ADOPTION OF EU DIRECTIVE ON ROAD INFRASTRUCTURE SAFETY AND DEVELOPMENT OF ADDITIONAL STANDARDS TO MANAGE SAFETY ON IRELAND’S ROADS

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ABSTRACT

This paper looks at the work undertaken in Ireland on updating and implementing design standards in compliance with the recent requirements set out in the EU Directive on Road Infrastructure Safety Management (RISM). These improved standards complement the actions in Ireland’s Road Safety Strategy (RSS) that aim to reduce road deaths and serious injuries on our roads.

Issues dealing with the practical problems associated with collecting large volumes of data, during drive through route inspections, are addressed. Solutions described herein and adopted have helped resolve some of the challenges associated with this type of data collection programme. Significant progress has been made in this area over a relatively short period. The RISM programme in Ireland has moved from data collection through analysis and review. Currently there is a programme underway implementing solutions on the ground.

In tandem with the inspection programme, the principles behind forgiving roadsides have been catered for in the design process and new guidelines issued. This philosophy sits well with the move to a safe systems approach, as set out in the Road Safety Strategy, currently in operation in Ireland. The guidelines and standards developed in recent years are expected to deliver substantial safety benefits. However the priority for now is ensuring these standards are disseminated to designers and programmes like the road safety inspection programme (RSI) put into operation. Beyond the design standards introduced for motorways and major interurban routes, this paper includes a section on Ireland’s new urban street standards. Other notable inclusions within the paper relate to the development of credible speed limits for the older legacy rural road network, in a progressive move away from a blanket speed limit based on road function. Ireland will continue to improve its road design standards and much of this work will be informed from Ireland’s participation with research as administrated by Conference of European Directors of Roads (CEDR TG Road Safety)
1. INTRODUCTION

A key target of the Irish Government’s Road Safety Strategy 2013 – 2020 is to reduce road traffic fatal collisions on Irish roads to 25 or less, per million population by 2020. This means reducing deaths from a total of 162 in 2012 to 124 or fewer by 2020. The Road Safety Strategy (RSS) also includes a provisional target for the reduction of serious injuries by 30%, from 472 (2012) to 330 by 2020, or 61 per million population [1].

Transport Infrastructure Ireland (TII) published a series of standards in the Design Manual for Roads and Bridges (DMRB) to meet the legal requirements of the EU Road Infrastructure Safety Management Directive (RISM). In the majority of cases these standards formalised a number of well defined procedures already in place or updated existing standards. Two new standards were developed where previously there was none. These relate to Road Safety Inspections (RSI) on the national road network and Temporary Safety Measures Inspections (TSMI), both deployed on Irish roads designated part of the Trans-European Road Network (TERN) as per the RISM Directive. The standards have been extended to include the rest of the non TERN network that makes up the 5,300 km of the national road network.

The purpose of this report is to introduce these standards and document the experience to date implementing these standards.

2. BACKGROUND

TII is primarily a funding and standards authority. However, in recent years the organisation has assumed the function of a Roads Authority on certain aspects of the national road network. There are in excess of 5,300 kilometres of national road network in Ireland. The national road network is comprised of 897 km of motorway, 298 km of dual carriageway, and 4,110km of single carriageway. These road types are divided between 2,651 km of national primary and 2,654 km of national secondary roads [2]. The primary network carries the majority of the road traffic and is mainly composed of the higher order road types.

TII is a major stakeholder in road safety and has made contributions to the current RSS on engineering design. For the strategy to deliver these ambitious targets a Safe Systems approach to road safety has been adopted [1]. Forgiving roadsides are an element of the Safe Systems approach to road safety. The concept of Forgiving Roads is to minimise the consequences of driving errors, rather than preventing them. Under the Safe System approach, addressing severe run-off-road crashes through safer roads and roadsides involves providing roads that minimise the risk to occupants of vehicles in a loss of control situation. Where vehicle do leave the carriageway adequate recovery space needs to be provided. Where a collision does take place with roadside objects these are designed in a way to limit the impact forces on vehicle occupants to minor levels [3].

A web portal has been created to publish and manage all Standards documentation, to make them more accessible to the road construction industry. The website is a repository for all current documents relating to Design Standards for Roads and Bridges, Manual of Contract Documents for Roadwork’s and Interim Advice Notes. The web portal is accessible at the following address: http://nrastandards.nra.ie/.

As well as the more recent developments on design standards for roads and bridges a completely new design manual for urban roads and streets has been published in 2013 by the Department of Environment. Additional policy decisions supported by the current RSS include the implementation of an additional 6,000 hours per month of speed enforcement and a major review on speed limits. Together with initiatives from policing and educational/awareness programmes these engineering
policies will contribute to the improvement of road safety for Irish road users and over the course of the current RSS will help achieve the goals set out therein.

3. FORGIVING ROADSIDES

In implementing the current RSS, Ireland is moving towards a Safe Systems approach to road safety. The Safe Systems approach recognises that, even with an emphasis on the prevention of road collisions through better road design, education and enforcement, some collisions may inevitably occur. Roads should therefore, be designed to expect and accommodate some degree of human error.

The Safe Systems approach builds on existing road safety interventions and comprises the following key principles [3]:

- Human Behaviour: No matter how well we are trained and educated about responsible road use, people make mistakes and the road transport system needs to accommodate this.
- Human Frailty: The finite capacity of the human body to withstand physical force before a serious injury or fatality can be expected is one of the main design considerations.
- Forgiving Systems: Roads that we travel on, vehicles we travel in, speeds we travel at and the attitudes of road users to each other, need to be more forgiving of human error.

The Forgiving Systems concept seeks to reduce the number of fatalities caused typically by run-off-road type crashes, by making roads more forgiving of driver error through the implementation of a range of safety enhancement measures. Under the Safe System approach, addressing severe run-off-road crashes through safer roads and roadsides involves providing roads that help minimise the risk of vehicles leaving the carriageway, in addition to providing adequate recovery space when vehicles do leave the road carriageway. These measures will 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 [3]. Implementing forgiving roadsides systems is a key action within the current RSS.

There are approximately 2,000 of km of legacy national roads in Ireland, i.e. roads that have not benefitted from the major national road improvement programme that was undertaken over the last decade. A common feature of these legacy roads is the presence of stone walls, ditches, trees and other obstacles along the edges of the roads. Figure 1 shows a breakdown of 1553 collision reported to the police in Ireland in 2014 on just the national road network.

A key challenge in the coming years for the TII, in partnership with local authorities, is to put in place appropriate road safety treatments to make these roads safer – even incremental safety improvements can make a big difference.
A document entitled, A Guidance Document for the Implementation of CEDR Forgiving Roadsides report, was published in 2014. This document builds on 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. The CEDR report was carried out by a team, representing 11 road administrations, including Ireland, set up under a ERA-NET project called, Improving Road Design to Forgiving Human Errors (IRDES).

The report identifies the main types of obstacles that may be found on roadsides and which may represent a risk to vehicle occupants in the event of a driver losing control of the vehicle. Roadside obstacles are categorised as follows:

**Table 1: Non exhaustive list of road side obstacles, categorized by hazard type [3]**

<table>
<thead>
<tr>
<th>Single Fixed Objects</th>
<th>Continuous Hazards</th>
<th>Dynamic roadside hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees</td>
<td>Embankments and slopes</td>
<td>Bicycles</td>
</tr>
<tr>
<td>Rocks and boulders</td>
<td>Ditches</td>
<td>Pedestrians</td>
</tr>
<tr>
<td>Utility poles and lighting posts</td>
<td>Road restraint systems</td>
<td>Parking</td>
</tr>
<tr>
<td>Safety barrier terminals and</td>
<td>Kerbs</td>
<td>Temporary advertising signs on timber</td>
</tr>
<tr>
<td>Headwalls</td>
<td>Permanent water bodies</td>
<td></td>
</tr>
<tr>
<td>Headstones</td>
<td>Pavement edge</td>
<td></td>
</tr>
<tr>
<td>Fencing at an angle to travel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The document also includes a description of common treatment solutions to make roadsides safer and identifies three categories of works that should be considered.
Table 2: Non exhaustive list of common treatments for roadside hazards [3].

<table>
<thead>
<tr>
<th>Removing and Relocating Obstacles</th>
<th>Modifying Roadside Elements</th>
<th>Shielding Obstacles</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Clear Zone concept</td>
<td>Breakaway devices</td>
<td>Rigid barriers.</td>
</tr>
<tr>
<td>Arrester beds in lane diverge</td>
<td>Ditch and slope treatments</td>
<td>Semi-rigid barriers.</td>
</tr>
<tr>
<td>Safe plantation</td>
<td>Route-Based Curve Treatments</td>
<td>Flexible barriers.</td>
</tr>
<tr>
<td>Roundabouts</td>
<td>Crashworthy masonry structures</td>
<td>Temporary safety barriers.</td>
</tr>
<tr>
<td></td>
<td>Shoulder modifications</td>
<td>Underriders.</td>
</tr>
<tr>
<td></td>
<td>Modification of retaining walls</td>
<td>Kerb-barrier combinations.</td>
</tr>
<tr>
<td>Safety barrier terminals</td>
<td>Safety barrier transitions</td>
<td>Impact attenuators.</td>
</tr>
</tbody>
</table>

Delineation and signage are normally the recommended treatments if all of the three measures (removing and relocating obstacles, modifying roadside elements, shielding obstacles) are deemed inappropriate for a particular location.

For new road developments, it is essential that potential hazards are identified and considered as early as possible during the planning phase. The provision of a Clear Zone (often called Safety Zone) is usually the most appropriate treatment. On existing roads, the identification of hazards may be established by road safety inspections, depicted in Figure 2 or by reference to collision histories. Hazards can be identified by considering traffic volumes and speeds, road geometry, surface properties and the expected severity of crashes.

Figure 2: Road Safety Inspection Video showing tagged hazards along a route

The following are a number of solutions proposed in the Irish Implementation plan for Forgiving Roadsides.

3.1. The Clear Zone Concept

The most effective roadside improvement can be accomplished by providing a Clear Zone, i.e. an obstacle-free area with a flat and gently graded ground. This provides motorists with room and opportunity to regain control of their vehicle in case of a run-off. Objects that cannot be eliminated
should be relocated outside the Clear Zone. Zones may be divided into two areas: the recovery zone (hard shoulders) and the limited severity zone as indicated within Figure 3.

The width of Clear Zones varies throughout the world, depending on the underlying policy and practicability. The national dimensions for a Clear Zone of 7 different European countries have been determined in the ERA.net funded project on Roadside Infrastructure for Safer European Roads (RISER). Common criteria for determining the dimensions are design speed, side slope gradients, road type, horizontal alignment (straight or curved roads), driving lane width and percentage of heavy-vehicles [4]. The Clear Zone requirements in terms of the width of the zone, shown in Figure 3, are included within the Irish DMRB TD 19.

3.2. Open Drains

Open drains (ditches) are defined as drainage features created to channel water, which mostly run parallel to the roadway. They are formed by the side-slope and back-slope planes, and are intended to provide adequate drainage and snow storage capacity. A recent Austroads research report on improving roadside safety discusses traversable open drains in the Clear Zone. The report found that, if drain sides are too steep, errant vehicles may roll over, increasing the severity of a run-off-road crash [5]. This report recommends that the side slopes of table drains should be flat enough to minimise the possibility of errant vehicles overturning. Side slopes not steeper than 1:4, ideally with a slope of 1:6, are preferred. In addition it was reported that run-off-road crash likelihood more than doubles for steep roadsides (1:3.5 or steeper) compared to flat roadsides (1:6 or less).

In DMRB TD 19/14, side slopes steeper than one in five are not recommended in the Clear Zone, as show in

![Figure 3: Clear Zone concept [3]](image_url)

![Figure 4 - Clear zone width and slope ratio from DMRB TD 19](image_url)
3.3. Pavement Edge Drop-offs and Other Continuous Obstacles

Pavement edge drop-offs are another roadside hazard that needs to be treated. Shoulders may not always be flush with the roadway surface. Such shoulder edge drop-offs can be caused by soil erosion next to the pavement, rutting by frequent tyre wear or from repaving, where material is added to the lane but not to the adjacent shoulder. Examples of these issues are shown in Figure 5. While Figure 1 shows significant numbers of single vehicle collisions are associated with the road edge and roadside environs.

![Figure 5 - Examples of excessive pavement edge drop-off [3]](image)

3.4. Roundabouts

The possibility of a vehicle entering the centre of the roundabout is increased due to the 90 degree angle of approach to a roundabout. It is, therefore, advised to keep this area free from any objects. It is not possible to protect objects in the centre of a roundabout with a safety barrier due to the 90 degree angle of approach, as safety barriers are tested at angles of impact of only 30 degrees. The CEDR report states that features, hazardous plants or trees should not be placed in the centre of roundabouts [3].

The revised Junction Standard (TD 301), to be published in 2015, will now specifically address these issues and will prohibit features, hazardous plants or trees in the centre of roundabouts.

3.5. Crashworthy Masonry Structures

Masonry structures, such as parapets, culverts and kerbs, can often be found on roadsides. They generally have minimal energy absorbance and are very hazardous obstacles for errant vehicles. If they cannot be removed from the Clear Zone, these structures should be modified.

Masonry structures such as bridge piers, walls or buildings, which cannot be removed or relocated, should be shielded with an appropriate system. Culvert ends can be hazardous obstacles to run off the road vehicles. If they cannot be removed, safer designs should be considered. A common treatment for culvert ends is bevelling also shown in Figure 6. The information shown in Figure 4 show the typical numbers of single vehicle collisions involved with fixed permanent engineered features.
3.6. Safety Barrier Terminals

There are two types of safety barrier terminals;

- they can either redirect vehicles back onto the carriageway, or
- stop a vehicle immediately so that it cannot pass through the barrier.

If the terminals are intended to stop a vehicle, they have to be treated as energy absorbing devices and must be tested according to EN 1317.

When terminals appear as hazards, countermeasures should be implemented. For rigid barriers, the most appropriate way to modify the terminal is to make it semi-rigid. This causes the vehicle to crash into a deformable barrier first, which guides the vehicle onto the rigid one. The second option is to make them breakaway so that, on impact, the terminal breaks and swings back behind the barrier. A deflection from the traffic lane towards the roadside is also an appropriate measure.

A further method of treating hazardous safety barrier terminals is to shield them separately by means of crash cushions. Within the Irish DMRB, TD 19 states that the preferred option for an upstream terminal is a ramp down terminal at flare of 1:20 away from the road. Where this is not possible a full height P4 terminal is required on all roads of design speed 100km/h or greater.

4. SAFETY RANKING AND MANAGEMENT OF THE ROAD NETWORK.

Safety ranking and management of the road network can be divided into two distinct processes. One process is a reactive approach (DMRB HD 15). The other process is more proactive and conducted as part of a series of drive through inspections (DMRB HD 16 & 17). These procedures were documented and included into the suite of TII standards and demonstrate compliance with the RISM directive.

4.1. Network Safety Ranking

The RISM Directive requires road authorities to identify sections of the network which have a high concentration of collisions. An existing internal procedure used to identify these locations was substantially borrowed from to help develop this new standard (DMRB HD 15). More commonly referred to as Network Safety Ranking, this standard requires the national road network to be analysed annually. This analysis is carried using all reported injury collision data for a rolling three year period.

This ranking process defines High Collision Locations as a section of the network which has a collision rate twice above the average for that type of road and where three or more collisions have occurred over a three year time period [7]. The first phase of the process classifies the road network into distinct groups by road type called Reference Populations (RPs). These five RPs typically divided
between rural motorways, rural dual carriageways, rural single carriageways, urban dual carriageways, and urban single carriageways. As each RP is of a similar road type, comparisons within each RP are readily made as each RP is expected to have a similar safety performance.

The process itself is long established and well documented elsewhere such as, the Road Safety Manual, produced by PIARC in 2003. The collision rate is the ratio between the collision frequency and the exposure measure. The exposure measure used by the TII is estimated vehicle kilometres travelled based on the middle of the three year time period. The analysis considers all fatal and all reported serious, and minor injury collisions with no adjustment for underreporting. Historical collision rates for the Irish national road network are shown in Table 3. These figures compare favourably to collision rates reported in other European countries [8].

Table 3 – Ireland’s collision rates by road type (rates quoted as ... per 100 Million km of travel)

<table>
<thead>
<tr>
<th>Ref Population</th>
<th>Period of Review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>03-05</td>
</tr>
<tr>
<td>National Network</td>
<td>2.918</td>
</tr>
<tr>
<td>Urban Single Carriageway</td>
<td></td>
</tr>
</tbody>
</table>

*At the time of analysis the 2013 data was not fully validated

The next phase of the process is a closer examination of the details of the individual collisions at these identified High Collision Locations. At the conclusion of this stage the review team will identify those sections where engineering countermeasures are most likely to reduce the number of collisions or at least provide a reduction in the severity of the collisions that may occur in the future at these locations. The team leading this phase of the process are all civil engineers with road design experience as well being certified lead road safety auditors and qualified forensic collision investigators. The process is a retrospective look at the safety issues on the road network but is now supplemented by a more proactive process, discussed in section 4.3 that identifies safety issues within the road environment from regular periodic inspections.

### 4.2. Temporary Safety Measures Inspection

Temporary Safety Measures Inspection (TSMI) is a new safety procedure for road works that was introduced to comply with the RISM Directive. The TSMI process is described in DMRB HD 16 Temporary Safety Measures Inspection. In general it can be described as an inspection of road works sites on the national road network. The purpose of these inspections is to ensure that temporary safety measures standards are being correctly implemented at road work sites and to record possible impacts of road works on the safety of traffic flow.

The process is developing to take into account more efficient and innovative ways of collecting information on site during these inspections. There are particular issues with data collection and information dissemination using standard “paper” based reports that can be improved using spatially aware devices. However, these refinements to the process are not mature enough to describe in this report. The relevant bodies that carry out TSMI are listed below [9]:

- TII - TSMI of projects directly procured by TII
- Local Authorities - TSMI of projects sanctioned and/or procured by the local authority
- Statutory Undertaker or Road Operator - TSMI of projects under their management
TII also conducts random TSMI on Local Authority, Statutory Undertaker and Road Operator temporary safety measures to ensure that the requirements of DMRB HD 16 are being met.

4.3. Road Safety Inspection

Road Safety Inspection (RSI) is a new safety procedure introduced in Ireland to comply with the RISM Directive. The RSI process is described in DMRB HD 17 Road Safety Inspection.

RSI is a proactive approach to improving the safety of the existing national road network. The Directive defines RSI as “an ordinary periodical verification of the characteristics and defects that require maintenance work for reasons of safety” [6]. This process can be further broken down into the following areas that together are used to capture and log issues on the network to help develop a programme to address and remediate defects:

4.3.1. Route Selection
RSI is carried out on all national roads. Inspections first began in Q3 2012. The Trans-European Road Network (TERN) was inspected first. The sequence in which the remaining routes were inspected was based on safety performance akin to the Network Safety Ranking process. The national roads are ranked in terms of their collision rate, fatal and serious injury collision rate as well as the overall length of route. Road Safety Inspections are carried out according to the results. The other requirements for compliance with the RIS Directive such as safety audits and network safety ranking cover both the TERN and non TERN network making up the Irish national road network. Therefore it was logical that RSI be extended beyond the TERN network to, to avoid having a two tier safety regime on the national network.

4.3.2. RSI Team
Information on RSI team qualification requirements is available from the Irish standards website. A competent inspection team appointed by the Authority consists of a minimum of two inspection team members, one of whom is also approved as inspection team leader. The approval of a team leader is conditional on having ten years post graduate experience with a minimum of seven years in the design and construction of road projects and/or road safety schemes and with two or more year’s experience of collision investigation and remedial measures. They will have taken part in ten road safety audits as team member, and will have attended an accredited three to five day course in road safety audit theory and practice.

4.3.3. Desktop Study
RSI teams must examine the collision trends for each route before the inspection takes place. The collision trends for each route are compared against control data to establish if particular collision patterns are associated with a route. The desktop study provides the RSI team with an understanding of the overall safety performance of a route before the inspection takes place. The desktop study does not consider individual collisions, or individual collision clusters as it is an inspection of the safety performance of the overall route.

4.3.4. Inspection
The function of TII is to oversee the inspection process. Once the desktop study has been completed, the RSI teams can commence the inspection. RSI is performed on a route by route basis. The RSI team drives the whole route in both directions, in daylight and darkness, and also in particular weather conditions if required. The RSI teams inspect all road elements and junctions along the mainline in addition to 200m of all side roads leading up to the main route. At the start of the process, the RSI teams took pictures of all the hazards identified. However, recent advances to capture and store spatial encode imagery, has resulted in a move away from static images to video footage of the hazard. The RSI team have identified all safety related items that require further review. The RSI findings are then compiled into the RSI report.
4.3.5. Report

An individual RSI report is prepared by the team for each route. The report includes a brief description of each hazard, the location of the hazard and a risk value assigned to the hazard. The risk value is based on the likelihood of a collision occurring and the likely severity of the outcome. The final report is submitted to TII for the preparation of suitable treatments.

While this process is relatively new, a number of significant changes to the process have already taken place. The initial assessment was based on assigning the hazard to a section of the network, recording this in structured spreadsheets. The reports include photographic images of each hazard. As stated earlier the process now is carried out using low cost spatially encoded video that is later attributed via a web-interface.

As with DMRB HD 16 this inspection process is developing to take into account more efficient and innovative ways of collecting information on site during these inspections. There are particular issues with data collection and information dissemination using standard paper based reports that can be improved using spatially aware devices. Figure 2 in Section 3, shows a screen capture form a cloud based platform used to display, disseminate and tag roadside hazards. Figure 7 shows an alternative view of the same tagged items, now displayed as a bar chart to help better describe the design issues identified during the inspection along this 12 km road section.

![Graph showing the number of hazard items identified along each network segment.](image)

**Figure 7:** Presenting hazards along a 12 km section of the N02 route, identified from a drive through inspection

5. OTHER RECENT DEVELOPMENTS

This section describes some other initiatives that TII has recently participated in developing. Credible speed limits and improvement on design speed calculation, particularly on the legacy rural road network, contribute to the goals set out within the current RSS. These developments, along with new standards dealing with safety barrier assessment, are focused on the rural road network. However the recent publication of a design manual for Irish roads and streets has provided guidance and good practice examples for the urban environment. To add context to the rural/urban safety issues Table 3 lists the collision rates for different time periods on the Irish network. Consistently the urban road environment presents far greater risk to the road user than rural roads per vehicle kilometre travelled.

The developments described here should not be taken as an exhaustive list of the programmes currently underway by Ireland.
5.1. Design Manual for Urban Roads and Streets

The Design Manual for Urban Roads and Streets (DMURS) was introduced in 2013. DMURS has been published by the Department of Environment, Community and Local Government at http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownload,32669,en.pdf.

DMURS is a set of guidelines to provide safe and attractive urban environments that encourage people to use sustainable modes of transport such as walking, cycling or public transport. DMURS seeks to reduce the priority that is traditionally given to private vehicular traffic by presenting a balanced approach to urban road design. DMURS is based on four key design principles: Connected networks; Multi-functional streets; Pedestrian focus and a Multidisciplinary approach.

DMURS design principles afford the most consideration to pedestrians and cyclists allowing for a self-regulated shared urban streetscape. DMURS is implemented in conjunction with associated spatial plans such as County Development Plans and Local Area Plans.

5.2. Credible Speed Limits

In Q4 of 2013 the Department of Transport, Tourism and Sport published its recommendations to reform the speed limit system and ensure that every speed limit in Ireland is both safe and sensible.

The report recommends a new appeals mechanism for inconsistent speed limits, the removal of misleading 80kmh speed limits on narrow country roads, and the end of inappropriate sign locations at badly chosen locations. Every speed limit in the country will be audited every five years by the and speed limit guidelines will become binding. The goal is to ensure that the speed limit on any given road is a fair reflection of the road conditions. Additional information can be found at http://www.dttas.ie/roads/publications/english/speed-limit-review-2013

5.3. Improvement to Design Speed Standard

TII has funded NUI Maynooth (NUIM) to develop practical tools to assess design speeds on single carriageway roads. NUIM undertook research and are developing an algorithm using Ubipix (a low cost application developed to acquire and disseminate spatially encoded video data) to validate this research through on site testing. Independently the results for this research will be reviewed and analysed before being introduced as an improved standard approach to design speed assessment.

5.4. Safety Barrier Risk Assessment

A new approach of considering safety barrier needs for online improvements was developed, where hazards within the ‘clear zone’ could be treated. This standard now considers the collision history, likelihood of leaving the road and the nature of the road side hazards to guide designers in their judgement of the need or otherwise for a safety barrier. It is anticipated that this process will reduce the amount of unnecessary safety barrier, itself presenting a hazard if inappropriately placed on the network. In addition TII have co-funded, with six other European road authorities, a CEDR research project (www.saversproject.com) which is looking at a trans-Europe guidance document dealing with the selection of appropriate vehicle restraint systems.

6. CONCLUSIONS

Reliance on older design standards, guidelines and existing programmes of countermeasures is unlikely to yield the same safety benefits going forward has they have done in the past. The topics discussed within this paper are relatively recent introductions to Irish road designs standards and guidelines and the changes that will result from adopting them have uncertain outcomes. Some of the changes have come about due to requirements at a European level while some others have been
adopted as part of a national road safety strategy. More changes to the existing standards will come about reflecting Ireland’s involvement with CEDR and the findings and recommendations from this trans-national research initiative.

The forgiving roadsides concepts discussed in section 3 are targeted towards single vehicle collisions. Some 28% (443 of 1553, see Figure 41) of single vehicle collisions on Ireland’s national road network have occurred with a roadside ditch. The presence of the ditch is an indicator of an older legacy road, typically a rural single lane carriageway. If all single vehicle collisions associated with road edge or road verged, shown in Figure 41, are combined then the figure grows to 40%. Considerable work remains to be done in estimating the work and costs associated with improving open drains and implementing clear zone concepts in order to reduce the numbers of single vehicles associated with these types of roadside hazards.

Masonry Structures are less prevalent within the figures shown in Figure 41 but there are 297 (19%) reported collisions with steel barriers. A further analysis has shown that only 0.67% of single vehicle collisions with steel barriers resulted in a serious injury and no fatality with a barrier was noted in 2014 from police collision data. In general terms, barriers appear to be protecting vehicle occupants form injury. Combining this figure with collisions involving other barrier types yields a figure of 30% of all single vehicle collisions involve with a vehicle restraint system. This is not a figure to be complacent about despite the low injury severity levels involved. The recent research from SAVeRS will strengthen current standards and guidelines in this area.

The processes around Network Safety Ranking remain important tools to target engineering interventions to reduce risk to the road user. Less reliance on the results from Networking Safety Ranking will be used to direct subsequent interventions as the RSI programme will influence future safety programmes to a larger extent. While the area of routine safety inspections at a network level is relatively new, the progress made to date, including the inspections of temporary safety measures and traffic management has been incorporated within the design standards. The development of the Upipix platform will continue based on the efficiencies and safer practices already made from adopting this type of technology.

The initiative around the Design Manual for Urban Roads and Streets and guidelines for local authorities on auditing speed limits for key actions within Ireland’s current Road Safety Strategy. These areas will have to be revisited and reviewed as they are rolled out, to make sure the positive contributions to road safety that they are expected to yield are delivered.

In a recent OECD publication it was noted that countries with the lowest road mortality rates are found within Europe. By way of explanation behind the reason for this, it suggests that Europe has implemented “systematic road safety strategies and programmes that are tackling the main factors for road crashes” [10]. These strategies include additional enforcement and legislative changes as well as improvements in medical emergency care. The “technical standards for road infrastructure” [10] was noted as another reason for the observed improvements in road mortality rates. Although this paper cannot cover all the other initiatives Ireland has taken to update its design standards and guidelines it does demonstrate the level of activity and commitment to improving these areas.
7. REFERENCES


