

REVIEW OF DATA QUALITY AND APPROACH OF THE AGENCY
ANNUAL REPORT ON SAFETY

Impact Assessment

European Railway Agency

Report No.: Task 3, Rev. 2

Document No.: 1LDI90Z-9

Date: 2015-12-09

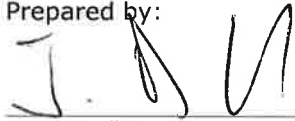


Project name: Review of Data Quality and Approach of the Agency Annual Report on Safety
 Report title: Impact Assessment
 Customer: European Railway Agency, 160 Boulevard Harpignies
 59300 VALENCIENNES CEDEX
 France
 Customer contact: Vojtech Eksler
 Date of issue: 2015-12-09
 Project No.: PP120964
 Organisation unit: Operational Risk
 Report No.: Task 3, Rev. 2
 Document No.: 1LDI90Z-9
 Applicable contract(s) governing the provision of this Report: ERA 2014 09 SC

Det Norske Veritas Limited
 Operational Risk
 Palace House
 3 Cathedral Street
 SE19DE London
 United Kingdom
 Tel: +44 (0)20 7357 6080

Objective: To model the costs and benefits of the mandatory and voluntary options for implementing a Common Occurrence Reporting Regime both at a Member State level and across the EU through the use of a partial general equilibrium model.

Prepared by:



Jonathan Ellis
Principal Consultant (Rail)

Verified by:



Dr. Edward Smith
Senior Principal Consultant

Approved by:



Dr. Edward Smith
Senior Principal Consultant

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Keywords:

Occurrence reporting
 Railways

Impact Assessment

Rev. No.	Date	Reason for Issue	Prepared by	Verified by	Approved by
0	16-10-2015	First issue for client comment	Dr. Jonathan Ellis	Dr. Edward Smith	Dr. Edward Smith
1	20-11-2015	Final Issue following client comments	Dr. Jonathan Ellis	Dr. Edward Smith	Dr. Edward Smith
2	09-12-2015	Final Issue adding data sources	Dr. Jonathan Ellis	Dr. Edward Smith	Dr. Edward Smith



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1 EXECUTIVE SUMMARY

1.1 Conclusions

The impact assessment supports a recommendation for the introduction of a mandatory occurrence reporting regime for all Member States and the collation of consolidated occurrence reports at an EU level by a central body. The European Railway Agency is identified as a suitable organisation to act in this capacity and a recommendation is made for an implementation involving the forming of one or more working groups of Member States under the Agency to develop a full taxonomy and guidance as a prelude to the mandatory legal instrument.

1.2 Supporting Argumentation

A partial general equilibrium model has been developed that models the costs and benefits associated with a common occurrence reporting regime at both a Member State and an EU plus Norway and Switzerland level. Information to populate this model has been sourced direct from the Member States and the infrastructure managers and railway undertakings in the EU, Norway and Switzerland, from Eurostat and the ERAIL database of Common Safety Indicator information.

The benefits have been established by correlating the safety performance of the Member States to the maturity of their existing National Occurrence Reporting regimes. Specifically, the benefits have been calculated from an assessment of the safety level achieved by Member States operating National Occurrence Reporting regimes and the degree of comprehensiveness of the regime (classified as comprehensive, intermediate or basic). This analysis indicated a statistically significant correlation between equivalent fatalities for employees, passengers and at level crossings and the level of maturity of the National Occurrence Reporting Regime. On this basis a reduction of 45% in passenger and employee equivalent fatalities and 34% in level crossing equivalent fatalities is anticipated if all Member States were to adopt a comprehensive National Occurrence Reporting Regime and associated comprehensive regulatory regime as defined in this report. It is assumed that 10% of the identified benefit arises from the comprehensive reporting, which is a necessary precondition of any comprehensive regulatory regime.

The costs were based upon the costs reported by infrastructure managers and railway undertakings who are currently engaged in administering occurrence reporting regimes.

The analysis undertaken in the model indicated that both a mandatory and a voluntary option for implementing a Common Occurrence Reporting regime were beneficial over a ten year period. That is the benefits from improved safety outweigh the costs of collecting, validating, verifying and analysing the data. Further a comprehensive occurrence reporting regime is considered a necessary element of a risk based regulatory regime.

Consideration of wider, non-financial, impacts revealed additional benefits from a mandatory implementation of a Common Occurrence Reporting regime at a Member State level with the collation of consolidated occurrence reports at an EU level by a central body.

2 PROBLEM DEFINITION

2.1 Requirements for Risk Data

2.1.1 Introduction

The framework for railway safety that has developed at an EU level is centred on the use of a risk based approach utilising a management system. This describes the procedures and processes that an RU or IM will employ in safely delivering its operations. Agency guidance and EU regulation provide the specifics of several processes that are central to this including

- CSM Monitoring¹
- CSM Supervision²
- CSM Risk Evaluation and Assessment³

These three regulations provide that once approved a Safety Management System must be monitored and supervised to ensure its ongoing effectiveness and that any significant changes made be evaluated from a risk perspective. Central to all of these activities is a knowledge of the level of safety in terms of the proper functioning of systems and the number or frequency of accidents and incidents.

Within the EU framework for railway safety occurrence data is collected at the Member State level and a statistical report made to the Agency for a limited set of Common Safety Indicators⁴ (CSIs). These include significant accidents and certain precursors and are used by the Agency to assess the achievement of Common Safety Targets as applied at a Member State level. These are reported annually in the form of an Annual Safety Report from each National Safety Authority (NSA). However, these indicators provide only a limited visibility of the ongoing safety performance in a Member State railway system.

This limits the effectiveness of the Safety Framework which has developed since the Safety Directive was first passed. Differing Member States collect differing types of occurrence with several confining the collection to those required for the CSI data. A risk based approach to safety, such as that being developed in the EU framework for railway safety is dependent upon occurrence data in order that risks may be identified and mitigated by IMs and RUs, that supervision by the NSA is appropriately targeted and that feedback on the effectiveness of the regulatory regime can be used to improve and further develop it. In relation to the three main categories of stakeholder identified (The EU level of the Agency, the national level of the NSA and the local level of the RU/IM) the following areas have been identified which are currently limited by an absence of data:

2.1.2 EU Level - The Agency

1) Development of Technical Specifications for Interoperability (TSIs) and the essential requirement for safety.


The Agency is responsible for the development of TSIs which are currently developed through the use of subject matter experts participating in Agency working groups and freely sharing their knowledge. These rules reflect current best practise but the Agency has an intention to

¹ Commission Regulation (EU) No 1078/2012 of 16 November 2012 on a common safety method for monitoring to be applied by railway undertakings, infrastructure managers after receiving a safety certificate or safety authorisation and by entities in charge of maintenance

² Commission Regulation (EU) No 1077/2012 of 16 November 2012 on a common safety method for supervision by national safety authorities after issuing a safety certificate or safety authorisation

³ Commission implementing Regulation (EU) 2015/1136 of 13 July 2015 amending implementing Regulation (EU) No 402/2013 on the common safety method for risk evaluation and assessment

⁴ Implementation Guidance for CSIs, ANNEX 1 OF DIRECTIVE 2004/49/EC DIRECTIVE 2004/49/EC as amended by DIRECTIVE 2009/149/EC ERA/GUI/09-2013, http://www.era.europa.eu/Document-Register/Documents/ERA%20Guidance_for_Use_of_CSIs_V2_1%202012-06-06.pdf



further develop these on a risk informed basis so that the standards are not overly prescriptive in areas of low risk or insufficiently prescriptive for areas of high risk. Currently available data from the CSIs is at an insufficiently granular level to allow a significant accident or incident to be related back to a technical requirement in a standard.

2) The role of system authority. The agency has the role of system authority for ERTMS. As the authority responsible for the development of the effective specification of the system the ongoing monitoring of the performance of the existing system is a pre-requisite of being able to assess change requests and improve the system.

3) Risk Based regulations. Related to the development of risk based rules and standards is the evolution of the regulatory framework itself which should be transparent and informed by an understanding of the risks, in particular that proportionality is needed in the regulations in relation to the risks they seek to manage.

2.1.3 National Level – The NSA

The application of the CSM on Supervision is limited if the knowledge of the railway risks in a Member State is limited, as it would be if only the data required for the CSIs were collected. A full risk picture at a national level and by individual railway actors is required to inform NSA of the areas in which it should focus its regulatory effort.

The basis of railway regulation within the EU is through the use of a Safety Management System (SMS) that each Railway Undertaking and Infrastructure Manager must have and which is formally approved by the NSA. The SMS should be informed by a thorough knowledge of the risks that an IM or RU is managing. The NSA should apply its understanding of the national risk picture when approving the SMS to provide that the IM or RU has an appropriate understanding of its own risks and that the SMS does address all areas of risk to the appropriate level.


2.1.4 Local level – The IM/RU

This is the level at which occurrence data is considered most complete. But again it is limited in trying to monitor low frequency high consequence risks against the 10^{-9} failures per operating hour set out in the CSM Risk Evaluation and Assessment. To accurately monitor against this criterion EU wide collection of data is necessary as no one Member State will experience sufficient failures or precursor events to be able to quantify the risk.

At the level of the Member State occurrence data is collected to varying degrees. The individual occurrence reporting regimes are described in the Task 1 report. The data collected form the basis of reporting of the CSIs to the Agency and to inform the National Investigation Body (NIB) of significant accidents requiring investigation, but occurrence reporting should also be used to inform the supervisory activities of the NSA, in effect focussing supervision on those areas or those actors at greatest risk.

A common basis for establishing a supervisory strategy for RUs that operate under the supervision of two or more NSAs is beneficial for the RU in having a consistent supervision and for the NSAs in having visibility of occurrences the RU has that occur in a different NSA's jurisdiction. For example in the case of an RU that operates for 90% of the time under one NSA and 10% under another, the second NSA will only have visibility of 10% of the occurrences that the RU reports and consequently the applied supervision may not be fully appropriate.

The CSM monitoring requires a similar approach from IMs and RUs in that within their approved SMS they are required to monitor the ongoing effectiveness of it on a risk informed basis. While it is clearly expected that an individual IM or RU will have knowledge of their own occurrences they do not have an



overview of the occurrences of others. This is significant in regard to low frequency high consequence accidents in which an individual organisation may not experience an occurrence and a picture of the risk may only be visible when data is pooled at an aggregate EU level. This takes on increasing relevance with the revisions to the CSM on Risk Evaluation and Assessment that permits explicit risk estimation by quantitative methods as a means of demonstrating the acceptability of a new or changed system⁵. For this quantitative assessment to be effective then relevant data on failures (occurrences) is required. Further the quantitative risk acceptance criteria is 10^{-7} failures per operating hour for a critical accident and 10^{-9} failures per operating hour for a catastrophic accident for electrical and electronically programmable systems. These failure rates per operating hour are so infrequent that they can only be assessed or monitored against at an aggregated EU level; no one Member State or IM or RU can be anticipated to have sufficient data to be able to accurately evaluate a catastrophic failure occurring at a frequency of 10^{-9} per operating hour.

It is therefore evident that access to accurate occurrence data at both an EU aggregate level and a national level is necessary for the full and proper functioning of the EU railway safety regime. From the evidence available in Task 1 it is evident that not all Member States operate a comprehensive occurrence reporting system. It is also evident that the current suite of CSIs does not extend to a description of every occurrence type on the railway.

Task 1 also sought information on the taxonomy on the Member State database (where they exist) and the scope of their occurrence reporting. Visual inspection of the Member State summary sheets reveals that aside from the commonality of the reporting of CSI occurrences there is no automatic further commonality, i.e. the Member states collect different information on an occurrence related to their own needs and objectives. This limits the comparability of differing Member States data and inhibits any ability to aggregate the data in a simple manner.

In summary, it can be seen that the EU railway safety regulatory structure presupposes an accurate set of occurrence data to properly function and, other than the CSIs, which are quite general, there is currently no mechanism for collecting, organising, and analysing such data. At a Member State level it is seen that again an accurate set of occurrence data is necessary, but the Member States have adopted different approaches to the scope and comprehensiveness of occurrence collection, organisation and analysis.

A further deficiency within the current EU level occurrence reporting is the ability to share safety critical alerts between the railway actors. The Agency maintains a system whereby the NSAs may issues alerts amongst themselves, but this is limited by an inability to identify a precursor that occurs in multiple EU Member States. A single precursor occurrence in a Member State may not be considered sufficiently severe to justify an alert, but if it occurs as a pattern across 28 Member States then that precursor may be providing an important leading indicator of a future accident. An ability to collectively analyse occurrence and precursor data across the EU Member States would provide an enhanced picture of emerging catastrophic risks that require the issuing of a safety alert.

Finally, the Agency is increasingly involved in supporting the railway sector in developing a mature safety culture at the operational level, in particular the need for a Just and a Reporting culture. These are cultures that seek, in part, to encourage the reporting of occurrences and near misses that often have no consequence, but which provide important indicators of the effectiveness of operational and technical rules, and the strength of barriers. These are occurrences that are frequently underreported as they are not associated with any consequence e.g. a driver over speeding or a signaller signalling a train

⁵ The CSM Risk Evaluation and Assessment also permits the use of codes of practise and reference systems which are anticipated to be primary means of complying with the CSM.

into a possession. Occurrences of this sort are often not witnessed and the literature indicates they are not reported for fear of consequence to the individual⁶.

Currently at an EU level (and in many Member States) operational near miss or occurrence reporting does not exist. As such important indicators of current or emerging cultural maturity do not exist at an EU level.

These various issues are summarised in the table below:

Table 1 – Issues Arising from the Current Limitations of Occurrence Reporting in the EU Railway Sector

Strategic Target	Specific Issue	Problem	Consequence
Efficient EU Safety Regulations	TSI and Standard Framework (Risk based rules)	EU level occurrence data as described in the CSIs is insufficiently timely or detailed to permit an assessment of the full and proper functioning of the standards regime or to permit risk based rule making.	TSIs and standards developed on the basis of expert judgement rather than being fully risk informed. Pace of development of standards is slowed.
	ERTMS System Authority	EU level occurrence data as described in the CSIs is insufficiently timely or detailed to permit an assessment of the full and proper functioning of the standards regime or to permit risk based rule making.	System authority role and full development plus management of change, of the ERTMS specification is delayed.

⁶ "Incident reporting or storytelling? Competing schemes in a safety-critical and hazardous work setting", J S Sanne, Safety Science 46 (2008) pp 1205-1222, for example

Strategic Target	Specific Issue	Problem	Consequence
	Risk Based Regulations	EU level occurrence data as described in the CSIs is insufficiently timely or detailed to permit an assessment of the full and proper functioning of the regulatory regime and permit risk based regulation.	Regulation applied in a blanket fashion and as such some areas over regulated and others under regulated.
Effective Safety Management	CSM Supervision	Scope and extent of occurrence reporting regimes in the EU Member States varies significantly. In a majority of Member States risk based supervision is not supported.	Supervisory activities not risk based. Some areas under supervised and others over supervised. Supervision of RUs operating between multiple jurisdictions is not treated as a single whole risk.
	CSM Monitoring	Scope and extent of occurrence reporting regimes in the EU Member States varies significantly. Aggregating data for monitoring of low frequency high consequence accidents difficult due to differences in reporting regimes.	Low frequency high consequence accidents are more difficult to monitor.

Strategic Target	Specific Issue	Problem	Consequence
	CSM Risk Evaluation and Assessment	Explicit quantitative risk estimation requires accurate occurrence data. Demonstration of the 10-9 risk acceptance criteria requires aggregated data from across the EU.	Explicit risk estimation using quantitative means is difficult in practise and results in a reliance on codes of practise, reference systems or qualitative explicit risk estimation. As previously these are also not informed by occurrence data at an EU level.
Cultural Maturity - Safety	Near misses and occurrences with no consequence, particularly relating to human errors, are highly valuable indicators of the strength of underlying safety barriers and safety performance.	Reporting of near misses or occurrences with non consequence are historically very low. Often reflecting the lack of a Just or Reporting culture.	The true strength of safety barriers and underlying safety performance is not understood and the system is considered safer than it actually is.
Safety Alerts	Sharing safety critical data between EU railway actors	EU level occurrence data as described in the CSIs is insufficiently timely or detailed to permit the early identification of safety critical failures spread across several jurisdictions.	Emerging safety issue not identified early enough to issue a safety alert.

2.2 Evidence for an Improvement in Safety as a Result of Improved Occurrence Reporting

In the previous section the problems associated with the current state of occurrence reporting in the EU at both EU and Member State level were discussed. Consequences to the effective operation of the management of safety in EU railways were highlighted.

It has to be emphasised though that occurrence reporting in of itself does not directly improve safety⁷. Data needs to be analysed and then the findings from this analysis acted upon. This is a part of a proactive and evidence based safety approach which is very much central to the progressive introduction

⁷ Indirect benefits are though realisable including raising awareness about hazards, improving a safety culture in an organisation and human behaviour which are important "soft" risk controls.

of formal requirements for a Safety Management System⁸ and is being extended in the 4th Railway Package. This will be discussed further in the discussion on costs associated with occurrence reporting. It is also relevant though in a consideration of the benefits of occurrence reporting as no direct causal link can be made between collecting data and safety improving.

The Task 1 report identified that the Member States employed a variety of different approaches to the scope and extent of occurrence reporting. If, as is stated above, evidence based approaches to safety do lead to improved safety output from the railway in a Member State then this would reasonably be expected to be visible in the Common Safety Indicators currently collected by the ERA. Those Member States employing a more comprehensive occurrence reporting system as a part of a proactive and evidence based safety approach should be achieving better safety levels than those Member States that have less comprehensive occurrence reporting systems. This is the basis of proactive and evidence based occurrence reporting systems already employed in other transport sectors. For instance the ICAO Safety Management Manual⁹ provides:

"safety data management builds upon three clearly defined steps. The first two steps (...) are the collection of safety data on hazards and the analysis of the safety data, to turn data into information. The third, and often overlooked, step is the mitigation or response activities to hazards (...) as a consequence of the safety information developed."

To test this hypothesis DNV GL defined three broad categories of occurrence reporting based upon a review of these Member State responses collected in task 1. It is important to note that these are National Occurrence Reporting systems and not those of the specific Infrastructure Managers or Railway undertakings.

Table 2 – The Criteria Used in Categorising the Occurrence Reporting Regimes Employed in the EU Railway Sector at Member State level

Basic Occurrence Reporting	National Occurrence Reporting is largely confined in scope to the reporting requirements of the Common Safety Indicators and the need to notify the NIB of significant accidents.
Intermediate Occurrence Reporting	National Occurrence Reporting goes beyond EU legal minimum requirements of the Common Safety Indicators and the need to notify the NIB of significant accidents, but is either not fully comprehensive or not clearly a part of a wider process to turn occurrence reporting into information and then mitigating action.
Comprehensive Occurrence Reporting	The national occurrence system extends into a comprehensive system for reporting accidents, incidents, and near misses. It is a part of a defined process for turning data into information and then subsequent mitigating action as a part of an holistic approach to the management of railway safety at the Member State level.

⁸ Directive 2008/110/EC of the European Parliament and of the Council of 16 December 2008 amending Directive 2004/49/EC on safety on the Community's railways (Railway Safety Directive)

⁹ ICAO Document 9859, Second edition 2009

On the basis of this classification DNV GL ascribed each of the National Occurrence Reporting regimes described in Task 1 to one of these three categories. This is clearly a subjective exercise but is based upon the description provided and DNV GL prior knowledge of the effective and proper operation of a Safety Management System in the rail, aviation, marine and oil/gas sectors¹⁰. The output of this is shown in table 3:

Table 3 – The number of Member State Occurrence Reporting Regimes by Category

Occurrence Reporting Regime	Number of Member States
Basic	11
Intermediate	8
Comprehensive	10

No pattern was evident in the spread of Member States that could be ascribed to geography or relative economic performance.

The safety performance of the Member States was evaluated in terms of equivalent fatalities over the period 2006 to 2014 using the Common Safety Indicator data entered into the ERAIL database. Equivalent fatalities were defined as being ten serious being equivalent to one fatal accident.

The CSI codes used for this were SK00 (employees killed in all accidents), SS00 (employees seriously injured in all accidents), PK00 (passengers killed in all accidents) and PS00 (passengers seriously injured in all accidents). For some Member States some data for the period 2006 to 2014 was absent. In this case the mean for the available years was assumed for the missing ones.

Table 4 – Passenger and Employee Equivalent Fatalities by Category of Occurrence Reporting 2006-2014

Occurrence Reporting Regime	Number of Member States	Passenger and Employee Equivalent Fatalities 2006-2014
Basic	11	445.1
Intermediate	8	394.8
Comprehensive	10	359.3

This analysis does not reflect the fact that differing Member States vary markedly in the size and usage of the railway within their borders. For this reason the equivalent fatalities 2006-2014 were normalised by the passenger train-km 2006-2014 for that Member State as reported as CSI R05 in the ERAIL database. Again, missing data for any one year was assumed to be the mean for the available year's data.

¹⁰ Task 1 provides an overview of the occurrence reporting regimes employed in these sectors.

Table 5 - Passenger and Employee Equivalent Fatalities by Category of Occurrence Reporting 2006-2014 Normalised by Train km

Occurrence Reporting Regime	Number of Member States	Passenger and Employee Fatalities 2006-2014	Train-Km 2006-2014	Equivalent Fatalities per train-km 2006-2014
Basic	11	445.1	11623	0.0395
Intermediate	8	394.8	6250	0.0632
Comprehensive	10	359.3	13710	0.0262

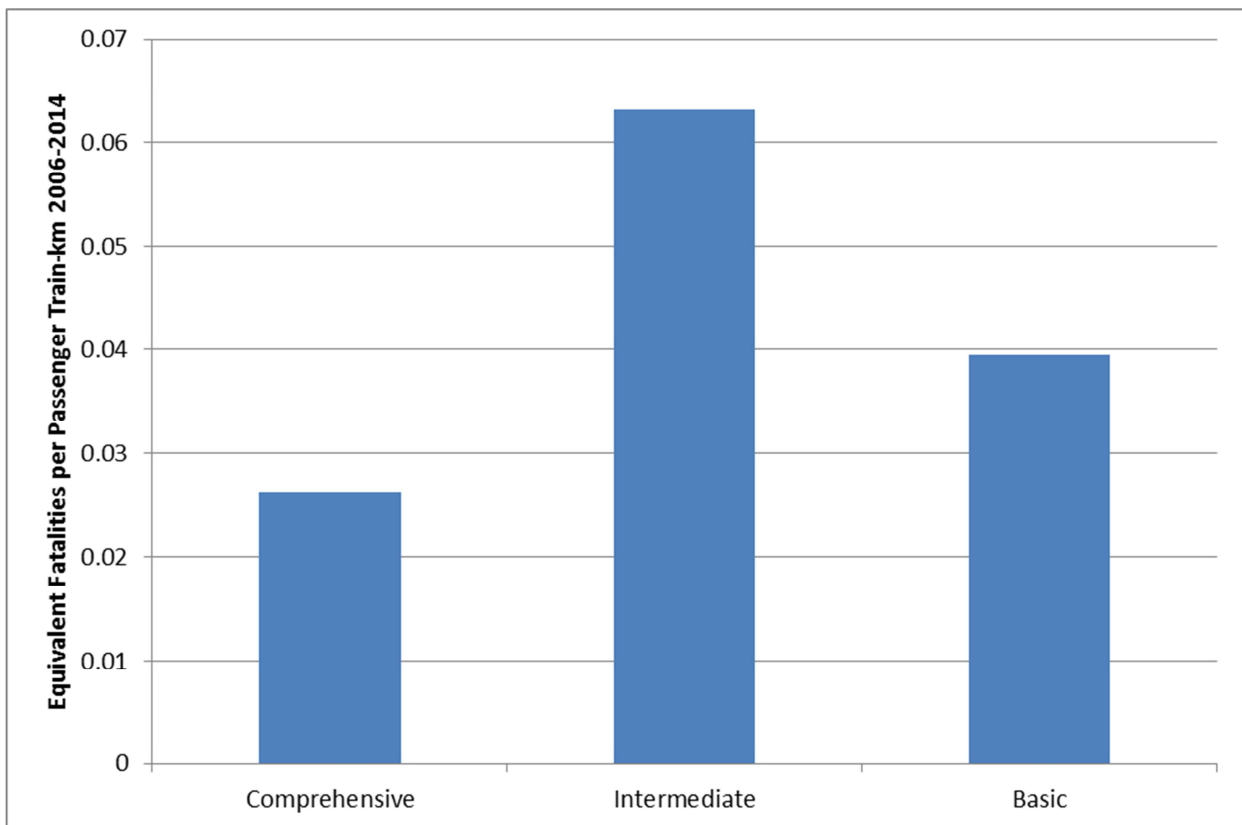


Figure 1 –Equivalent Fatalities for Passengers and Employees 2006-2014 Normalised by Train km for the Different Categories of Reporting Regime

To simplify the estimation of any safety benefit gained from moving from a basic or intermediate reporting regime to a comprehensive one a numeric average of the basic and intermediate regime was taken.

Table 6 - Passenger and Employee Equivalent Fatalities by Category of Occurrence Reporting, with Basic and Intermediate Regimes Combined, 2006-2014 Normalised by Train km

Occurrence Reporting Regime	Number of Member States	Passenger and Employee Equivalent Fatalities 2006-2014	Train-Km 2006-2014	Passenger and Employee Equivalent Fatalities per train-km 2006-2014
Basic and Intermediate	19	839.1	17514	0.0480
Comprehensive	10	359.3	13710	0.0262

Between the Member States there will be many factors that can affect the safety performance of the railway within a given Member State. But this finding, which is in accord with received wisdom indicates that those Member States employing a comprehensive reporting system at Member State level, experience 45% fewer equivalent fatalities for passengers and employees per passenger train-km over the nine year period.

An assessment of variance between the two categories of reporting regime establishes a significance in the difference to better than 1%. This is that the two sets of Member States are different in their safety performance with a less than 1% probability that this is due to random fluctuation.

This would support the contention that that the introduction of a comprehensive occurrence reporting system across all Member States would represent a significant benefit. If those Member States currently employing a basic or intermediate occurrence reporting system at Member State level where to switch to a comprehensive one then an estimate of the improvement in safety performance is a reduction of 380 equivalent fatalities over the period of 2006-2014 or an improvement factor of 0.55 over the nine year period.¹¹

¹¹ Calculated as $839.1 - (0.0262 * 17514)$

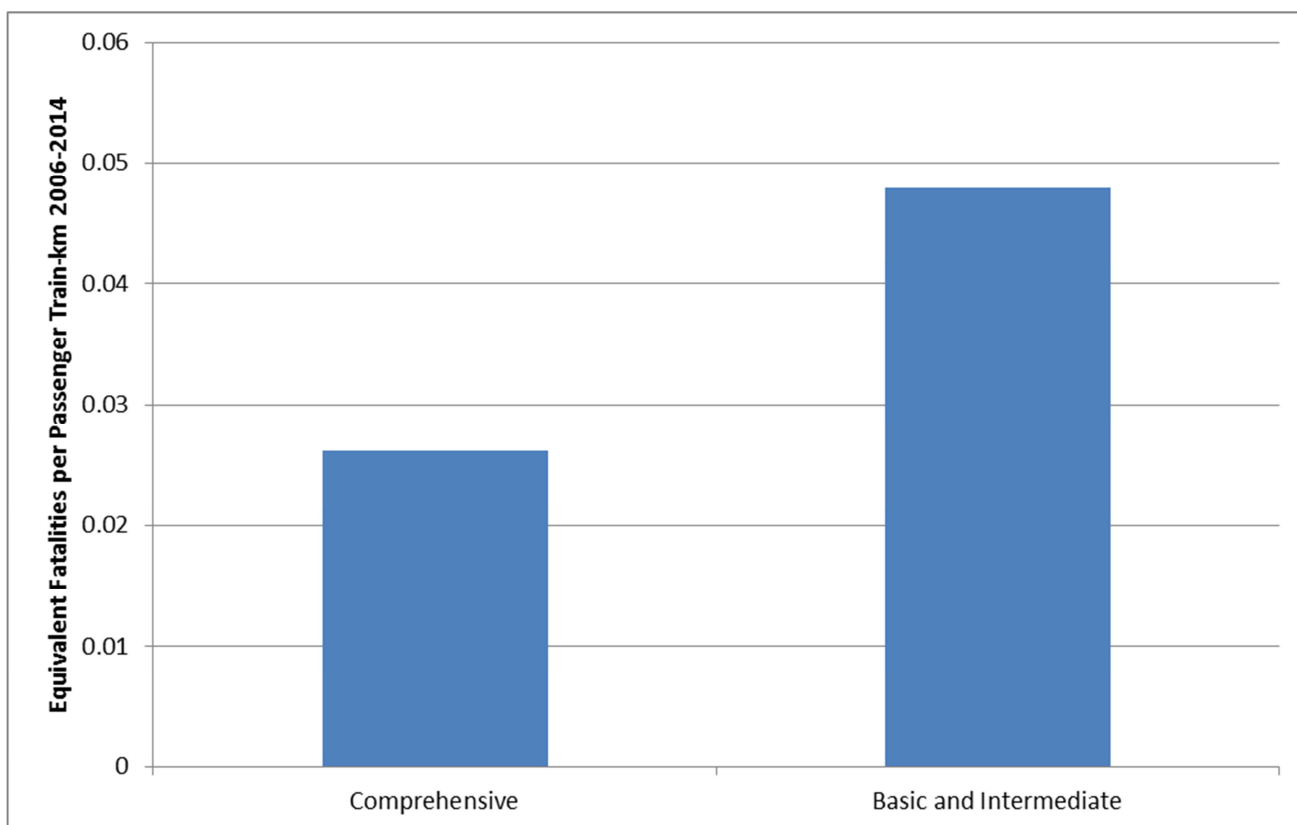


Figure 2 –Equivalent Fatalities for Passengers and Employees 2006-2014 Normalised by Train km for the Different Categories of Reporting Regime, with Basic and Intermediate Regimes Combined

The Agency guidance on the CSIs¹² provides an estimate for the value of preventing a fatality of €1,870,000. Thus, the introduction of a comprehensive national; occurrence reporting regime across all Member States would be associated with an annual safety benefit of approximately €80 million at market PPP prices for 2010.

Further categories of harm were investigated to determine if similar relationships exist. These were level crossing user fatalities and serious injuries and fatalities and serious injuries to unauthorised persons for the period 2006-2014. Data was again taken from the ERAIL database of the Common Safety Indicators (CSIs). The CSI codes used for this were TK03 (total number of persons killed in level crossing accidents), TS03 (total number of persons seriously injured in level crossing accidents), UK00 (total unauthorised users killed in all accidents) and US00 (total unauthorised users seriously injured in all accidents). For some Member States some data for the period 2006 to 2014 was absent. In this case the mean for the available years was assumed for the missing ones.

The appropriate normalising factors from the ERAIL database used for these two groups were T03 (total number of active and passive level crossings) and R08 (number of line km).

¹² Implementation on Guidance for CSIs, ANNEX 1 OF DIRECTIVE 2004/49/EC DIRECTIVE 2004/49/EC as amended by DIRECTIVE 2009/149/EC ERA/GUI/09-2013, http://www.era.europa.eu/Document-Register/Documents/ERA%20Guidance_for_Use_of_CSIs_V2_1%202012-06-06.pdf

Table 7 – Level Crossing Equivalent Fatalities by Category of Occurrence Reporting 2006-2014 Normalised by Number of Level Crossings

Occurrence Reporting Regime	Number of Member States	Level Crossing Users Equivalent Fatalities 2006-2014	Number of level crossings 2006-2014	Equivalent Fatalities per level crossing 2006-2014
Basic	11	1758.4	52934	0.0333
Intermediate	8	564.9	15266	0.0370
Comprehensive	10	1387.1	59951	0.0231

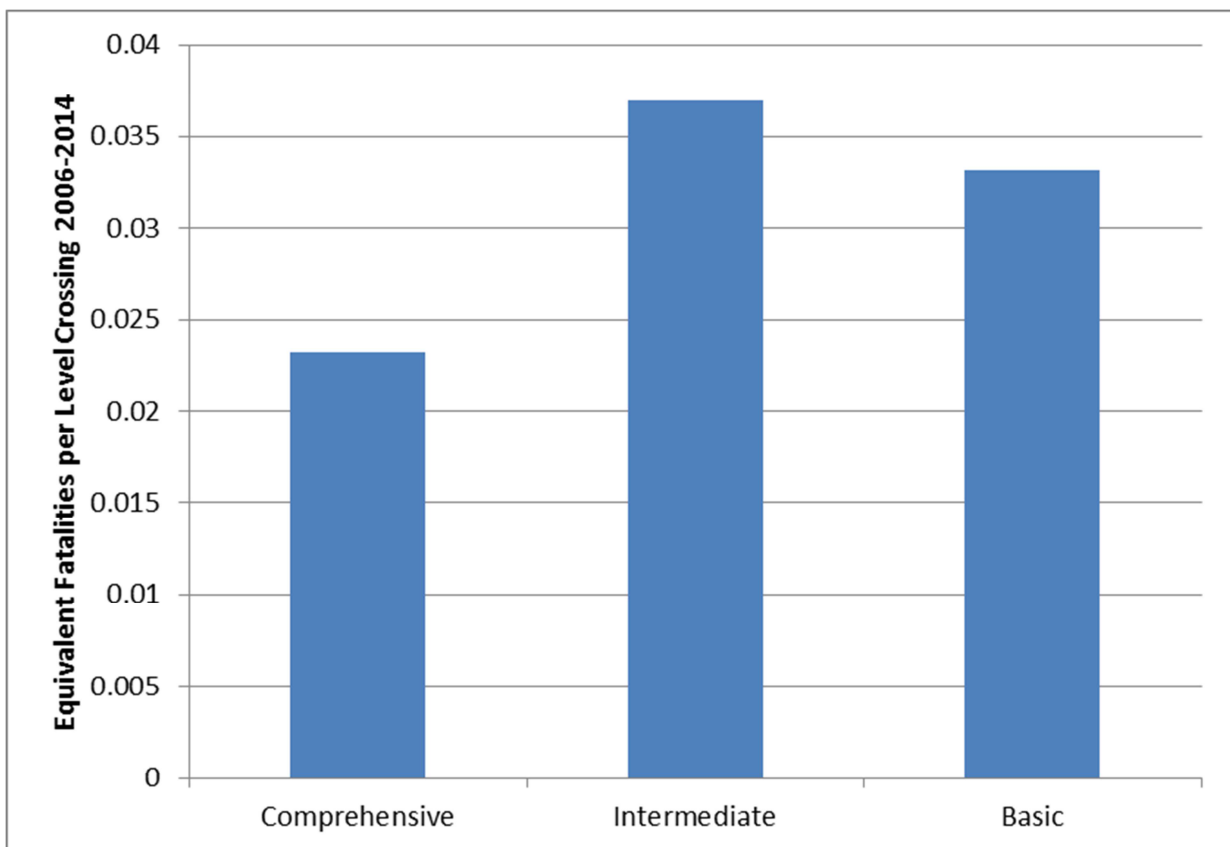


Figure 3 – Level Crossing Equivalent Fatalities 2006-2014 Normalised by Number of level Crossings for the Different Categories of Reporting Regime

Table 8 – Unauthorised User Equivalent Fatalities by Category of Occurrence Reporting 2006-2014 Normalised by Line km

Occurrence Reporting Regime	Number of Member States	Unauthorised Users Equivalent Fatalities 2006-2014	Line-Km 2006-2014	Equivalent Fatalities per line-km 2006-2014
Basic	11	3328	86320	0.0386
Intermediate	8	1106	44357	0.0249
Comprehensive	10	3258	97846	0.0333

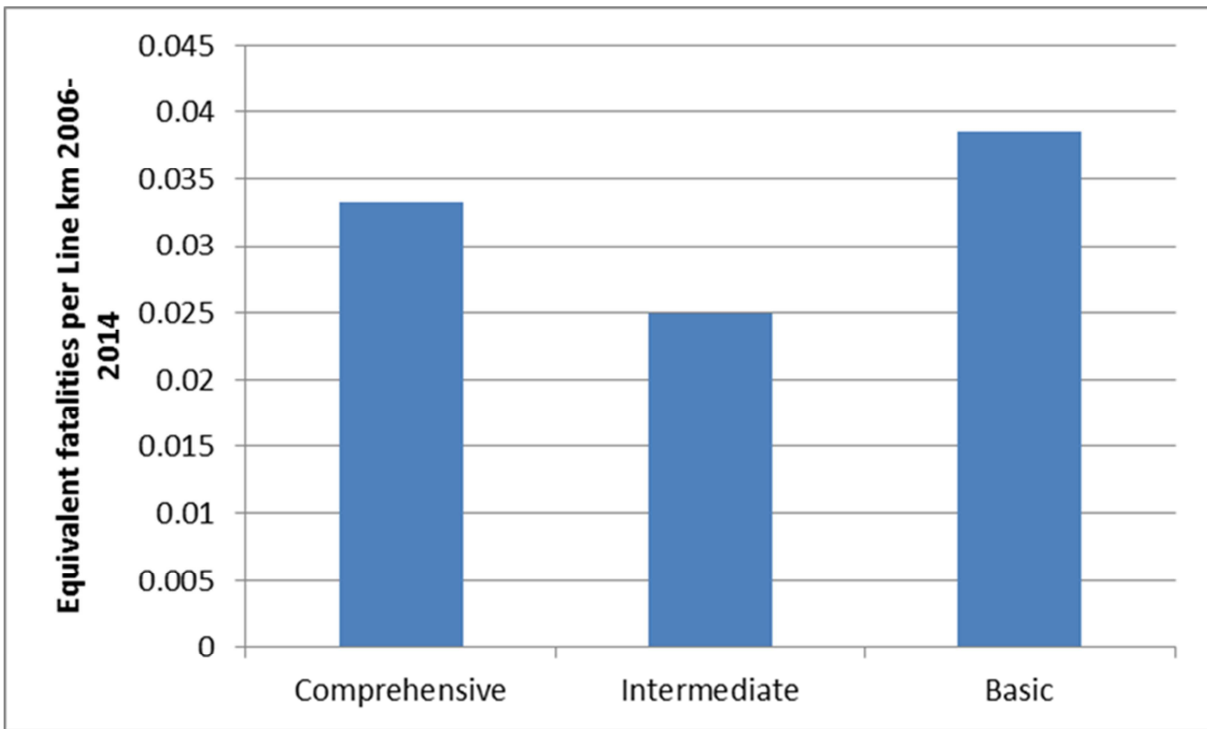


Figure 4 – Unauthorised User Equivalent Fatalities 2006-2014 Normalised by Line-Km for the Different Reporting Categories

Again combining the basic and intermediate categories of reporting for ease of analysis gives the values in Table 9 and Figure 5 for level crossing equivalent fatalities and Table 10 and Figure 6 for unauthorised user equivalent fatalities:

Table 9 – Level Crossing Equivalent Fatalities by Category of Occurrence Reporting 2006-2014 Normalised by Line km for the Different Reporting Categories with Basic and Intermediate Combined

Occurrence Reporting Regime	Number of Member States	Level Crossing Users Equivalent Fatalities 2006-2014	Number of level crossings 2006-2014	Equivalent Fatalities per level crossing 2006-2014
Basic and Intermediate	19	2323.3	68200	0.0341
Comprehensive	10	1387.1	59951	0.0231

An improvement factor of 0.66 is evident for level crossing fatality rates. A significance test indicates that the differences seen between the basic and intermediate and comprehensive reporting systems for level crossing user equivalent fatalities are significant at the 5% significance level.

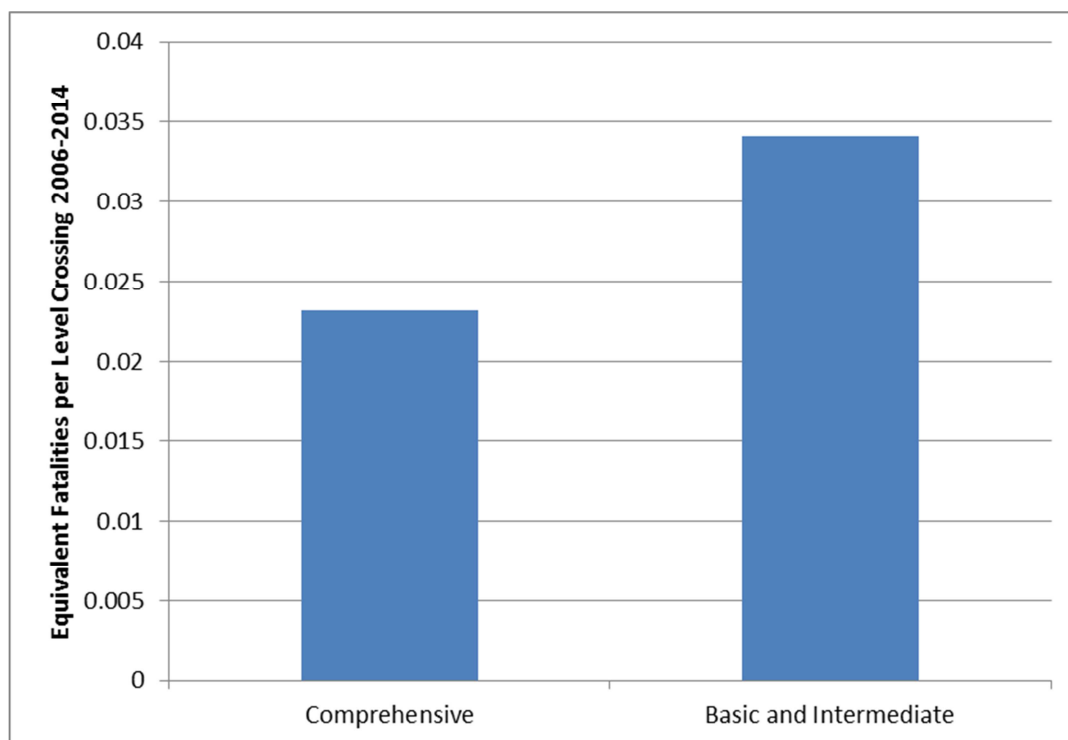


Figure 5 – Level Crossing User Equivalent Fatalities per Level Crossing 2006-2014 by Category of Reporting Regime, Basic and Intermediate Combined

Table 10 – Unauthorised User Equivalent Fatalities by Category of Occurrence Reporting 2006-2014 Normalised by Line km for the Different Reporting Categories with Basic and Intermediate Combined

Occurrence Reporting Regime	Number of Member States	Unauthorised Users Equivalent Fatalities 2006-2014	Line-Km 2006-2014	Equivalent Fatalities per line-km 2006-2014
Basic and Intermediate	19	4434	130677	0.0339
Comprehensive	10	3258	97846	0.0333

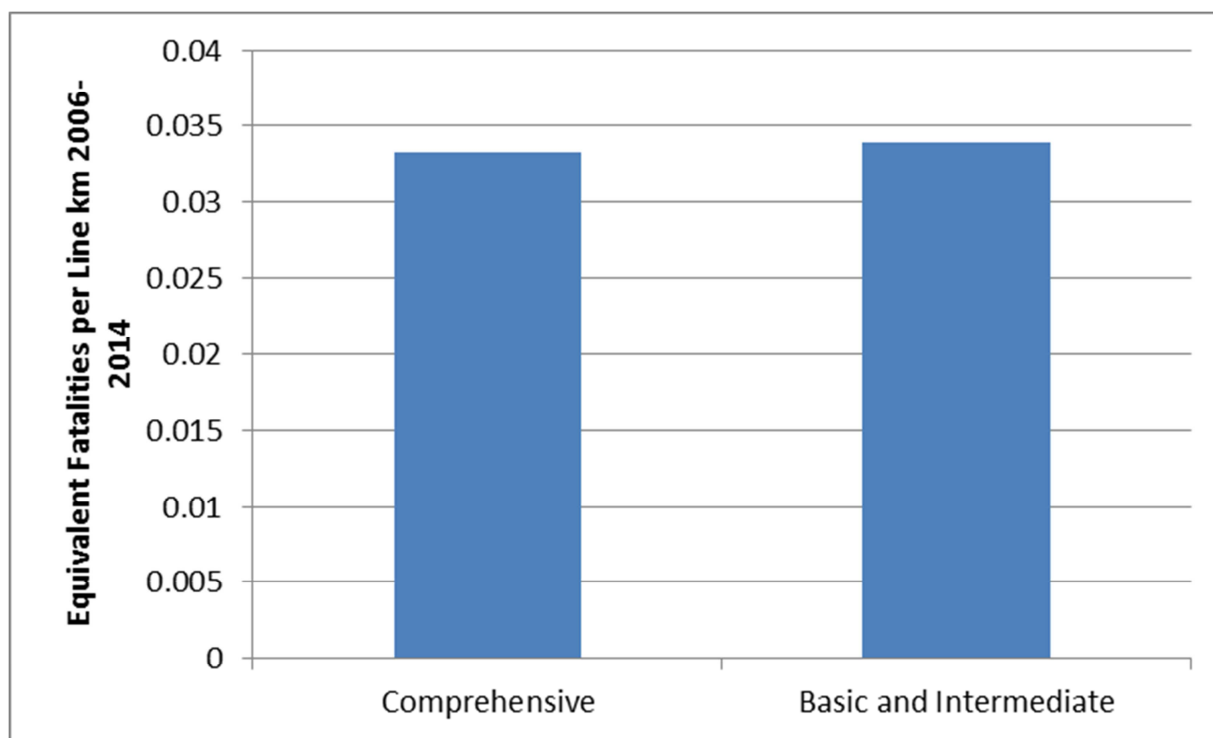



Figure 6 - Authorised User Equivalent Fatalities by Category of Occurrence Reporting 2006-2014 Normalised by Line km for the Different Reporting Categories with Basic and Intermediate Combined

An improvement factor of 0.98 is evident for unauthorised user equivalent fatality rates. A test of significance reveals no significance between the equivalent fatalities for unauthorised users for the two reporting categories.

2.3 Discussion of Safety Benefit

In order to be able to use the identified safety benefit in a cost benefit analysis it is first of benefit to consider why this benefit is arising. Reporting in of itself will not improve safety performance of a railway. Noting that this analysis addresses occurrence reporting at the Member State level only which is used as a component of the regulatory regime then it is likely that the differences seen are indicators of



differences in the application of the regulatory regime. Further these differences represent the ability of a properly risk informed regulatory regime to exert influence on the regulated industry to manage safety.

This would explain why the significance of the differences between reporting regime is most pronounced for passengers and employee safety, which is direct within the scope of control of the regulated railway and becomes less significant for level crossing users, whose behaviour is less within the direct control of the railway and not significant for unauthorised users over whom the regulated railway has little direct influence.

This safety benefit can then be monetised using the Value per Fatality values contained in the Implementation Guide for the CSIs¹³.

In addition to the direct safety benefit from a reduction in equivalent fatalities this reduction also implies a reduction in accidents and a reduction in all the wider impacts that this implies. An accident resulting in a fatality or a serious injury will be accompanied by other adverse impacts which may include:

- Damage to the rolling stock or railway infrastructure
- Environmental damage
- Suspension of train services or delay to train services whilst the accident is attended by the emergency services
- Suppressed demand for railway services due to delay and perception of safety
- Cost of accident investigation
- Cost of emergency service attendance at the scene
- Reputational damage to the railway

A reduction in all of these can be expected. In keeping with the conservative approach taken to the benefits in this impact analysis these have not been factored in.

¹³Implementation on Guidance for CSIs, ANNEX 1 OF DIRECTIVE 2004/49/EC DIRECTIVE 2004/49/EC as amended by DIRECTIVE 2009/149/EC ERA/GUI/09-2013, http://www.era.europa.eu/Document-Register/Documents/ERA%20Guidance_for_Use_of_CSIs_V2_1%202012-06-06.pdf



3 POSSIBLE OPTIONS FOR THE INTRODUCTION OF NATIONAL OCCURRENCE REPORTING REGIMES ACROSS ALL MEMBER STATES.

3.1 Overview of Issues and Problem Definitions

The preceding sections discuss the strategic issues and problems encountered with the established arrangements for Common Occurrence Reporting in relation to the mission and objectives of the Agency and the benefits associated with a comprehensive reporting system at a national level. This and subsequent sections then seek to bring these two aspects together to develop policy options by which the benefits may be realised and the problems addressed.

The task 1 report described the principle features of any occurrence regime that align to the objectives of that regime. These are whether the occurrence reporting should be mandatory or voluntary or whether it should be centralised or devolved. The table below discusses these:

Table 11 – The Relative Merits of Different Types of Reporting Regime as Identified in the Task 1 Report

Feature of Occurrence Reporting Regime	Description	Advantages	Disadvantages	Use	Speed of Implementation
Mandatory	The requirement to report occurrences is established through legal instrument.	<p>In principle all occurrences should be captured in a common format to a common definition.</p> <p>Requires constant management of the types of occurrences reported to avoid "data graveyards" – these should be aligned to specific objectives and /or benefits that are regularly reviewed to ensure their achievement and continued relevance.</p>	<p>If not administered or managed to maintain the achievement of benefits it can rapidly become a data graveyard in which data with no explicit purpose or use is contained. This can rapidly erode good will in regard to the occurrence reporting system.</p> <p>Unless operated in a just culture then the reporting of incidents or near misses may not be comprehensive as reporters fear repercussions.</p>	Situations in which standardised occurrences reports are required from a group or industry in which only a limited number of accident types or precursors are possible and are all well-defined. Characteristic of mature industries with limited rate of change.	Rapid. A mandatory approach would require all Member States to implement an occurrence reporting system by a specified date.

Feature of Occurrence Reporting Regime	Description	Advantages	Disadvantages	Use	Speed of Implementation
Voluntary	The requirement to report occurrences is voluntary but encouraged.	<p>In principle such a regime should attract a lower burden of cost because reporters wish to report rather than having to. A greater variety of near misses and incidents is typical as users are free to report. Narrative text and more unusual precursors to accidents can be reported.</p> <p>The occurrence reports will always be of relevance, significance or benefit to someone, if only the reporter.</p>	In practise a substantial effort is required in order to promote and attract reports. Reports may be more narrative in nature and less structured. The database may be less comprehensive.	Scenarios in which research is needed or in which a large number of accident types or precursors are possible which are ill defined. Characteristic of emerging industries or those with a high rate of change. Can often be used as an intermediate stage in the development of a mandatory or harmonised system.	This would be expected to be a slow implementation driven by Member State appreciation of the benefits of occurrence reporting.

Feature of Occurrence Reporting Regime	Description	Advantages	Disadvantages	Use	Speed of Implementation
Centralised	A single database is established into which all Member State National Occurrence Reporting systems submit reports.	There is one source of the truth which can be managed efficiently by a single entity. Data are all presented in the same format.	Set up cost may be significant as the existing reporting infrastructure in individual Member States is not used. Consequently there may be resistance to using the system. Change is relatively easy as modifications to only one database and reporting system are required.	In situations in which little existing Member State infrastructure exists or where it is not harmonised. Characteristic of changing or evolving industry where new risks or reporting requirements may emerge.	In principle this should be a rapid implementation compared to the devolved scenario described below in that only one system is required to be developed.
Devolved	The individual National Occurrence Reporting Systems each act in an autonomous manner, providing management reports to the Agency or other central body as appropriate.	Set up cost are small as the existing infrastructure present in the Member States is utilised at little additional cost.	Multiple versions of the truth which may not be harmonised (differing reporting requirements and definitions between Member States). Change is difficult to effect as it requires updates to 29 separate reporting systems and databases.	In situations in which a mature well developed reporting infrastructure exists that can readily be harmonised. Characteristic of mature industry subject to little change.	This is considered a slower implementation than the centralised system as it will proceed at the pace of the Member State that is last to implement the system.

In general the Member States and the railways contained within their borders exhibit features that are mixed between mandatory and voluntary and centralised and devolved. Despite the railway being established for over 100 years in many countries the use of a proactive, evidence based safety Management System is a recent development in some Member States, driven primarily by the legislative changes promoted by the EU in the Safety Directive, which in turn supports the opening up of the EU rail market as a single European railway area. It is noted that other jurisdictions such as Australia are also following a similar approach.

Comprehensive reporting and analysis systems, which a Safety Management System requires in order to fully function, is only present in a third of EU member states. The reporting system at an EU level is immature and can be expected to develop. On this basis it may be assumed that a voluntary devolved system is best suited to an EU Common Occurrence Reporting system. However, as the use of a Safety Management System becomes more embedded across the EU Member States it is anticipated that it will become subject to less change and that reporting requirements and accident types will become stable. In this scenario a mandatory centralised system would be better.

An idealised situation would be represented as a voluntary devolved system in the immediate term and a mandatory centralised one in the long term. Policy proposals for this are explored in the following sections.

3.2 Specific Objectives

The general description of the problem earlier has been broken into a series of specific objectives against which policy tools can be assessed.

Table 12 – The Mapping of the Specific Objectives for the Occurrence Reporting System against the Identified Problem Drivers

Problem Driver	Specific Objective
	SO1
The collection of occurrences is not optimal	To ensure that all occurrences which are safety related are collected and provide a complete and clear picture of safety risk in the EU and Member States.
	SO2
Suboptimal data integration (low quality and incompleteness)	To ensure that occurrence reports stored in the national databases and EU level database (CSI reporting) are complete and contain high quality data.
	SO3.1
Lack of occurrence analysis at MS level and at European level	To ensure that reported occurrences are effectively analysed, and safety hazards are identified.

Problem Driver	Specific Objective
	S03.2
Lack of appropriate corrective and preventative actions at MS level	To ensure that corrective and preventative actions are undertaken and the effectiveness of these are continually monitored.

These specific objectives can be further broken down into operational objectives.

S01 would comprise:

- achieving a comprehensive collection of occurrences through a harmonisation and clarification of reporting requirements.
- a clarification and development of a 'Just Culture' that encourages reporting
- the obligation to establish reporting schemes
- a clarification of the flow of information between the Member States and the Agency

S02 would comprise:

- the standardisation of the data entry process
- the establishment of mandatory data fields
- the establishment of data verification/quality checking processes

S03 would comprise:

- the creation of an obligation to analyse occurrence data and to identify actual or potential safety hazards
- adopting preventative or corrective actions where appropriate, including safety alerts, revising technical standards, improving culture and promoting risk based regulation.

3.3 Policy Options

The following policy options have been developed as a response to the problem statements and the specific objectives identified earlier.

0. The baseline option is for the situation as described in the problem statement to continue as is.

1. Occurrence Reporting at a national level. A voluntary occurrence reporting framework is established for use by the Member States. This would be based upon the provision of guidance and publicising the benefits of National Occurrence Reporting.

2. Occurrence Reporting at an EU level. A voluntary occurrence reporting framework is established at an EU level by the Agency, based upon the provision of guidance and publicising the benefits of National Occurrence Reporting, which feed into it.

3. Mandatory Occurrence Reporting at a national level. An occurrence reporting framework is established through EU regulation as an obligation upon all member States, who then provide data in a common format to the Agency, who would collate it.

4. European centralised approach. An occurrence reporting framework is established through EU regulation as a centralised system run and maintained by the Agency or equivalent EU level organisation.

A variant on this that has also been assessed in this impact assessment is a European centralised approach (**option 4.1**) collecting consolidated occurrence reports similar to the current Suite of Common Safety Indicators but to a greater degree of granularity.

Option 4 represents the scenario in which occurrence reports are both to the relevant NSA and concurrently to the EU level organisation such that both a National database of occurrence reports and an EU level database of occurrence reports exist. These may have similar, related or different taxonomies. Data validation and verification would be undertaken at both the national and EU level.

Option 4.1 is similar in that again a National database of occurrence reports exists as does an EU level one. But, in this instance the EU level database is comprised of a consolidated extract of the occurrence reports in the national databases and an occurrence is only reported once, at the national level. The EU level database being fed either automatically or periodically from the national level ones. Data validation and verification would be undertaken at the national level only.

In order to determine the suitability of these five policy packages to address the problem drivers and achieve the objectives of an occurrence reporting regime a coarse filter was applied as set out in the table below. This filter asks the simple question of whether the policy package has the potential to address the four problem drivers in Table 12. This is a preliminary assessment to be further developed and evidenced.

Table 13 – A High Level Analysis of the Identified Policy Measures

	The collection of occurrences is not optimal	Suboptimal data integration	Lack of occurrence analysis at MS level and at European level and of appropriate corrective and preventative actions
0. Baseline	Current occurrence reporting regimes vary greatly in scope and comprehensiveness. Currently it is judged that ten Member States operate a comprehensive occurrence reporting regime, with eleven basic and eight intermediate.	Existing reporting forms, taxonomies and databases are incompatible. Data cannot be easily extracted (indeed most databases are confidential) and compared across the EU, or even between two adjacent Member States.	Occurrence analysis is currently possible within ten Member States only and to a very limited extent (the CSIs) at an EU level. Risk based regulation and decision making are not a realistic prospect.

	The collection of occurrences is not optimal	Suboptimal data integration	Lack of occurrence analysis at MS level and at European level and of appropriate corrective and preventative actions
1. Occurrence reporting at a national level	The provision of guidance and the demonstration of benefits encourages all Member States to establish a National Occurrence Reporting regime. This is expected to take several years to achieve occurrence reporting across all Member States as it competes with other national priorities.	A standard reporting form and database taxonomy is provided in the guidance, but Member States are still free to vary this to address local or national concerns. Variability in the quality and completeness of data can still be expected. Existing databases will be difficult to adapt to the new format.	Occurrence analysis is encouraged at a national level, but is increasingly difficult at an EU level due to remaining differences in national taxonomies and data quality issues as each Member State is responsible for checking their own data. There is the potential to miss actions based on learning from other Member States.
2. Occurrence Reporting at an EU level	The provision of guidance and the demonstration of benefits encourages all Member States to establish a National Occurrence Reporting regime, which provides a further cascade of occurrence reporting to the Agency. This is expected to take several years to achieve occurrence reporting across all Member States as it competes with other national priorities.	A standard reporting form and database taxonomy is provided in the guidance as a means of supporting the EU level occurrence reporting. This helps to standardise EU level reporting, but Member States are still free to vary this to address local or national concerns. Variability in the quality and completeness of data can still be expected. Existing databases will be difficult to adapt to the new format.	Occurrence analysis is encouraged at both a national level and an EU level. EU Level analysis cannot progress effectively until all Member States are contributing to the EU level occurrence reporting and to a similar level of consistency. EU level data validation can help drive this consistency, but not until all Member States utilise the system.

	The collection of occurrences is not optimal	Suboptimal data integration	Lack of occurrence analysis at MS level and at European level and of appropriate corrective and preventative actions
3. Mandatory occurrence reporting at a national level	National occurrence reporting regime is established in each Member State to a common format and structure. Those Member States with existing comprehensive regimes are forced to modify them at additional cost.	Data entry to the national occurrence reporting system is to a common format and optimal. Cascading of this data to an EU level is done at regular intervals (e.g. monthly) and is facilitated by all occurrence data being to a common format. Validation of data is done at a local level in the Member State with the further verification being undertaken by the Agency at an EU level.	Occurrence analysis at Member State level is undertaken in real time and that for EU level on a regular basis, but sufficient for risk based regulation and risk based supervision to be enacted.

	The collection of occurrences is not optimal	Suboptimal data integration	Lack of occurrence analysis at MS level and at European level and of appropriate corrective and preventative actions
4. European centralised approach	All occurrence reports are provided directly to the Agency. The use of a standardised form allows information to be structured in a common manner. Data is provided in real time. This would represent a large number of occurrences coming in centrally which may impact the ability to optimally collect occurrence reports. Agency is also not well placed to understand if a serious occurrence has not been reported as, unlike an NSA, it has no supervisory activity in that Member State.	As the Agency is one step removed from the Member State in which the occurrence occurred then the validation of data is more difficult as missing or incomplete data has to be sought from the reporter by the Agency. The Agency may lack the local contacts in the Member State to easily question or probe missing data.	Occurrence analysis at the EU level is undertaken in real time. Risk based regulation and supervision is possible, but may be impacted by data quality issues.
4.1 European centralised approach; consolidated occurrence reports	Summarised or consolidated occurrence reports are provided directly to the Agency. The use of a standardised form allows information to be structured in a common manner. Data is provided at periodic intervals and validated by the Member States.	The Agency is reliant upon the Member States for proper reporting and analysis. The granularity of reporting and volume of data is less than the full option 4 but it greater than the level of reporting seen for the CSIs currently.	Occurrence analysis at the EU level is undertaken at regular or periodic intervals. Risk based regulation and supervision is possible, but may be impacted by data granularity.

The analysis in Table 13 has been summarising these in terms of the policy options ability to positively or negatively impact the identified problem drivers. This has been done against a simple scale of:

- 0 no impact
- + addresses a part of the problem driver
- ++ addresses a majority of the problem driver
- +++ is considered to address all of the problem driver
- marginal cost associated with writing guidance material
- investment needed in reporting infrastructure and database creation
- substantial investment needed
- + significant costs or barriers to implementation
- ++ some costs or other barriers associated with implementation
- +++ Few costs to other barriers to implementation

Table 14 – Qualitative Assessment of the Identified Policy Options

	The collection of occurrences is not optimal	Suboptimal data integration	Lack of occurrence analysis at MS level and at European level and of appropriate corrective and preventative actions	Ease of Implementation	Cost	Overall
0. Baseline	0	0	0	0	0	0
1. Occurrence reporting at a national level	+	+	0	+++	-	++++ (4)
2. Occurrence Reporting at an EU level	++	++	+	+++	-	++++++ + (7)


	The collection of occurrences is not optimal	Suboptimal data integration	Lack of occurrence analysis at MS level and at European level and of appropriate corrective and preventative actions	Ease of Implementation	Cost	Overall
3. Mandatory occurrence reporting at a national level	+++	+++	+++	++	---	+++++++ ++ (8)
4. European centralised approach	++	+++	+++	+	--	+++++++ + (7)
4.1 European centralised approach with Consolidated Occurrence reports	++	+++	+++	++	-	+++++++ +++ (9)

The ease of implementation is a subject judgement based on the assessment that voluntary guidance is relatively cheap to write and implement, but that mandatory systems necessitating changes to existing or the creation of new occurrence reporting systems will require greater effort and investment to implement.

The highest scoring options are option 3 (scoring 8) and option 4.1 (scoring 9).

3.4 Scope of Comprehensive Occurrence Reporting

The justification for the adoption of an Occurrence Reporting system at National level is the observation that those Member States operating a comprehensive National Occurrence Reporting Regime attain an improved safety performance. Those Member States operating a Comprehensive National Occurrence Reporting regime today record approximately 70 occurrences per million train km per annum. This then allows the scale of reporting necessary across the EU, Norway and Switzerland to be estimated. This indicates that the scope of occurrence reporting at national level on an annual basis should be approximately 280,000 occurrence reports, necessitating an increase in the volume of occurrence reports



made annually of 180,000¹⁴. This would apply to both the voluntary and mandatory options (options 2 (voluntary) and option 3 (mandatory)).

In option 4 (European Centralised Approach) the volume of occurrence reporting at a National level would remain at 280,000 occurrences per annum. In this option all of these occurrences are separately reported to the EU level and so reporting to this level would be 280,000 occurrences per annum. The total volume of occurrence reporting at both EU and national level would be 560,000 per annum.

In option 4.1 (European Centralised Approach with Consolidated Occurrence Reports) the volume of occurrence reporting at a National level would remain at 280,000 occurrences per annum. The volume of consolidated occurrence reports has been modelled in section 4 as between 10 and 30% of all National Occurrences.

¹⁴ Please note that the current volume of occurrence reporting is not simply the difference between 280,000 and 180,000 as a number of Member States choose to report a greater scope of occurrences.

4 QUANTITATIVE COST BENEFIT ASSESSMENT

4.1 Estimation of Benefits

A partial general equilibrium model was developed to quantify the costs and benefits of the policy options identified earlier. A partial general equilibrium model was considered appropriate as the impact of an occurrence reporting regime for railways in the EU in terms of costs and benefits can be assumed to be contained within the railway and not impact wider society or the economy, which would necessitate a general equilibrium model.

The partial general equilibrium model firstly generates a base case scenario for safety analysing the trends in equivalent fatalities for both passengers and employees and level crossing users. This indicated an annual decrease of 8.4% in passenger and employee equivalent fatalities and a 4.6% annual decrease in level crossing user equivalent fatalities.

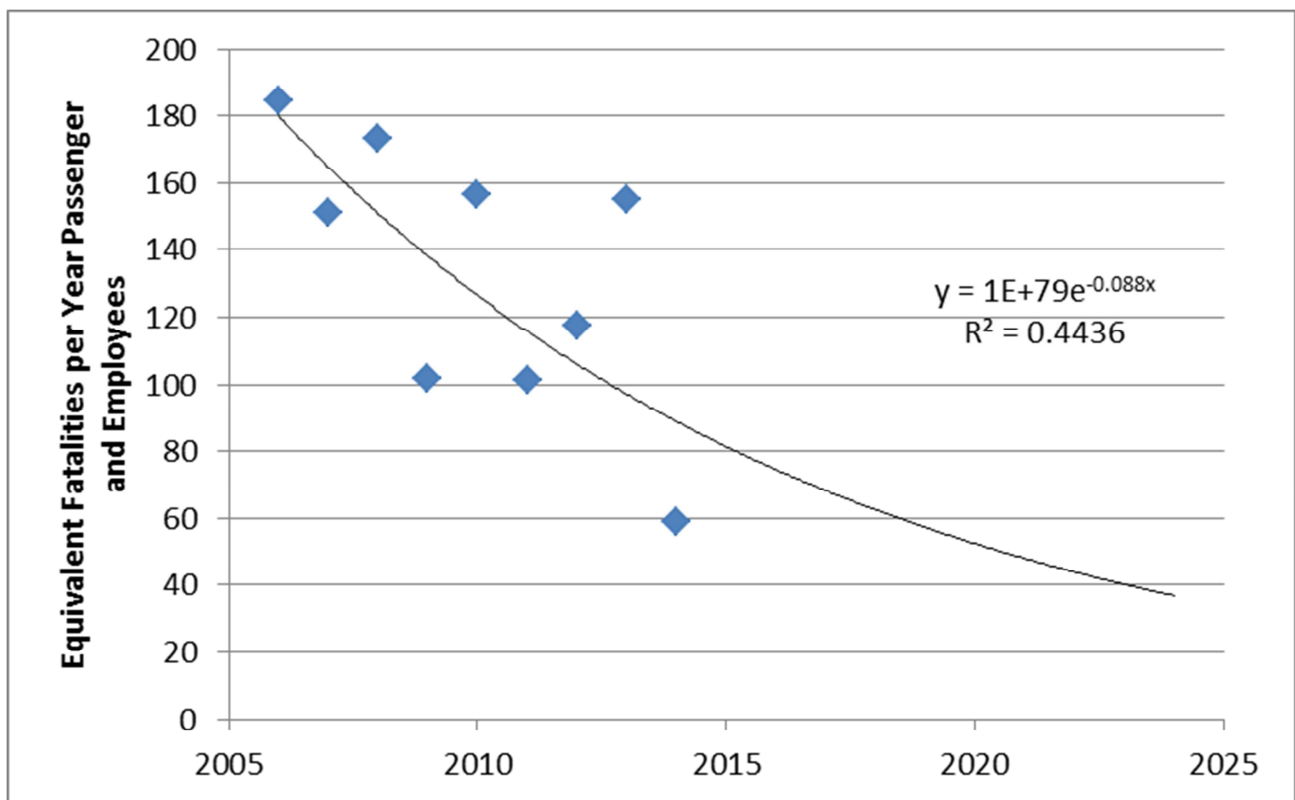


Figure 7 – The Trend over Time of Passenger and Employee Equivalent Fatalities, 2006-2014

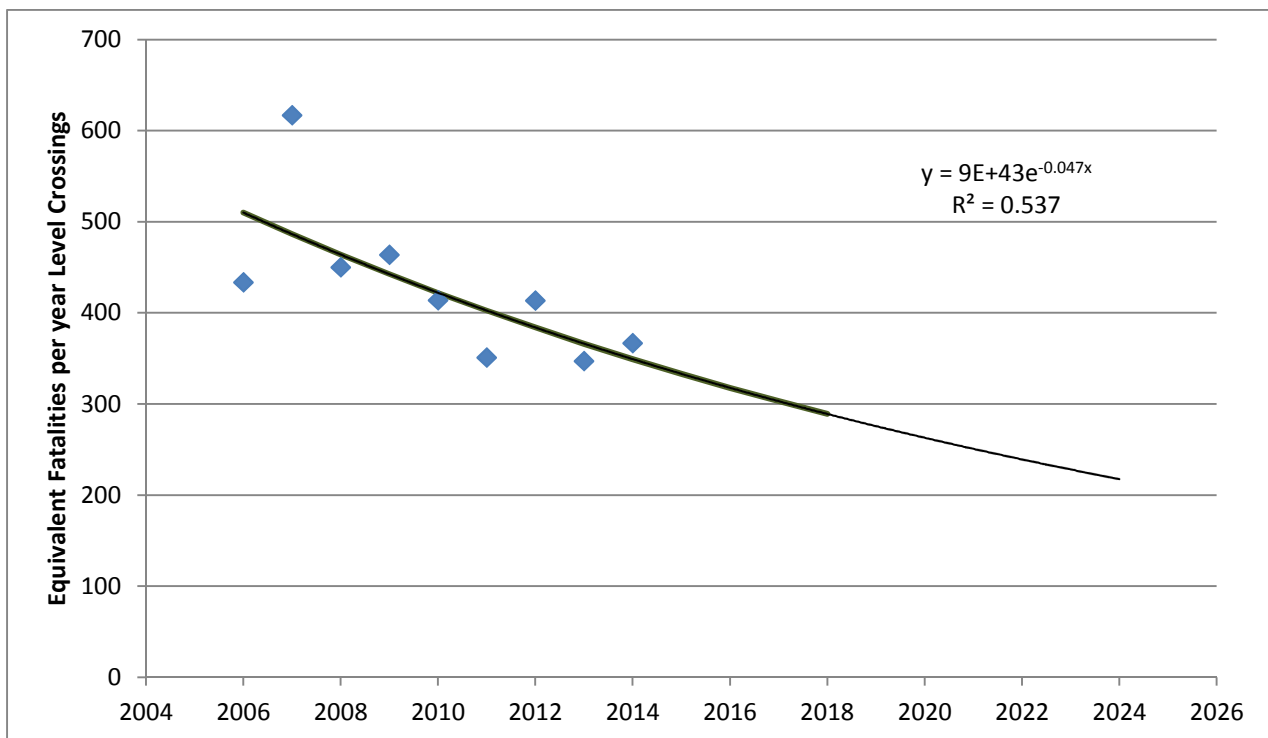


Figure 8 – The Trend over Time Of Level Crossing Equivalent Fatalities, 2006-2014

These percentage reductions were then assumed to be maintained for the next ten years creating a baseline level of safety expressed as equivalent fatalities.

This creates a baseline in the current and future equivalent fatalities for passengers, employees and level crossing users for the next ten years. This is then varied by assessing the impact of the policy scenarios identified above on this baseline. In applying the policy options highly conservative assumptions have been assumed, in part reflecting the underlying uncertainty inherent in an impact analysis.

In assessing the mandatory options it has been assumed that:

- 1) In the ten year period of year 0 to year 9 it is assumed that legislation is introduced in year 1.
- 2) It is assumed that the legislation requires an occurrence reporting system be implemented within 2 years and that half of all Member States not currently having a comprehensive reporting system will implement an occurrence reporting system within one year, given the very substantial safety benefits that are evident from it. The remainder will implement in the second of the two year legislative window.
- 3) The benefits of comprehensive occurrence reporting regime on level crossing safety is an improvement factor of 0.686 and for employee and passenger safety an improvement factor of 0.55 for level crossing safety as calculated earlier.
- 4) The benefits of a comprehensive occurrence reporting regime are realised once three years of reporting data have been accumulated as a time series of three years (three data points) is required for trend analysis.
- 5) Further benefits are available through analysis at an EU level. This is assumed to be achieved once two thirds of all Member States have implemented a comprehensive reporting regime and again requires three years' worth of reporting data for the benefit to be realised. This benefit is set at a further 10% improvement in equivalent fatalities. The 10% reduction is believed reasonable based upon professional judgement in comparison to the benefits achieved at a Member State level.

In assessing voluntary options it has been assumed that:

1) The voluntary adoption of an occurrence reporting regime will be implemented over a ten year period, on a linear basis.

For both the mandatory and voluntary options the benefit in terms of a reduction in equivalent fatalities is monetised using the value per fatality prevented stated in the CSI guidance¹⁵. In accord with this guidance the values have been inflated from the base year of 2010 using the increase in GDP per capita quoted by Eurostat, up to 2014, with an assumed GDP per capita increase of 1.25% thereafter¹⁶. A discount rate of 4% has been applied to all monetised benefits¹⁷. The difference in equivalent fatalities for both passenger and employees and level crossing users for the scenarios:

- Mandatory adoption of COR at Member State level (policy option 3)
- Mandatory adoption of COR at a Member State and EU level (policy option 3, 4 and 4.1)
- Voluntary adoption of COR at Member State level (policy option 1)
- Voluntary adoption of COR at a Member State and EU level (policy option 1 and 2)

are shown below:

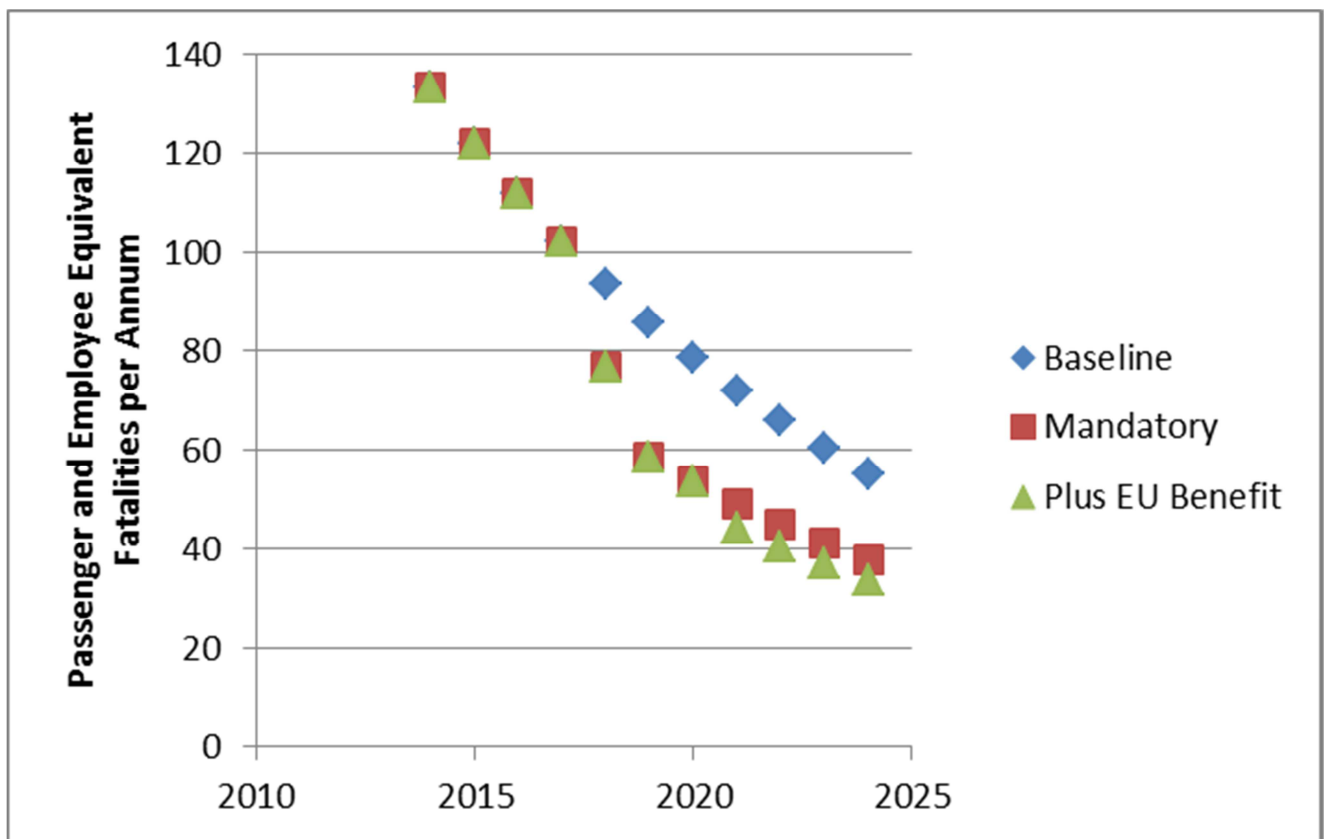


Figure 9 – The Forecast Passenger and Employee Equivalent Fatalities for the Mandatory Policy Options

¹⁵ Implementation on Guidance for CSIs, ANNEX 1 OF DIRECTIVE 2004/49/EC DIRECTIVE 2004/49/EC as amended by DIRECTIVE 2009/149/EC ERA-GUI-02-2015

¹⁶ http://ec.europa.eu/smart-regulation/guidelines/tool_54_en.htm

¹⁷ The 2015 Ageing Report Economic and budgetary projections for the 28 EU Member States (2013-2060) EUROPEAN ECONOMY 3|2015 http://ec.europa.eu/economy_finance/publications/european_economy/2015/pdf/ee3_en.pdf

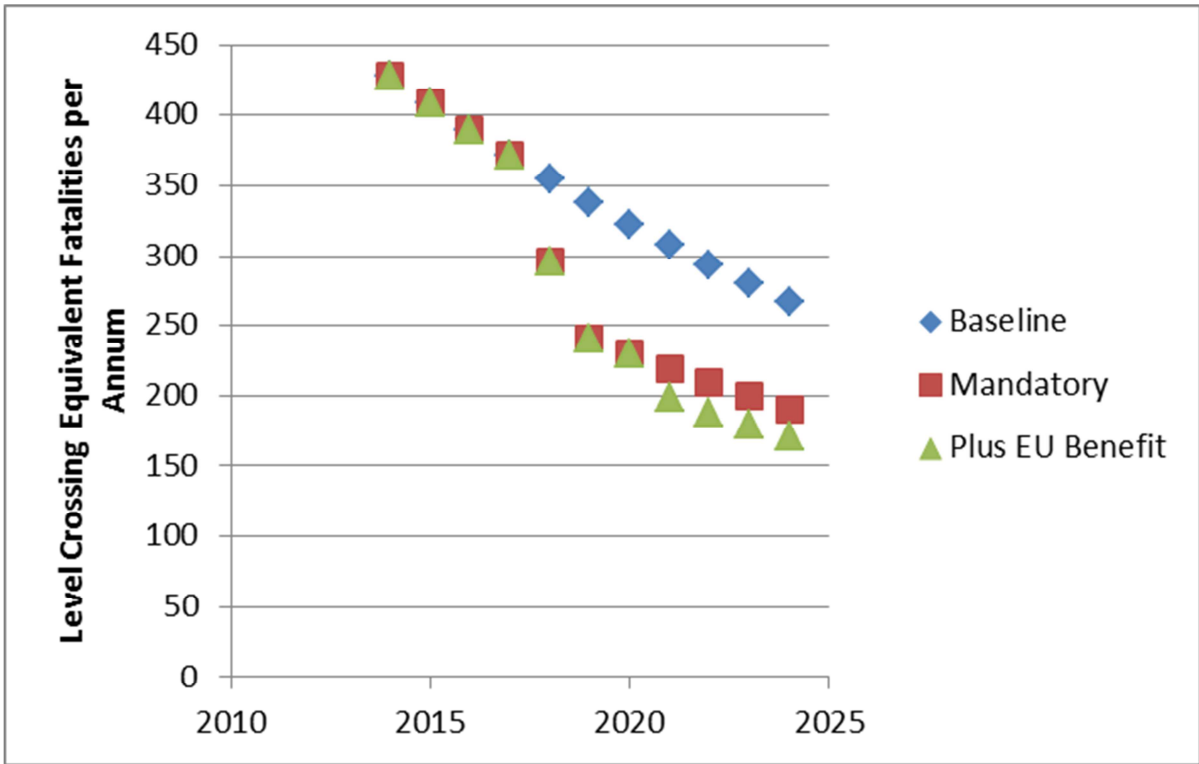


Figure 10 - The Forecast Level Crossing Equivalent Fatalities for the Mandatory Policy Options

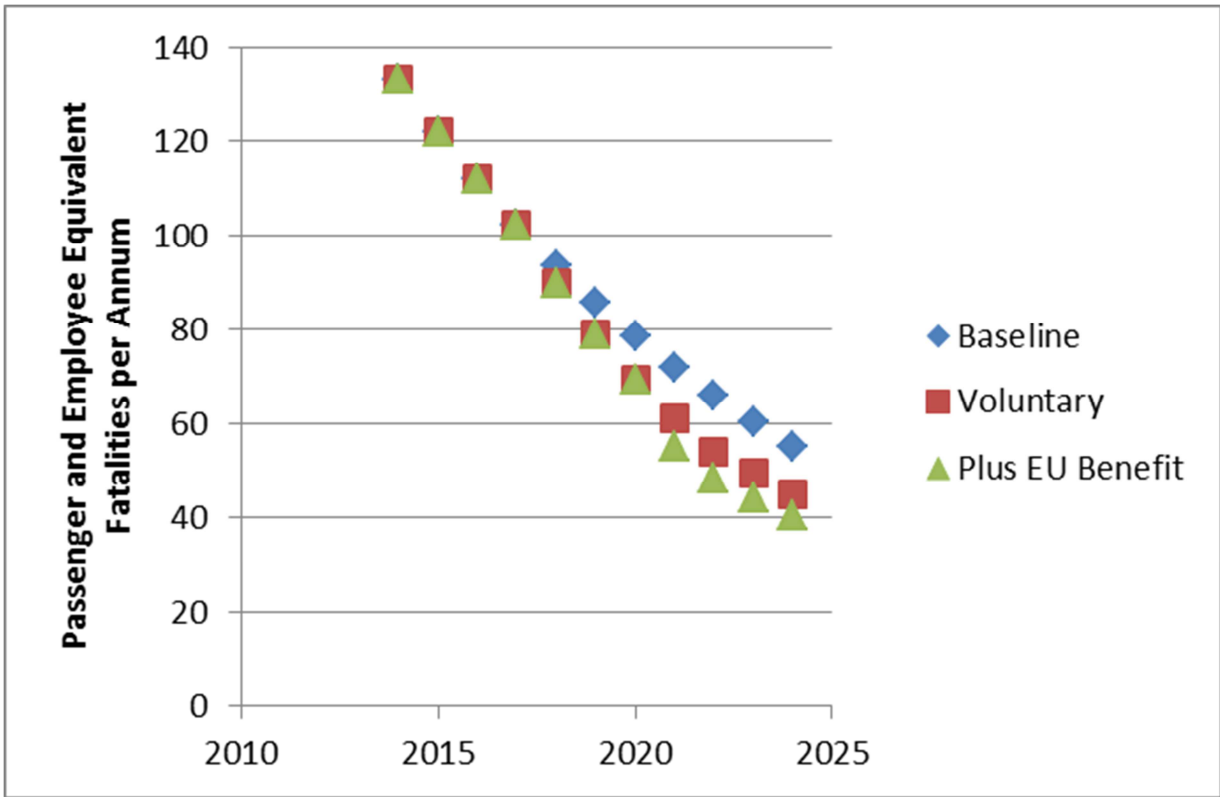


Figure 11 - The Forecast Passenger and Employee Equivalent Fatalities for the Voluntary Policy Options

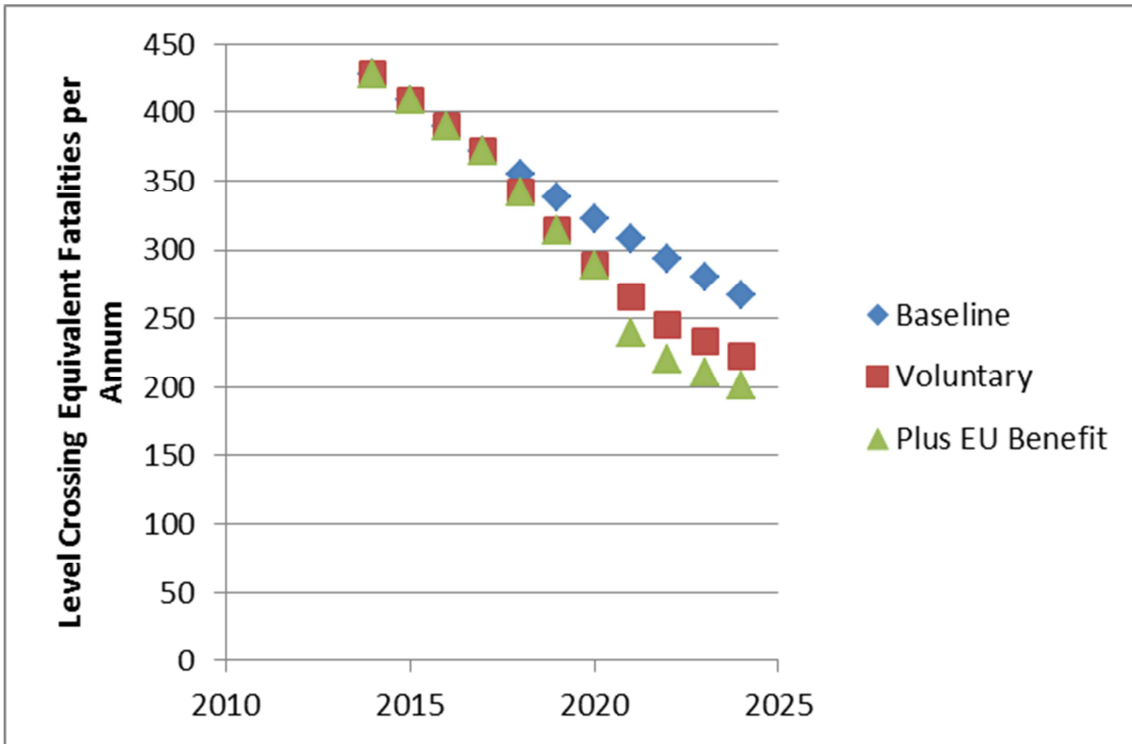


Figure 12 - The Forecast Level Crossing Equivalent Fatalities for the Voluntary Policy Options

Monetising these benefits and discounting as discussed provides a forecast benefit for passenger and employee and level crossing users for the options:

- Mandatory adoption of COR at Member State level
- Mandatory adoption of COR at a Member State and EU level
- Voluntary adoption of COR at Member State level
- Voluntary adoption of COR at a Member State and EU level

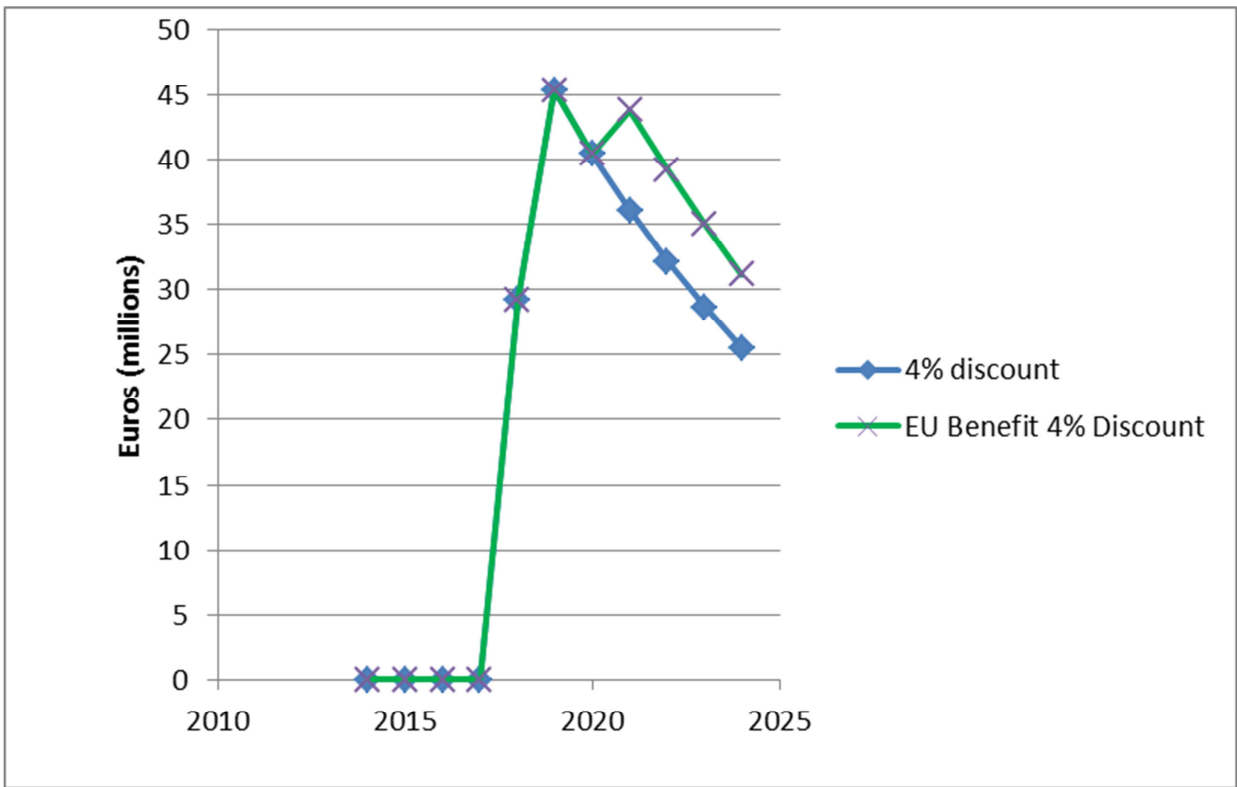


Figure 13 – The Annual Benefit in Euro for the Mandatory Policy Options for Passenger and Employee

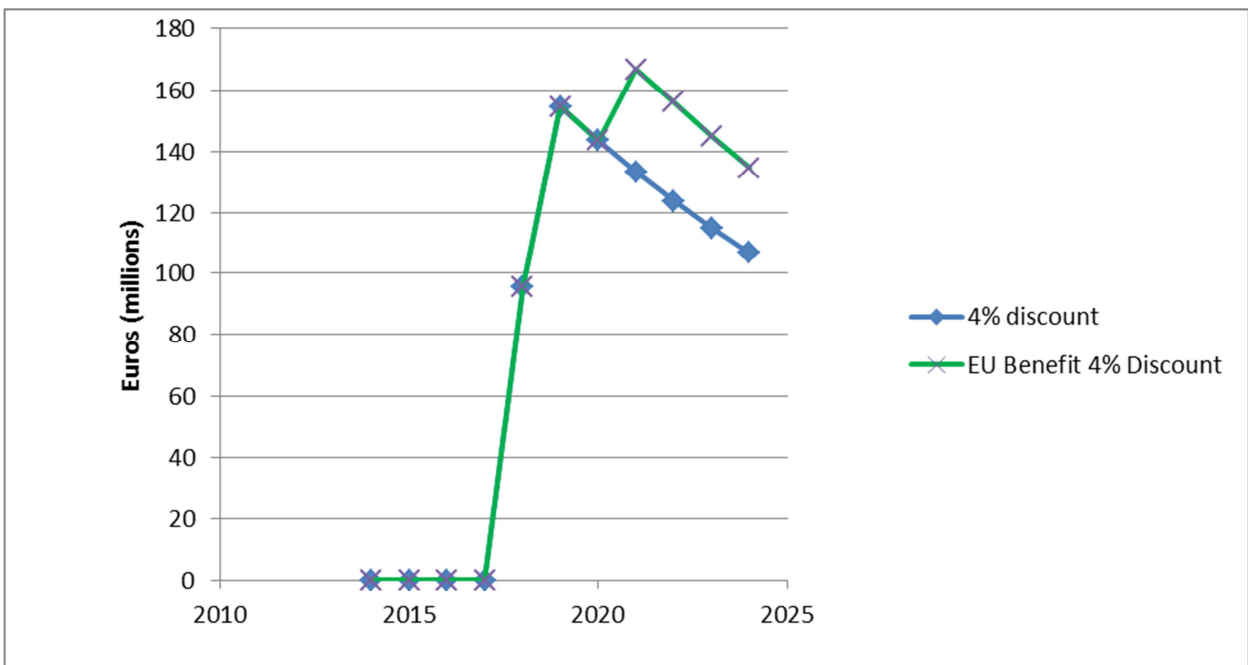


Figure 14 - The Annual Benefit in Euro for the Mandatory Policy Options for Level Crossings

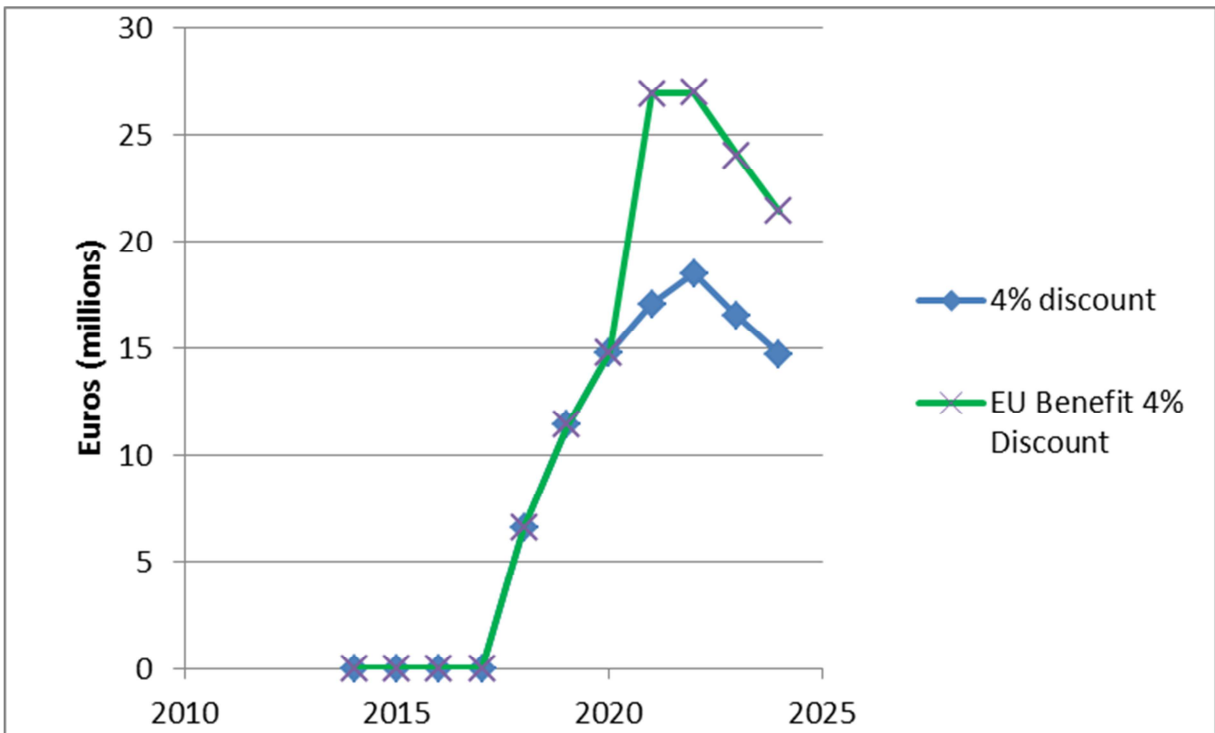


Figure 15 - The Annual Benefit in Euro for the Voluntary Policy Options for Passenger and Employee

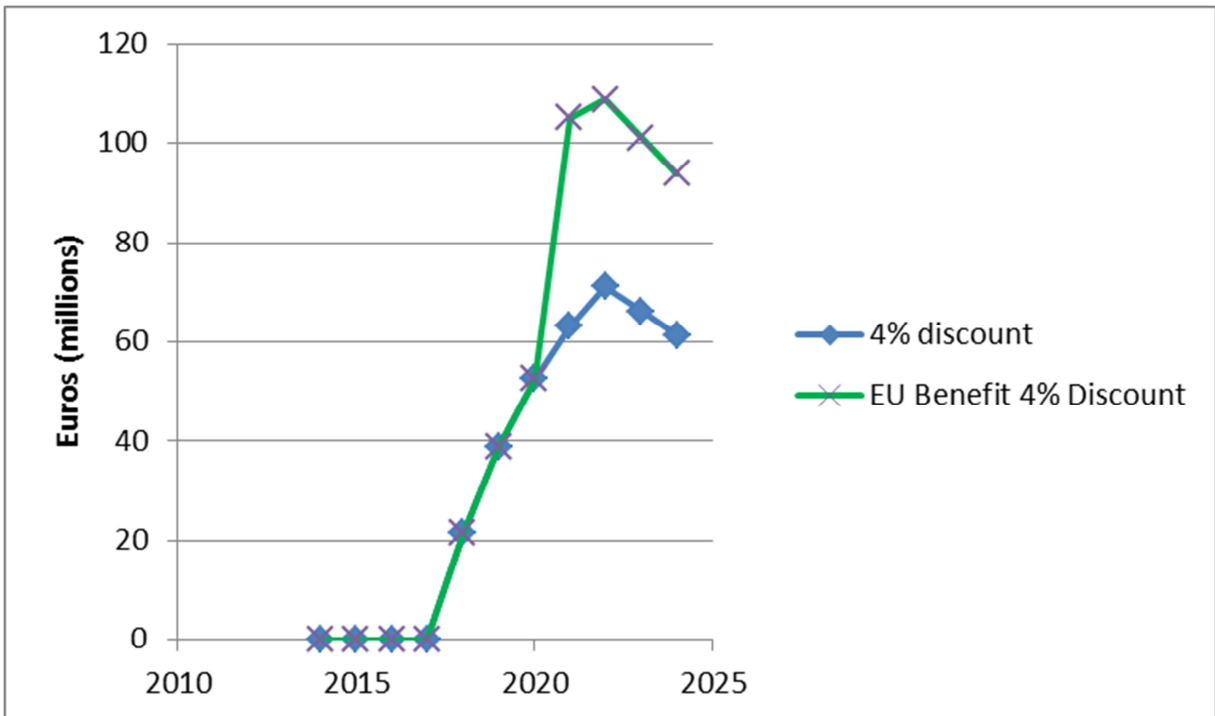


Figure 16 - The Annual Benefit in Euro for the Voluntary Policy Options for Level Crossings

4.2 Estimation of Costs

The costs associated with a Comprehensive Common Occurrence Reporting Regime were estimated using input from railway undertakings and infrastructure managers. This input was obtained using a survey. Infrastructure managers and railway undertakings were chosen as the source of the cost data as it was considered that they were already operating occurrence reporting regimes that went beyond the requirements of the Common Safety Indicator reporting.

The survey was distributed by the Agency to the infrastructure managers via the European Railway Infrastructures Managers and to railway undertakings via the Community of European Railways. A total of 14 responses were received to the survey, representing 12 infrastructure managers and 2 railway undertakings. The respondents requested that the information provided be treated as confidential. For this reason individual responses were collated and a mean cost per occurrence reported calculated for:

- IT hardware costs
- IT software costs
- Full time equivalent (FTE) employees required to collate, input, validate and analyse the data

The mean IT cost (hardware and software) per occurrence was calculated at €10.65 and the number of FTE employees needed as 0.00126 per occurrence; this equated to one FTE processing 800 occurrence reports per annum which at approximately 4 a day is deemed realistic.

The responses from the infrastructure managers and railway undertakings showed a wide range in the volume of occurrence reporting per annum from 240 per annum to 100,000 per annum. This highlights that even at the level of the industry scope for the harmonisation of occurrence reporting to a comprehensive form exists.

Having estimated a cost per occurrence the mean volume of occurrences required to support a comprehensive common occurrence reporting regime was estimated. Using data received in the first survey and presented in the Task 1 report the number of occurrences being reported annually for those Member States currently considered to be employing a comprehensive occurrence reporting regime was calculated, normalised by the train km reported from the ERAIL database to establish a mean number of annually reported occurrences per train km. Using the reported number of train km per Member State a calculation was made of the number of occurrences that would be reported in a Member State if it reported at the same rate per train km as the mean value calculated above. This was compared to the actual occurrences reported per train km and a calculation made of the additional occurrences required to achieve a comprehensive reporting regime in that Member State. In total an additional 180,000 occurrence reports will be required across the EU, Norway and Switzerland on an annual basis. The additional costs associated with this are then:

IT costs €1.8 million

FTE 210 persons

The FTE figure was monetised using the cost per hour worked for an employee (including social costs) obtained from Eurostat and assuming wage inflation of 1%¹⁸ per annum. This was combined with data on the hours worked per week obtained from Eurostat assuming a productivity improvement of 1.1%¹⁹ per annum. This generated a cost per week which was converted to an annual cost by assuming 46 working weeks per annum, deducting holidays, training, and absence.

¹⁸ E-Mail correspondence with Torsten Holvad of the European Railway Agency, 23rd September 2015

¹⁹ The 2015 Ageing Report Economic and budgetary projections for the 28 EU Member States (2013-2060) EUROPEAN ECONOMY 3|2015 http://ec.europa.eu/economy_finance/publications/european_economy/2015/pdf/ee3_en.pdf

For the costs associated with EU level collation of reports two scenarios were considered. The first is the collation of all occurrence reports centrally by a single organisation in the EU, so that the occurrence report goes both to the Member State and the central European organisation. The second scenario is the collation of occurrence reports at Member State level and then the reporting of consolidated occurrence reports to the central European organisation. Costs for the central European organisation have been estimated using the same approach as for the Member States above, but with EU mean data from Eurostat for the cost of labour per hour, and the number of hours worked per week. In all cases costs have been discounted by 4% per annum to generate Net Present Values.

It should be noted that the volume of occurrences reported will extend beyond those for just level crossing users and passengers and employees to include unauthorised users, near misses, etc... Conservatively costs for these have been allowed and no associated benefit assumed. Figures 17 and 18 show the projected annual costs for both the mandatory and voluntary policy options over a ten year period.

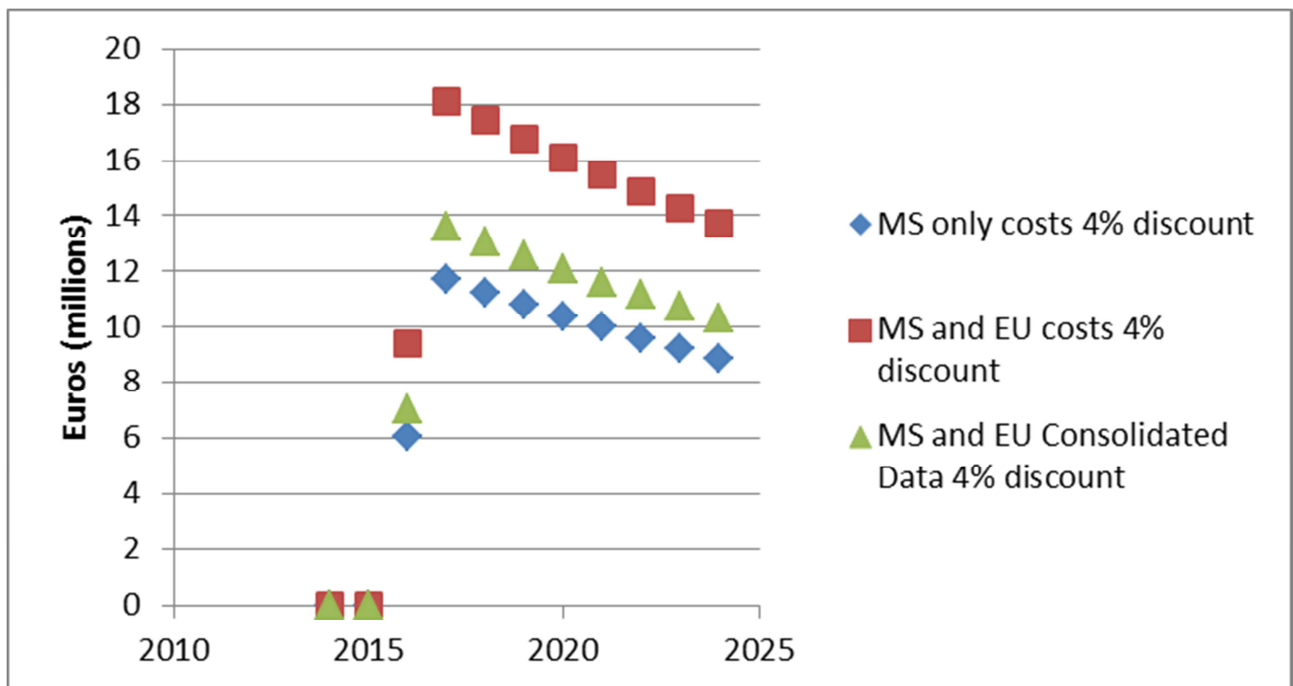


Figure 17 – The Projected Annual Costs for the Mandatory Policy Options for the next decade

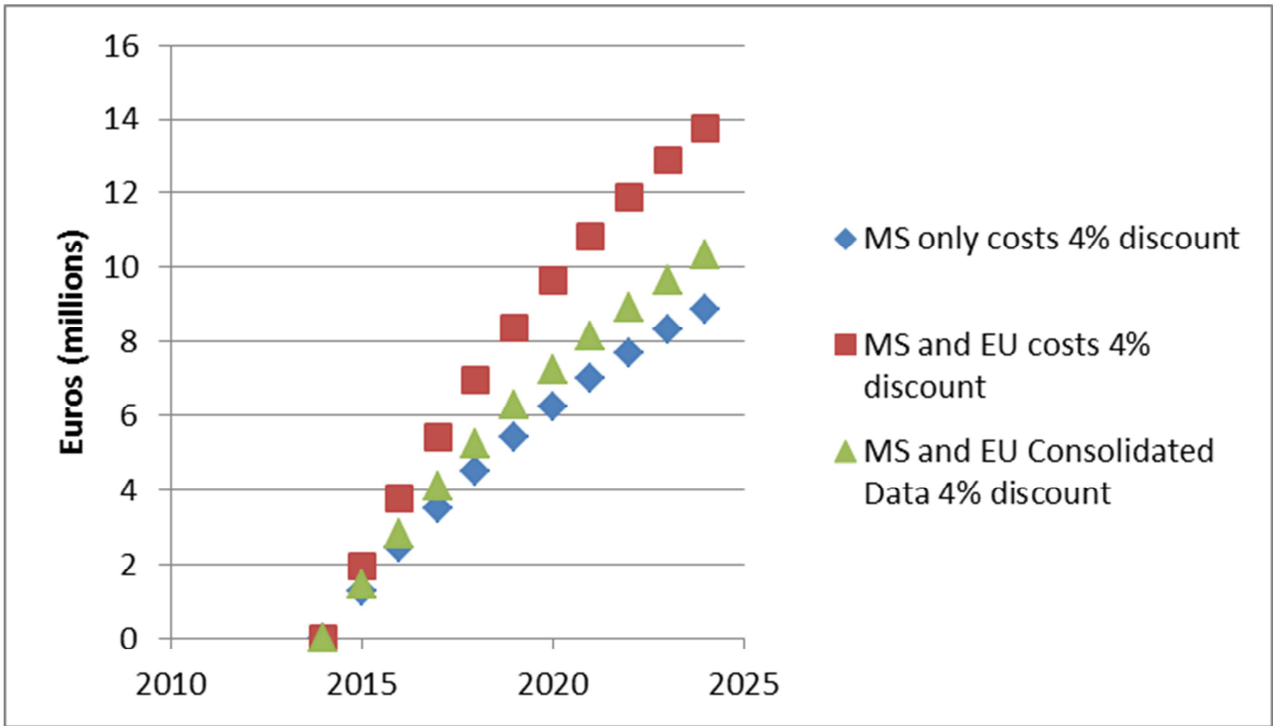


Figure 18 – The Projected Annual Costs for the Mandatory Policy Options for the next decade

4.3 Overall Cost Benefit

Combining the costs and benefits over a ten year period provides the following overall cost benefit scenarios for both the mandatory and voluntary occurrence reporting regimes as shown in figures 19-22.

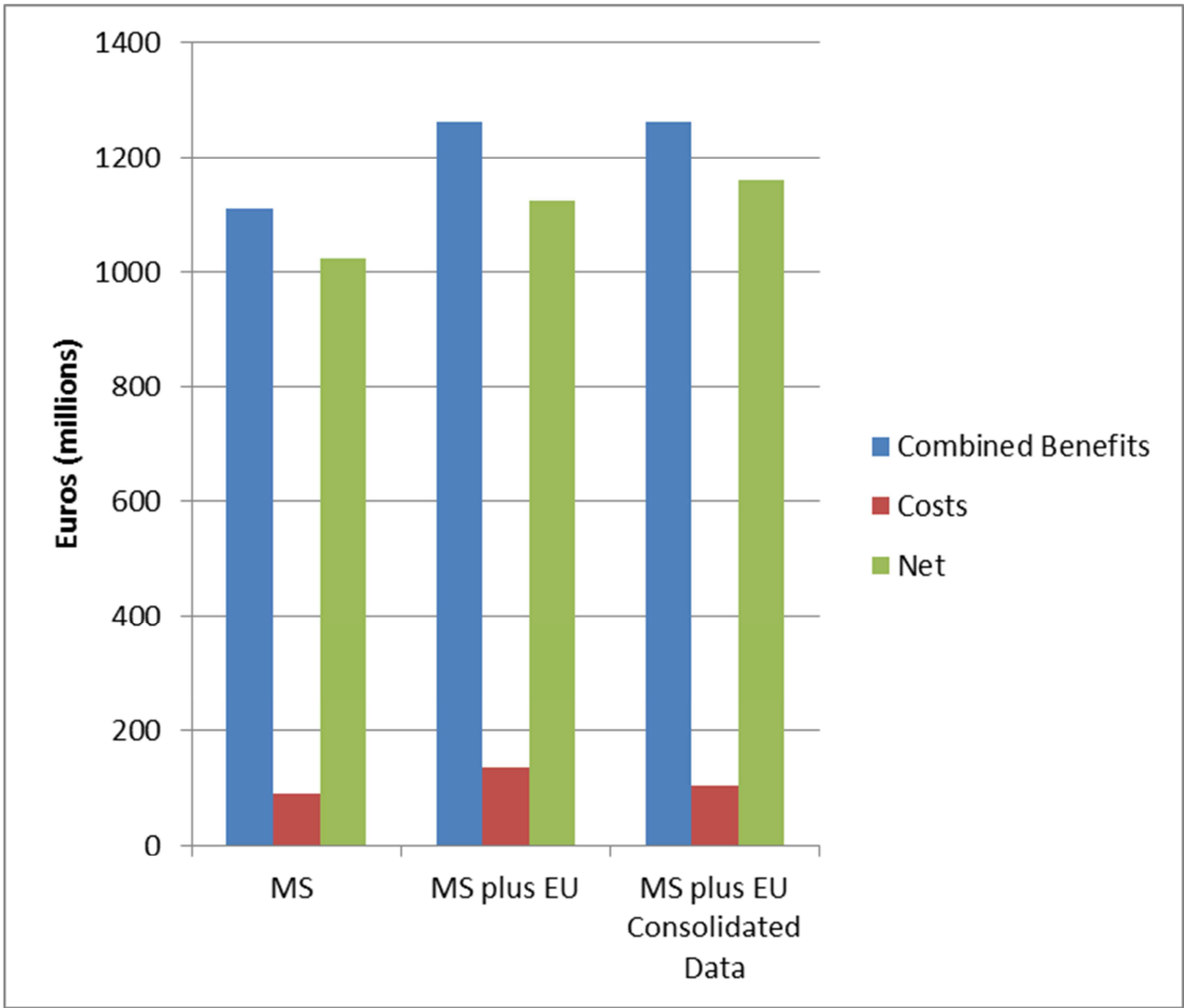


Figure 19 – The Projected Total Costs and Benefits of a Ten Year Period for the Mandatory Policy Options

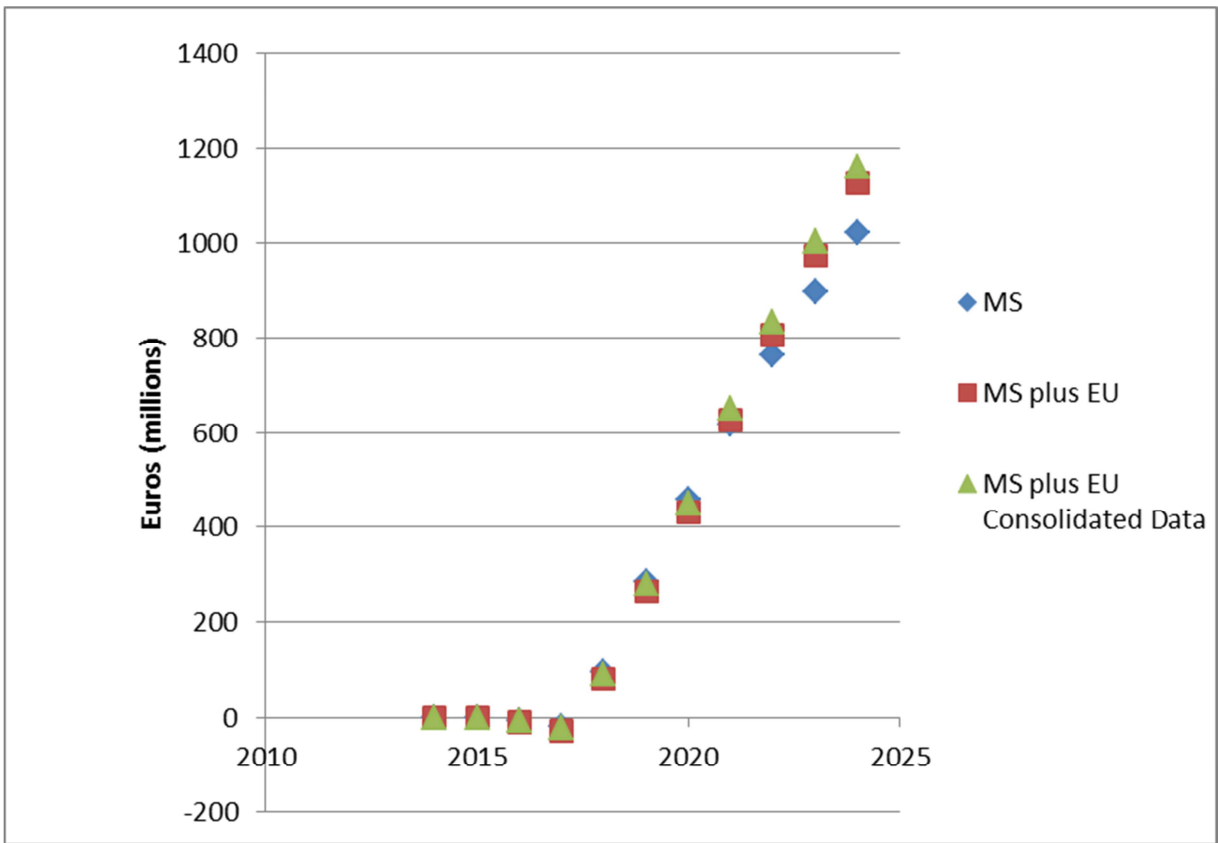


Figure 20 – The Projected Cumulative Net Benefit for the Mandatory options over a Ten Year Period

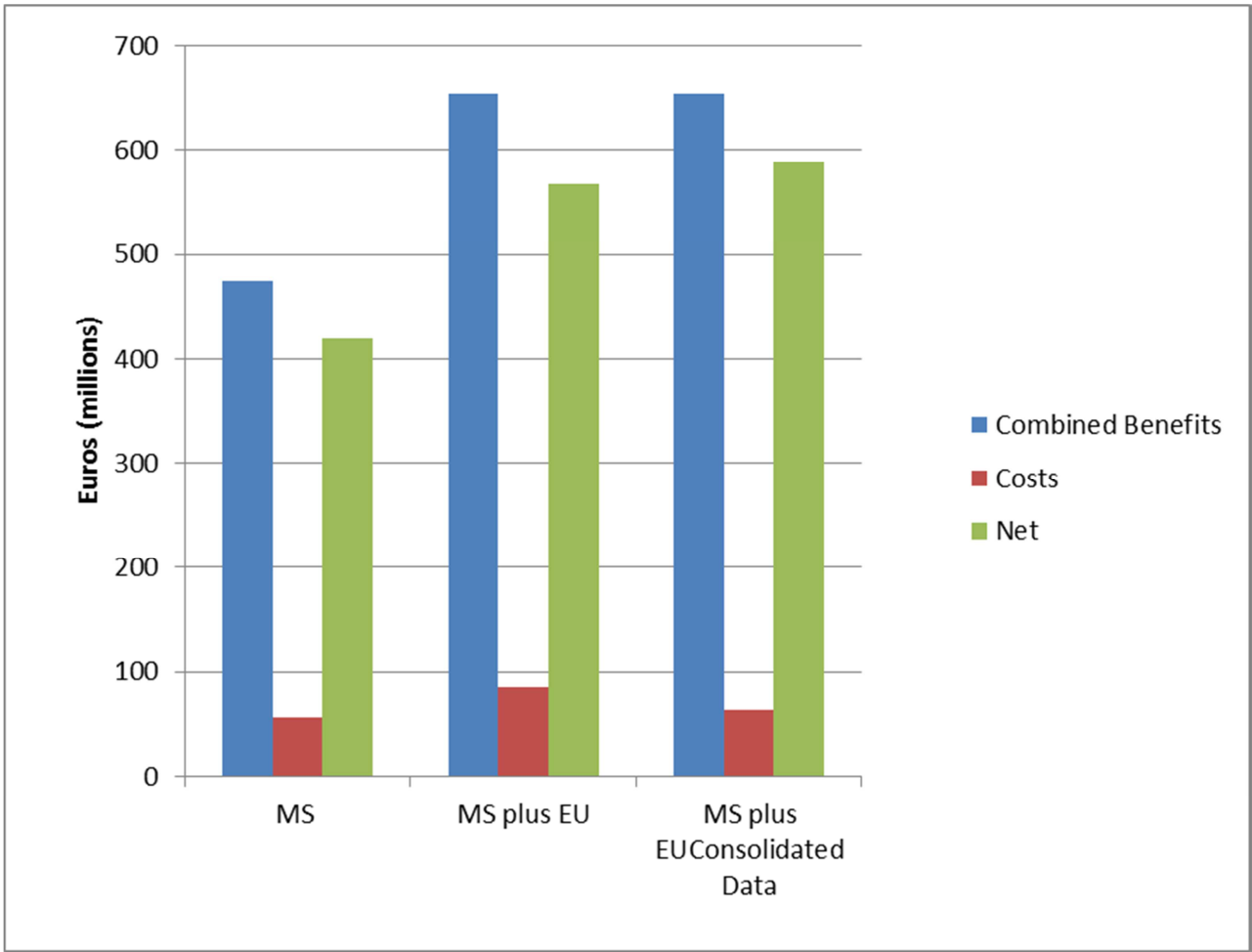


Figure 21 – The Projected Total Costs and Benefits of a Ten Year Period for the Voluntary Policy Options

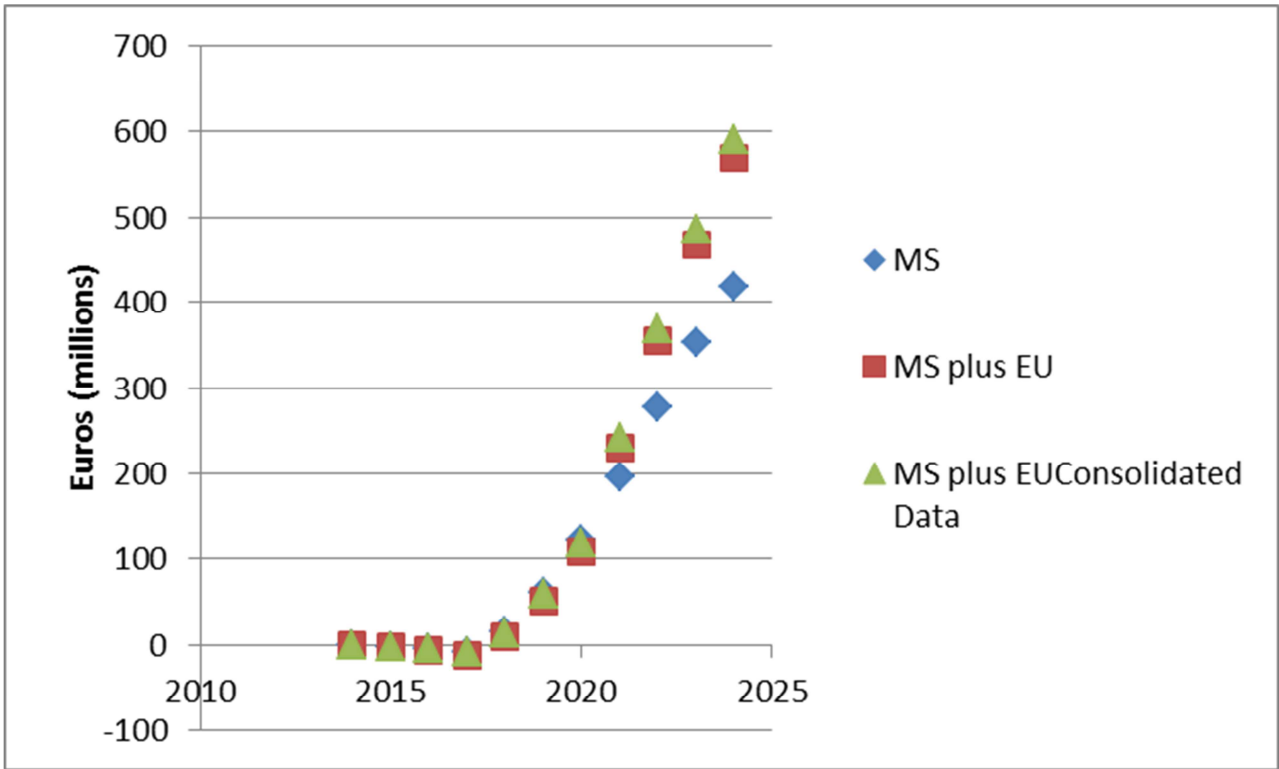


Figure 22 – The Projected Cumulative Net Benefit for the Voluntary Options over a Ten Year Period.

This analysis assumes that all of the benefit of reduced equivalent fatalities found in those regimes employing a comprehensive reporting regime is attributable to better reporting. In reality reporting is only one aspect, albeit a highly important one, of a regulatory regime that requires reported data to be acted on. To reflect this in a conservative manner it has been assumed that only 10% of the benefit is attributable to improved reporting. The use of this figure is supported by other studies such as that for the assessment of electronic data recorders in automotive fleets. A review of this data²⁰ provided the following estimates for the reduction in accidents from the fitment of electronic data recorders which effectively act to report occurrences by the driver of a vehicle:

Table 15 – The Impact on Safety in Terms of Reductions of Accidents Following Fitment of Electronic Data Recorders as Reported in Various Studies; after Transport Research Laboratory¹⁹

Impact on Accidents
15% reduction
28% reduction
56% reduction

²⁰

Study on the benefits resulting from the installation of Event Data Recorders, Transport Research Laboratory http://ec.europa.eu/transport/road_safety/pdf/vehicles/study_edr_2014.pdf

Impact on Accidents
20% reduction
6-7% reduction in casualties
9-66% reduction
20% reduction (+/- 15%)
No significant effect
Reduction 10%

Whilst this is not a perfect analogy it is examining the impact of collecting data on driver performance on safety and indicates that allocating 10% of the overall benefit identified above to reporting is a reasonable assumption.

This amends the cost benefit as shown in figures 23 and 24 and 25 and 26:

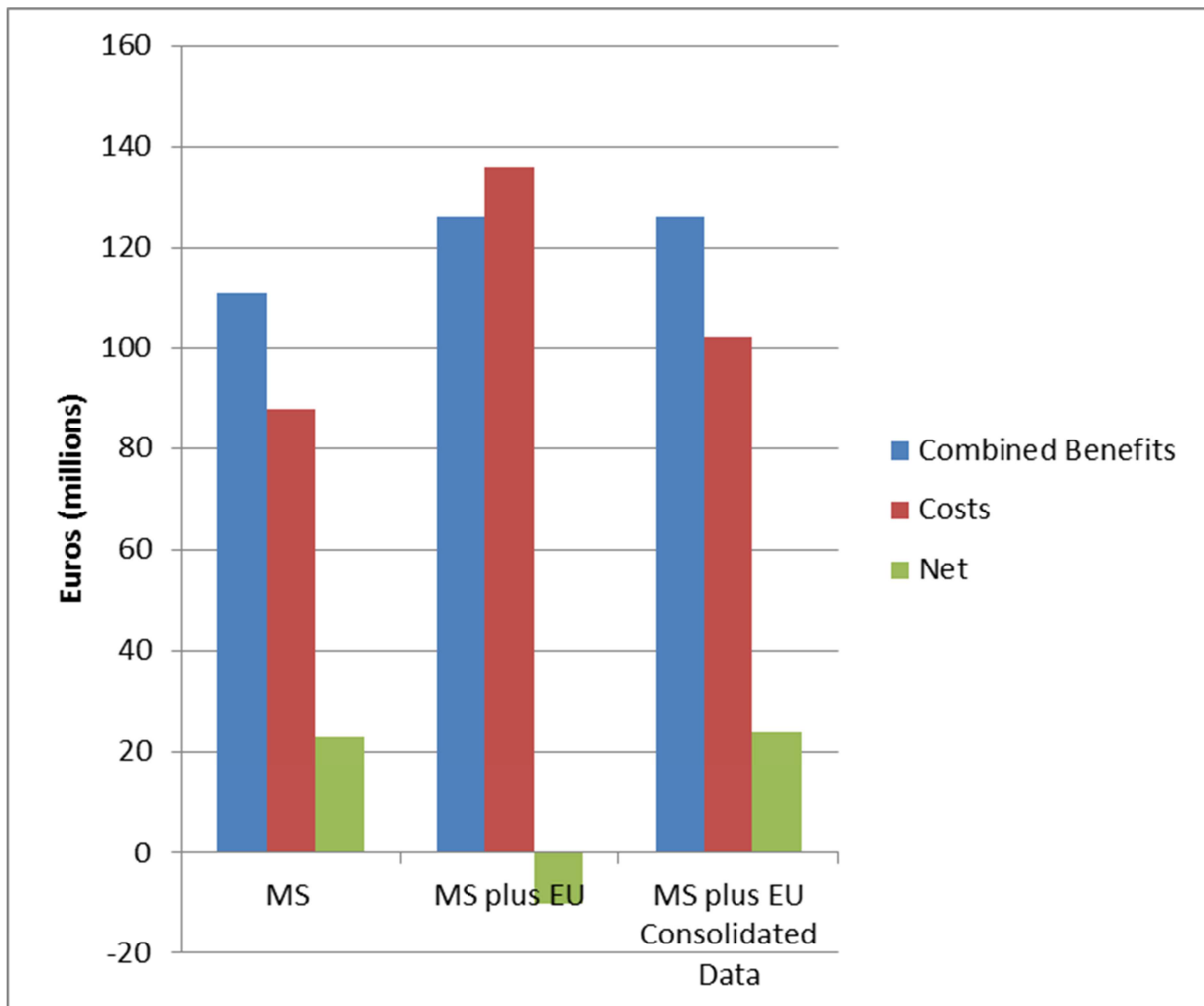


Figure 23 – The Projected Total Costs and Benefits over a Ten Year Period for the Mandatory Policy Options, Assuming that only 10% of the Projected Benefit is due to the Occurrence Reporting Regime

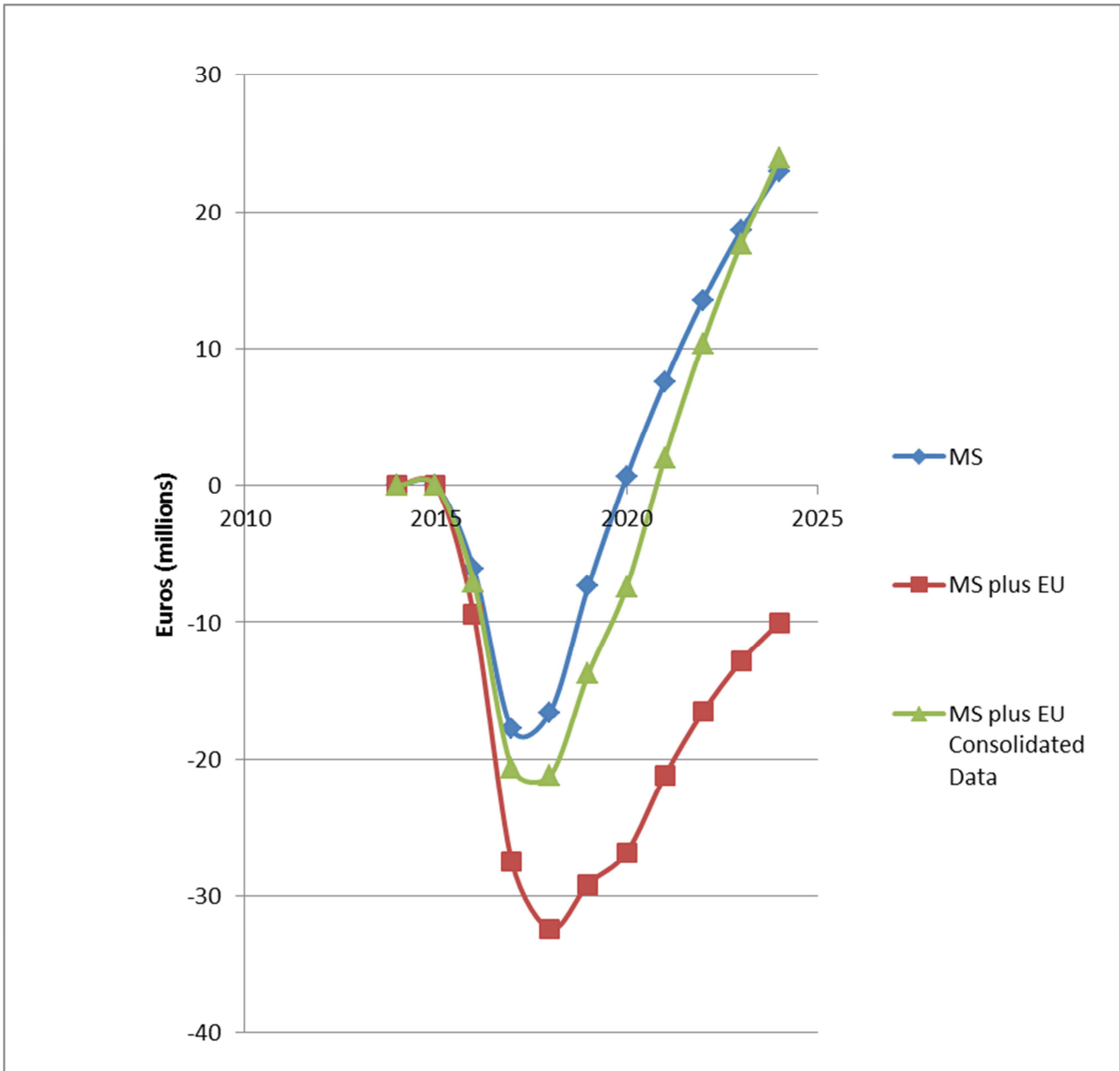


Figure 24 – The Projected Cumulative Net Benefit over a Ten Year Period for the Mandatory Policy Options Assuming that 10% of the Benefit is Attributable to Occurrence Reporting

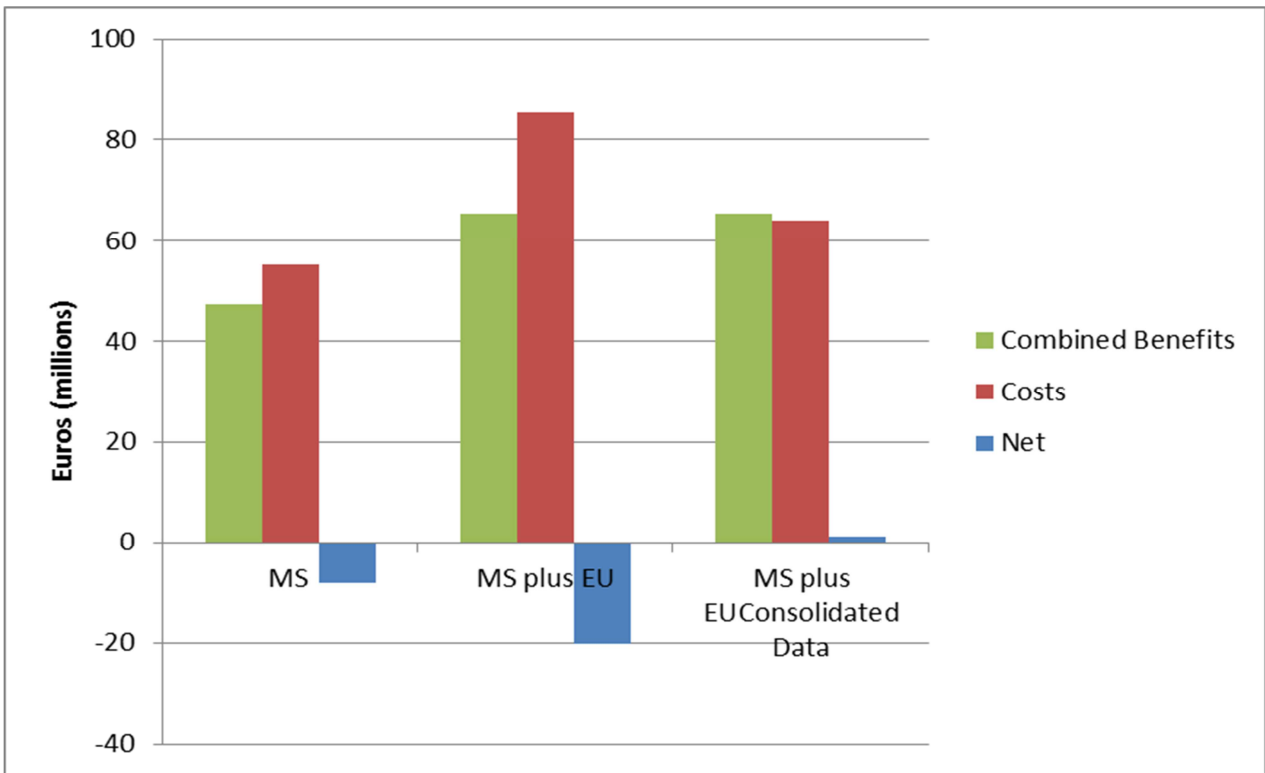


Figure 25 – The Projected Total Costs and Benefits of a Ten Year Period for the Voluntary Policy Options Assuming that 10% of the Benefit is Attributable to Occurrence Reporting

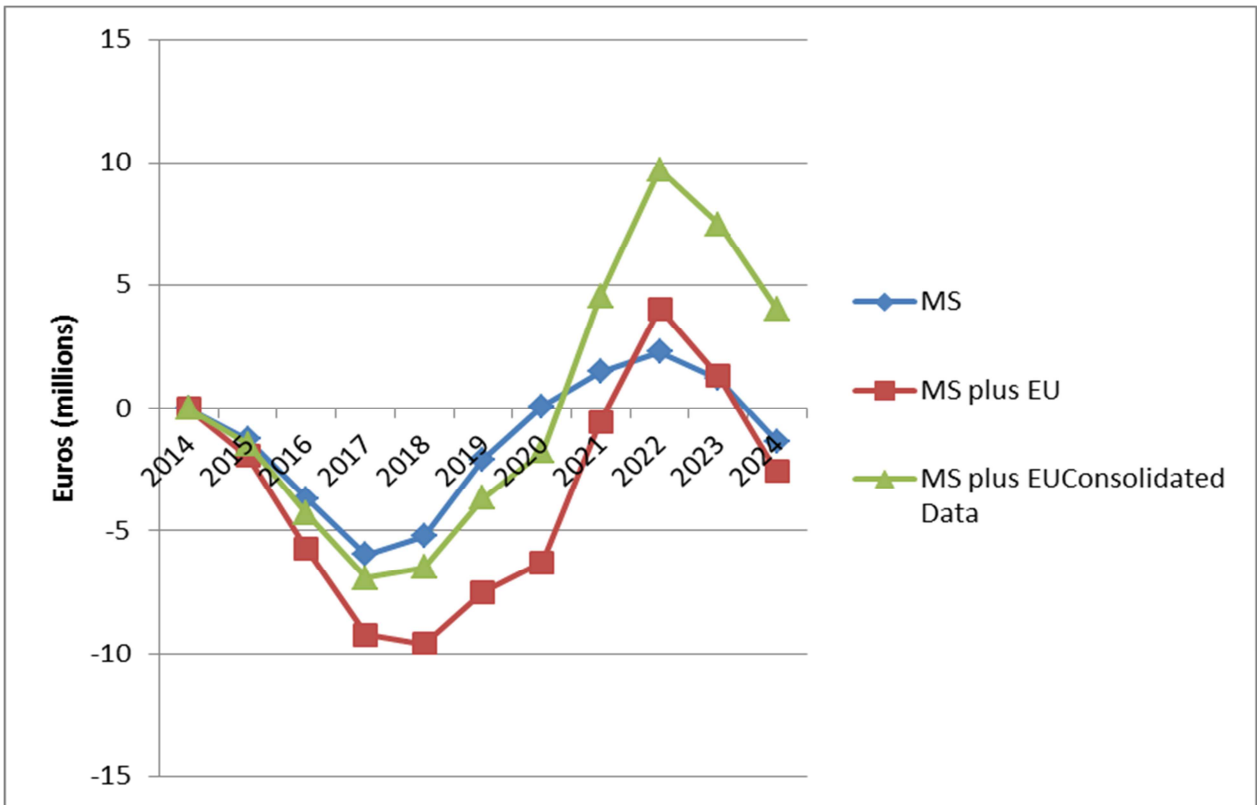



Figure 26 – The Projected Cumulative Net Benefit over a Ten Year Period for the Voluntary Policy Options Assuming that 10% of the Benefit is Attributable to Occurrence Reporting



The 10% benefit cost benefit assessment concludes that it is the option of a comprehensive occurrence reporting system instigated at a Member State level and with consolidated occurrence reports reporting to a central European organisation that is the positive cost benefit assessment options for the mandatory implementation scenario and cost neutral voluntary implementation scenario.

Preferred Option: A comprehensive Common Occurrence Reporting Regime implemented within each Member State and with Consolidated Occurrence Reports Reported to a Central European Organisation. This can be either voluntary or mandatory.

4.4 Analysis of Wider Impacts of the Preferred Option

4.4.1 Impact on Rail Safety

The introduction of the preferred option will have significant positive benefits for rail safety in the European Union and at both the Member State and EU level.

4.4.2 Economic Impact

As demonstrated above in the partial general equilibrium model the economic impact of the preferred option is positive over a ten year period.

4.4.2.1 Impact on the Member States

The Member States shall be asked to make a significant investment in a common occurrence reporting system. Those already employing a comprehensive occurrence reporting system are anticipated to receive little additional benefit compared to those yet to implement one. Based upon a full application of the benefits it is estimated that under a mandatory regime 19 Member States will benefit with the mean benefit being €69 million, four Member States will be cost and benefit neutral and six Member States will experience a loss with the mean loss being €4 million over the ten year period.

Under a voluntary scheme 19 Member States will see a benefit with the mean benefit being €29 million, four will remain cost and benefit neutral and six will see a loss with the mean loss being €2.6 million over the ten year period. This benefit does not include the assumption that 10% of the benefit is attributable to reporting.

4.4.2.2 Impact on the Industry

No overall impact is anticipated on the industry as comprehensive occurrence data collection is already in evidence in infrastructure managers and railway undertakings as seen in the survey results.

4.4.3 Impact on the internal market and competitiveness of EU companies

This is anticipated to improve as improved safety improves the competitiveness of the EU rail market and internal barriers in the internal market from safety are reduced.

4.4.4 Administrative Burden

This has been addressed in the partial general equilibrium model where estimates of the additional staff and IT costs have been made as a part of the calculation of the overall costs of the various options considered.

4.4.5 EU Budget

The costs that fall to a central European organisation in regard to consolidated occurrence reports collection and reporting are estimated in the partial general equilibrium model at €17 million over ten years for the mandatory option and €11 million over ten years for the voluntary option. It is anticipated that this would be funded from the EU budget.

4.5 Social Impacts

4.5.1 Standards and Rights Related to Job Quality

As discussed in the Task 1 report occurrence reporting regimes can be compromised by the actual or perceived negative consequences of reporting on any individual and issues of confidentiality in terms of individuals reporting. At the level of the European consolidated occurrence reports reporting there should be no requirement to report personal or confidential information. At the Member State level the majority of Member State databases are already either confidential or only extend to the collection of CSI data, which is itself anonymised.

The mandatory option would clarify reporting requirements and could easily be combined with a Just Culture or “no blame” policy included in the legal instrument as is the case with common occurrence reporting in aviation. The voluntary option could recommend this in guidance.

4.5.2 Employment

No direct consequences for employment are anticipated for either the mandatory or voluntary option.

4.5.3 Personal Data

At the EU level no personal data should be held. At a national level suitable provision will have to be included. The mandatory option could achieve this through the legal instrument. The voluntary option could only recommend this in guidance.

4.5.4 Public Health and Safety

Public health and safety are impacted by train accidents and both the mandatory and voluntary options would positively impact this in proportion to the reduction in accidents.

4.6 Environmental Impacts

The environment is impacted by train accidents and both the mandatory and voluntary options would positively impact this in proportion to the reduction in accidents.

4.6.1 Impact on fundamental Rights

There would be positive impacts on the right of EU citizens to safe communication by train for both the mandatory and voluntary options.

4.6.2 Impacts on Simplification of Existing Legislation

No impact is anticipated for either the mandatory or voluntary options.

4.6.3 Impacts on Third Countries

Third country train passengers would benefit from a safe EU railway network and therefore be impacted in proportion to the intensity of safety improvements from either the mandatory or voluntary options.

4.7 Comparing the Policy options

Both the mandatory and the voluntary option provide a positive cost benefit analysis over a ten period, with the mandatory option being marginally more positive, although the impact on the EU budget is marginally higher for the mandatory option. The mandatory option however, provides better protection through the legal instrument for job protection (a “no blame” or Just Culture) and confidentiality. As confidentiality and the need for a “no blame” culture for the individual reporting have been shown to be important considerations in the effective operation of other reporting regimes (task 1 report) it is the mandatory option that is recommended as most beneficial overall.

4.8 Implementation Considerations

Both the qualitative and the quantitative assessments indicate that both a mandatory and a voluntary approach have benefits and are capable of addressing the identified problem drivers. In both cases most benefit is obtained from both a comprehensive national and EU level reporting of consolidated occurrence reports. The analysis has been based on the assumption of an implementation of both a voluntary and a mandatory scheme in 2015. However, at a practical level there would obviously be much work required before either could be introduced, not least developing and approving necessary legal instruments for a mandatory approach and writing guidance for a voluntary approach and investing in reporting and analysis systems for both.

The role of the central European reporting body could be fulfilled by a wide variety of organisations. The most obvious and the recommended option would be to use the existing European Railway Agency as:

- The strategic role of the Agency which “was set up to help create ... (an) integrated railway area by reinforcing safety and interoperability” aligns well with the role of a central European reporting body.
- The Agency is currently responsible for collecting and disseminating (via the ERAIL database) the statistics on the Common Safety Indicators and as such is already experienced in acting as a central European reporting body, with consequent efficiency anticipated.
- The Agency is highly experienced in engaging with both the Member States National Safety Authorities and the railway sector in defining such a reporting system and developing guidance for one.
- The Agency is central to the development and functioning of the regulatory structure for railways in the EU, one component of which is occurrence reporting. The Agency is thus well placed to not just administer the European level occurrence reporting but to see it integrated fully into the regulatory structure at which point the full benefits may be realised.

The recommended implementation plan would then be for the Agency to initially launch a working group or series of working groups to prepare a full taxonomy and guidance for reporting with the Member States. This would seek to encourage voluntary adoption in advance of the mandatory legal instrument and prepare the ground for the implementation of a mandatory occurrence reporting system through the use of the guidance.



5 CONCLUSION

The impact analysis supports a recommendation for the introduction of a mandatory occurrence reporting regime for all Member States and the collation of consolidated occurrence reports at an EU level by a central body. The European Railway Agency is identified as a suitable organisation to act in this capacity and a recommendation is made for an implementation involving the forming of one or more working groups of Member States under the Agency to develop a full taxonomy and guidance as a prelude to the mandatory legal instrument.

APPENDIX ONE – DATA SOURCES

Data Source or Assumption	Reference
Number of Occurrences Reported per Annum	From Survey of Member States
Costs Associated with Occurrence Reporting	From Survey of Infrastructure Managers and Railway Undertakings
GDP per Capita	Eurostat http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00001&plugin=1
Cost of Labour	Eurostat http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tps00173&language=en Statistical Data on Switzerland 2015, Federal Statistics Office, Switzerland
GDP Growth Rate	Correspondence with the Agency 18/9/2015 http://ec.europa.eu/economy_finance/publications/european_economy/2015/pdf/ee3_en.pdf
Labour Productivity Growth and Wage Inflation	Correspondence with the Agency 23/9/2015 http://ec.europa.eu/economy_finance/publications/european_economy/2015/pdf/ee3_en.pdf
Hours worked per Week	Page 38 Task 3 Report Eurostat http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tps00071&plugin=1
Passenger and Employee Fatalities and Serious Injuries	ERAIL Database https://erail.era.europa.eu/safety-indicators.aspx
Persons Killed or Seriously Injured in Level Crossing Accidents	ERAIL Database https://erail.era.europa.eu/safety-indicators.aspx
Number of Active Level Crossings	ERAIL Database https://erail.era.europa.eu/safety-indicators.aspx
Unauthorised Persons Fatalities or Serious Injuries	ERAIL Database https://erail.era.europa.eu/safety-indicators.aspx
Train km	ERAIL Database https://erail.era.europa.eu/safety-indicators.aspx

Data Source or Assumption	Reference
Line km	ERAIL Database https://erail.era.europa.eu/safety-indicators.aspx
Value per Fatality	Implementation Guidance for CSIs, ANNEX 1 OF DIRECTIVE 2004/49/EC DIRECTIVE 2004/49/EC as amended by DIRECTIVE 2009/149/EC ERA/GUI/09-2013 http://www.era.europa.eu/Document-Register/Documents/ERA%20Guidance for Use of CSIs V2 1%202012-06-06.pdf
Discount Rate Applied	Correspondence with the Agency 18/9/15 http://ec.europa.eu/smart-regulation/guidelines/tool_54_en.htm
10% additional benefit from EU level Common Occurrence Reporting	Page 32 of Task 3 Report - professional judgement
Net Benefit due to Reporting Assumed 10% of Gross Benefit	Study on the benefits resulting from the installation of Event Data Recorders, Transport Research Laboratory http://ec.europa.eu/transport/road_safety/pdf/vehicles/study_edr_2014.pdf
Number of Occurrence Reports Collated at EU Level	Assumed equivalent to 10% of the volume of National Occurrence Reporting
Timing for Introduction of Mandatory Reporting Benefits and Costs	Page 32 Task 3 Report - professional judgement
Timing for Introduction of Voluntary Reporting Benefits and Costs	Page 32 Task 3 Report - professional judgement





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