

## **Road Safety Audit Guidelines**

**March 2007**

**Summary :**

This Advice Note provides guidance on undertaking Road Safety Audits on National Road schemes. It is intended to be read in conjunction with the Standard NRA HD19 – Road Safety Audits.

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

**SECTION 2 PREPARATION AND  
IMPLEMENTATION**

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**PART 3**

**NRA HA 42/07**

**ROAD SAFETY AUDIT GUIDELINES**

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# 1. INTRODUCTION

## 1.1 Definitions

These Guidelines should be read in conjunction with the National Roads Authority (NRA) Design Manual for Roads and Bridges Standard NRA HD19, Road Safety Audits (NRA DMRB 5.2.2).

*Road Safety Audit:* The evaluation of road schemes during design and construction to identify potential safety hazards which may affect any type of road user before the scheme is opened to traffic, and to suggest measures to eliminate or mitigate those problems. This is a formal process involving signed written reports.

*Road Safety Check:* The checking of road schemes during design and construction to identify potential safety hazards, including an informal reporting system.

*Road Schemes:* All works that involve permanent change to the existing road layout. This includes any change to kerb or road edge, vertical alignment, signs, road markings, lighting, signalling, drainage, landscaping and installation of roadside equipment.

*Design Office:* The organisation managing the various phases of scheme preparation and supervision of construction.

*Design Team:* The group undertaking the various phases of scheme preparation and supervision of construction on behalf of the Design Office. This may be a team within the Design Office or a separate consultant.

*Audit Team:* A team of a minimum of two persons, independent of the Design Team and approved by the Overseeing Organisation. The Audit Team shall comprise staff with appropriate levels of training and experience in road safety engineering, accident investigation, and road safety audit, as set out in memorandum produced from time to time by the Overseeing Organisation. Each member of the Audit Team shall consider the scheme design at specific stages to identify road safety problems. In the case of Design and Build schemes, the Audit Team shall be from a

completely separate organisation to the Design Team.

*Audit Team Leader (ATL):* The person nominated and approved as Audit Team Leader in accordance with the memorandum discussed above.

*Director:* The Head of Engineering in the Overseeing Organisation. The Overseeing Organisation for National Roads is the NRA.

*Scheme Project Manager (SPM):* The person responsible for ensuring the progression of a scheme in accordance with policy and procedures.

*Design Team Leader (DTL):* The person within the Design Team responsible for managing the scheme design.

*Exception Report:* A report prepared by the Scheme Project Manager on each recommendation in the Audit Report where Design Team and Audit Team cannot agree appropriate means of addressing an underlying safety problem identified by the Audit.

*Overseeing Organisation:* Where the scheme is not on a National Road, then the appropriate overseeing organisation shall be substituted for NRA.

During the course of scheme preparation and construction the Design Office or Design Team may change, as may the personnel within the Design Team and Audit Team. It is recommended that, where possible, the same Audit Team is used throughout the scheme delivery to ensure a consistent approach.

## 1.2 History and Background

The road safety audit process was initiated when road safety engineers realised that they were carrying out accident remedial schemes on relatively new roads. Adopting the principle of “prevention is better than cure”, they decided to use some of the safety experience they had gained from the remedial work, and design safety into new road schemes. The UK Institution of

Highways and Transportation (IHT) Guidelines on Accident Investigation and Prevention produced during this time included a section on "safety checking", suggested as an accident prevention mechanism. Since then, the important milestones in the development of road safety audit have been:

- 1980 some UK local authorities start doing road safety audits;
- 1980-90 road safety engineering and road safety checks developed in Ireland;
- 1990 results of road safety engineering and road safety checking as applied to National Roads reported to local authority Spring Show Conference;
- 1990/94 Standard and Advice Notes, UK;
- 1990/96 IHT Guidelines, UK;
- 1990s Denmark, Australia, New Zealand introduce procedures;
- 1996 Road safety checking continues in Ireland and is mentioned in the Department of the Environment Road Safety Engineering Manual, 1996, with some recommendations on road safety checking;
- 1999 Dublin Corporation introduces formal road safety audit procedures;
- 2000 Irish Standard introduced as part of NRA DMRB.

### 1.3 Stages of Audit

Road safety audits and subsequent actions shall be completed at four specific stages in the preparation of the scheme. These stages are:

Stage F: Route selection stage;

Stage 1: Completion of preliminary design prior to land acquisition procedures;

Stage 2: Completion of detailed design, prior to tender of construction contract. In the case of design and build contracts, a Stage 2 audit shall be carried out in accordance with the requirements of the contract;

Stage 3: Completion of construction, (prior to opening of the scheme to traffic wherever possible).

In general, larger and more complex schemes shall be audited at Stages F, 1, 2 and 3. In the case of smaller schemes, Stages F, 1 and 2 may be combined. For temporary traffic management schemes, only Stage 2 and 3 audits shall be required.

Where no previous stage audit has been undertaken, then those factors that would normally be considered at an earlier stage shall be included as necessary.

An indication of stage of audit by scheme type is shown in Table 1/1.

Where a choice of routes is available, Stage F audits should be carried out in two phases. Phase 1 should be a comparative assessment of the routes from a road safety point of view. Once the route has been chosen, Phase 2 of the audit will be carried out on the chosen route, in the standard problem and recommendation format.

Stage Scheme type	F	1	2	1/2	3
Major scheme	X	X	X		X
Minor scheme / Traffic scheme (complex)		X	X		X
Minor scheme / Traffic scheme (simple)				X	X
Major development	X	X	X		X
Minor development				X	X
Pavement improvement scheme				X	X
Temporary traffic management			X		X

Table 1/1: Stages of Road Safety Audit and Type of Scheme

## 1.4 Scope of Audit

The Standard sets out the procedures required to implement road safety audits on National Road schemes. It defines the relevant schemes and stages in the design and construction at which audits shall be undertaken and sets out the requirements for post-implementation accident monitoring.

The Standard is commended to other Roads Authorities for use in the preparation of their own road schemes on non-national roads.

The purpose of a road safety audit is to identify potential road safety hazards within the scheme design. Road safety audits should not consider structural safety. They should consider only those matters, which have an adverse effect on road safety. A road safety audit is not a check of compliance with design standards.

Road safety audits should consider road safety under all operating conditions.

There is little direct overlap between the task of road safety audit (which relates principally to future operational safety of the scheme) and the Safety Health and Welfare at Work Act and its current Regulations. However, it will be important to ensure that Stages F, 1 and 2 road safety audits are received by the relevant Project Supervisor for Design Process for the scheme prior to invitation to tender, and placed within the Safety File. Stage 3 (post-construction) road safety audits should also be placed within the Safety File.

Recommendations for dealing with identified road safety hazards should make allowance for the fact that strategic decisions on route choice and junction type reflect a balance of factors including safety. Recommendations requiring major changes in these areas are therefore unlikely to be practicable to implement, particularly after Stage 1 of the road safety audit process.

For certain categories of scheme it may be necessary to confine the scope of the audit so that only particular pre-defined elements of the road layout are assessed. Specification of these "Confined Road Safety Audits" is at the discretion

of the SPM in consultation with the Overseeing Organisation

These guidelines apply to all engineering schemes implemented on roads for which the NRA is the Funding Authority, except where an exemption from the auditing requirement is given by the Director of the NRA.

These guidelines also cover road maintenance or temporary road schemes where a specific requirement to carry out a road safety audit has been placed in the scheme brief or contract.

These guidelines also apply to arrangements between developers and Roads Authorities regarding road safety audits of the road and traffic elements of development planning proposals. Further information on this issue is provided in Section 6.3.

## 1.5 Accident Causation

Work carried out at University College Cork in 1994 found that in Ireland driver/rider factors were the most important contributors to the cause of road accidents followed by road condition factors. This is true for both urban and rural situations and for all casualty types.

The way in which the road itself influences the road user is crucial. Accidents occur because road users fail to cope with their road environment. Although this can often be due to carelessness or impairment, their ability to cope can be influenced for good or ill by basic design factors, and by the signs and markings that provide information and warning.

Safety principles based on research carried out into road traffic accidents are described in more detail in Chapter 2. The road safety auditor's role is to use safety engineering experience to ask the question "how will all road users cope at all times and in all conditions with this road environment?", to identify safety problems, and to suggest measures that will minimise future accident occurrence and severity.



## 2. ROAD SAFETY PRINCIPLES

It is important for road safety auditors to try to base their comments on sound safety experience, and where possible, to have the means to back up the recommendations from documented sources. NRA HD 19 requires the auditor to be able to produce “background reasoning” for road safety audits. The source of some the information provided below is the Austroads Road Safety Audit Guidelines.

### 2.1 General Safety Principles

Road Safety Audit is a formal procedure that uses experienced Auditors with extensive safety engineering knowledge to identify safety deficiencies in road schemes. A broad experience in road, traffic and safety engineering will ensure that a road safety auditor has the knowledge and ability to refer back to the basic principles in road safety, and ask a series of pertinent questions:

- Does the design layout create confusion or ambiguity for road users that could lead to potential road traffic accidents ?
- Is there too much, or too little information for road users ?
- Is there too little, or too much visibility, or an obstruction to road users’ view ?
- Does the layout create hazards or obstacles to road users that could contribute to an increased risk of injuries ?

If there is a “yes” answer to any of these questions, then the safety of the scheme could be compromised and remedial measures may be required to remove this potential or actual deficiency. Drivers and other road users have to perceive and process vast amounts of sensory and visual information to negotiate a road layout. The designer’s role is to provide a safe road environment that should:

- provide adequate information for road users of the layout and conditions ahead;
- provide adequate warning of hazards or unusual layouts ahead;
- provide positive control of road users’ passage through conflict points or unusual sections;

- provide a road performance that can “forgive” road users’ errors or inappropriate behaviour.

Desirable minimum Design Standards should be used wherever possible and advance information and warning should be used to inform road users of the layout ahead. However, driver overload must be avoided as it may cause road users to focus too much on the unimportant data and shed vital information. Conflicting information, an over abundance of road signs or a lack of delineation can cause overload.

Therefore a “safer” road environment can be defined as a layout that:

- provides clear, concise and phased release of road user information;
- provides a consistent standard of road design and traffic control;
- provides adequate warning of hazards.

### 2.2 Designing for the Road User

It is important that a road improvement caters for all road users. Often the needs of the motorist are incorporated within a scheme whilst the needs of the vulnerable user are ignored. The vulnerable road users that need to be considered are:

- pedestrians – the old, young and those with mobility or sight impairment;
- cyclists – children, commuters and leisure users;
- equestrians;
- motorcyclists.

Each vulnerable road user has different needs from the road network and it is important that designers and auditors are aware of their specific requirements. In the urban environment the pedestrian is likely to be the principal user and designs must incorporate safe crossing locations, adequate visibility to and from the crossings and appropriate lighting.

In addition to the needs of vulnerable road users, particular attention should be paid to the needs of lorries, buses or other specialist vehicles.

To assist in the determination and needs for all road users, it is essential that traffic data and local user surveys are used to shape the design process and tailor a 'safer' environment.

## 2.3 Roadway Elements and Safety

### 2.3.1 Design Context

Safe road design varies from the urban to the rural road network; and a number of external factors can create a situation in which a safe road in one location becomes unsafe due to external factors beyond the designer's control. These factors can include traffic volumes, population density, noise, or road user familiarity.

The function of a road should be clear to all road users, and a well planned and defined road hierarchy can assist in providing a safe road network. The design speed can also be an important factor in influencing the safety of a road and should be appropriate to the location, local road users and level of private access control.

### 2.3.2 Junctions

The most important point to consider with respect to the safety of junctions is that both the layout and control method should be simple and clear, with defined priorities for all road users.

The assumption that 'straight on' traffic has priority is widely accepted and it needs to be remembered that alterations to this, despite reinforcement with signs and lines can still be confusing if visual clues such as fences, kerbing or lighting remain unchanged.

It is important to attempt to make any minor approach perpendicular to the main road, and junctions with acute angles should be avoided. These angled junctions pose a particular problem for the elderly or those with restricted neck movements, and forward and side visibility is often restricted. Similarly, it is advisable to avoid intersections on the inside of bends as foliage often encroaches into sight lines after several years.

Roundabouts used as a form of junction control have their own rules and design requirements. It is important that a roundabout looks like a roundabout from all approaches, and for all users,

in order to prevent potential conflict. One of the primary requirements in good roundabout design is that the radius is tighter on the entry than the exit, this ensures a slow entry and lower circulating speed.

Visibility is a key requirement for all junction types, all road users need to see and be seen by others. Care should be taken with siting street furniture and vegetation within visibility splays. Vulnerable road users often experience difficulties crossing junctions. It is important that their needs are provided for and that safe crossing places are implemented where required.

### 2.3.3 Links

Links that are well designed with few private access points traditionally have a good safety record. However, within the urban environment strict access control is more difficult.

The principal factors affecting the safety of road links are:

- **Private access control** - there is a direct correlation between the number of access points between links and the accident numbers on any given road. This is also true of central reserve gaps in dual carriageways;
- **Proximity of junctions** - the majority of accidents take place at junctions, it is essential that junction spacing is maximised and consistent junction types are used;
- **Horizontal & vertical curves** - accident frequency increases at crests and dips (vertical curvature) and increasing the degree of horizontal curvature increases accident frequency;
- **Visibility** - adequate forward visibility to junctions, crossings and safe stopping distances is crucial to ensure a safe road design;
- **Design Speed** - the design speed influences the likely pre-crash impact speed in a road traffic accident. Therefore, it is important that the road environment and design speed selected are appropriate and where possible excess speed is discouraged;
- **Combinations of elements** - where two or more sub-standard design elements are combined, it is more likely that a hazard will emerge.

### 2.3.4 Road Features

The relationship between cross-sectional elements and safety is affected by the type and volume of traffic, and also by the surrounding environment.

Lane widths can be critical in affecting safety, where they are too narrow vehicles may collide on horizontal curves, and there may also be inadequate space for two wheeled vehicles. Where lane widths are too wide the alignment may encourage excess speed.

On high speed links there is a safety benefit to be gained by the provision of a hard shoulder and central reserve gaps should be of adequate width, depending on the size of vehicles turning.

Vehicles parked on the carriageway affect the road environment, layout and consequently safety. Safety problems experienced with parked vehicles are:

- parked vehicles causing physical obstructions which are sideswiped or run into;
- parked vehicles causing sudden braking or nose-to-tail shunts;
- parked vehicles which deflect oncoming vehicles into adjacent vehicle paths;
- parked vehicles blocking visibility for any road user;
- parked vehicles between which pedestrians emerge.

To reduce the risk of parked vehicles contributing to an accident it is important that designs should minimise parking in main traffic lanes.

Trees and foliage can greatly enhance the environmental impact of the street scene. However, left un-maintained, they can also restrict visibility considerably. In addition to this, saplings grow into large trees, which can provide an unforgiving road hazard in the event of a road traffic accident.

### 2.3.5 Forgiving Roadsides

Studies during the 1960s and 1970s in the USA, followed by work in the 1980's in Europe demonstrated that single vehicle non-pedestrian accidents are a significant problem on motorways, dual carriageways and inter-urban high speed single carriageway roads.

In these collisions a high proportion of vehicles that leave the roadside go on to strike trees, lamp columns, road structures or other items of unprotected street furniture. A hierarchy of treatment has been established to minimise the consequence of this type of accident:

- Where possible provide a “clear zone” with all items of rigid street furniture placed at a distance from the carriageway edge appropriate to the operating speed;
- Where this is not possible use breakable or frangible street furniture;
- Where this is not possible protect the street furniture with safety fence



## 3. PROCEDURES

### 3.1 NRA Standard HD 19

The requirements for carrying out road safety audits in Ireland are described in the NRA Design Manual for Roads and Bridges Standard NRA HD19 (NRA DMRB 5.2.2) - Road Safety Audits.

The Local Authority is the Roads Authority and as such owns the road, once construction is complete. For National Roads the NRA is the Roads Funding and Standards Authority, and as such pays for the design and construction and sets out Standards for construction.

### 3.2 Other Guidelines

In Ireland, Dublin Corporation has produced a series of Road Safety Audit Procedures and Guidelines. International Standards can be found (amongst others) in the UK, Australia, New Zealand and Denmark. In the UK the IHT has produced Guidelines on Road Safety Audit.

### 3.3 Roles and Responsibilities

A brief resume of the roles is provided below:

Commission the Audit:

*Scheme Project Manager/ NRA.*

Provide a brief, plans and other information:

*Scheme Project Manager.*

Carry out the Audit:

*Audit Team.*

Respond to the Audit:

*Design Team.*

Finalise action:

*Scheme Project Manager/ NRA.*

Appendix A, based on the flowchart in NRA HD 19 (NRA DMRB 5.2.2), shows the road safety audit process which is described in more detail in Chapter 4.



## 4. ROAD SAFETY AUDIT PROCESS

### 4.1 Audit Team Make-up

A Road Safety Audit Team should comprise at least two people who are independent of the Design Team. This independence is vital to ensure that the Design Team does not influence the recommendations of the road safety audit and therefore compromise safety at the expense of another issue. Team members should have recent relevant experience of undertaking road safety audits and should also have more general road safety engineering experience.

In most situations the Audit Team will comprise a senior person who will adopt the role of Audit Team Leader. The second person in the team will be the Audit Team Member.

Training of road safety auditors is essential and any Audit Team Member should have attended recognised road safety engineering training and road safety audit training courses.

***The current NRA requirement for Road Safety Audit Teams is as follows. Three categories of person are identified:***

#### *Audit Team Leader*

Audit Team Leaders should preferably be road safety engineers with at least two years experience of accident investigation and remedial measures, will have taken part in ten road safety audits, and will have attended an accredited three to five day course in road safety audit theory and practice.

In some instances, road engineers with at least two years experience in road design will qualify provided they have taken part in ten road safety audits, and have attended a two week accredited Road Safety Engineering course which includes a three to five day module in road safety audit theory and practice.

Audit Team Leaders will have done as team members at least two audits of a similar stage and scheme type to that for which approval is being sought. They will also have done at least five road safety audits within the preceding two years.

#### *Audit Team Member*

Audit Team Members will be road safety engineers, road design engineers or road traffic

engineers. They will have taken part as trainees in five road safety audits, and will have attended an accredited three to five day course in road safety audit theory and practice.

#### *Trainees:*

Road engineers who wish to train as road safety audit Team Members may take part in audits as observers – an additional team member who does not sign the report.

### 4.2 Audit Team Approval

The Scheme Project Manager will request CVs from prospective audit team leaders and team members prior to the appointment of an audit team. These CVs should be submitted to the NRA Road Safety Section for approval. Applications for approval of audit teams must be submitted on the standard form in Appendix D and can be emailed to roadsafetyaudits@nra.ie. Acceptance will be of individuals, rather than of consultancy firms bidding for the work, and the approval process will be carried out for each individual audit. Quality checks will be carried out on a sample of completed road safety audits and the results of these checks may be taken into account when audit teams are being approved.

When an audit team is approved, the SPM may appoint the team and must prepare an Audit Brief. The checklist in Appendix E must be completed and must accompany the brief.

As approval shall be given to an Audit Team only for the audit for which it is sought the approval procedure must be carried out for each following audit stage for each scheme. Although it is recommended that where possible the same Audit Team is used throughout the scheme delivery to ensure a consistent approach, it may in certain circumstances be necessary for NRA to refuse approval for a team.

### 4.3 Site Visits Including Stage 3

A site visit must be carried out at the first audit stage being undertaken by an audit team. Site visits must also be carried out at Stage 2 unless otherwise agreed with the Scheme Project

Manager, and always at Stage 3. These should be carried out by all members of the audit team together at every stage requiring a site visit. They should take into account the topography, local amenities, tie-ins of the scheme and any other relevant details. Photographs should be collected and stored for future reference.

The Stage 3 site visit should be made during both daylight and darkness conditions. The Scheme Project Manager should invite a representative of the Gardai to attend the Stage 3 visit, along with a representative of the local Roads Authority.

#### 4.4 Checklists

An example of a road safety audit checklist is shown in Appendix B. Road safety auditors should 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.

#### 4.5 Road User Role Play

One of the most important checks carried out involves assessing the safety of the scheme from different potential road users' perspectives. The road safety auditor should always be asking the question: “What is it about this scheme that will lead road users to fail to cope with the road environment?”

During the design stages the auditor has to imagine what it would be like to walk, cycle and drive the scheme. "Driving" should include cars, vans, trucks and buses. "Walking" should be considered from the perspective of the elderly, the child, the wheelchair user and those with sight impairment. Cycling includes children, leisure cycling, and utility or commuter cycling. Where appropriate, the needs of the equestrian should be considered.

#### 4.6 Methodology for Design Stage Audits

Road safety audit is carried out at four key stages on National Road schemes, as noted in Section 1.3. The section below describes a working method for carrying out design stage (F, 1, and 2) Audits. It is assumed that the audit team consists of two members.

- The audit team looks through plans to understand the scheme concept;
- Consideration should be given to a meeting between the Audit Team, the Scheme Project Manager and the Design Team, particularly on larger or more complex schemes;
- The audit team visits the site;
- Both team members systematically and independently examine all plans and other information provided and write down any comments;
- The team members discuss their individual findings;
- The audit team decides which comments are related to safety and discuss possible recommendations. Any comments recorded by team members that do not go forward to the final report should be noted, together with a reason stating why that issue is not to be included;
- One team member produces a draft Audit Report;
- The second audit team member checks the report and edits if necessary;
- If required, the audit team leader attends a meeting with the Design Team, Scheme Project Manager and NRA Project Manager to discuss the draft report;
- The audit team produces the final report, signed by all members of the team, and sends it to the Scheme Project Manager. Copies should be sent by SPM to the Design Team and NRA Project Manager;
- The Feedback Form should be filled in by the Design Team in consultation with the SPM, and discussed with the audit team, as detailed in 4.10;
- The final Feedback Form is signed by all three principal parties involved: Design Team Leader, Audit Team Leader and Scheme Project Manager;
- A copy of both the final report and the Feedback Form should be sent for information to the NRA Road Safety Section. This can be emailed to roadsafetyaudits@nra.ie or sent on CD. *The receipt of these reports is necessary for approval of the team for subsequent audits.*

#### 4.7 Methodology for Stage 3 Audits

At Stage 3 it is recommended that the Resident Engineer and a representative of the organisation responsible for future road maintenance should be available for consultation with the audit team as required on the day of the audit. The Gardai may have specific local information and knowledge of safety issues. The Garda District Superintendent should be notified by the Scheme Project Manager in advance of the Stage 3 audit. The Gardai are thus given the option of sending a representative to meet the audit team on the day of the audit.

The road safety audit team observers do not sign the audit report.

A suggested working method for undertaking Stage 3 road safety audits is as follows:

- The audit team visits the site during daylight;
- The audit team walks, drives and, where appropriate, cycles along and across the scheme;
- One team member takes notes of all the possible safety points;
- The other team member takes photographs of all the possible safety points;
- Before leaving the site a team meeting is held to ensure that the note-taker has covered all safety points;
- The audit team visits the site during darkness;
- One team member produces a draft Audit Report and circulates it to all present at the site visit;
- The report is edited following comments from the other team members and observers;
- The audit team leader attends a meeting with the Design Team, Scheme Project Manager and NRA Project Manager, to discuss the draft report;
- The audit team produces the final report, signed by all members of the team, and sends it to the Scheme Project Manager. Copies should be sent by SPM to the Design Team and NRA Project Manager;
- The Feedback Form should be filled in by the Design Team in consultation with the SPM, and discussed with the audit team, as detailed in 4.10;
- The final Feedback Form is signed by all three principal parties involved: Design Team

Leader, Audit Team Leader and Scheme Project Manager;

- A copy of both the final report and the Feedback Form should be sent for information to the NRA Road Safety Section. This can be emailed to roadsafetyaudits@nra.ie or sent on CD.

There is often pressure to open new road schemes as soon as they are completed. This makes it difficult to carry out the process described above and provide an immediate report. On these occasions it is recommended to undertake a "pre-Stage 3" audit shortly before completion. If the recommendations from the pre-Stage 3 audit are acted upon, the final Stage 3 audit will be less onerous. It may also be possible to provide the Resident Engineer with a copy of the hand-written notes taken during the Stage 3 visit, or with a typed up version shortly afterwards. The Resident Engineer can then start to act upon these notes prior to receiving the formal Stage 3 audit report.

In the case of greenfield road alignments particular care should be taken in examining the tie-ins to the existing alignment. Because of the difficulty of seeing these areas in operation before road opening it may be necessary to return immediately after opening to complete the audit.

#### 4.8 Audit Brief

The list below describes the items that should be provided for road safety audit. It is the responsibility of the Scheme Project Manager to ensure that the audit team receives the necessary information. The Road Safety Audit Brief Checklist in Appendix E must be completed and given to the audit team as part of the audit brief.

- Design Brief;
- Design checklist (if relevant);
- Departures from Standard;
- Scheme plans (list separately if possible);
- Other scheme details (list separately if possible) e.g. signs schedules;
- Accident printout for existing roads affected by the scheme;
- Traffic surveys;
- Previous Road Safety Audit Reports;
- Previous Exception Reports;
- Start date for construction;
- Any other information (list separately).

## 4.9 Audit Report

Having carried out a road safety audit by looking through scheme plans or examining the completed scheme on site a formal report is written.

The following items should be included within the audit report:

- A brief description of the scheme being audited, and the audit stage;
- The dates when the audit was carried out (and the date of the site visit);
- A list of the audit team members and any other personnel attending the site visit;
- A series of road safety problems and recommendations for action - it may be useful to include a plan showing the location of the problems;
- A statement signed by the audit team members to certify that they have examined the scheme;
- For design stage audits, a list of all plans and other information examined;
- Feedback Form for completion by the Design Team Leader and the Audit Team Leader.

The main element of the report is the section on problems and recommendations and the following points should be borne in mind when writing this section:

- All problems identified in a Safety Audit Report must relate to road safety problems. Non-safety items identified can be itemised in a separate report or letter;
- All safety problems highlighted should be stated as clearly as possible. A clear identification of a problem will help the Design Office or Design Team to consider not only the recommendation in the report but also to consider alternative ways to overcome the safety problem.

Road safety audit teams should exercise caution in documenting differences in the potential severity of problems, as a problem would not be described in the report unless it were considered to affect the safety of the scheme to some extent. It is recommended that the meeting between Audit Team, Design Team, SPM and NRAPM is used as

the primary means to discuss the relative importance of issues raised within the draft report.

Recommendations should be as practical as possible and be relative to the overall scheme cost. There is little value in putting forward a recommendation that will add more than a small percentage increase to the cost of a scheme. Costs and benefits are discussed in more detail in Section 6.1.

It must be recognised that the implementation of certain measures will be outside the authority of the Design Team and Scheme Project Manager. Recommendations to implement such measures should not be included, although such measures may be discussed within the report.

Safety problems that remain unaddressed throughout the audit process should be repeated at subsequent audit stages. Recommendations may change as appropriate to the stage the design has reached. For example, a Stage 1 audit on a realignment scheme might identify problems with the position of a particular junction, and would consequently recommend either closure or relocation. At Stage 2, if the design shows the junction in its originally proposed location the auditors should note this and recommend alternative measures to mitigate the problem such as additional signing, road markings, change of road surface, etc.

A sample Road Safety Audit Report is shown in Appendix C.

## 4.10 Design Team Response

The recipient of a road safety audit report will be the Scheme Project Manager, who will have to decide whether or not to act on the recommendations contained within the report.

The draft report may be discussed at a meeting between the Audit Team, Design Team, Scheme Project Manager and NRA Project Manager (in consultation with the NRA Road Safety Section if required). For Stage 1 and 2 Audits this meeting may take place some days after the report has been completed. Due to time pressures for Stage 3 audits it is suggested that the meeting takes place immediately after the Stage 3 site visit. The purpose of the meeting is to clarify issues raised within the audit report. The auditors should be

prepared to indicate the importance of issues raised within the report, and to justify why the problems are genuine safety issues. They should not be under external pressure to change their report. However, once issues have been clarified the auditors may feel that they can amend sections of the report; for example a recommendation within their report may be amended in the light of new information that demonstrates that their original ideas could not be implemented. As long as the auditors accept that the new recommendation will have a genuine safety benefit, they can change their draft report, and produce a final version.

Having received the final audit report, the Scheme Project Manager should pass a copy to the Design Team, who prepare an Audit Response using the Road Safety Audit Feedback Form included in Appendix F. The Scheme Project Manager considers this response. In most cases the Scheme Project Manager will instruct the Design Team to make changes in response to the audit report. Where these are major changes it may be necessary to carry out a re-audit of that part of the scheme. Where there is a proposal to provide an alternative means of addressing a particular problem, the alternative should be described on the Road Safety Audit Feedback Form. The Feedback Form is returned to the audit team who will do one of the following:

- Accept the proposed alternative measure;
- Following discussions with SPM and Design Team, accept a modified version of the proposed alternative measure;
- Reject the proposed alternative measure.

The Audit Team Leader should then sign the Feedback Form and return it to the Scheme Project Manager, who also signs the form to acknowledge completion of the Design Response procedure. Copies should be sent by SPM to the

Design Team and NRAPM. A copy should also be sent for information to the NRA Road Safety Section. This can be emailed to roadsafetyaudits@nra.ie or sent on CD.

#### 4.11 Exception Report

For those cases where the Design Team and the Audit Team cannot agree appropriate means of addressing an underlying safety problem identified by the audit, as indicated in Table 4/1, an Exception Report must be prepared.

The Exception Report should be prepared by the Scheme Project Manager. It must address only those items in the Audit Report for which an Exception Report is necessary.

An Exception Report will take one of the two following forms:

Where the Design Team accepts an identified problem, but Design Team and Audit Team cannot agree on an appropriate recommendation, the Exception Report should describe the reasons why the audit team recommendation cannot be implemented and outline the alternatives considered and the difficulties involved in implementing them.

Where the Design Team does not accept that the identified problem exists, the Exception Report should produce some evidence as to why the problem is not valid. It may be that the audit team did not have all information available, or that the scheme design has changed since the plans used in the audit were prepared

While the road safety auditor concentrates on road safety issues, the Scheme Project Manager will have to weigh up the various consequences of implementing the recommendations within the audit report.

Problem accepted	Recommended measure accepted	Alternative measures or reasons accepted by auditors	Exception report needed
Yes	Yes	-	<b>NO</b>
Yes	No	Yes	<b>NO</b>
Yes	No	No	<b>YES</b>
No	No	No	<b>YES</b>

**Table 4/1: Feedback Form Responses, Requirement for Exception Report**

There will inevitably be some conflict between safety and other issues within the audit process. Some examples are given below:

- Large conspicuous road signs are generally a good idea from a safety point of view, while they can have an adverse affect on visual intrusion;
- Street lighting generally improves road safety but has implications for light pollution;
- Multi-lane approaches to roundabouts can have a poor safety record but will reduce traffic delays.

When writing an Exception Report it should be noted that both the Road Safety Audit and Exception Reports could be used in future litigation. The legal implications of road safety audit are examined in Chapter 5.

Exception Reports must be sent to the Director of the funding authority and overseeing organisation for decision. The final decision to accept or reject the disputed recommendations rests with the funding authority for the scheme. For National Roads this is NRA. The Exception Report Decision Form, given in Appendix G, must be returned to the Scheme Project Manager for action on the decision

After the Director's decision copies of the Exception Report and the Exception Report Decision Form should be sent by SPM to the Audit Team, the Design Team and NRA Project Manager. A copy should also be sent for information to the NRA Road Safety Section. This can be emailed to roadsafetyaudits@nra.ie or sent on CD.

#### 4.12 Accident Monitoring

When a scheme has been completed, it is important to monitor its performance in terms of the number and severity of road accidents and casualties.

NRA HD 19 has a requirement for the NRA Road Safety Section to monitor schemes three years and six years after completion. The Standard requires that accident locations and common accident types are identified and that accident rates and severity ratios are compared with average rates.

Although this monitoring is necessary, it is of limited use unless it is related back to the original

road safety audit reports. A suggested working method for monitoring is outlined below:

- Identify accident locations;
- Identify accident types;
- Identify which items highlighted in the road safety audit report were amended on site;
- Look at the audit reports and compare the recorded accidents against the problems highlighted in the report. Those problems that have not been addressed and recommend measures not implemented will be of particular interest;
- Prepare a monitoring report for the overseeing organisation (with a copy to the original audit team).
- It may also be useful to examine maintenance records as these could highlight where damage-only accidents have occurred.

#### 4.13 Note for the Resident Engineer

Resident Engineers (RE) can take a constructive role within the road safety audit process. The key stages for involvement are:

- prior to construction, copies of Stage F, 1 & 2 road safety audit reports, responses and decisions should be despatched to the RE;
- during the construction process any on-site re-design or alterations should be referenced back to the Design Team. A safety assessment or Audit may be required;
- prior to the scheme opening, the RE and future maintenance representative should have an opportunity to consult with the Stage 3 audit team. The RE will be in a position to give advice to the audit team, but should not attempt to influence their task. Once the Stage 3 site visit is complete the RE, subject to the agreement of the SPM, may be in a position to address some of the findings immediately without having to wait for the formal audit report.

## 5. LEGAL IMPLICATION

### 5.1 Background

There are no formal legal requirements to carry out road safety audits in Ireland. Safety checking processes are referred to in Chapter 9 of "A Guide to Road Safety Engineering in Ireland", published by the Department of the Environment in 1996.

Statutory duties that are relevant in the general area of road safety are contained in the 1961 Road Traffic Act. This Act has provisions for both Roads Authorities and the Minister of the Environment to promote road safety.

The 1993 Roads Act places a duty on people using public roads to take reasonable care for their own safety and for other people using the road. The 1993 Act also places a duty on Road Authorities to construct and maintain roads. In carrying out these duties the Roads Authority has a responsibility to consider the needs of all road users, and can provide for the safety of road users.

The 1994 Road Traffic Act makes provision for the Roads Authority to carry out traffic calming measures in the interest of safety.

With no experience (up to the end of 2006) of claims having been made against Roads Authorities in Ireland, in respect of deficient road safety audit, the guidance on how to deal with possible litigation can only be speculative. There is increasing evidence, however, of claims being made against Roads Authorities in cases of road traffic accidents. There are many reasons given for this, but it appears that there is an increasing awareness on the part of both claimants' solicitors and the judiciary of the possibility of contributory negligence awards against Roads Authorities.

Following the occurrence of a road accident, it may be possible that a claimant would argue that the Roads Authority is in breach of a statutory duty, and/or is negligent. Legal proceedings are more likely to ensue in those cases where there is evidence to suggest that a road factor is dominant in accident causation. This might be at a site with a history of similar types of accidents relating to a road problem, for example poor alignment or road lighting. Or it may be a situation where it can be

shown that certain aspects of the drainage or signing were both substandard and contributory to accident occurrence. Or it may be where it can be shown that certain procedures, such as road safety audit, were not carried out in accordance with existing recommended good practice.

In order to succeed, a claimant must show that the Roads Authority failed to take such care as in all the circumstances was reasonably required to ensure that the road was not dangerous to traffic. In this respect authorities could be judged, *inter alia*, on the basis of the consistency and objectivity of their internal procedures (including road safety audit), and their compliance with any published advice on road safety audit.

### 5.2 Areas of Concern

The NRA is therefore concerned about the legal implications of both general safety engineering work, and the requirement for effective road safety audit procedures.

A number of potential issues arise, once an accident has occurred on a new road scheme or a road improvement. In devising road safety audit guidelines, the NRA has addressed the following issues:

What are the legal implications on a road where an accident occurs and litigation ensues if:

- *no effective, consistent road safety audit procedures exist?*  
It is considered that until there is a statutory obligation to carry out road safety audit in Ireland, a Roads Authority is not obliged to do this work;
- *despite publishing a set of specific procedures, a road safety audit has not been carried out on one of the NRA's roads?*  
Although this would be seen as contrary to the written procedures, it is considered likely that this would be viewed as a mistake, rather than as a breach of statutory duty or negligence;

- *a road safety audit has been carried out, but the recommendations have not been acted upon?*

Mis-feasance could apply here. The importance of acting on road safety audit reports, and having a well documented Exception Report process is strongly emphasised;

- *a road safety audit has been carried out, but has failed to identify a relevant problem?*

The road safety auditor is considered likely to be judged on the basis of whether he or she could reasonably have been expected to identify that particular problem.

It is important that a clear procedure for managing and organising road safety audit is established, and that the practice of undertaking and reporting road safety audit is clearly specified, and that the actions are fully and consistently documented.

In undertaking road safety audits for the NRA, parties involved should:

- ensure that the terms of reference for each road safety audit are clear;
- establish exactly what information has been received by the road safety audit team and subsequently used as information to assist with the road safety audit;
- in writing road safety audit reports at Stages 2 & 3, ensure that safety issues raised at earlier stages, which have not been addressed, are re-examined where appropriate. In some circumstances it may be appropriate to suggest alternative solutions at subsequent stages;
- note that the Stage 3 road safety audit is the final opportunity to examine the scheme from a road safety point of view before it is opened to traffic;
- ensure that road safety audit team members are aware of their responsibilities in undertaking a road safety audit;
- ensure that Scheme Project Manager and Design Team staff are aware of their responsibilities in responding to a road safety audit;
- maintain the documentation of a formal set of road safety audit procedures;
- maintain a record of the full documentation for each road safety audit undertaken;

- ensure that road safety audit ties in with responsibilities under the Safety Health and Welfare at Work Act and its current Regulations;
- monitor the safety performance of road schemes after they are open;
- give consideration to specific indemnification for road safety audit work carried out by staff working in this area.

Consultants carrying out road safety audit work on behalf of the NRA will be expected to provide adequate professional indemnity cover for this type of work.

## 6. ROAD SAFETY AUDIT ISSUES

### 6.1 Costs and Benefits

The costs attributed to a road safety audit can be divided into two distinct components. Firstly there is the cost of the audit itself. The cost of a road safety audit is related to the time spent to complete it, rather than the cost of the scheme itself. It takes less time to audit a scheme involving a new link road with a simple junction at each end than it does to audit a complex traffic signal junction in an urban area. Research carried out by the IHT found that the average time taken to complete an audit was 25 hours.

The second element of cost relates to the implementation of the recommendations contained within the audit report. In general, these costs are not significantly high and items identified at Feasibility Stage and Stages 1 and 2 may have no cost implications at all (although they may require some re-design time). There are, however, some instances where audit recommendations, particularly at Stage 3, will add to the cost of a scheme. For example, a recommendation for applying anti-skid surfacing on the approach to a set of traffic signals.

It is difficult to identify the benefits of carrying out a road safety audit on a scheme in a quantitative way. When an audit has been carried out, the scenarios are that either the recommendations are implemented or they are not. Although the subsequent accident record can be examined only one of the scenarios can be evaluated. It is not possible to judge how an individual scheme that has been audited would have performed had the audit not been carried out.

Whilst it may be possible to look at schemes in a wider national context and check the performance of audited schemes versus those that have not been audited, it would be inadvisable to not carry out road safety audits as part of an experiment, due to potential legal liabilities.

Some work carried out in New Zealand suggests that the benefit to cost ratio for road safety audits is in the order of twenty to one. In Denmark, the first year rate of return for road safety audits has been estimated as over 149%. This figure was

based on estimates for accident savings that might be made by introducing audit recommendations.

A further qualitative benefit is the extent to which design engineers receive improved safety awareness through the road safety audit process. Local authorities in the UK who have carried out this work over a decade or more have noticed a reduction in the number of comments being made by auditors.

### 6.2 Risk Assessment

A road safety auditor may sometimes comment on a safety issue and make a recommendation that has only a small safety benefit, the cost of implementation of which far outweighs any benefit to be gained. It is therefore suggested that auditors carry out an informal risk assessment of each problem documented, assessing both the probability of such a collision occurring and the severity of outcome of the predicted collision. This should be done for both possible situations, with and without the recommendation implemented, so that the expected reduction in risk resulting from implementing each recommendation can be obtained.

The post-audit meeting between Audit Team, Design Team, SPM and NRAPM can be used as the primary means to discuss the relative importance of issues raised within the draft report. The information from the risk assessment can be used by the Scheme Project Manager to help decide whether or not to implement the recommendations.

### 6.3 Auditing Development Schemes

The auditing of any changes to the road layout that are development-led within the local authority planning process is another area that needs clarification.

A road safety audit is a requirement for any development scheme that results in a permanent change to the road layout on a national road, whether inside or outside urban areas.

Many Roads and Planning Authorities require a road safety audit too late in the planning process to address fundamental safety issues. Once planning approval has been given it is difficult to require developers to make significant changes to schemes, especially if they are costly or reduce the amount of land available for development. It is important therefore that the road safety audit process is built into the planning procedure of each authority so that audit reports and their responses can be given due consideration by the Planning Authority.

The four stages of Road Safety Audit are summarised in Table 6/3. Whether all these stages are necessary depends on the size and impact of the development concerned.

Stage F:	Preplanning, concept stage
Stage 1:	Completion of preliminary design
Stage 2:	Completion of detailed design
Stage 3:	Completion of construction.

**Table 6/3: Road Safety Audit Stages**

In the case of large developments a Stage F audit should be submitted during preplanning talks, and Stage 1 and 2 audits as part of the planning application. In the case of small developments a combined Stage 1/2 road safety audit should be submitted as part of the planning application. In all cases the planning application should contain the report from at least one stage of road safety audit. Any relevant Audit Report and Audit Response can then be considered by the Local Authority before planning permission is granted.

The findings of the road safety audit may possibly lead to the refusal of the planning application but it is more likely that the developer would be given planning permission conditional to specific requirements resulting from the road safety audit report recommendations. Although the developer, as instigator of the scheme and commissioner of the audit, takes on the role of the Scheme Project Manager in the road safety audit process, it is up to the Roads Authority to ensure that the resulting road layout is acceptable and safe for public use. Discussions in preplanning and use of planning conditions provide methods of ensuring that the developer implements the recommendations of the road safety audit report.

The following are examples of requirements that can be included as conditions to a planning approval.

- *The agreed recommendations from the road safety audit process must be completed by the developer to the satisfaction of ..... County Council, as the Roads Authority, before the public road hereby permitted is taken into charge by ..... County Council.*
- *The development shall not open for the approved use intended by the developer until the road safety audit process has been complied with by the developer in accordance with NRA Standard TD19 and the agreed recommendations from the road safety audit report have been completed by the developer to the satisfaction of ..... County Council, as the Roads Authority,*

The following is an example of a statement of grounds for refusal of planning approval.

- *The development is not permitted because following the adherence of the road safety audit process, fundamental road safety issues remain. These issues have not been resolved, and it is therefore considered that were the development to go ahead in its proposed form it would pose a significant traffic hazard to road users*

If a developer refuses to implement a certain recommendation in the road safety audit report then an Exception Report would be required. The final decision to reject or accept the Exception Report, i.e. to either implement the disputed recommendation or not, rests with the Planning Authority and Roads Authority.

Once the change in road layout is completed, a subsequent Stage 3 road safety audit should be carried out. The requirement for this can either be enforced through planning condition or reached by agreement between the Planning and Roads Authority and the developer.

It must be stressed that in order to facilitate the road safety audit procedure within the planning process it is necessary for senior roads and planning staff to review in-house planning application processes, so that the requirement for road safety audit is included within each county development plan and becomes part of the planning application process.

## 7. REFERENCES

- AA Foundation for Road Safety Research, Urban Accidents: Why do they happen?, 1989.
- Austroroads, Road Safety Audit Procedures, 1994, updated 2002.
- Department of Transport, Denmark, Road Safety Audit Procedures.
- Department of the Environment, A Guide to Road Safety Engineering in Ireland, 1996.
- Dublin Corporation, Road Safety Audit Procedure, 2000.
- Dublin Corporation, Road Safety Audit Guideline, 2000.
- Highways Agency, Design Manual for Roads and Bridges, Volume 5:  
HD 19/03, Road Safety Audits, 2003.
- Institution of Highways and Transportation, Guidelines for the Safety Audit of Highways, 1990, 1996.
- National Roads Authority, NRA Design Manual for Roads and Bridges, Volume 5:  
NRA HD 19, Road Safety Audits, 2004.
- Roads Act, 1993.
- Road Traffic Act, 1961.
- Road Traffic Act, 1994.



## 8. ENQUIRIES

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

Head of Project Management and Engineering  
National Roads Authority  
St Martin's House  
Waterloo Road  
Dublin 4

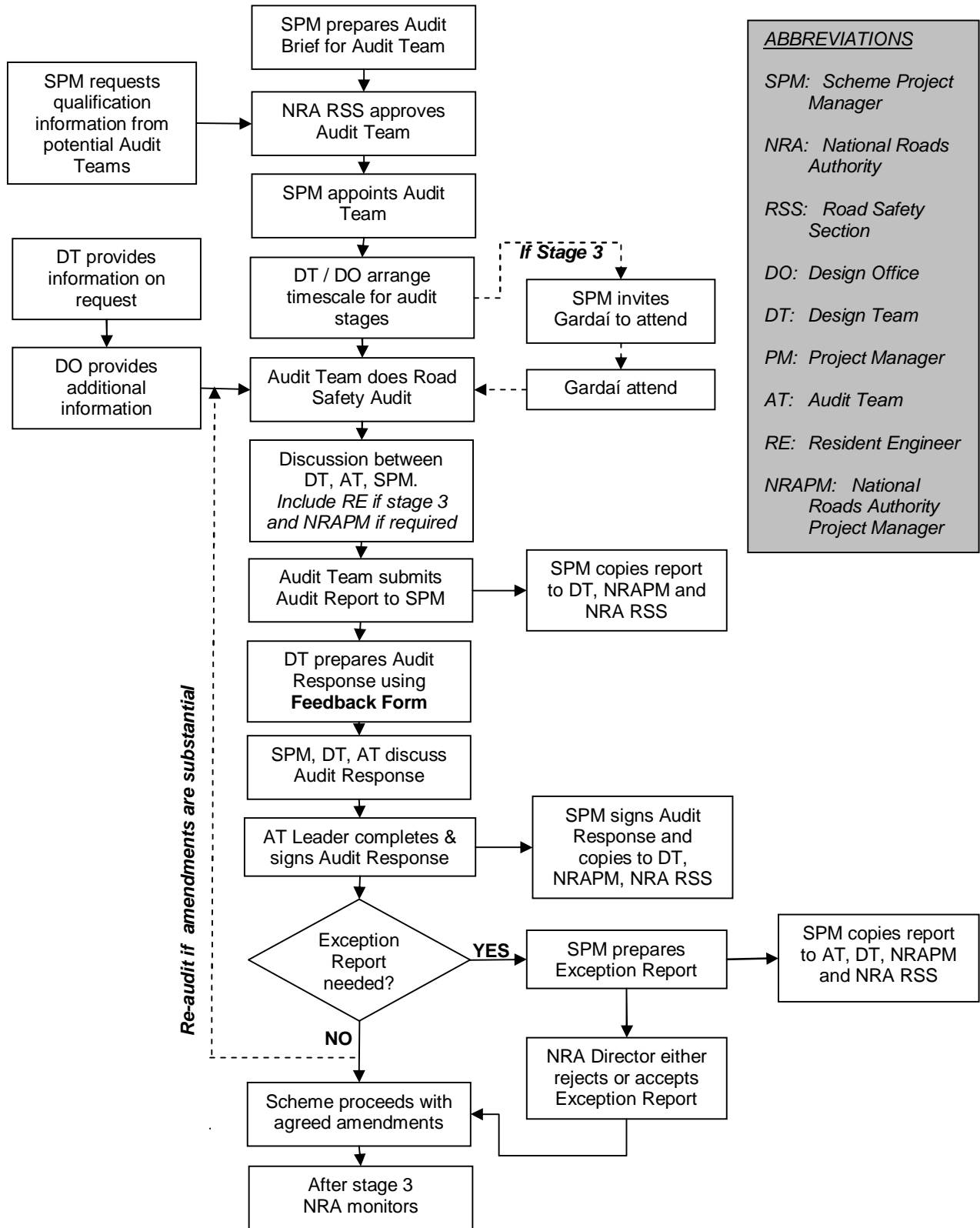


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E O'CONNOR

Head of Project Management and Engineering



# APPENDIX A: Road Safety Audit Flow Chart





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# APPENDIX B:

## Auditor's Checklist – Major Issues to be Considered

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(Source: IHT Road Safety Audit Guidelines)

### Checklist for Stage F - Feasibility

#### General

Consistency of standards with adjacent road network, especially at tie-ins  
Secondary effects on surrounding road network  
Where a preferred scheme is being chosen, relative safety performance of options

#### Routes

Impact of standard of route, related to design flows and speed, on safety  
Overtaking opportunities  
Consistency of junction arrangements, access control  
Frequency of junctions (public and private) related to safe access  
Horizontal and vertical alignments consistent with visibility requirements, both along the road and at junctions  
Facilities for pedestrians, cyclists and equestrians  
Provision for unusual aspects of traffic composition (heavy concentrations of particular types of road user), or environment (e.g. sunrise / sunset glare, fog, or wind)

#### Area Schemes

Designation of functions for different elements of the road hierarchy  
Scheme consistent with overall safety plan

### Checklist for Stage 1 - Preliminary Design

#### General

Review any previous Road Safety Audit in order to allow for subsequent design changes  
For major schemes, determine need for land take for safety requirements

#### Alignments and Sight lines

Any elements of horizontal and vertical alignments which may produce hazards due to reduced sight lines, especially where these are combined and / or there are departures from standards  
Sight lines obstructed by bridge abutments, parapets, landscaping, structures or street furniture

#### Junctions

Minimising potential conflict points at junctions (including numbers of private accesses)  
Conspicuity of junctions on approach, and sight lines from minor road approaches and private accesses  
Control of approach speed, and layout of approach roads  
Provision for turning traffic  
Location and access of lay-bys

#### Other

Impact of landscaping on visibility and road user perception  
Concept of road marking / signing for road user perception  
Provision for safety aids on steep hills  
Facilities for pedestrians, cyclists and equestrians  
Potential for flooding due to inadequate drainage  
Compatibility with adjacent network at tie-ins  
Servicing access and maintenance arrangements

### Checklist for Stage 2 - Detailed Design

### General

Review any previous Road Safety Audit in order to allow for subsequent design changes

*Note:* Scope for altering alignments or junction design is less extensive at this stage, so the Road Safety Audit will focus mainly on details of signing, marking, lighting, etc, and issues which affect visibility and drivers' perception of the road scene, and provide aids to safety.

### Junctions

Appropriateness of corner radii or curvature in relation to approach speed

Road users' perception of road layout

### Road signs and markings

Locations of signs and markings to aid, inform, and warn of hazards, without obscuring visibility or misleading drivers

Consistency of signing and marking information

### Lighting and signals

Consistency of lighting within the scheme and with the adjacent network

Safe positioning of lighting columns, signals and operational equipment

Confusion or conflict between lighting and traffic signals

Positioning of heads for traffic and pedestrian signals to ensure clarity to appropriate road user, and avoid confusion to others to whom they do not apply

Safe access and servicing arrangements

### Facilities for vulnerable road users

Location and type of crossing facilities; visibility

Dedicated cycle or pedestrian facilities

Provision of facilities for people with mobility impairments

### Landscaping

Potential obstruction to visibility from landscaping, taking account of future growth

Potential for trees to become collision objects: choice of appropriate species

Ability to maintain planted areas safely

### Protective aids

Positioning of safety fences, and guard rails to protect against vehicle conflicts or roadside objects (poles, columns, statutory undertakers' apparatus), without obscuring visibility

Use of arrester beds

### Surface characteristics

Appropriate surfacing for high speed roads, or locations (e.g. bends) which are potentially hazardous when wet

Appropriate surfacing for approaches to junctions, and thresholds to villages or residential areas in towns, to encourage lower vehicle speeds

## **Checklist for Stage 3 - Pre-opening**

### General

Review any previous Road Safety Audit in order to allow for subsequent design changes.

The main emphasis is to inspect the scheme from the viewpoint of the different road users, considering where appropriate the needs of pedestrians, cyclists, equestrians, public transport operators, and HGVs as well as car drivers.

Inspection at appropriate times of day, in particular in daylight and darkness

Checklist 2 provides an appropriate aide memoire

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## **APPENDIX C: Sample Road Safety Audit Report**

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### **SOMETOWN BY-PASS**

#### **ROAD SAFETY AUDIT STAGE 2**

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#### **1. INTRODUCTION**

- 1.1 This report describes a Stage 2 Road Safety Audit carried out on a proposed by-pass at Sometown, on behalf of Campbell and Bellamy Partnership. The audit was carried out between 12 and 18 October 2000 in the offices of ABC Consultancy.
- 1.2 The audit team members were as follows:-  
  
Richard Harris, MSc, MIHT, MCIT; Director, ABC Consultancy;  
  
Wallace Grommit, AMIHIE, Engineer, ABC Consultancy.
- 1.3 The audit comprised an examination of the drawings relating to the scheme supplied by the design office. Mr Grommit visited the site on 12 October 2000.
- 1.4 This Stage 2 audit has been carried out in accordance with the relevant sections of NRA HD 19/01. The team has examined only those issues within the design relating to the road safety implications of the scheme, and has therefore not examined or verified the compliance of the design to any other criteria.
- 1.5 Appendix A describes the drawings examined by the audit team.
- 1.6 All of the problems described in this report are considered by the audit team to require action in order to improve the safety of the scheme and minimise accident occurrence.

## 2. ITEMS RESULTING FROM THIS STAGE 2 AUDIT

Accident details have not been supplied with this scheme.

### 2.1 General problems/ problems at multiple locations

#### 2.1.1 Problem – safety fence end treatments

Vehicles that leave the carriageway can be launched from the leading ramped ends of safety fence.

##### **Recommendation**

Leading ramped ends should be tapered away from the approach direction of traffic. Particular attention should be paid to the leading ramped ends of safety fence at:

- M99 northbound entry slip road;
- M99 northbound entry slip road/ N99 eastbound approach to roundabout;
- N99 eastbound entry to roundabout;
- N99 northbound (3 locations);
- N99 southbound.

#### 2.1.2 Problem – protection of various hazards

A number of drainage ditches/head walls/balancing ponds/pylons appear to be unprotected. Vehicle occupants could be injured if vehicles overturn in ditches or strike head walls or pylons. Vehicle occupants could drown in balancing ponds.

##### **Recommendation**

The need for safety fence should be considered at the following locations:

- The north side of the N99/M99 northbound link (drainage ditch and culvert 4);
- The inside of the M99 exit slip road loop (balancing pond and pylons);
- The south side of the N99 northbound east of Marsh Lane track (brook running alongside road);

#### 2.1.3 Problem – Temporary Warning Signs

Drivers need to be aware of the new arrangements.

##### **Recommendation**

New Road Layout Ahead and/or New Roundabout Signs should be provided on all approaches except the M99 exit slip road.

### 2.2 Problems at specific locations

#### 2.2.1 Problem – M99 northbound entry slip road

The slip road has a section at a radius that is 3 steps below standard: the merge length, taper length and hard shoulder width are all sub-standard. Departures from Standard in isolation may have no road safety consequences. Wholesale departures could combine to create a dangerous situation. It is not understood why there needs to be 4 different radii on the slip road. The 255m radius is not listed as a Departure.

##### **Recommendation**

Whilst at this stage, with earthworks underway, it may not be possible to amend the design, consideration should be given to the provision of a constant radius over a greater length.

#### 2.2.2 Problem – Marsh Lane roundabout

The N99 eastbound and the M99 exit slip road approach to the roundabout will be relatively high speed in low flow conditions. The straight approaches could lead to a situation in which drivers lose control and overrun the central island.

**Recommendation**

Consideration should be given to block paved chevrons on the central island to increase roundabout conspicuity. Central island chevrons should be mounted on breakable posts, or erected as in Diagram 515.1A. Consideration should be given to yellow borders to the signs. Consideration should be given to the angle of the sign facing the N99 eastbound entry, to the length, height and position of the sign facing Warren Road, and to the position of the sign facing the M99 entry slip road, in order to ensure optimum sign face conspicuity for approach traffic. Antiskid surfacing should be provided on the approaches.

**2.2.3 Problem – Marsh Lane track/Pipers Lane**

Drivers on Marsh Lane track need to be aware that they are approaching a junction.

**Recommendation**

A junction warning sign should be provided in advance of the Marsh Lane track/ Pipers Lane junction and a STOP sign should be provided at the junction.

**2.2.4 Problem – N99 at Marsh Lane**

A gully is located near to the footway crossing on the south side of Marsh Lane. This could be a trip hazard for pedestrians.

**Recommendation**

The gully should be sited away from the footway crossing.

**2.2.5 Problem – N99 at Marsh Lane**

Pedestrians and cyclists cross Marsh Lane south of the speed limit de-restriction. Drivers might accelerate away from the junction through the crossing having seen the signs.

**Recommendation**

The speed limit boundary should be sited south of the crossing point.

**3. AUDIT TEAM STATEMENT**

We certify that we have examined the drawings and other information listed in Appendix 1. This examination has been carried out with the sole purpose of identifying any features of the design that could be removed or modified to improve the safety of the scheme. The problems that we have identified have been noted in the report, together with suggestions for improvement which we recommend should be studied for implementation.

signed.....Richard Harris, ABC Consultancy

date.....

signed.....Wallace Grommit, ABC Consultancy

date.....

**APPENDIX 1:**

**LIST OF DRAWINGS EXAMINED**

01300/D11 Rev A

01300/D12 Rev B

01300/D13 Rev C

## ROAD SAFETY AUDIT FEEDBACK FORM

Scheme: **Sometown By-Pass**

Audit Stage: **2**

Date Audit Completed: **12<sup>th</sup> - 18<sup>th</sup> October 2000**

Paragraph No. in Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Describe alternative measure(s). Give reasons for not accepting recommended measure	Alternative measures or reasons accepted by auditors (yes/no)
2.1.1	Yes	Yes		n/a
2.1.2	Yes	No	Suggest providing earth bunds around drainage ditch and balancing pond instead of safety fencing.	Yes
2.1.3	Yes	Yes		n/a
2.2.1	Yes	Yes		n/a
2.2.2	Yes	Yes		n/a
2.2.3	Yes	Yes		n/a
2.2.4	Yes	No		No
2.2.5	Yes	Yes		n/a

Signed: \_\_\_\_\_ Design Team Leader      Date \_\_\_\_\_

Signed: \_\_\_\_\_ Audit Team Leader      Date \_\_\_\_\_

Signed: \_\_\_\_\_ Scheme Project Manager      Date \_\_\_\_\_



## APPENDIX D: Application for Approval of Road Safety Audit Team

Name of Scheme / Development: \_\_\_\_\_

Route no: \_\_\_\_\_ County: \_\_\_\_\_

Stage of Road Safety Audit: \_\_\_\_\_ (If NRA scheme) NRA Project Ref No.: \_\_\_\_\_

(If NRA scheme) Is scheme Traditional Contract / D&B / PPP / ECI? Delete as applicable

Scheme Project Manager: \_\_\_\_\_

Brief description of proposed change to National Road: \_\_\_\_\_

### Proposed Team Members:

Ensure at least two are proposed.

Attach CVs if individual has not had approval previously or if relevant details have changed

Name			
Completed 3 - 5 day course in Road Safety Audit? (Yes/No)			
Completed 10 day course in Accident Investigation & Prevention? (Yes/No)			
No. of years working in Accident Investigation and Prevention <i>other than on Road Safety Audit</i>			
No of Road Safety Audits completed			
No of audits completed of similar stage and type			
No of audits completed in past 5 years			

Contact in Consultancy firm: \_\_\_\_\_ Phone no. \_\_\_\_\_

Name of Firm & Address: \_\_\_\_\_

Please submit completed form to; NRA Road Safety Section or email to [roadsafetyaudits@nra.ie](mailto:roadsafetyaudits@nra.ie)







## APPENDIX F: Road Safety Audit Feedback Form

### ROAD SAFETY AUDIT FEEDBACK FORM

Scheme: \_\_\_\_\_ Route No. \_\_\_\_\_

Audit Stage: \_\_\_\_\_

Date Audit Completed: \_\_\_\_\_

	To Be Completed By Design Team Leader			To Be Completed by Audit Team Leader
Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Describe alternative measure(s). Give reasons for not accepting recommended measure	Alternative measures or reasons accepted by auditors (yes/no)

Signed: \_\_\_\_\_ Design Team Leader      Date \_\_\_\_\_

Signed: \_\_\_\_\_ Audit Team Leader      Date \_\_\_\_\_

Signed: \_\_\_\_\_ Scheme Project Manager      Date \_\_\_\_\_



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## APPENDIX G: Road Safety Audit Exception Report Decision Form

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Scheme: \_\_\_\_\_ Route No. \_\_\_\_\_

(If NRA scheme) NRA Project Ref No.: \_\_\_\_\_

Audit Stage: \_\_\_\_\_ Date Audit Completed: \_\_\_\_\_

Exception Report Item	Paragraph No. in Road Safety Audit Report	Decision by Director (Accept ER / Reject ER)

Signed: \_\_\_\_\_ Director of Overseeing Organisation      Date \_\_\_\_\_

