

## Joint road safety operations in tunnels and open roads

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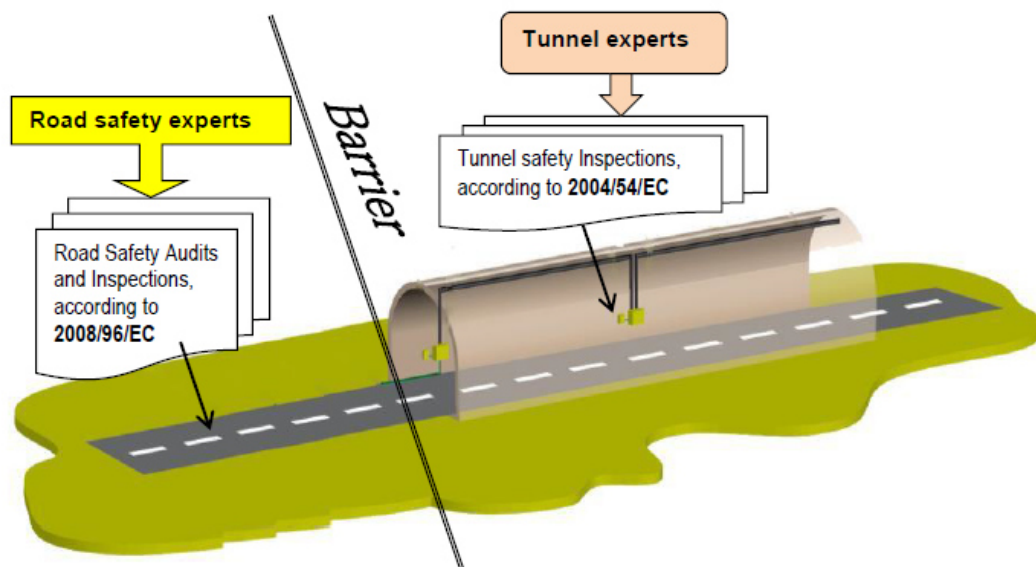
**Abstract.** The objective of the ECORoads project is to overcome the barrier established by the formal interpretation of the two Directives 2008/96/EC and 2004/54/EC, which in practice do not allow the same Road Safety Audits/Inspections to be performed inside tunnels. The project aims at the establishment of a common enhanced approach to road infrastructure and tunnel safety management by using the concepts and criteria of the Directive 2008/96/EC on road infrastructure safety management and the results of related European Commission (EC) funded projects. ECORoads has already implemented an analysis of national practices regarding Road Safety Inspections (RSI), two Workshops with the stakeholders, and an exchange of best practices between European tunnel experts and road safety professionals, which led to the definition of common agreed safety procedures. In the second phase of the project, different groups of experts and observers applied the above common procedures by inspecting five European road sections featuring both open roads and tunnels in Belgium, Albania, Germany, Serbia and Former Yugoslav Republic of Macedonia. This paper shows the feedback of the 5 joint safety operations and how they are being used for a set of recommendations and guidelines for the application of the RSA and RSI concepts within the tunnel safety operations.

### 1. Introduction

The general objective of the ECORoads project is to overcome the barrier established by the formal interpretation of the two Directives 2008/96/EC (on road infrastructure safety management) and 2004/54/EC (on tunnels), which in practice do not allow the same Road Safety Audits/Inspections to be performed inside tunnels, as shown in Figure 1.

The main problem is that, while from the user (driver) point of view a road is a unique linear infrastructure generally in open terrain and sometimes in closed environment (tunnels), the strict application of the two Directives leads to a non-uniform approach to the infrastructure safety management outside and inside tunnels.





**Figure 1.** The “barrier” between the two EU Directives.

This project is the follow-up of the initiative related to the European Road Safety Directives and the two workshops held at the European Social and Economic Committee (EESC) by a group of international stakeholders in February and May 2013: a debate that was initiated as a result of the coach crash in Switzerland that caused more than 28 fatalities, including 22 children.

The collision occurred in 2012 with the end wall of an emergency parking facility in the Sierre tunnel, Switzerland, which was opened in 1999 and was rated as “good” in a 2005 European Tunnel Assessment Programme (EuroTAP) test. The end wall was placed at 90 degrees with respect to the direction of the adjacent traffic flow, without any adequate protection from collision.



**Figure 2.** Left: the lay-by in Sierre Tunnel. Source: [5]. Right: similar situation (source: Hasani A., Albanian Roads Authority).

This feature of tunnel design is typical of many European tunnels, as shown in Figure 2 (90° walls without any protection), where operations such as RSA or RSI according to the prescriptions of the Directive 2008/96/EC, could be beneficial for risk prevention.

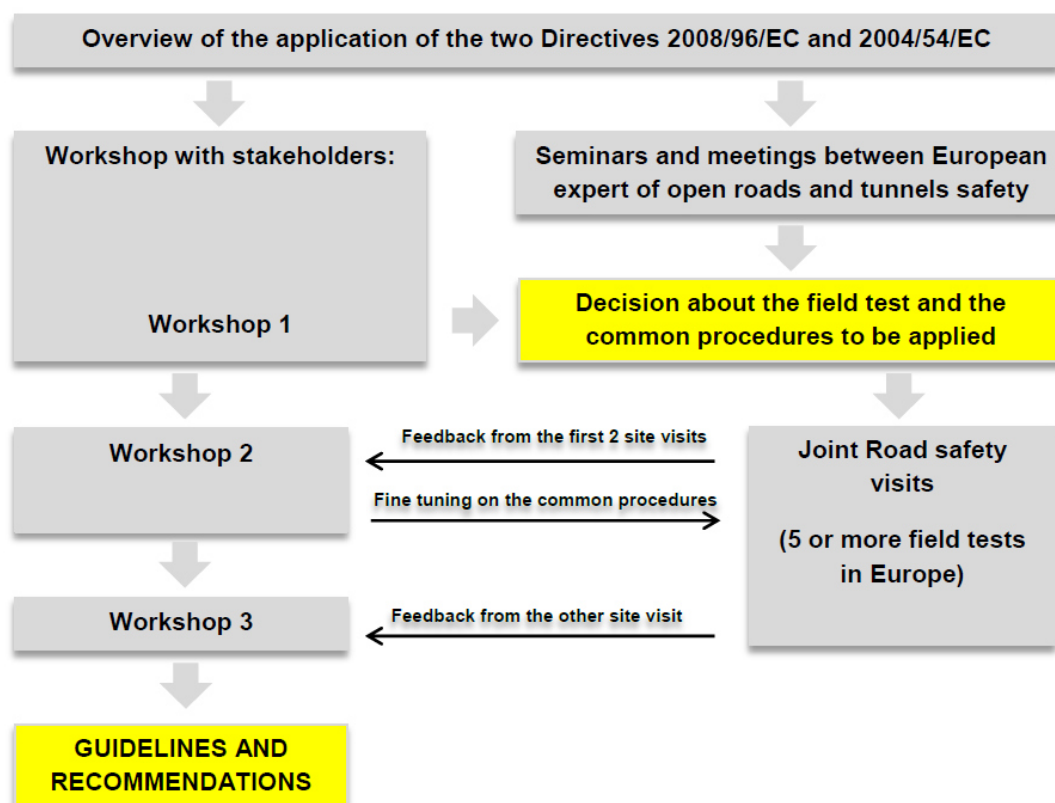
Indeed, this Directive does not apply to road tunnels covered by Directive 2004/54/EC (Art.1, point 4 of the Directive 2008/96/CE)

On the other hand, Directive (2004/54/EC) does not deal directly with RSA or RSI inside the tunnels. There is only a general statement about taking "all aspects of the system composed of the infrastructure, operation, users and vehicles" into account in Annex 1. Different interpretation and application by Member States may further amplify the gap between the two Directives.

The ECORoads consortium submitted to the European Commission a proposal aiming at the deployment of mixed groups of tunnel and road safety experts performing joint safety inspections in both tunnels and open roads, in order to find a common agreed inspection methodology able to enhance safety in roads and tunnels. The project has been financed by the European Commission and started in June 2015

## 2. Methodology

The overall approach of the ECORoads is based on the previous successfully project Pilot4Safety [1] and is divided into several phases, including a clear overview of the application of the two Directives in the Member States, a series of workshops with the stakeholders (European tunnel and road managers), and the exchange of best practices between European experts in the two fields:



**Figure 3.** ECORoads Methodology.

Clear overview of the application of the two Directives in the Member States and the extent of the gap between them already described in the previous section. Such an overview has been conducted on the basis of the results of two previous studies on the effectiveness of the Directive 2008/96/EC[2]

and on the implementation and effects of Directive 2004/54/EC [3], plus direct contact with several infrastructure managers.

Workshops with the stakeholders (European tunnel and road managers from at least 10 European countries), organized according to the following Figure 3:

### *2.1. Joint Audit/Inspection procedures*

During the Seminar for exchange of best practices on RSA/ RSI at open roads and tunnels, and during dedicated meetings among the ECORoads partnership, held between November 2015 and January 2016, a preliminary procedure has been agreed, based on the following considerations.

The Directive 2008/96/EC applies to road sections of the Trans-European Transport Network, whether they are at design stage, under construction or in operation. Its provisions may also be applied to national road transport infrastructure, not being part of the TEN-T but constructed - entirely or partly - using Community financial assistance.

Based on a large literature review, the Pilot4Safety Project Handbook [4] concluded to the following consolidated definitions of RSA and RSI:

- Road Safety Audit describes a systematic and independent examination of a project designed to highlight potential safety issues at the earliest possible stage of planning and construction, to reduce or eliminate these problems and limit the risk for different types of road users.
- Road Safety Inspection is a preventive safety management tool implemented by road authorities/ operators as part of a global Road Safety Management. A RSI is a systematic field survey organised sufficiently frequently on all existing roads or sections of a road to secure adequate safety levels. It is carried out by trained road safety experts to identify hazardous conditions and deficiencies that may lead to serious accidents. RSI results in a formal report on detected road hazards and safety issues.

The Directive on Tunnels (2004/54/EC) makes reference to periodic inspections carried out by the tunnel's Inspection Entity at maximum intervals of 6 years for any given tunnel; it requires a Safety Documentation (Annex II), which describes the processes for approval of the design, for opening of a tunnel, for modifications in the physical and operational characteristics of a tunnel and for performing periodic exercises for tunnel staff and emergency services, and includes the content and results of a Risk Analysis.

Regarding the typical processes of the distinct Road/ Tunnel Safety procedures described above, both RSA/ RSI and tunnel safety inspection (TSI) contain the assignment from the Client/ Assignor (responsible authority/ body/ unit) and an independent approach by the assignee (Auditor/ Inspection Team) to perform the appropriate activities and report back, with interaction between two sides before and after the duration of these activities and reporting.

Therefore, compared to RSA/ RSI, other procedures are foreseen for safety assessment of tunnels that are subjected to the Tunnel Directive.

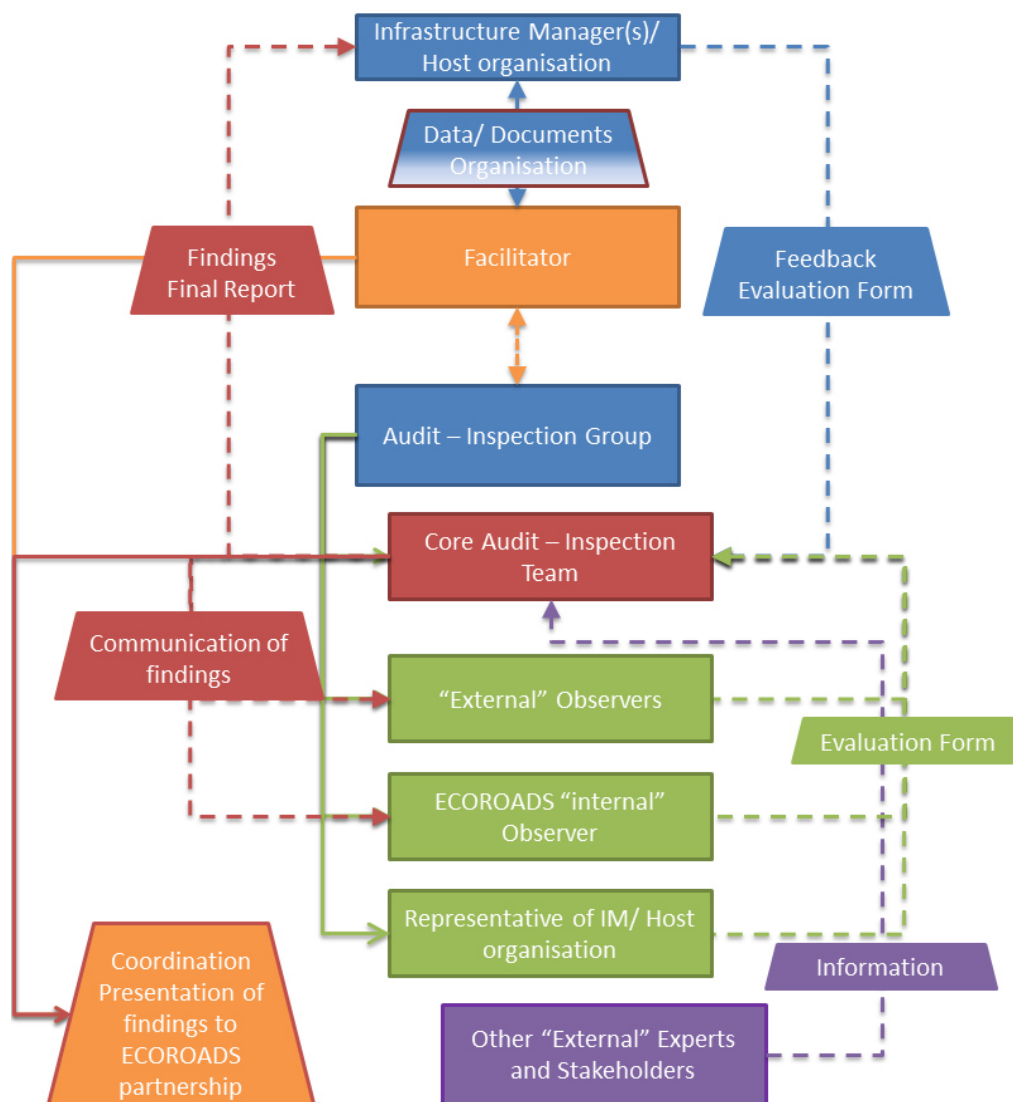
To this end, the ECORoads objective was to experiment on the incorporation of the tunnels' safety procedures in an integrated approach for joint safety operations at both tunnels and open roads, with focus on road safety. The ECORoads approach is purely "operational" and finalized to an integrated practical approach that is going to be substantiated in practical guidelines and recommendations.

On the basis of the feedback from the 1st project Workshop held in September 2015 and the Seminar for exchange of best practices held in November 2015, and considering the experimental approach of the project, the following categories of involvement in the field tests process are foreseen:

- Infrastructure (Road/ Tunnel) Manager(s): the administration/ authority/ manager(s) of the road/ tunnel infrastructure of each of the ECORoads field tests.
- Host organisation: The organisation/ authority that organises and facilitates the field test.

- Audit/ Inspection Group: the mixed international team of (road/ tunnel) experts and other stakeholders that will take part in a field test. It consists of the Core Audit/ Inspection Team, the “External” observers, the Facilitator , internal observer and other experts.
- Core Audit/ Inspection Team: the mixed international team of experts that are assigned/ authorised to jointly and independently perform an audit/ inspection visit.
- “External” Observers: stakeholders with different competences, representing different authorities accompanying the Core Audit/ Inspection Team in a field test.
- Facilitators: local/national experts ensuring organisation, communication and cooperation between the infrastructure manager(s) and the project.
- ECORoads “Internal” Observer: A member of the ECORoads consortium.
- Other “External Experts” and Stakeholders: other local and national interested parties (incl. road user groups) providing complementary information to each Core Audit/ Inspection Team.

The roles and responsibilities of the actors involved in the field tests and their interactions are schematically presented in Figure 4.



**Figure 4.** Roles and responsibilities of parties involved in ECORoads field tests.



The Deliverable D5.1, available on the website of the ECORoads project [5], describes the common organisational and technical details for the performance of the ECORoads joint road safety operations. In the same deliverable it is also explained how these procedures are built on the basis of the Audit and Inspection approach agreed during the Pilot4Safety project.

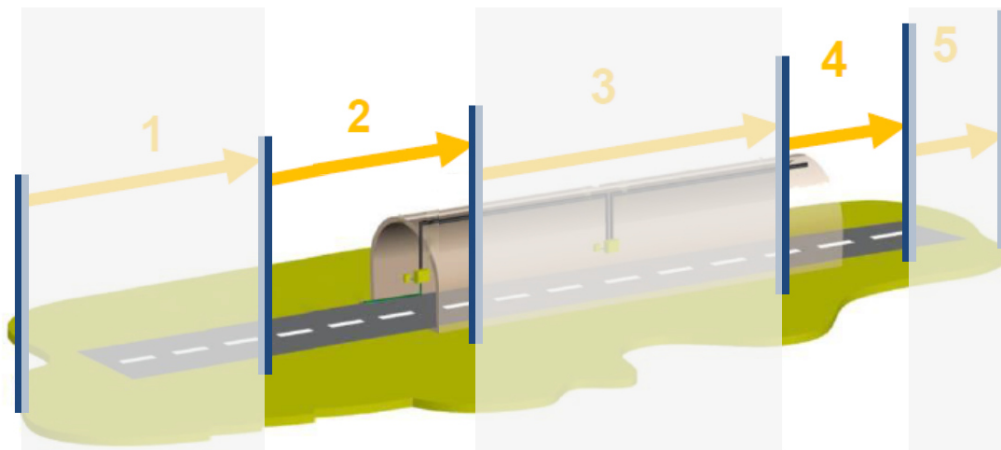
### 3. Results

After a call for expression of interest, ECORoads received 15 applications with a road stretch dossier and a letter of commitment duly signed by the owner of the infrastructure; in August 2015 a specific project committee selected 5 sites and then the operation started as in the following Table 1.

**Table 1.** Overview of the 5 test sites.

TEST SITE, Country	Dates of the joint visits	N. of Experts (core team)	N. of Observers	N. of other Experts	Tunnel type and length	Length of open road inspected
KENNEDY TUNNEL, Belgium	07-08 March 2016	3	3	6	2 tubes, 690 m each	1200 m
KRRABE TUNNEL, Albania	05-06 April 2016	4	4	5	2 tubes, 2230 m and 2500m	1500 m
TUNNEL RENNSTEIG, Germany	17-18 August 2016	3	3	4	2 tubes, 7916 m each	400 m
TUNNEL STRAZEVIKA, Serbia	27-28 Sept.r 2016	3	1	12	Single tube 745 m	650 m
TUNNEL DEMIR KAPIJA, Former Yugoslav Republic of Macedonia	18-19 October 2016	4	0	9	Single tube 554 m	400 m

For the scope of the ECORoads project, the transition area between an open road and a tunnel has been defined: as a minimum requirement, it is intended as the sum of: a) the distance calculated as the distance covered in 10 seconds by a vehicle travelling at the speed limit before the tunnel portal and b) the stopping distance inside the tunnel after the portal, for a vehicle travelling at speed limit, if not identical with design speed. This minimum rule obviously applies on the opposite direction, as shown in Figure 5.

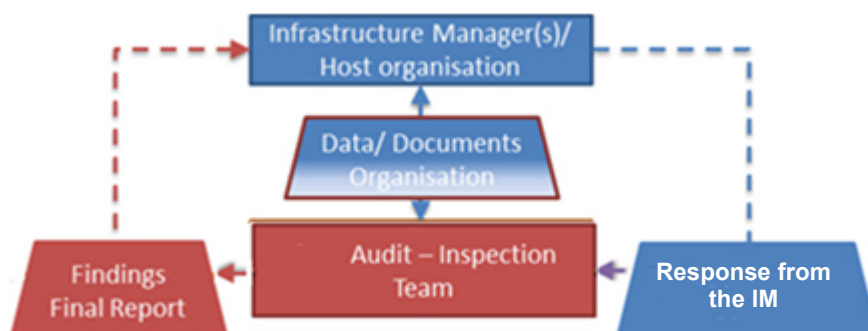


**Figure 5.** Transition areas 2 and 4 in ECORoads field tests. Source [5].

#### 4. Conclusions

At the time of preparing this paper, ECORoads is preparing the final guidelines and recommendations. However, it is possible to resume some important messages the project is delivering:

- Joint safety operations are possible, as demonstrated by their successful completion in the five test sites;
- Joint safety operations are useful: there was an unanimous consent about the joint operations' added value;
- Cost effectiveness of joint safety operations. The complexity of the scheme in the previous Figure 4 was due to organisational and monitoring purposes originated by an external subject. When organized by the infrastructure manager, the scheme is much more simple, as shown by the following Figure 6. Moreover, if the joint operations are organized in parallel with the "current" RSA/RSI (thus having the road safety experts available on site), the cost of having an additional expert is low. It is relatively easy in case of the same Infrastructure Manager (IM), while coordination is needed in case of different ones. In both cases, there is a relevant cost-effectiveness in terms of enhanced safety.



**Figure 6.** Simplified approach when operated directly by the IM.

- Involving a foreign expert does not necessarily imply more difficulties and adds value, because he/she brings a different approach and a different point of view to the safety team. At least the team leader and the foreign expert should be able to properly communicate.

An excellent cooperation of the Infrastructure Managers (IMs) has been noted: sometime they immediately reacted to the inspection reports by taking immediate countermeasures, like in the following Figure 7.



**Figure 7.** Installation of guardrail in front of perpendicular wall of lay-by in Krrabe tunnel (source: Hasani A., Albanian Roads Authority).

The following key points and issues are based on the evaluation of the five joint safety operations, exchange of best practices and comments received during and after the 3 workshops with the major stakeholders.

- According to the project results, certain concepts of Directive 2008/96/EC (on road infrastructure safety management) can be applied in the scope of Directive 2004/54/EC (on tunnels) in close cooperation of the managing departments in the two areas.
- Road sections including tunnel sections should be inspected/audited from both tunnel experts and road safety experts.
- Transition areas between tunnels and open roads, as above defined, are of particular interest in terms of their impact on road safety.
- An innovative update of the new safety standards following the technical developments is welcomed. A harmonized approach regarding fire detection, fire-fighting and communication coverage in tunnels should be addressed.
- Member States, as supervision authorities, should ensure the mutual recognition of Road Safety Auditors and Road Safety Inspectors certified by other Member States.
- A coordinated approach to the road safety management of both tunnels and the transition areas is recommended. This will surely facilitate better future integration of road and tunnel infrastructure, taking also into account the costs and benefits of deploying intelligent transport systems and services.
- Since the majority of road fatalities in the EU occur outside the TEN-T, an extension of scope beyond the TEN-T to other roads should be considered.
- Exchange of experts and best practices should be enhanced and facilitated.

## 5. Final considerations

There are common elements regarding the safety management in the two areas (open roads and tunnels) which could be tackled in an harmonized way through a coordinated communication by the concerned open road and tunnel experts. Coordinated actions can be foreseen by adding/inserting



harmonized legal texts in the bodies of the two Directives; any eventual insertion in one Directive should take into adequate consideration the consequences in the other Directive and vice-versa.

The above mentioned coordinated communication between road and tunnel managers (that will in any case maintain their specific roles and responsibilities) should not be demanded to their individual willingness, but somehow made compulsory and periodic, in order to ensure the concrete possibility of conducting joint safety operations.

## References

- [1] Pilot4Safety - Pilot project for common EU Curriculum for Road Safety experts: training and application on Secondary Roads (<http://pilot4safety.fehrl.org>)
- [2] Study on the effectiveness and on the improvement of the EU legislation framework on Road Infrastructure Safety Management (*Directive 2008/96/EC*)  
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