



# Study on the implementation and effects of Directive 2004/54/EC on minimum safety requirements for road tunnels in the trans-European road network

EXECUTIVE SUMMARY

17 June 2015

ICF International in association with





*This page is intentionally blank*



# Study on the implementation and effects of Directive 2004/54/EC on minimum safety requirements for road tunnels in the trans-European road network

FINAL REPORT

A report submitted by [ICF Consulting Services](#)  
in association with

[TRT Trasporti e Territorio](#)

Date: 17 June 2015

Job Number

[ICF Consulting Limited](#)  
Watling House  
33 Cannon Street  
London  
EC4M 5SB  
T +44 (0)20 3096 4800  
F +44 (0)20 3368 6960  
[www.icfi.com](http://www.icfi.com)

---

## Document Control

<b>Document Title</b>	Study on the implementation and effects of Directive 2004/54/EC on minimum safety requirements for road tunnels in the trans-European road network – Executive Summary
<b>Prepared by</b>	Enrico Pastori (Lead author), Marco Brambilla, Daniele Apicella, Andrew Jarvis
<b>Checked by</b>	Andrew Jarvis
<b>Date</b>	17 June 2015

This report is the copyright of European Commission Directorate General for Mobility and Transport and has been prepared by ICF Consulting Ltd under contract to European Commission Directorate General for Mobility and Transport. The contents of this report may not be reproduced in whole or in part, nor passed to any other organisation or person without the specific prior written permission of European Commission Directorate General for Mobility and Transport.

ICF has used reasonable skill and care in checking the accuracy and completeness of information supplied by the client and/or third parties in the course of this project. ICF is however unable to warrant either the accuracy or completeness of client and/or third party information nor that it is fit for any purpose. ICF does not accept responsibility for any legal, commercial or other consequences that may arise directly or indirectly as a result of the use by ICF of inaccurate or incomplete client and/or third party information in the course of this project or its inclusion in project outcomes.

## Executive summary

### *This report presents a mid-term evaluation of Directive 2004/54/EC*

This is the final report of a mid-term evaluation of Directive 2004/54/EC. The Directive was intended to improve the safety of road users in tunnels by preventing critical events that might endanger human life, the environment and tunnel installations, and to reduce the consequences of accidents when they do occur. It was adopted in the wake of a number of serious road tunnel fires that caused significant loss of life.

The main aim of the evaluation is to analyse how Member States have implemented the Directive 2004/54/EC, to assess whether it has served its purposes and to identify its other economic, social and environmental effects. It considers the Directive's overall benefits and costs and looks at practices applied by Member States. The evaluation comes ten years after the Directive entered into force, at a point where the deadline for most Member States to fully implement the Directive's requirements has passed and those Member States that secured an extension need to be making the investments required to secure compliance by the final deadline in 2019. It is an opportunity to take stock and assess the extent to which the measures specified by the Directive have been applied and the Directive's overall objectives achieved.

The study was carried out for the Directorate-General for Mobility and Transport (DG MOVE) of the European Commission ('the Commission') under a contract with ICF International<sup>1</sup>. ICF worked in collaboration with TRT<sup>2</sup>. TRT carried out the larger part of the research.

This summary explains the evaluation method before describing the objectives of the Directive and the results of the evaluation by reference to its main themes.

### *The evaluation process involved desk-based research and analysis, written consultations and interviews*

The terms of reference required the contractor to address a series of evaluation questions relating to the Directive that map onto the Commission's standard evaluation framework - addressing topics of relevance, coherence, effectiveness, efficiency, sustainability and EU added value. At the start of the study the evidence needs, the evidence-gathering approach and analytical approach required to address each evaluation question were determined. The project then moved into an evidence gathering phase that collected and reviewed:

- Data on the safety equipment installed in tunnels as of 2012-2014, as determined by Member States' reports to the Commission;
- Data on accidents and fires in tunnels from 20 Member States for the 2010-2014 period;
- The tunnel safety literature, making use of academic, government and others references (sources for this activity included the CIRCABC repository<sup>3</sup>, the PIARC website<sup>4</sup>, independent studies, datasets, research papers and presentations to international meetings and symposiums).

Tunnel Managers, Administrative Authorities and tunnel safety experts in the EU, Norway, Switzerland and selected international institutions were then consulted via questionnaires that were distributed by email. In addition, semi-structured interviews were conducted with selected stakeholders. These helped to clarify particular aspects of the implementation of the Directive and to identify good practices. Further research was carried out on five Member States (France, Germany, Greece, Italy and Slovakia) to inform the preparation case studies of the situation and impact of the Directive in these countries.

---

<sup>1</sup> [www.icfi.com](http://www.icfi.com)

<sup>2</sup> [www.trt.it](http://www.trt.it)

<sup>3</sup> [CIRCABC](http://www.circabc.com) is the Communication and Information Resource Centre for Administrations, Businesses and Citizens, established by the European Commission.

<sup>4</sup> PIARC is the World Road Association. Its website is at <http://www.piarc.org/en/>

In the final phase of the study responses to the evaluation questions were developed based on the totality of evidence gathered. Whilst data availability in many areas of interest to the evaluation was good, in others the scarcity of relevant information imposed constraints on how far specific evaluation questions could be addressed. Particular challenges were faced in relation to: (i) attribution of reductions in accidents in tunnels and of their consequences to the Directive; (ii) determination of the additional costs of the Directive over and above what Member States would otherwise have spent on tunnel maintenance and upgrades. In both cases the information needed to distinguish the impact of the Directive from other drivers of change was absent. These issues constrained responses to questions relating to effectiveness and efficiency of the Directive.

***The objective of Directive 2004/54/EC was to establish minimum safety requirements for road tunnels in the trans-European Network***

The Directive was designed to improve the safety of road users in tunnels. It applies to tunnels that: are in the trans-European Network; were in operation, under construction, or at design stage as of 30 April 2006; and are over 500 metres in length. Any refurbishment work needed to bring tunnels already in operation up to the prescribed standards had to be completed by 30 April 2014. Seven countries<sup>5</sup> with a higher than average density of tunnels were given an additional five years to complete the refurbishment of tunnels already in operation.

The Directive was intended to: adapt safety requirements to technical progress; achieve a large degree of harmonisation of practice and protection across the designated road network; and lead to the adoption of a harmonised risk analysis method. The Directive requires that safety measures are deployed further to a preliminary risk analysis. It identifies:

- administrative provisions to ensure a **clear allocation of responsibilities** amongst the entities involved (i.e., Administrative Authorities, Tunnel Managers, Safety Officers and Inspection Entities);
- **administrative procedures** ensuring a sound management of tunnel safety (e.g., periodic inspections); and
- **safety measures** including technical requirements and operational measures to ensure that tunnels are safe.

Of the 787<sup>6</sup> EU tunnels identified by the evaluation as being in the scope of the Directive, 548 were in operation as of 30 April 2006 and 239 are “new”, i.e. have been, or will be, put into operation after 1 May 2006. 157 of these new tunnels have become operational since 1 May 2006 and the remainder are planned, or are under construction.

***The principal conclusion is that the Directive is having a positive influence on road tunnel safety management but the job of bringing all TEN-T road tunnels over 500m into compliance with its requirements is far from complete and so the minimum safety standard prescribed by the Directive is not yet in place. Some Member States have much to do if they are to complete refurbishment programmes by the 2019 deadline.***

The evaluation concludes that the Directive:

- Has had a positive effect in the awareness of the problem of tunnel safety.
- Is prompting investments that complement other road safety measures, such as safety campaigns, improvements in vehicle safety and introduction of speed control systems.
- Is credited with improving the capacity of tunnel managers and emergency services to manage dangerous events, and to prevent and mitigate the effects of accidents and fires.

<sup>5</sup> Italy, Spain, Austria, Greece, Slovenia, Luxembourg and Croatia.

<sup>6</sup> If Norway is included the total number of tunnels in scope is 949.

- Is recognised as having led to a standard to approach regulation in this area since it establishes minimum safety levels;
- Has triggered research into new solutions and technologies.

Greater progress has been made with the operational and procedural aspects of the Directive than the infrastructure measures. These operational and procedural improvements represent the most significant impact of the Directive in the first ten years of its implementation.

Innovative practices have been identified in relation to: research on the causes of the incidents and on the suitable safety measures, identification of cost efficient measures and innovative techniques, cooperation programmes and joint training among the different subjects involved in the management of the incidents.

The Directive is, however, still far from achieving its overall objective of delivering a minimum level of safety in TEN-T road tunnels in the EU. The tunnel refurbishment programme has not been completed in many countries. Some Member States will face significant challenges in meeting their 2019 deferred deadline. These are also the countries that have a large number of tunnels. Action by the Commission to engage with these Member States on this issue is warranted.

The text below provides the findings on: the state of **implementation**, the **relevance** of the Directive's objectives and requirements; its **coherence** in the context of EU and other prevailing law; the **effectiveness** of the prescribed measures, procedures and arrangements; its **efficiency** (focusing on the additional costs and the results achieved); **sustainability**, considering whether the changes made will have ongoing value, and its EU **added value**.

#### **Implementation: the 2014 deadline prompted action in many countries but there is still much more to do to achieve full implementation in certain Member States**

All the Member States have correctly transposed the Directive into their national legislation. However, nearly a decade since its adoption, the refurbishment of the tunnels in operation by the 30 April 2006 is far from complete. The degree of implementation of the Directive varies widely among Member States.

In those Member States with 2014 deadline, 82% per cent of the tunnels in scope (as measured by total tube length) subject to the 2014 deadline are compliant with the provisions of the Directive. In those Member States with a deadline extension to 2019 only 17% of the tunnels (by tube length) covered by the 2019 deadline are compliant. Considering the EU28 as a whole the overall compliance rate is 30% when assessed on total tube length and 26% when based on the number of tunnels.

The 2014 deadline for the refurbishment works was the most important driver for the implementation of the Directive. The main factor hampering the implementation of the safety requirements was the cost of refurbishing tunnels. The existence of innovative technologies has not been a key driver for implementation. Sixteen derogations have been reported for 13 tunnels, of which half concern water supply. Ten out of the 13 derogated tunnels are in Croatia.

#### **Relevance: The Directive's objectives and requirements align well to the problems they are intended to address; some adjustments would further improve the fit**

For the Directive to be relevant its objectives and the implementing measures should be appropriate to the identified problems. The Directive was intended to address the causes and mitigate the consequences of road accidents and fires in tunnels through a combination of infrastructure and tunnel management measures. The individual measures in the Directive work in combination to provide a safer road tunnel environment.

Data gathered on traffic accidents and fires in tunnels tend not to link events to specific attributes of tunnel infrastructure but the research suggests that the measures codified in the Directive are consistent with improving the general level of safety in tunnels. The Directive has, for example, enhanced the response of operators and emergency services that can mitigate the negative consequences of an accident. Nevertheless, a number of tunnel safety issues have been identified as insufficiently addressed by the Directive. Examples are flooding, communication inside the tunnel to

help tunnel users rescue themselves, the definition of tunnels in particular conditions (e.g. tunnel located in rural areas or far away from emergency services stations), and the detection of high temperatures on heavy vehicles before they enter the tunnel.

***Coherence: Directive 2004/54/EC is a coherent component of the acquis, although there is some support for integration with Directive 2008/96/EC on road infrastructure safety management***

The assessment of coherence considers whether the Directive contradicts other interventions with similar objectives. In general, the provisions of the Directive fit well into the overall regulatory framework for road safety. The change required by the Directive varied widely across the Member States; in some cases its requirements were broadly consistent with pre-existing national standards, in other countries it set standards at a much higher level than had been required before.

A number of the stakeholder and experts consulted were in favour of the integration of Directives 2004/54/EC with Directive 2008/96/EC on road infrastructure safety management. They see benefits in reducing the differences in the approach taken to safety in tunnels of different lengths (i.e. below and above 500 m).

***Effectiveness: Some measures are recognised as having made a particular contribution to reducing the consequences of incidents in tunnels; the aggregate impact of the Directive is harder to determine.***

Evidence on the achievement of the Directive's operational, specific and global objectives is mixed and in some cases absent. It has reduced the time taken to identify events in tunnels and the time for emergency services to respond. This helps to mitigate the effects of accidents and fires. High impact measures in the Directive include the requirement for a control centre and monitoring systems, and the specification of ventilation, equipment to close the tunnel and fire resistance equipment.

The cumulative impact of the investments and organisational changes triggered by the Directive on the number of incidents, injuries and lives lost in road tunnels cannot be determined with the available data. Road safety has improved significantly across the EU road network over the last ten years, but isolating the contribution of the Directive (where implemented) to the trends seen in specific tunnels, individual Member States and the EU as a whole is not feasible, as it would require a greater depth and consistency of investment and incident data collection at Member State level. Impact is also affected by implementation, which as noted above, is far from complete.

There is evidence to suggest that the Directive has increased the time required for tunnel design. On the operational side, the provisions have changed the managing operations and practices in tunnels, introducing new roles and responsibilities. The general impact of the refurbishment works prompted by the Directive on the environment, local populations and the traffic flows are considered to be minor, but data to quantify them are not available.

Broadening the scope of the Directive to include non-TEN-T tunnels would harmonise the safety and the regulations at national European levels. Taking into account the fact that ordinary roads are often older than motorways included in the Trans European Road Network. The cost of this extension of scope has been provisionally estimated at 1.6-2.4 billion Euro.

***Efficiency: The costs of achieving compliance have been significant in some Member States. Infrastructure costs vary according to factors that include the rigour of pre-existing national standards and the tunnel's condition. Operational costs are more evenly spread.***

The most costly aspects of the Directive are the tunnel infrastructure requirements. Many tunnels have required upgrading to bring them into compliance. The operational measures of the Directive also imposed significant costs, especially in those countries where risk management was not previously implemented and the Safety Officer role was not in widespread use.

It is not possible to identify the costs generated by the Directive from the budgetary allocations made for maintenance and refurbishment. Similar challenges apply to the identification of expenditure triggered by the Directive's procedural and administrative requirements. The measures undertaken to



implement the Directive are estimated to have on average a cost of 2-3 million Euro per kilometre of tube length for the refurbishment of tunnels but there is wide variation. Costs vary by country (based on the pre-existing standards), and by tunnel (according to factors that include tunnel age and physical characteristics).

The main source of financing for tunnel upgrades and maintenance was public funding. Concessionaires' equity and user tolls played a minor role. EU funds were used more extensively in Greece than in other countries.

***Sustainability: The measures required by the Directive continue to add value to tunnel safety, though technological change is reducing the need for fixed communication systems.***

This aspect of the evaluation examined the extent to which positive changes attributable to the Directive are expected to last beyond the period of their implementation. Communication and firefighting systems are the main areas where technologies influence safety measures, while traffic management technologies influences operational measures. Some measures of the Directive are considered obsolete. As an example, developments in communication systems (e.g. GSM coverage and use of smartphones) have reduced the need for emergency stations.

***EU Added Value: The Directive has delivered EU added value, effecting changes that go beyond what might have been achieved by national action alone.***

The evaluation considered the extent to which the Directive has brought about changes that would not have occurred through Member States acting independently, or cooperating bilaterally.

The Directive has delivered EU added value. Operators, ministry officials and road administrators share the view that the Directive, transposed into the national regulations, has had much stronger effects than recommendations or guidelines. It has established a common safety objective for all TEN-T road tunnels in the EU.

There is support for compliance with the Directive being a principle of conditionality for access to EU funds for financing the refurbishment or construction of the new tunnels, including tunnels outside the TEN-T network and outside the EU.