

Road Safety Inspection Guidelines

June 2012

Summary:

This Advice Note provides guidance on undertaking Road Safety Inspections on National Roads. It is intended to be read in conjunction with the Standard NRA HD 17 – Road Safety Inspection.

**VOLUME 5 ASSESSMENT AND
PREPARATION OF ROAD
SCHEMES**

**SECTION 2 PREPARATION AND
IMPLEMENTATION**

PART 2

NRA HA 17/12

ROAD SAFETY INSPECTION GUIDELINES

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1 INTRODUCTION

General

1.1 These Guidelines should be read in conjunction with the National Roads Authority (NRA) Design Manual for Roads and Bridges Standard NRA HD17, Road Safety Inspection.

Definitions

1.2 *Road Safety Inspection:*

Is an ordinary periodical verification of the characteristics and defects of an operational road that require maintenance work for reasons of road safety.

1.3 *Authority:*

For National Roads the Authority is the National Roads Authority (NRA).

1.4 *Inspection Team:*

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*. Current NRA training and experience requirements for Inspection Teams are available on the NRA website. www.nra.ie/Publications/RoadSafety

1.5 *Inspection Team Leader:*

An *Inspection Team Member* meeting the requirements of the Authority for *Inspection Team Leader* and appointed by the Authority to lead the *Inspection Team* for the particular *Road Safety Inspection*.

1.6 *Inspection Team Member:*

A person meeting the requirements of the Authority for participation in the *Road Safety Inspection* and appointed by the Authority for the particular *Road Safety Inspection*.

1.7 *NRA Road Safety Engineering Team:*

A team of persons within the Authority capable of assessing the problems identified in *Road Safety Inspection* and capable of making recommendations to the Authority in respect of remedial measures necessary to address the issues raised.

1.8 *Road Operator:*

A road operator is defined as a company undertaking construction, maintenance or operation of a National Road under a contract agreement with the Authority, and in circumstances where direct responsibility for the construction, maintenance or operation of the section of road has been transferred to the company. A Road Operator may be appointed under a Public Private Partnership or other form of contract with the Authority.

1.9 *Inspection Brief:*

Prepared by the Authority for the Inspection Team to give direction on the extents of the Safety Inspection and to include all relevant data on that route section.

History and Background

1.10 In 2008, motorists travelled 43,790 million vehicle kilometres on Irish roads (source CSO statistics), and the distance per vehicle travelled each year by the Irish road fleet is consistently amongst the highest in Europe. Ireland is a small island nation with a dispersed population and road travel is important.

1.11 This high usage of the country's roads carries a consequential road traffic collision risk, and in 2010 the number of fatalities on Irish roads was 212 (source Road Safety Authority).

1.12 There is a duty on road users to travel with care, and there is a corresponding obligation on those who plan and construct road infrastructure to ensure that it is as safe as is realistically possible.

1.13 In recent decades the very high cost to society of collisions has led to an emphasis on road safety within Ireland and Europe. The assumption that collisions are an inevitable consequence of travel has been strongly challenged. In Ireland, implementation of road safety measures over the last 40 years has led to a downward trend in the number of road deaths, from around 600 per year in the early 1970's to 212 in 2010. This was achieved in the context of an almost four-fold increase in road travel during

that period, and in that respect a better indicator of the achievement is the decrease in the number of deaths per 10,000 licensed vehicles, which fell from 10 in 1970 to 1 in 2010.

1.14 The Member States of the European Union have become increasingly focused on road safety management. In its White Paper of 2001 'European transport policy for 2010: time to decide' the Commission expressed the need to carry out safety impact assessments and road safety audits in order to identify and manage high collision concentration locations within the Community. It also set the target of halving the number of fatalities on the roads within the European Union between 2001 and 2010, from 50,000 to 25,000.

1.15 EU DIRECTIVE 2008/96/EC of 19 November 2008 on road infrastructure safety management was the culmination of that policy, and it set out the processes for all elements of road safety management, including periodic Road Safety Inspection.

1.16 On the 23rd September 2011, S.I. No. 472/2011, European Communities (Road Infrastructure Safety Management) Regulations 2011 were made. These regulations gave effect to the EU Directive in Ireland, including the requirement for Road Safety Inspection, and also gave effect to the provisions of the Directive in relation to the publication of national guidelines for the various elements of road safety assessment, including road safety inspection.

1.17 These guidelines relate to Road Safety Inspections on national routes, and have been prepared in compliance with the requirements of Section 8 of the 2011 Regulations. They are addressed to all stakeholders: the National Roads Authority (NRA), local authorities, Road Operators with responsibilities for the operation and maintenance of sections of the national network, road safety consultants and road safety inspectors, and they describe the responsibilities of each body in the delivery of the services required by the Directive and the Regulations. Any person carrying out road safety inspection activities covered by the Regulations or the Directive should ensure that those activities are carried out in accordance with this guideline.

1.18 A standard has also been written which describes the specific requirements relating to the inspection of National roads. It is contained in the NRA Design Manual for Roads and Bridges as HD17/12 Road Safety Inspection, and those involved in Road Safety Inspection are referred in the first instance to that document

2 ROAD SAFETY INSPECTION

Road Safety Inspection Definition

2.1 The Directive and the Regulations both contain the same definition of a Road Safety Inspection (RSI) as “an ordinary periodical verification of the characteristics and defects that require maintenance work for reasons of safety”. The terminology of this definition gives an indication of the scope of the Road Safety Inspection as follows:

- The term *ordinary* indicates that an in-depth, forensic investigation is not expected;
- The measures to be carried out in response to the inspection are described as *maintenance work*; this suggests that major changes to the layout of the road, entailing high cost, are not envisaged as counter-measures; however, it is anticipated that engineering works are required to remediate the issues;
- The term *periodical* indicates the need for inspections to be repeated at intervals, rather than being a once-off event;
- Recommendations on remedial measures do not form part of the Inspection. The National Roads Authority will therefore assume responsibility for the development and design of remedial measures, independent of the Inspection process, but based on the Inspection report.

Road Safety Inspection in EU Directive

2.2 The Directive expands on the role of RSI as follows: “*Once road sections with a high accident concentration have been treated and remedial measures have been taken, safety inspections as a preventive measure should assume a more important role. Regular inspections are an essential tool for preventing possible dangers for all road users, including vulnerable users,*” (Extract from Preamble 9 of the Directive).

2.3 To get a clearer understanding of the objectives of Road Safety Inspection, it is worthwhile focussing on its place within the four road safety assessment procedures listed in the Directive, which are:

- i. *Road Safety Impact Assessment*, which demonstrates, on a strategic level, the implications on road safety of different planning alternatives of a project, whether construction of a new road or rehabilitation of an existing road.
- ii. *Road Safety Audit*, which provides independent technical control aimed at identifying unsafe features of a proposed road project, and includes proposals for remedy. Audits have been carried out on Irish roads since 1999, and will be familiar to road safety practitioners. Road Safety Audit is mostly concerned with schemes pre-opening.
- iii. *Network Safety Management*, which targets remedial measures to parts of the network with high concentrations of collisions (high collision locations). Collision cluster management has also been an established road safety response in Ireland for many years.
- iv. *Road Safety Inspections*, which are periodic checks, enabling the detection and hence reduction of collision risk in a preventive way through relatively minor road safety improvement schemes on the existing road network.
- v. *Temporary Safety Measures Inspection*, which are checks on sections of roads which are subject to road works to ensure that the guidelines applying to Temporary Safety Measures at road works are properly applied and to record possible impacts on the safety of traffic flow.

Unique Role of Road Safety Inspection

2.4 Road Safety Inspection is an assessment of **existing** roads, whereas road safety audit and road safety impact assessment both relate to **new roads** or **developments** impacting on existing roads.

2.5 Road Safety Inspection is a **pro-active** process, in that it seeks to identify the safety defects of the road and enable counter-measures to be provided before the problem manifests itself; Network Safety Management on the other hand is **reactive**, in that the collisions occur before the problem is either identified or remedied, and the collision clusters are used to identify/prioritise locations for treatment.

Scope of Road Safety Inspection (RSI)

2.6 RSI is an on-going process, with roads being subject to re-inspection at regular intervals.

2.7 RSI responds to the safety implications of changing conditions on the road network. The road environment is dynamic; it is not fixed over its design life. Roadside features are added or removed, materials forming the road deteriorate and are replaced, new developments are built on the road frontage altering access conditions and changing traffic flows.

2.8 Changes also occur to our understanding of road safety and road design standards; certain engineering designs that would have been considered safe in the past are today considered unacceptable.

2.9 The list of common changes to roads that need to be considered in periodic road safety inspection is:

- Improved road design and road safety standards;
- New products and technology which improve road safety;
- Layout changes arising from improvement works, such as road realignment or junction improvement;
- Layout changes arising from works consented to in planning, such as additional roadside accesses;
- Increased traffic flows, or changed traffic composition, again often arising from development;
- Changes in speed limits or other specific regulatory interventions;
- Changes in driver behaviour in response to a change in national legislation;
- Materials that have deteriorated, been damaged, or have reached the end of their service life.

Other Road Safety Assessment Procedures

2.10 New schemes automatically receive a road safety health check through a combination of *Road Safety Impact Assessment*, at the initial planning stage, and *Road Safety Audit*, during the various stages of implementation of the scheme.

2.11 *Road Safety Audit* has proven to be an effective safety tool, with various studies showing positive results: Surrey County Council found savings of 1 casualty per year on audited schemes; in New Zealand the benefit to cost ratio of works associated with audit recommendations was 20:1; and in Denmark works arising from audit recommendations had a First Year Rate of Return of 149%.

2.12 In relation to existing roads, cluster analysis as part of *Network Safety Management* has been a typical reactive response to road safety deficiency and many locations with high fatality rates have been successfully treated over the last fifteen years. Clustering of collisions is, as a result, now less defined, and their spread by location is increasingly random.

Occurrence of Safety Inspection

2.13 The Directive states that “*Member States shall ensure that periodic inspections are undertaken ...*”. The Regulations state that Safety Inspections shall:

- *comprise periodic inspections of the road network, and*
- *be sufficiently frequent to safeguard adequate safety levels for the road infrastructure in question.*

2.14 The length of the time interval between inspections is dependent on the type of road. Motorways generally need less frequent inspections than single carriageways for a number of reasons, including:

- They are designed to a high standard – this is particularly true of the recently constructed major inter-urban network in Ireland.
- They have low collision rates relative to other roads.
- They are access controlled, so roadside development is not an issue.

- They are controlled in respect of statutory undertakers, so change to the road environment arising from utility installation is minimal.
- Their layout is not frequently changed by upgrading or maintenance.

Therefore the maximum periods between inspections shall be:

- **5 years for Motorways and type 1 and 2 dual carriageways.**
- **3 years for other roads.**

2.15 These are the intended intervals; however, there may be circumstances where it is sensible to shorten these periods, and the NRA will make a decision where it requires additional inspections. Circumstances where that might arise are:

- On very busy strategic routes, such as the M50.
- Where incremental changes have been made to a route.
- Where traffic flows have increased significantly since the opening of the road or since the previous inspection.

2.16 In respect of the inspection itself, the matters of timing that are of relevance are:

- **The inspection must be carried out by day and at night, in both directions.** Driving in darkness adds to the driving workload of drivers and at night they are often reliant on reflective road signs and delineation when 'reading' the layout of the road. A third of collisions occur during darkness, but less than one third of travel occurs at that time.
- **Inspections should be targeted if supported by the collisions trend report.** Inspections should be carried out to identify issues that may be raised in the collision trends report, e.g. a preponderance of collisions in the wet may mean that an inspection during wet weather is necessary.
- **Inspect at times of normal operation of the road.** Unless otherwise required, avoids times when the road environment conditions are abnormal, such as when special events are occurring. However if events are frequent (occurring at least weekly), and if the conditions during those events are considered

to affect road safety, then the route should also be driven under those conditions. School-times and commuter congestion are examples of factors which may need consideration if they apply to the route and are significant in safety terms. Off-peak conditions should however always be considered.

Safety and Health

2.17 The inspection team should exercise caution when working in live traffic and while inspecting from the vehicle. Each Inspector must be familiar with, and comply with, current legislation and best practice in relation to occupational health and safety pertaining to inspection or other activities on a live carriageway.

2.18 Websites and other sources providing guidance on safety of works and other activities on live carriageways, should be checked regularly for updates. These include the HSA website www.hsa.ie.

3 ROAD SAFETY INSPECTION PROCESS

Inspection Management

3.1 The Directive states that:

“Member States shall ensure that periodic inspections are undertaken by the competent entity”, and the term ‘competent entity’ is stated to be “any public or private organization set up at national, regional or local level, involved in the implementation of this Directive by reason of its competences.”

The national Regulations define the “Authority” as the National Roads Authority and outline its role in the road safety inspection process as follows:

“The Authority shall ensure that safety inspections in respect of roads in operation are undertaken in accordance with guidelines issued by the Authority for that purpose.”

3.2 The National Roads Authority will, therefore, take the lead role in administering Road Safety Inspection on National roads. National routes usually cross at least one local road authority boundary and it is preferable that a single body, having responsibility for complete route, would undertake the administration of the inspection.

Roles in Inspection

3.3 The National Roads Authority will:

- Provide guidelines on road safety inspections;
- Programme and administer inspections of national routes;
- Appoint the RSI team;
- Provide a brief and supporting document for the inspection;
- Fund the inspection;

3.4 The NRA road safety engineering team, in association with other NRA engineering staff, will develop recommendations for remedial measures taking into consideration the contents of the Inspection report. These recommendations will be prioritised with a view to being funded in

the subsequent years’ road programmes. This process however is not part of the Inspection.

3.5 The Inspection Team will:

- Hold the required qualifications and experience (the requirements are set out hereafter).
- Carry out the inspection in line with the guidelines.
- Advise the Road Authorities/Road Operator in good time, and, if appropriate, the emergency services, that a road safety inspection is being carried out.
- Liaise with local authorities/road operator after the inspection in regard to road safety issues that they may be aware of.
- Forward the draft Inspection report directly to the Authority.
- When requested, discuss the draft Inspection report with the NRA road safety engineering team.

Inspection Team

3.6 The Directive states that “training and certification of safety personnel by means of training curricula and tools for qualification validated by the Member States should ensure that practitioners get the necessary up-to-date knowledge”.

3.7 The intent is that the various elements of road infrastructure safety assessment are to be carried out by appropriately qualified and experienced road safety practitioners. The NRA requirements in relation to the inspection team for the national road network are stated hereunder. These requirements may be updated from time to time and the NRA website www.nra.ie should be consulted to determine the current requirements.

3.8 **The RSI Team shall contain at least two members.** The quality of a road safety inspection is dependent largely on the quality of the judgments made by the Inspection Team, and in that respect the opinions of a team of at least two experienced practitioners are better than those of a sole inspector. The benefits of a team approach are well established in road safety audit: greater certainty of balanced reports and greater likelihood of issues being fully identified. An additional consideration is that it is often not practical to carry out an RSI alone.

3.9 **One team member shall be appointed Team Leader and shall hold, by December 2013, a Certificate of Competency in Road Safety Audit, recognised by an EU Member State.** This is considered the qualification that guarantees a reasonable level of ability in relation to road safety inspection.

3.10 **Team Members shall be Chartered Engineers (currently registered with Engineers Ireland, or equivalent), with at least 7 years experience, including experience in road design, road safety engineering and collision investigation.** Experience is a necessary requirement, and will help to ensure high-quality inspections of a consistent standard across the country and over time. Trainee Road Safety Inspectors should however be encouraged to attend inspections, but their roles should be purely to observe rather than participate.

3.11 **All team members shall be independent of the maintenance and operation of the road.** The inspection is intended to be a fresh, independent look at the road (the phrase 'looking at the road with fresh eyes' has been used in the guidelines of other European countries), and therefore it is not recommended that the team would be accompanied on the inspection by representatives of the road authority and/or road operator. In addition, those who have had a role in the design or maintenance of the route, within the three year period prior to the inspection, will not be eligible to participate.

Desk Study

3.12 The Inspection Team should assemble and study the available route data prior to undertaking the site visit to ensure that they have sufficient knowledge of the route to make informed judgements during the visit. The following sections describe the types of information that should be considered by the Team.

A. Mapping

3.13 Electronic route mapping will be provided to the Inspectors, to enable plans of the route to be printed. Plans and drawings should be of a size and scale that will be manageable in the field. If the mapping is up-to-date it will include recent road realignments; if not, alignments should be

provided by the road authority and overlaid on the mapping.

3.14 In addition the following features should be added to the mapping:

- NRA road section references (available as 1km geo-references) should be placed on the road centreline to enable defects to be identified by location;
- The carriageway type should be stated on the maps;
- Significant features, such as towns or large developments should be highlighted (a large development is one generating more than 500 vehicular movements or more than 100 truck movements per day directly onto the route);
- Speed limits should be shown;
- Road numbers should be shown;
- The dates of significant changes to the road layout should be written on the mapping so that the impacts of positive factors (such as road improvement schemes) and those of negative factors (such as additional private accesses) can be assessed.

3.15 Mapping at a scale of 1:250,000 or so is appropriate as a key plan but the choice of scale and layout is dependent on the route length and the size of drawing to be used.

B. Video Information

3.16 Video information, collected as part of the annual SCRIM (Sideways Force Coefficient Routine Investigation Machine) and Road Surface Profiler (RSP) surveys, is available from the NRA. It is in electronic format and can be viewed on standard video player software.

C. Collision Information

3.17 The RSI guidelines of various European countries contain differing recommendations on the need for knowledge of collision information when carrying out road safety inspection. Some state that because RSI is carried out on routes independent of their collision history no check is necessary on the actual collision record of the route being inspected, and that collisions are specifically considered elsewhere in road safety management, specifically in Network Safety

Management.

3.18 Collision history of a route is not the factor that triggers a road safety inspection, however collision information needs to be considered when carrying out the RSI. Since the intention of RSI is to improve road safety, and given that defects may have contributed to past collision occurrence and may continue to do so, it is sensible for the Road Safety Inspection Team to have knowledge of collision occurrence, and to carry out the inspection in full knowledge of that history. It is recommended therefore that the current road safety performance, such as collision trends of the route, is known by the Inspectors when road safety inspection is being carried out.

D. Road Collision Factors

3.19 The NRA compiles summary statistics from national collision data, concentrating on key information that will be of use to road safety practitioners.

3.20 Interrogation of that data will give the Inspection Team an appreciation of the relative importance of various factors in collision occurrence in this country and will provide particular data on the road being inspected. It is intended that this information will be made available by the NRA for download by the Inspection Team.

3.21 The information consists of:

- Collision rates per million vehicle kilometres of travel by route and road type
- Collision data by road user type
- Collision data by collision type
- Collision data by contributory action
- Collision data by light condition
- Collision data by weather conditions

3.22 It is sufficient for the inspection team to have an overall appreciation of the nature, severity and distribution of collisions along the route; an in-depth collision analysis is not required.

E. Traffic Information

3.23 The NRA website contains information on traffic flows recorded by automatic traffic counters sited on the national road network. The

information is detailed, and provides AADT, percentage HCV, directional split as well as detailed profiles of traffic flows over different time periods. This will normally be sufficient information for the inspection team to carry out its work.

3.24 However, not all routes have enough counters to provide a complete picture of the variation in flow by route location, and in that case the only alternative source of data may be the National Traffic Model held by the NRA.

3.25 It is recommended that the NRA should be consulted directly in situations where the Inspection Team cannot source adequate traffic data.

F. Road Speeds

3.26 Precise information on travel speeds on the network is not readily available. The RSA website does contain limited information, entitled "Free Speed Surveys", compiled in recent years, which contains the results (expressed by road type and vehicle type) of speed surveys carried out at various locations of the national network.

<http://www.rsa.ie/en/RSA/Road-Safety/RSA-Statistics/Surveys--Consultations/Speed/>

G. Scrim Results

3.27 The frictional quality of the road surface can be a significant factor in the frequency and severity of road collisions. The national road network is surveyed and investigated annually by the NRA and this information is available to the inspection team. Sections of the Network highlighted for consideration through the implementation of HD 28 Management of Skid Resistance should be noted on the mapping prior to the inspection and should be checked on site.

H. Previous Inspections

3.28 Previous inspection reports should be made available to the inspection team and these should be read by them to give context to the current inspection and to enable confirmation by them that the items raised in past inspections were resolved.

Site Visits

3.29 The inspection has two parts:

- A. Review of the route in both directions on video,
- B. Site visit thereafter.

A. Review of Video

3.30 The advantages of initially looking at the route on video are that the inspectors:

- Get an overall appreciation of the route in advance of the site visit;
- Get an indication of the type of safety issues that may exist;
- Identify quickly locations of potential concern that subsequently can be confirmed by site visit;
- Require less time for the subsequent site visit.

3.31 All members of the team should inspect the route and its elements on video, to obtain an overview over the section and to check overall factors such as:

- The overall nature of the road environment – urban or rural – and the various types of road and junction present.
- Speed limits – are the limits appropriate?
- Consistency of road type – are there any pronounced changes in the general standard of carriageway and junction provided?
- Curvature and visibility – is the alignment quality and sight distance provision appropriate?

3.32 The team should use the video inspection for a number of tasks: as an aid to identifying its initial safety concerns (subject to confirmation on site), to plan its site visit, to list items of a factual nature to be checked during the site visit, and to note areas to be specifically checked during the visit.

B. Site inspection

3.33 The inspection team will need some basic equipment for its site visit, such as:

- Maps, and drawings of road improvement schemes where relevant;

- Speed gun, if available;
- Tape measure and measuring wheel;
- Camera with video capability;
- Chalk for temporary marking;
- A handheld GPS to provide location information.

3.34 The field inspection should concentrate on checking safety conditions noted from the video and logging other concerns arising from the site visit. The following recommendations may facilitate the inspection process:

- In some instances, measurements and sketches should be made to assist in describing the nature and extent of the safety issues identified;
- Single carriageway roads should be driven in both directions; this will occur automatically in the case of dual carriageways and motorways;
- Each road section should be driven more than once, and assessed from the point of view of all road users;
- Photographs should be taken and, if necessary, short video clips;
- Junctions and other significant features should be inspected on foot, but only where it is safe to do so;
- The existing traffic flow, traffic composition and traffic speed (relative to speed limits) should be noted;
- The inspection of urban areas should be confined to the safety impact of the route as a whole and its users;

3.35 If there are road works on the route and the road works are minor so that it remains possible to drive the route to inspect it, then the inspection team should consider the road as it normally operates without the road works.

3.36 If the road works are major involving a diversion off the route, then the inspection team should isolate that section of the route from the inspection and return at a later date to inspect this particular section.

3.37 Inspection of road works is not covered by these guidelines but is covered by *NRA HD 16/12 Temporary Safety Measures Inspection Guidelines*.

What is to be inspected

3.38 The inspection should cover the complete mainline (between the extremities of the route as defined in the brief) and the side roads, including junctions, as far as the advance direction sign (ADS) on the minor road, or to 200m from the mainline where there is no sign.

3.39 All elements of the road should be inspected. The Directive specifically excludes road tunnels since their safety assessment is covered by Directive 2004/54/EC of the European Parliament. Road tunnels need not be inspected, but the approaches to the tunnel portal should be included in the Inspection, and should be carefully examined to identify possible safety issues.

3.40 It is worthwhile to provide a non-exhaustive list of the general items that will need inspection by the team, both on video and on site. An example of a road safety inspection checklist is given in Appendix B. Inspection Teams may use this or other lists when carrying out their work. However, checklists should be used intelligently, and not simply as a “tick box” system. It is recommended that they are used at the end of the process, to ensure that no major potential safety issue has been overlooked.

Inspection Report

3.41 The Inspection Team will prepare a written report, which will be forwarded directly to the Authority.

3.42 Standardisation of the report format is desirable for the following reasons:

- It indicates to the inspection team the quantity and quality of the information required;
- It enables the NRA to directly compare the safety performance of various routes, by reference to common report information;
- It enables the changes in assessed safety performance of a route to be easily monitored over the years, from inspection to inspection;
- It enables easier monitoring of the quality and consistency of RSIs.

3.43 The standard template report format is provided in Appendix A. The text in *Italics* is sample text or items requiring a response.

3.44 Each safety problem has a risk rating derived from two factors: the likelihood of occurrence and the predicted severity of outcome. There are three risk levels: High, Medium and Low, and the inspection team should make its selection in accordance with the following table:

Risk Rating		Likelihood of Occurrence		
		Likely	Possible	Unlikely
Severity of Outcome	Severe	High	High	Medium
	Medium	Medium	Medium	Low
	Minor	Medium	Low	Low

3.45 Definitions of Occurrence and Severity are included in the standard risk assessment form in Appendix E.

3.46 The mapping appended to the report should provide the following detail:

- Atlas mapping
 - Administrative boundaries;
 - The route and its terminal points;
 - Significant national features that assist in location;
- Route mapping
 - Administrative boundaries;
 - Road numbers - including intersecting roads;
 - Speed limits;
 - Carriageway type;
 - NRA Safety Section road section references;
 - Traffic figures by section;
 - RSI problems marked by location

3.47 Once the first inspection is carried out on a route, the same safety issues may arise in subsequent inspections where corrective action had not been taken in the intervening period. The inspection form contains a column in which to note items that remain from previous inspections, where the current Team considers them valid.

3.48 The inspection team should describe the safety issues fully, clearly and precisely; this is to ensure that the NRA Road Safety Engineering Team has sufficient information to understand the

existing problem and to develop an appropriate response. Background reasoning in support of the Team's findings should be included in the report.

3.49 Only those safety issues which lie within the defined scope of the Inspection should be written into the report. Non-safety items, and safety items beyond the extent of the route, should not be included.

3.50 The Inspection Report shall be provided by the Team Leader directly to the Authority and should be sent by the date, if any, specified in the Inspection Brief.

3.51 Modifications or additions can be made to the template report for administrative purposes, but these should not fundamentally alter the format of the report. Modifications may be needed to:

- suit quality systems,
- add a disclaimer or similar,
- provide a summary of a long or complex report.

Subsequent Actions To The Inspection Report

3.52 Once the inspection report has been prepared, the inspection team leader shall send it to the Authority and on receipt the Authority shall forward it to the NRA Road Safety Engineering Team for review.

3.53 The NRA Road Safety Engineering Team may, if it considers that clarification or discussion of the report would be of benefit, arrange a meeting involving the following:

- NRA Engineering staff
- Road authorities/road operators relevant to the meeting
- The Inspection Team Leader, and other Team Members considered necessary by the Authority.

3.54 The Inspection Report shall be issued to the Authority by the Team Leader in final format following that meeting, or in the absence of a meeting, by a date specified by the Authority.

3.55 The Road Safety Engineering Team will assess the problems identified and make recommendations to the Authority, in consultation with NRA Engineering Inspectors.

3.56 The expectation is that the issues raised in road safety inspection will, in the main, be remedied by engineering works.

4 ROAD SAFETY INSPECTION ISSUES

Factors in Collision Occurrence

4.1 An EU working document on the Directive for road infrastructure safety management states “Today [2006], in the European Union, road infrastructure and design are contributing factors in one out of three fatal accidents.”

4.2 A complete picture of the significance of various factors in collision occurrence is presented in the figure hereunder, and it can be seen that human factors are by far the greatest contributor to collision occurrence - a factor in 93% of collisions (compared to 34% in the case of the road environment and 13% in the case of vehicle factors). This distribution of collision factors is broadly applicable to this country.

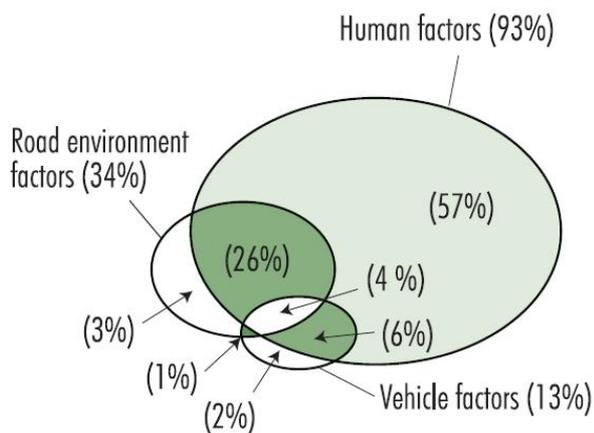


Figure 1: The contribution of accident factors
Source: J. Treat et al, Tri-Level Study of the Causes of Traffic Accidents, Washington DC

4.3 From an initial reading of the figures, it appears that human factors are by far the predominant contributors to collisions, and road factors are appreciably less significant. However it would be a misinterpretation of the figures to assume that they indicate a limited potential for collision reduction arising from improvement to the road environment.

4.4 Recent thinking on road safety is that significant scope exists for improving safety by better design of both the roadside and the vehicle, and that reduction in the occurrence and severity

of collisions arising from such improvements can be significant.

Vehicles as Factor in Collisions

4.5 In the case of vehicles, for example, seat-belts and anti-lock brakes have been major safety improvements to vehicles in the past; electronic stability control is an effective current safety device and the vehicular guidance systems likely to be used to increase automatic control of vehicles in the future are also likely to provide a significant safety benefit.

Road Environment as Factor in Collisions

4.6 The situation is similar in relation to the road environment, though the examples may not be as concrete as those relating to the vehicle. The two main areas of current road safety focus in relation to the road environment are:

- Self-Explaining roads; and
- Forgiving Roadside

4.7 The first item refers to the ability of a road to be ‘legible’ to drivers and in that way to lessen the chance of their making an incorrect judgement. Self-explaining roads have characteristics of informing, warning and guiding road users.

4.8 The second item, the forgiving roadside, is a response to the fact that, despite our best efforts in road safety, collisions occur, and it seeks to use engineering measures to reduce their severity.

4.9 A self-explaining road with forgiving roadides should:

- Assist the driver in making the correct decision.
- Be forgiving of driver error.
- Lessen the consequences if a collision occurs.

Humans as Factor in Collisions

4.10 Human errors (in observations, decisions, and actions) play their part in most collisions and the objective is to eliminate these errors, but should they occur, to stop them from having severe consequences.

Common Safety Factors in Collisions

4.11 It is not possible to list all safety issues that can be encountered on a road safety inspection; the expectation is that inspectors, by their qualifications and experience, will not need to rely on the use of exhaustive checklists, but will be sufficiently competent for the task.

Reference Guidance Documents

4.12 The collective experience of road safety professionals, both national and international, is an invaluable resource for the inspection Team, and the following is a list of documents which can be consulted for guidance on the assessment of road safety issues:

- KW. Ogden, Department Of Civil Engineering, Monash University, a report prepared for the Federal Office of Road Safety, *“Traffic Engineering Road Safety: A Practitioner’s Guide”*, Australia, 1994
- PIARC, The World Road Association, *“Road Safety Manual”*, France, 2003.
- CEDR (Conference of European Directors of Roads), *“Existing Treatment for the Design of Forgiving Roadsides. State of the Art Report”*, France, 2011.
- University of Catania, European Union, Province of Catania, *“Operative Procedures for Safety Inspections on Two-Lane Rural Roads”*, Italy.
- Service d’études sur les transports, les routes et leurs aménagements, *“Road Safety Inspections – Methodological Guide”*, France 2008.
- Transfund New Zealand, *“Safety Audit Procedures for Existing Roads”*, New Zealand, 1998.
- Norwegian Public Roads Administration, *“Road Safety Audits and Inspections”*, Norway, 2006.
- PIARC, The World Road Association, *“Road Safety Inspection Guideline for Safety Check of Existing Roads”*, 2007.

Recurrent Safety Factors

4.13 A list of recurrent road safety factors is provided in Appendix C. These are factors that are well documented, are understood to have a significant impact on safety and relate to the road environment; it is not intended that the inspector would use this as a checklist.

Road Collision Factors

4.14 The NRA has developed a database of factors relating to collisions on Irish roads, using the most recent editions of the Road Collision Factors. This information will be provided to Inspectors to give them historical information on the overall performance of the road network in collision terms, against which they can compare the performance of the route being inspected.

5 REFERENCES

Highways Agency. Design Manual for Roads and Bridges, Volume 5: *HD 19, Road Safety Audits*. HA, London

Institution of Highways and Transportation. *Road Safety Audit Guidelines*. IHT, London, 2008

National Roads Authority. *2010 Project Management Guidelines*

6 ENQUIRIES

All technical enquiries or comments on these guidelines should be sent in writing to:

Head of Network Management, Engineering Standards & Research
National Roads Authority
St Martin's House
Waterloo Road
Dublin 4



.....
Pat Maher
Head of Network Management,
Engineering Standards & Research

APPENDIX A: SAMPLE ROAD SAFETY INSPECTION REPORT

[START OF SAMPLE REPORT]

ROAD SAFETY INSPECTION REPORT

1. Introduction

1.1 This report has been prepared in respect of a Road Safety Inspection carried out on the *N90 Bally to Drum (townland and NRA Safety Section, Section ID to townland and NRA Safety Section, Section ID)* road on behalf of the National Roads Authority, St. Martin House, Waterloo Road, Dublin 4.

1.2 The inspection covered that section of the mainline between (*NRA road section reference*) and (*NRA road section reference*) on the mainline and extended to cover the sections of intersecting roads to the location of the Advance Direction Sign where present, or to 200m from the mainline in the absence of an ADS.

1.3 The inspection was carried out over the period (*date of commencement*) to (*date of completion*) and consisted of a viewing of a video of the route on (*dates*) and a site visit on (*dates*). The weather during the visit was (*describe*).

1.4 The Inspection Team membership was as follows:

<i>Name</i>	<i>Qualification</i>	<i>Organisation</i>	Inspection Team Leader
<i>Name</i>	<i>Qualification</i>	<i>Organisation</i>	Inspection Team Member
<i>Name</i>	<i>Qualification</i>	<i>Organisation</i>	Inspection Team Member (<i>if required</i>)

1.5 The following people attended the inspection as observers:

<i>Name</i>	<i>Qualification</i>	<i>Organisation</i>
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1.6 The information used in connection with the inspection was:

Item	Source	Description
<i>An inspection brief</i>	<i>NRA</i>	<i>Copy in Appendix A</i>
<i>Mapping</i>	<i>NRA</i>	<i>1:1000 and 1:2500 digital vector maps Map of local roads Speed limit mapping.</i>
<i>Scheme Information</i>	<i>NRA</i>	<i>List of major and minor improvements to the road layout over preceding 5 years. See Appendix B</i>
<i>Collision information</i>	<i>NRA</i>	<i>NRA collision database version 1.1. Principal data listed in Appendix C</i>
<i>Traffic Information</i>	<i>NRA website</i>	<i>From NRA ATCs –see Appendix D</i>
<i>Video of the route</i>	<i>NRA</i>	<i>Digital chainage referenced video in .avi format: file ref A12345.avi</i>
<i>Previous RSI Reports</i>	<i>NRA</i>	<i>RSI of 02-06-12, copy in Appendix E</i>
<i>SCRIM data</i>	<i>NRA</i>	<i>Data hardcopy in Appendix F</i>
<i>Other information</i>	<i>Various</i>	<i>See Appendix G</i>

- 1.7 The inspection has been carried out in accordance with National Roads Authority Design Manual for Roads and Bridges standard (*letters/numbers/year*) "Road Safety Inspection".
- 1.8 The extent of the route is shown on the mapping hereunder (*or overleaf*).

Mapping panel with route and road numbers highlighted

2. Road Safety Inspection

2.1 Brief Description of the Route Features

(Refer to route length, carriageway type, junctions, speed limits, principal features)

The N90 is 100km in length, consisting of 55km of Type 2 dual carriageway and 45 km of single carriageway (6.5m carriageway, no shoulders). All 7 junctions on the dual carriageway section are grade separated and all 30 junctions on the single carriageway are at-grade priority. The route has junctions with the N98 and N97. The speed limit is generally 100kph but reduces to 50kph through the urban areas, and a 5km section of rural single carriageway is governed by a 60kph limit at Castle townland. The route is largely flat over its western half and thereafter runs through mountainous countryside. The dual carriageway section is recently improved to a high standard as is a quarter of the single carriageway section.

2.2 Summary Description of the Implications for Road Safety of the Route Characteristics

(Refer to cross-section and alignment, traffic flow and speed, collisions, engineering characteristics)

The horizontal alignment of the road between (A) and (B) is particularly poor, having closely spaced tight-radius bends and there is evidence of collision clusters on this road section.

There are frequent industrial accesses on road section C where the single carriageway is narrow and has no hard shoulders. In addition the road has no turning lanes, has limited forward visibility and does not cater well for the significant number of turning movements by heavy vehicles.

Significant lengths of the dual carriageway are without roadside protection to traffic route lighting, and traffic speeds were observed to be high. Etc.

2.3 The particular road safety problems are listed in the following table:

No.	Problem	Location	Risk	Sample Photos	Previous RSI item
1	<i>The mounting height of the barrier on the north side of the road is very low and as a consequence the barrier provides inadequate protection at the high embankment.</i>	<i>(NRA road section ref)</i>	<i>Medium</i>	<i>thumbnail</i>	<i>Yes</i>
2	<i>Roadside vegetation obstructs sight distance to the right for drivers exiting the L1234</i>	<i>(NRA road section</i>	<i>Medium</i>	<i>thumbnail</i>	<i>No</i>

		<i>ref)</i>			
3	<i>This section of road does not have road studs, and night-time guidance for drivers was noted to be poor. Collisions during hours of darkness are over-represented.</i>	<i>(NRA road section ref)</i>	<i>Medium</i>	<i>thumbnail</i>	<i>No</i>
4	<i>The east/west orientation of the straight road and the absence of roadside hedging leave drivers exposed to glare when the sun is low.</i>	<i>(NRA road section ref)</i>	<i>Low</i>	<i>thumbnail</i>	<i>No</i>
5	<i>The flatter sections of road were observed to be subject to ponding and, where it coincides with poor surface frictional characteristics, hazardous wet-weather collisions are likely.</i>	<i>(NRA road section ref)</i>	<i>High</i>	<i>thumbnail</i>	<i>Yes</i>
6	<i>The speed limit of 60kph on this section of road is much lower than the safe travel speed of the road. The limit is ignored by many drivers and obeyed by others, creating significant disparities in vehicular speeds</i>	<i>(NRA road section ref) (NRA road section ref)</i>	<i>Low</i>	<i>thumbnail</i>	<i>Yes</i>
7	<i>The verge on the south side of the road is low relative to the road; the drop from the road pavement is approximately 60mm. There is evidence of over-running by vehicles, particularly on the inside of the bends, creating the risk of loss-of-control collisions.</i>	<i>(NRA road section ref)</i>	<i>High</i>	<i>thumbnail</i>	<i>No</i>
8	<i>There is a proliferation of signage on the approach to the village; directional signs, warning signs, speed limit signs and information signs (including many commercial signs) are closely grouped. Drivers may be unable to assimilate the critical message that there is a concealed junction located on the bend.</i>	<i>(NRA road section ref)</i>	<i>Medium</i>	<i>thumbnail</i>	<i>No</i>

APPENDIX B: ROAD SAFETY INSPECTION CHECKLIST

It is worthwhile to provide a non-exhaustive list of the general items that will need inspection by the team, both on video and on site:

- Roadside /verge area
 - Clear zones
 - Ditch profiles
 - Manholes
 - Poles and pylons
 - Emergency phones (location, protection, exposure of users to passing traffic)
 - Weather stations/IT equipment/traffic counter equipment
 - Trees
 - Walls and noise barriers
 - Guardrails – both unnecessary and missing guardrail
 - Facilities for vulnerable road users.
- Roadway
 - Passing – passing opportunities and visibility.
 - Stopping sight distance, hidden dips
 - Road curvature and super-elevation.
 - Signing –superfluous and missing signs
 - Markings
 - Illumination
 - Facilities for vulnerable road users.
 - Road pavement – lack of skid resistance, major defects.
- Junctions and accesses
 - Visibility provision at junctions and accesses
 - Junctions – location, design.
 - Signing – directional, warning and regulatory signage.
 - Markings
 - Pedestrian crossings – location, design, visibility.
- Bridges
 - Alignment of bridge approach
 - Visibility at crest
 - Visibility at intersections beside bridges (ramps of diamond junctions)
 - Bridge parapet – height, transition to road guardrail, visibility obstruction.
 - Provision for pedestrian and bicycle traffic

APPENDIX C: ROAD SAFETY FACTORS

The following list has been gathered from various sources and it represents the principal factors encountered by professionals involved in road safety assessment. It may be of use to inspectors to refresh their thoughts in advance of inspections.

Two-way Roads

- Overall legibility of the road
 - non-appropriateness of the road layout;
 - consistency of road type;
 - discontinuity in the layout.

- Bends
 - Geometry
 - presence of an isolated bend with a small radius or a bend after a straight section (radius less than about 150 m);
 - presence of a bend with a moderate radius (less than about 250m) after either a larger radius or with low side friction.
 - unprotected hazards on outside of isolated bends
 - Legibility
 - presence of a bend with poor legibility; users do not clearly see the bend;
 - inconsistent bend signage.
 - Visibility
 - presence of a bend hidden by a crest, leading to insufficient visibility of the bend.
 - Roadside
Possibility of avoidance and recovery:
 - presence of grass or hard verge;
 - presence of loose gravel;
 - presence and depth of vee drain and distance from carriageway edge.
 - presence of a height difference between the road and the verge (edge drop-off).
 - Limitation of the severity of collisions
 - presence of obstacles in the safety zone: trees, posts, headwalls, masonry items, large sign supports, heavy guardrails, lighting columns;
 - presence of an abrupt change in level;
 - superfluous or improperly fixed restraint systems: unnecessary items, improper terminals, insufficient heights, insufficient lengths.

- Junctions and access roads
 - Type of junction
 - type of junction inconsistent with traffic flows;
 - proliferation of junctions;
 - Reciprocal visibility
For drivers crossing the mainline or turning right at junctions with heavy intersecting traffic:
 - presence of hidden markings on the horizontal alignment or the longitudinal profile;
 - presence of occasional masking due to signing or vegetation;
 - excessive width of a secondary road that encourages users to form two queues on approach.
 - Legibility
For users of a secondary road:
 - poor legibility of the presence of a junction, its priority or the driving lines to be followed.

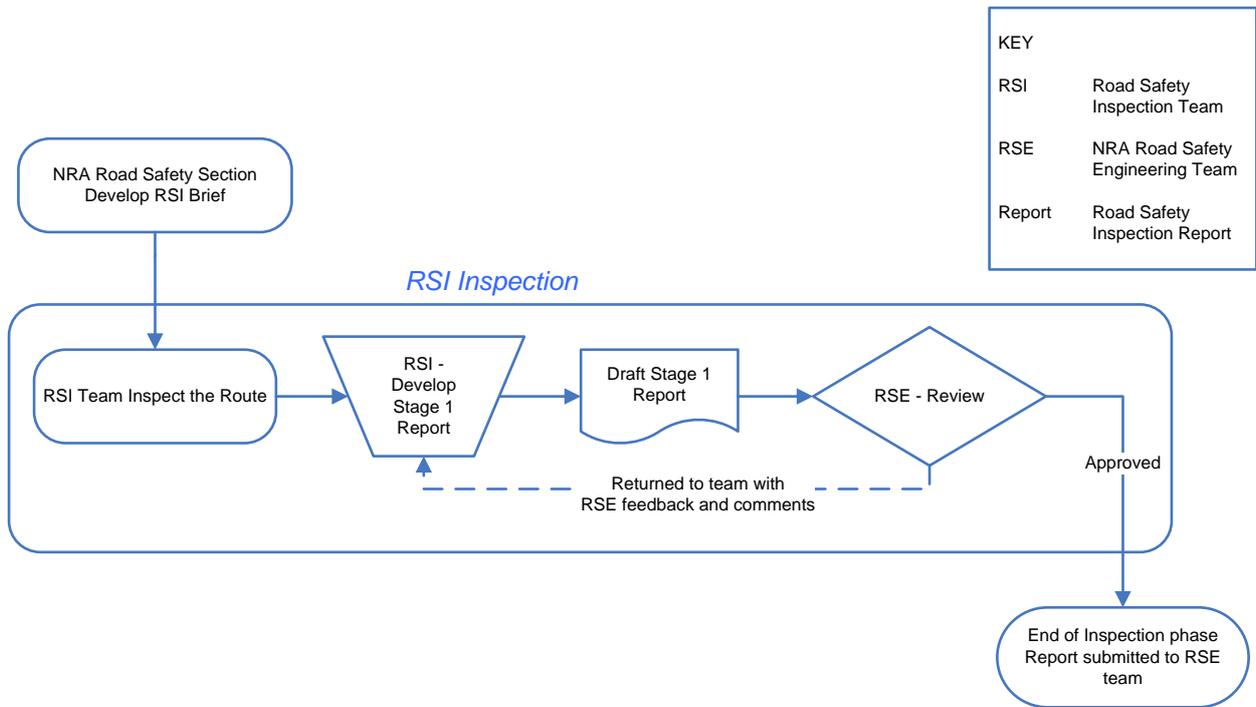
- Accesses
 - presence of numerous accesses
 - presence of numerous gate posts within the clear zone.
- Cross-section
 - Three-lane sections (including climbing lanes)
 - absence of lane for turning right at junctions
 - Accesses or junctions on climbing lanes.
 - Overtaking zone
 - absence of a merging area at the end of an overtaking zone;
 - presence of a conflict point upstream: junction, urban crossing without anything to encourage users to slow down;
 - long overtaking zone that encourages users to get accustomed to driving at speed.
 - Carriageway width
 - poor distribution of carriageway width and shoulder width, carriageway overly wide or too narrow.
 - Vulnerable users
 - absence of or discontinuity in pedestrian and cycle paths;
 - presence of a zone of conflict between different types of users;
 - Signage
 - discontinuity, lack of homogeneity, inconsistency, lack of legibility and visibility;
 - speed limit inappropriate for location and users.

Divided Roads

- Overall legibility of road
 - unsuitability of road layout;
 - consistency of road type;
- Bends
 - Geometry
 - presence of an isolated bend with a small radius or a bend on a straight section;
 - presence of a bend with a significantly diminishing radius.
 - Legibility
 - presence of a bend with poor legibility; users cannot clearly see the bend
 - Visibility
 - presence of a bend hidden by a rise and with insufficient visibility of the bend
- The roadside
 - Possibilities of avoidance and recovery, and emergency stops
 - absence or insufficient width of the hard shoulder;
 - absence of median strip;
 - Limitation of gravity of crashes
 - absence of restraint system on the central median on motorways;
 - presence of obstacles in the clear zone: trees, posts, non-chamfered pipe heads, masonry, overly large sign supports, overly large guardrails, lighting columns;
 - superfluous or improperly fixed restraint systems: unnecessary items, poor terminals, insufficient heights, insufficient lengths;
 - absence of restraint systems for trucks at a sensitive installation (railway, road, river etc.) or on a structure for crossing a route (road, railway, river).

- Junctions and access roads
 - Type of junction
 - geometry accommodating entry in the wrong direction;
 - presence of non-isolated fixed obstacles inside a wider section of road or on the central island of a roundabout: trees, posts, headwalls, masonry, overly large sign supports, overly large guardrails, lighting columns.
 - Legibility and visibility
 - poor visibility or legibility at interchange entries or exits
 - gap in the median on dual sections.
- Discontinuity of cross-section
 - poor change from a dual-carriageway cross-section to a single-carriageway cross-section;
- Special users
 - bicycle, pedestrian or slow-moving vehicle travel on divided roads with a speed limit of 100 km/h or more;
- Vertical and horizontal signing
 - lack of consistency, legibility, visibility;
 - speed limit not appropriate for location.

APPENDIX D: ROAD SAFETY INSPECTION FLOW CHART



APPENDIX E: ROAD SAFETY INSPECTION RISK ASSESSMENT FORM

Risk is the likelihood of harm multiplied by the severity of harm

RISK RATING		LIKELIHOOD OF OCCURRENCE		
		LIKELY High probability of occurrence	POSSIBLE Medium probability of occurrence	UNLIKELY Probability of collision is close to random
SEVERITY OF OUTCOME	Severe Potential fatality Major injury/illness Long term disability	H	H	M
	Medium Injury/illness Causing short term disability	H	M	L
	Minor Minor injury/illness	M	L	L

Risk Rating

H = High Risk

M = Medium Risk

L = Low Risk