

CEDR Transnational Road Research Programme

Call: **Safety**

Funded by Belgium-Flanders, Ireland, Netherlands, Slovenia, Sweden, United Kingdom



Conférence Européenne
des Directeurs des Routes
Conference of European
Directors of Roads

Provision of Guidelines for Road Side Safety (PROGReSS) – Road side safety elements, state of the art report

WP1 Tech Review – Summary Report

Deliverable 1.1

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WP1 Tech Review – Summary Report

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Summary report

PROGReSS – Provision of Guidelines for Road Side Safety is a project funded within the CEDR 2016 Safety Call, in which the results of a status quo review of available EU roadside safety standards and guidelines are combined with the experiences from National Road Authorities in applying these in the design, operation and maintenance phases of EU high speed roads (speed limits higher than 70 km/h). A special emphasis is put on the six funding countries (Belgium-Flanders, Ireland, Netherlands, Slovenia, Sweden, and United Kingdom), plus Germany and Portugal which are included to increase the geographic representation of the results.

The primary objectives for PROGRESS are:

- To review existing roadside safety design, maintenance and operational requirements for clear (obstacle free) zones and also for road restraint systems (as defined by for e.g. EN 1317).
- To determine to what extent national road authorities in Europe and their contractors are capable of implementing and maintaining compliance with the standards and guidelines throughout the life cycle of roads.
- To develop recommendations for safe roadside design and management ensuring broad acceptance among member NRA's of CEDR.

This report describes and assesses the findings of the literature review and summarises the potential relationships between the design and operation (including maintenance) of road side elements and safety.

The objectives of WP1 are to:

- Review European and international literature on road side safety.
- Define the critical road side elements and their definitions from European studies.
- Establish best practices for safe road side design.
- Establish best practices for safe road side maintenance.
- Establish relationships between safety and clear road side zones versus road restraint systems.
- Review EU (CEN) standards for road and vehicle restraint systems relevant to safe road side design.
- Review road side safety design and management practices and country specific standards and guidelines in the six countries funding this CEDR research programme (Belgium-Flanders, Ireland, Netherlands, Slovenia, Sweden, United Kingdom).
- Benchmark road side safety performance in the participating eight countries.

Within this Work-Package, Task 1.1 consisted of summarising the results of several roadside safety projects and collecting the most relevant studies related to the application of guidelines and standards in the improvement of roadside safety. This review focused on studies that explore and highlight the relationship between compliance to standards and

guidelines and safety. The intention is to establish to what degree road authorities can determine the consequences of deviations from recommended standards and practice on safety when making design choices.

Task 1.2 focused on identifying any quantified relationships between roadside design elements (which are featured in the road side design guidelines of the six funding countries) and the real world crashes. The aim was to evaluate the relevance of the road side design guidelines and standards and provide input to an eventual revision by making the relationships with safety explicit. To achieve this goal an in-depth literature review was carried out and a matrix was developed to illustrate all identified relationships between the different road side design elements with road safety in general and crashes in particular.

Task 1.3 reviewed the relationship between the design and management of road side elements and factors with road safety in general and crashes in particular. This task focused on the standards and guidelines for road side design and management of the six funding countries plus the relevant CEN standards.

Task 1.4 assessed the standards and guidelines that relate to specifically road side maintenance and operations to establish whether maintenance of road side furniture and equipment are related directly to road safety or whether these are inferred (i.e. preventive versus reactive). An overview as to what is current practice was obtained. Specific attention was given to road worker safety during maintenance of road sides.

Task 1.5 provided a benchmark of the roadside safety performance in the six funding countries plus Germany and Portugal based on crash data analysis. Also, the co-occurrence patterns of attributes related to the run-off-road (ROR) crashes were identified from road safety inspections' reports, as well as the interventions' patterns associated with these crashes.

The technical review of existing standards and guidelines developed in this work package 1 allowed to consolidate an overall view on international practices as regards the design and management of rural road sides, which will be the basis for carrying out work on following work packages. A summary of the qualitative findings is presented in Table 1.

Table 1 – Summary of Tech Review (WP1) findings

Task	Contents	Results
Task 1.1 (Chapter 2)	<ul style="list-style-type: none"> Summarise the results of several roadside safety projects Collect the most relevant studies related to the application of guidelines and standards in the improvement of roadside safety. <p>The review focused on studies that explore and highlight the relationship between safety and compliance to standards and guidelines.</p>	<ul style="list-style-type: none"> 10 road side safety projects and 137 studies were analysed. There are not any projects that have looked thoroughly into the application of guidelines and standards on road side safety. 13 studies selected. None of the studies related to the application of European guidelines and standards on road side safety. Only 3 related to the application of other guidelines and standards. All other studies (10) are focused on neighbouring roadside safety issues rather than directly on the application of guidelines and standards. The effect of the application of guidelines and standards on roadside safety has not been sufficiently studied or reported in scientific journals in Europe or the rest of the world.
Task 1.2 (Chapter 3)	<ul style="list-style-type: none"> Identify any quantified relationships between roadside design elements (which are featured in the road side design guidelines of the six funding countries) and the real world crashes. Evaluate the relevance of the road side design guidelines and standards Provide input to an eventual revision by making the relationships with safety explicit. In-depth literature review <p>A matrix was developed to illustrate all identified relationships between the different road side design elements with road safety in general and crashes in particular.</p>	<p>The literature review focused on identifying roadside design elements and parameters, of which the effect on accident frequency and severity has been quantified.</p> <p>All quantified relationships identified through the literature review were collated in a matrix</p> <p>Within the matrix, roadside design elements and related parameters were grouped into three categories, with regards to their relation to the risk model from a roadside safety perspective</p> <p>These roadside elements are related to: Clear/Safety zones; Hazards reduction; Side slopes; Shoulders; Drainage structures; Passively safe poles and Roadside and Median barriers</p> <p>150 road side safety features were identified to contribute to road safety by the frequency and/or severity of crashes in this literature review.</p>

Task	Contents	Results
Task 1.3 (Chapter 4)	<ul style="list-style-type: none"> Summarise a review of existing design standards and guidelines related to road side design and management. Analyse the relevant CEN standards, the Directive 2008/96/EC, and the related guidelines for the six funding countries. 	<ul style="list-style-type: none"> Impact of RISM on road equipment and component selection quality – no impact was determined Proposed to extend the reach of the RISM Directive to include Non-TEN-T roads in an attempt to improve safety for all road users on all rural roads within the EU Belgium (Flanders), Ireland, Netherlands, Slovenia and Sweden include requirements in their RRS standards relating to the area at the side of the road which should be kept free of hazards. UK is the only funding country which does not specify clear/obstacle free zones in their standards.
Task 1.4 (Chapter 5)	<ul style="list-style-type: none"> Discussion of the standards and guidelines that relate specifically to road side maintenance and operations Evaluate if maintenance of road side furniture and equipment are directly related to road safety or whether these are inferred (preventive versus reactive) 	<ul style="list-style-type: none"> UK has the most comprehensive maintenance standards and guidelines when compared to the other five funding countries Temporary safety measures applying to roadworks, health and safety for temporary construction sites, employer responsibility relating to employee safety and personal protective equipment have been implemented across the EU between 1989 & 2008 and have been adopted by all countries Road side operations and maintenance procedures appear to be of a similar format with country specific differences in terms of the frequency of inspections
Task 1.5 (Chapter 6)	<ul style="list-style-type: none"> Benchmark roadside safety performance in the six funding countries plus Germany and Portugal based on crash data analysis. Identification of patterns of attributes related to the ROR crashes in RSI reports Identification of proposed RSI intervention' patterns associated with ROR crashes. 	<ul style="list-style-type: none"> Almost 28,000 persons were killed in ROR crashes in the six funding countries plus Germany and Portugal within the decade 2006-2015. It was not possible to calibrate ROR CPMs using the data available. New model fitting will be attempted, if more data is made available within the PROGRess timeframe. Latent Dirichlet allocation (LDA) was applied to identify the importance given to road side issues in RSI performed in Ireland. Important key words relating to the “forgiving roadside” and “clear zone” concepts as well as the relevant European technical standards (EN1317 and EN 12767) are absent from the extracted latent topics. The frequency of topics related to road side safety is higher in the problems record set than in the solutions record set, meaning that problems are more easily identified and related to the road side area than interventions may be.

The PROGRess work plan comprises a total of seven work packages, five of them dealing with the essential content of the project, one work package for dissemination and a project management work package to ensure smooth project progress and provide liaison between the CEDR management team and the project team. Work package 1 consisted of a technical review of existing standards and guidelines in each of the contributing countries, and a consolidation of knowledge on the design and management of rural road sides internationally. Results from this Work package will be used in Work package 3, to identify the effective, promising and innovative practices used by different road authorities and to prepare a complete assessment of roadside safety management in order to develop the intended roadside safety evaluation tool.