greater comprehensibility of the standards containing the railway safety principles.

In particular, the responsibilities of the individual operators have been outlined better concerning the issuance of operating orders and requirements to regulate the operating procedures on the basis of their specific organisation, but with the obligation of guaranteeing compliance with clear principles fixed by a third party.

In particular, we note that with the text issued by the Agency entitled *Attribuzioni in materia di sicurezza della circolazione ferroviaria* [Powers for railway traffic safety], the duties were divided between the Railway Undertakings with a view to making them responsible and raising awareness concerning monitoring the level of safety of their part of the system and in terms of their external interfaces.

We now wish to clarify the critical areas that we indicated at the start of these conclusions.

We start by analysing the problem of the part of the accident rate that has causes attributable directly to the rolling stock in operation.

Alongside one area with an extremely high level of safety characterised by advanced technological solutions where the events, in terms of intensity and therefore in relation to the volumes of transport and traffic, are at very low levels and probably close to the limit of what it is technically possible to eliminate, there is another area where most of the events occurred, which, in turn, happen substantially in two distinct areas of operation: regional and local passenger services, and freight transport.

In both cases, we recorded rolling stock in service that shows limits in terms of how up-to-date it is.

If we examine the nature of the accidents in 2013 and also in the first few months of 2014 it seems clear that these are concentrated specifically in the remaining pockets of old technology.

Accidents are strongly linked to maintenance deficiencies and in some cases to obsolete or inadequate rolling stock (especially freight wagons). As stated in the foreword, the implementation of more advanced, common and shared regulations on maintenance activities could definitely reduce events which, it must be said, often involve rolling stock from abroad.

6. Conclusions

However, when we analyse the accidents caused by infrastructure problems, we can say that these cases are substantially made up of derailments, and this is closely related to requirements to further develop maintenance management processes and the investments to be made in them. A minority of the events are due to problems with the ground, because of landslides, irregularities in the surface on which the rails sit due to embankments being washed away or old engineering works failing (brick bridges, etc.) due to repeated abuse or sudden and violent weather events. In this specific area, this Directorate General is aware that the infrastructure manager RFI is committed to drawing up a more precise mapping of the places where there are potential risks.

As regards the topic of accidents at level crossings, we have already talked in the foreword about the work that the relevant institutions have started with the preparation of proposals to amend the Highway Code to reduce the incidence of poor behaviour by drivers of road vehicles.

We must stress that, in terms of the railway part, the infrastructure manager RFI has not only continued with its plan gradually to eliminate level crossings, a plan that for obvious reasons still requires more time and resources, but has also implemented various technical measures intended to regulating their safe operation in a better way, consistent with the recommendations issued by this Directorate General.

Before concluding this report, we wish to deal with the problem of collisions with people which, compared with the other events, seem to remain at a stable level, a situation which has to be of concern to the Directorate General. In order to try to discern, from the extremely generic nature of the numbers, cases of suicide from those of bad behaviour and those of another kind that cannot yet obviously be defined directly, the Directorate General intends to undertake a wider investigation of these events in order to examine every possible technical solution that might help to reduce the number of these events.

With this same view in mind, the European Railway Agency has been asked to promote in the European Commission's RISC committee the adoption of a specific EU technical standard for the mandatory installation in driver's cabs of cameras facing the tracks. These are considered essential for reconstructing this type of accident.

In conclusion, we confirm that one of the Directorate General's primary objectives continues to be the monitoring of the response of the railway world and competent EU institutions to the eleven recommendations that were issued in April 2012 following the conclusion of the Viareggio accident investigation. The institutional responses, especially from the EU, so far show, as has already been indicated, that the dialogue between the institutions has not been easy but, as we have said, we can glimpse some potentially positive openness.

Marco Pittaluga