Ireland: Implementing research outputs on safety management from CEDR (Conference of European Road Directors) research programme - Paper 3

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ABSTRACT
This paper focuses on how Ireland, through progressively sharing information and research with other road authorities in the international community, has developed and implemented innovative solutions in order to mitigate the impact of road deaths and serious injuries on its roads.

Since 2006 Ireland, along with other European National Road Administrations (NRAs), has agreed to share its road research priorities and to open up research budgets via the CEDR group - Conference of European Road Directors - which facilitates information exchange and experiences of road-related issues at a European level [1]. Among other achievements, this has enabled the organisation of successful transnational calls for research which, in turn, have delivered outstanding research projects which Transport Infrastructure Ireland (TII) has implemented to target its road safety needs.

This paper demonstrates how Ireland, through implementing the safe system approach as detailed within these research projects, is seeking to actively reduce road deaths by aiming to minimise the effects of human error along with looking to:

- minimise the risk of vehicles leaving the carriageway (e.g. via delineation)
- provide adequate recovery space when vehicles do run off the road, and,
- ensure that any collision that does occur in the roadside will be with objects that limit the impact forces on vehicle occupants to minor levels (no fatal or serious injury outcomes).

This paper also covers how these research topics were developed and implemented so as to complement existing design standards and to influence how designers and motorway operators regard road safety and the whole life cost of collisions.
1. BACKGROUND

This paper focuses on how Ireland has implemented particular safety research projects undertaken by various research institutes throughout Europe with funding provided by European Countries. The paper looks at the Standards that have been developed as a result of this research and also how the implementation of this research is carried out in Ireland.

2. CEDR

TII along with other European National Road Administrations (NRAs) have agreed, since 2006, to progressively share road research priorities and to open up research budgets. Among other achievements, NRAs throughout Europe have been able to organise successful transnational calls for projects and programmes which has enabled the delivery of outstanding research projects to effectively target TII’s road safety needs.

The initial impetus for this initiative was given with the assistance of EU support through the two ERA-NET ROAD projects. Since 2010, the transnational effort has been continued through the CEDR group on research.

This paper focuses on how Ireland (TII) has implemented particular safety research projects, namely,

- SAVERS: Selection of Appropriate Vehicle Restraint Systems
- ASAP: Appropriate Speed saves All People
- BRoWSER: Base-lining Road Works Safety on European Roads
- EUSight: Stopping Sight Distance and its role and impact on highway geometric design.
- PRACT: Predicting Road Accidents
- ESRET: European Safety Review Tool
- SPACE: Speed Adaption Control by Self-Explaining Roads
- IRDES: Improving Roadside Design to Forgive Human Errors
- EuRSI: European Road Safety Inspection
- RISMET: Road Infrastructure Safety Management Evaluation Tools
- ERASER: B16 Evaluations to Realise a Common Approach to Self-Explaining European

3. TII ROAD SAFETY SECTION

Transport Infrastructure Ireland (TII) operates, maintains and improves the national primary and secondary road network in Ireland. The TII Safety Section is involved extensively in road safety
research which is aimed at understanding the patterns of vehicle collisions on the national road network. A significant amount of the road safety research carried out involves analysis of spatial data. In addition to analyzing retrospective collisions data, the Safety Section has a programme of proactive inspections and analysis of roadside hazards. The Safety Section also evaluates road safety remedial measures and traffic calming schemes which are funded by TII and the section compiles evaluation reports. The Safety Section actively participates in transnational road safety research programmes and benefits from collaborating with road authorities and road safety research groups outside of Ireland, allowing for a sharing of knowledge, experience and ideas.

Safety Standards are published via the TII Publications Website [2] which has been created to allow access to the stakeholders in the construction industry.

The Safety Section has made significant contributions to the current Government Road Safety Strategy 2013-2020 (RSS) in Ireland.

4. TECHNICAL ASPECTS

The following chapter looks at the different areas covered by the various research projects and details how TII have implemented the research into standards, advice and general principles of road design and safety.

4.1. Forgiving Roadsides

The Safe Systems approach to road safety is built upon three key concepts namely; Human Behaviour, Human Frailty and Forgiving Systems [3]. The Forgiving Systems concept seeks to reduce the number of fatalities caused by run-off crashes by designing roads to be more accommodating and forgiving of driver error by implementing a range of safety enhancement measures. Forgiving Roadsides provide a significant contribution to road safety by providing drivers of errant vehicles that leave the main carriageway with adequate recovery road side space in which to bring their vehicle under control while also ensuring that, where a collision does occur in the roadside, appropriate treatments are in place to limit the impact forces on vehicle occupants to minor levels.

4.1.1. ERA-NET ROAD Joint Research Programme

The aim of this joint research programme is to improve road safety through increasing awareness and acceptance of joint road safety solutions across Europe following the concepts of “self-explaining” roads and “forgiving” roadsides [4].
The five projects commissioned in the programme were:

**SPACE**: Speed adaption control by self-explaining roads  
**IRDES**: Improving roadside design to forgive human errors  
**EuRSI**: European road safety inspection  
**RISMET**: Road infrastructure safety management evaluation tools  
**ERASER**: Evaluations to realise a common approach to self-explaining European roads

### 4.1.2. TII Implementation

TII made a decision to incorporate the outcomes of this research into the design process and TII design standards so that national roads will be more forgiving in the event of loss of control incidents, thereby reducing the number of fatalities and serious injuries on Irish roads.

A TII document entitled ‘A Guidance Document for the Implementation of CEDR Forgiving Roadsides report’ [3] builds upon the work done by CEDR TG Road Safety under the chairmanship of Ireland, when in 2009 they commissioned a road safety research project on Forgiving Roadsides. Ireland was one of 11 road administrations that commissioned products under ERA-NET called IRDES – Improving Roadside Design to Forgiving Human Errors.

TII have also implemented the guidance and best practice recommended in this document by changing the requirements of where safety barriers are required e.g. requiring a 1:5 side slope alongside national roads and flaring the barrier terminals away from the road. The guidance has also been used to create drainage details that are passively safe.

### 4.2. SAFETY BARRIERS

Safety barriers are forgiving roadside treatments intended to shield hazardous obstacles and/or prevent vehicles from running off the roadway [3]. However, if installed incorrectly safety barriers can also be a hazardous roadside object. Safety barriers are therefore a special case in that they can be both a hazard and a forgiving roadside treatment in safety terms.

#### 4.2.1. SAVERS

The SAVeRS project (Selection of Appropriate Vehicle Restraint Systems) [5], commissioned under the 2012 CEDR Call aims to reduce the severity of “run-off-road” (ROR) crashes. The project looks at
what vehicle restraint systems (VRS) are to be selected for certain traffic conditions and also identifies the location of where to install these systems.

The Author was the Project Executive Board Project Manager for this project, which produced a practical and readily understandable VRS guidance document along with a user-friendly web-based tool which will allow for an operator to select the most appropriate solution in different road and traffic configurations for all types of VRS.

4.2.2. TII Implementation

The use of safety barriers and other restraint systems is usually subject to national regulations and standards. In Ireland these standards are covered by NRA TD 19 (for barriers) and NRA BD 52 (for parapets) and series 400 of the NRA specifications which have all been produced and updated by TII.

TII accepts that it is not always possible to provide wide recovery areas and as such is implementing the results of the SAVERS project, which gives guidance on identifying where there is a need for a Vehicle Restraint System (VRS) and what the appropriate VRS is for a specific location and traffic condition.

The implementation of these results include TII implementing the user-friendly web-based database as a tool to be used when determining the most cost beneficial and safest safety barrier systems along existing and new national roads. These costs will be compared to the cost of removing the hazard in accordance with the Forgiving Roadside research.

An example of where TII used the SAVERS tool was to determine the containment requirements on TII Structures; an example of the outcome of this determination is as follows:

Each structure was rated in category of high risk and low risk, traffic volume, gradient, AADT, HGVs etc

An H2 and an N2 parapet was used for the assessment on a motorway structure and the following result was achieved:

- Life time cost of H2 €100000
- Life time cost of N2 €230000
- Fatality return period for N2/km = 11 years
- Fatality return period for H2/km = 34 years
In summary, it is clear that a minimum H2 would reduce the chance of a fatality by 3 times and would be 2.5 times more cost effective over the life of the barrier in this instance.

TII have also recently arranged a ‘Design of Vehicle Restraint Systems’ course for designers. The course has recently been piloted and is awaiting accreditation from the Dublin Institute of Technology. The training course intends to develop skills in design, installation and maintenance of Vehicle Restraint Systems (VRS), including safety barrier and parapet systems, in accordance with relevant standards (IS EN 1317, TD19, BD52 and MCDRW Series 400) and is an opportunity for designers to be informed about the latest thinking in Vehicle Restraint Systems. Training in the use of the SAVERS tool has been included in the curriculum.

4.3. Temporary Traffic Management
Temporary traffic management is used at work sites on all public roads to warn, instruct and guide road users in the safe negotiation through or around the work site.

4.3.1. ASAP
The ASAP project - Appropriate Speed saves All People - is designed to address issues of speed management in work zones for both the road user and road worker and to present to European road users consistent traffic control techniques regardless of where they travel within Europe [6]. The main objective of the ASAP project is to obtain knowledge on effective speed management measures through road work zones and to use the information obtained from national expertise and practitioners along with on-going research and consultations with stakeholders, for practical and readily understandable recommendations in terms of engineering design, enforcement and driver education/information, with the aim of reducing risks to road workers without significantly increasing the risk to road users. ASAP provides a guide, not for setting the speed limit, but for choosing the best speed limit reduction methods that will result in appropriate speed in work zones.

4.3.2. BRoWSER
The aim of the Browser project – Base-lining Road Works Safety on European Roads – is to help National Road Authorities to take an evidence-led data approach to managing road worker safety. The project was established following the CEDR groups call “to significantly reduce risks to road workers with an objective of Zero Harm” at their Transnational Road Research Programme in 2012. This project supports the safety of road workers and their interaction with road users by enabling road authorities to understand how, when and where road workers are harmed when working on the roads.
and understanding why accidents at road works happen and whether this is influenced by the layout and standards of the works. This knowledge of how road workers are exposed to risk from accidents and road user error is essential for effective safety management as it allows the real risks to be managed rather than those perceived to be the problem. The project focuses on the interaction between road users and traffic and collects data for road worker accidents, incidents and where available near misses along with data for road works practices, network characteristics and road user data for road works.

The BRoWSER project provides the framework for a pan-European database (EuRoWCas – European Road Worker Casualty Database) a sound foundation for the delivery of knowledge based interventions that can drive action by turning shared data into usable information and allow for benchmarking of safety. The project provides NRAs with the guidance to implement this data-led approach to managing road worker safety along with the Benefit Case and recommendations for the consistency of road works. The Benefits Case followed a consultation process with NRAs who identified the following benefits for a EuRoWCas database [7]:

- Benchmarking and monitoring performance
- Determining effectiveness of approach/principles
- Case building

4.3.3. TII Implementation

TII has been actively involved in, and has provided co-funding, for both of these research project and the Author was part of the Project Executive Board (PEB).

TII are currently involved in the drafting of a national guidance document, ‘Temporary Traffic Management – Operations Manual' and will be including the results of the ASAP project into this manual. In the interim the maintenance operators involved in maintaining the Motorway Network have had a half- day training on the implementation of the results of this project on traffic management arrangements. It is the intention to also brief the Irish Traffic Police on these outcomes as it was found that active enforcement was the number one deterrent to speeding motorists.

TII was one of twelve organisations, across nine European countries, who partook in the consultation process for the BRoWSER projects [7] benefits case in 2013. The Benefits Case Report outlines the principles and benefits of the EuRoWCas database.
TII upholds the view that timely, accurate and consistent road worker accident data will assist national road authorities reduce the risk to road workers and will assist in monitoring improvements to safety. TII are currently implementing this research database in full across all of its projects where traffic management is required. TII have developed a website to record traffic management through a GPS linked mapping website and will develop this further to allow the reporting of all incidents on traffic management sites. It is hoped to implement this project on a Europe level and as such early implementation by a member state will greatly assist other European Countries in demonstrating the benefits of recording incidents on a consistent level.

4.4. Road Geometry

4.4.1. EUSight

The EUSight project is part of the sixth transnationally funded research programme carried out under the CEDR (Conference of European Directors of Roads) Transnational Road Research Programme initiated via the ERA-NET ROAD project. The aim of the EUSight project is to perform a detailed examination of the subject of Stopping Sight Distance (SSD) and its role and impact on highway geometric design [8].

4.4.2. TII Implementation

The result of the EUSight Project determined that the UK and Ireland are a lot more conservative regarding SSD then the rest of Europe. The UK and Ireland are therefore currently working together to come up with a common approach on how to align the SSD and resulting vertical curves to be more in line with other European Countries. The resulting consequences may have an affect on safety and as such may require additional research from a UK and Ireland perspective.

4.5. Road Safety

4.5.1. PRACT

PRACT (Predicting Road Accidents - a Transferable Methodology Across Europe) is a project funded by the National Road Authorities of Germany, Ireland, UK and Netherlands within the Conference of European Directors of Roads (CEDR) 2013 Transnational Research Programme – Safety [9]. The aim of the project is to develop a European accident prediction model structure for motorways and higher ranked rural roads that could be applied to different European road networks with proper calibration. An important product of the PRACT project is the establishment of a European Accidents
Prediction Models (APMs) and Crash Modification Factors (CMFs) web repository with an open access database and guidance for their application and transferability on the European road networks.

4.5.2. ESRet

ESRet was also funded as part of the 2013 CEDR Call. The main aim of the project is to develop practical tools to assist road authorities in undertaking route based site visits and assessments following the identification of high risk locations as part of a Road Authority’s Network Safety Management (NSM) activity. The project delivered a smart phone ‘app’ that can be used in the field by practitioners to collect and record road attribute data and a web-based tool that will receive the data collected in the field via the mobile phone network. Compare the attribute data to design standards and safe system rules to identify deficits and generate potential treatments based on the deficits identified and the results of data analyses undertaken by the road authority.

4.5.3. EURSI

The EuRSI project examined the implementation of Road Safety Inspections on rural roads where a large percentage of fatalities occur. EuRSI is a research project of the cross-border programme ‘Safety at the Heart of Road Design’. The project, which began in 2009, was led by the National University of Ireland (Maynooth) and is funded by the European road safety research programme ERA-NET Road. The primary objective of the EuRSI project is to develop up to date technologies for data collection and Road Safety Inspection procedures. EuRSI also investigates approaches to risk assessment on rural roads as well as examining the introduction of a trans-national standard to promote a common approach for RSI. This project resulted in a Mobile Phone App called UBIPIX which is a readily downloadable app and easy to use GPS linked video mapping website which tracks your gps coordinates and collates them to video. It also has the capability to tag and label points on the map to be analysed later.

4.5.4. TII Implementation

Ubipix, which is a platform for collating, processing and publishing GPS, video and map data online, would probably be considered the greatest success to come out of any CEDR project from a TII point of view. TII have employed Ubipix as a standard tool when carrying out road inspections and traffic management inspections and it has superseded the previous paper/excel approach by enabling GPS tagged video and images to be recorded, uploaded, published, analysed and shared online within minutes [11].
TII are currently assessing how to implement other elements of the research into the field of road inspections and accident prediction modeling. These projects are currently coming to a close and will be investigated to see what elements, if not all, of the projects could be included in future TII work.

5. CONCLUSIONS

This paper outlines how Ireland, through the sharing of information and research with road authorities through CEDR and following extensive consultation with international experts, has shown its commitment to implementing new and innovative solutions in trying to reduce the number of fatal collisions on Irish roads.

The paper has shown how TII has not only partaken in research through funding but has implemented this research to provide a safer and more forgiving environment to cater for incidents involving errant drivers. The paper has shown that TII is proactive and innovative in the development of appropriate design standards and procedures, through implementation of research.

Finally it is shown that for a member state to get real benefit from research, that a pooled collaboration gets much better results and value for money. It is also demonstrated that member states need to be active during the research process to truly get results that are implementable for conditions encountered by road authorities on the ground.

6. REFERENCES

http://browser.zag.si/dl/CEDR%20BRoWSER%20Benefits%20Case%20July%202013.pdf