



Bonneagar Iompair Éireann
Transport Infrastructure Ireland

TII Publications



Road Safety Audit Guidelines

GE-STY-01027
December 2017

About TII

Transport Infrastructure Ireland (TII) is responsible for managing and improving the country's national road and light rail networks.

About TII Publications

TII maintains an online suite of technical publications, which is managed through the TII Publications website. The contents of TII Publications is clearly split into 'Standards' and 'Technical' documentation. All documentation for implementation on TII schemes is collectively referred to as TII Publications (Standards), and all other documentation within the system is collectively referred to as TII Publications (Technical).

Document Attributes

Each document within TII Publications has a range of attributes associated with it, which allows for efficient access and retrieval of the document from the website. These attributes are also contained on the inside cover of each current document, for reference.

TII Publication Title	<i>Road Safety Audit Guidelines</i>
TII Publication Number	<i>GE-STY-01027</i>

Activity	<i>General (GE)</i>		Document Set	<i>Standards</i>
Stream	<i>Safety(STY)</i>		Publication Date	<i>December 2017</i>
Document Number	<i>01027</i>		Historical Reference	NRA HA 19

TII Publications Website

This document is part of the TII publications system all of which is available free of charge at <http://www.tiipublications.ie>. For more information on the TII Publications system or to access further TII Publications documentation, please refer to the TII Publications website.

TII Authorisation and Contact Details

This document has been authorised by the Director of Professional Services, Transport Infrastructure Ireland. For any further guidance on the TII Publications system, please contact the following:

Contact: Standards and Research Section, Transport Infrastructure Ireland
Postal Address: Parkgate Business Centre, Parkgate Street, Dublin 8, D08 DK10
Telephone: +353 1 646 3600
Email: infoPUBS@tii.ie

TII Publications



Activity:	General(GE)
Stream:	Safety(STY)
TII Publication Title:	Road Safety Audit Guidelines
TII Publication Number:	GE-STY-01027
Publication Date:	December 2017
Set:	Standards

Contents

1. Introduction	1
2. Road Safety Principles	5
3. Road Safety Audit Process	10
4. Road Safety Audit Issues	23
5. References	26
Appendix A:	27
Sample Auditor’s Checklist	27
Appendix B:	32
Sample Road Safety Audit Report Stage F Part 1	32
Appendix C:	59
Sample Road Safety Audit Report Stage 3.....	59
Appendix D:	80
Sample Exception Report & Decision	80

**Updates to TII Publications resulting in changes to
Road Safety Audit Guidelines GE-STY-01027**

Date: December 2017

Page No:

Section No:

Amendment Details:

This document supersedes the March 2015 version of GE-STY-01027. The principle changes from the previous version are as follows:

- a) Definitions section removed, all relevant definitions are included in GE-STY-01024 Road Safety Audit.
- b) The Maintenance schemes and Collision Causation Sections have been removed.
- c) Information in relation to road safety research has been updated.
- d) An additional item has been included under Section 3.6 Site Visits which highlights that there may be a requirement to visit the site at a particular time to suit traffic patterns.
- e) The Methodology or audits Section has been reworded for clarity.
- f) Risk Matrix information has been removed.
- g) Sample Stage F and Stage 3 audits have been included in the Appendices and a sample Exceptions Report has also been included.

Contents Table

1. Introduction	1
1.1 General	1
1.2 History and Background	1
1.3 Scope of Audit	1
1.4 Stages of Audit	2
1.5 Scheme Categories	2
2. Road Safety Principles	5
2.1 General Safety Principles	5
2.2 Designing for the Road User	6
2.3 Roadway Elements and Safety.....	6
2.4 Road Features.....	7
2.5 Forgiving Roadsides.....	8
3. Road Safety Audit Process	10
3.1 Procedure on National Roads.....	10
3.2 Procedure elsewhere.....	10
3.3 Audit Brief	10
3.4 Audit Team Make-up	12
3.5 Audit Team Approval For Schemes on National Roads.....	12
3.6 Site Visits	12
3.7 Checklists	13
3.8 Road User Role Play	13
3.9 Methodology for Audits	13
3.10 Methodology for Design Stage Audits.....	14
3.11 Methodology for Stage 3 Audits.....	14
3.12 Pre-Stage 3 Audits.....	15
3.13 Methodology for Stage 4 Audits.....	16
3.14 Audit Report.....	16
3.15 Audit Report Problems and Recommendations	17
3.16 Stage F Audit Report	18
3.17 Designer's Response.....	18
3.18 Re-audit	20
3.19 Exception Report	20
3.20 Audit Completion	21

4. Road Safety Audit Issues	23
4.1 Costs and Benefits.....	23
4.2 Risk Assessment	23
4.3 Auditing Development Schemes.....	24
5. References.....	26
5.1 TII Publication (Standards)	26
5.2 TII Publication (Technical)	26
5.3 Other Publications	26
Appendix A:	27
Sample Auditor’s Checklist	27
Appendix B:	32
Sample Road Safety Audit Report Stage F Part 1	32
Appendix C:	59
Sample Road Safety Audit Report Stage 3.....	59
Appendix D:	80
Sample Exception Report & Decision	80

1. Introduction

1.1 General

These Guidelines should be read in conjunction with TII Publication GE–STY–01024 Road Safety Audit. All necessary definitions for these Guidelines are detailed in Section 1 of the associated Standard GE–STY–01024.

1.2 History and Background

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

Since then the concept grew over the years from an informal check of new schemes to the current system of Road Safety Audit as an essential integral part of design and construction procedures.

Since the year 2000 Road Safety Audit has been a part of NRA and TII standards and has been a requirement on all schemes on national roads. Since 2011 there has been a legal requirement for Road Safety Audit on the Trans European Network – Transport (TEN-T) as EU Directive 2008/96/EC on Road Infrastructure Safety Management was adopted in Ireland as Statutory Instrument No. 472 of 2011, European Communities (Road Infrastructure Safety Management) Regulations 2011.

1.3 Scope of Audit

TII Standard GE-STY-01024 sets out the procedures required to implement Road Safety Audits on national roads. It defines the requirement for audit and the stages in design and construction at which audits shall be undertaken. On national roads, Road Safety Audits must be carried out in accordance with TII Standard GE-STY-01024.

These guidelines are intended for use on all road schemes to which the TII Standard GE-STY-01024 applies. These are all schemes on national roads which result in new road construction or permanent change to the existing road or roadside layout.

The primary purpose of a Road Safety Audit is to identify potential safety hazards within the scheme design or construction as they could affect road users by changing road user behaviour or by changing the outcome of an incident involving an errant vehicle. Road Safety Audits should consider road safety under all operating conditions and for all road users.

The way in which the road layout influences the road user is crucial. Collisions occur due to road users failing to cope with their road environment. Although this can often be due to carelessness or impairment, their ability to cope and the severity of the outcome can be influenced for good or ill by basic design elements, forgiving roadsides and by the signs and markings that provide information and warning.

A Road Safety Audit is not a check of compliance with design standards, nor is it concerned with structural safety.

Road Safety Audit relates principally to future operational safety of the scheme, and is not primarily concerned with matters that are principally covered by the Safety, Health and Welfare at Work Act and its Regulations. However all Road Safety Audit reports for a scheme are received by the Project Supervisor for the Design Process for that scheme, and 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 more practicable to implement if identified at the earlier stages of the Road Safety Audit process, during the early phases of design.

1.4 Stages of Audit

Road Safety Audits and subsequent actions are in general completed at specific stages in the preparation of the scheme. These stages are:

- **Stage F:** Route selection stage;
- **Stage 1:** Completion of preliminary design;
- **Stage 2:** Completion of detailed design;
- **Stage 1 & 2:** Completion of detailed design, for small schemes where only one design stage audit is appropriate;
- **Stage 3:** Completion of construction;
- **Stage 4:** Early operation.

Not all of the above stages are necessary for each scheme. Some of the stages may be omitted depending on the type, size and complexity of a scheme. Table 1.1 provides an indication of requirement of audit stage for sample scheme types.

The procedure for each stage of audit is discussed in detail in Section 3.

1.5 Scheme Categories

Road Scheme. A scheme which results in new road construction or permanent change to the existing road or roadside layout.

Development Scheme. A scheme which results in a change to the road or roadside layout that is initiated and/or executed for commercial or private development.

Table 1.1: Examples of scheme type and audit stage requirement

No Audit is required on like-for-like repair or replacement of existing road infrastructure		
	Example Scheme Description	
Pavement Improvements	Pavement repair such as patching, edge strengthening which does not result in widening the carriageway, inlay works with similar materials.	No Audit Required
	Pavement overlay which does not change the cross section, vertical alignment, camber or superelevation	No Audit Required
	Surface rejuvenation such as mechanical abrasion etc.	No Audit Required
	Surface dressing of an existing carriageway	No Audit Required
Signing & Road Markings	Replacement of a worn road sign with a new road sign of the same type	No Audit Required
	Replacement of a damaged road sign with a new road sign of the same type	No Audit Required
	Refreshment of existing worn road markings	No Audit Required
	Replacement of worn or missing road studs	No Audit Required
Safety Barrier	Replacement of a length of damaged safety barrier with barrier of the same or similar type.	No Audit Required

Audit is required on any piece of road infrastructure which requires a design							
	Example Scheme Description	Audit Stages Required					
		X – Required (X) – Alternative to St1 and St2					
		F	1	2	1 & 2	3	4
New Alignment	Off-line road scheme with multiple options.	X	X	X		X	X
	On-line road scheme – Minor land take required		X	X		X	
	On-line road scheme – No land take required				X	X	
	New junction or access onto the road		X	X	(X)	X	
Realignment	Realignment of bend				X	X	
	Realignment of junction				X	X	
	Alteration of type of junction control, such as traffic signals, mini roundabout etc.				X	X	
	Sight line Improvements				X	X	
Pavement Improvements	Change to the existing cross section, widening or narrowing the pavement				X	X	
	Change to the existing vertical alignment				X	X	

Audit is required on any piece of road infrastructure which requires a design							
	Example Scheme Description	Audit Stages Required					
		X – Required (X) – Alternative to St1 and St2					
		F	1	2	1 & 2	3	4
	Change to the existing pavement which affects the horizontal or vertical alignment of public or private entrances				X	X	
	Change to existing camber or superelevation				X	X	
Signing & Road Markings	Installation of road signs: Single installation, multiple installations, or addition or amendment to sign on existing supports				X	X	
	Installation of road markings which results in a change to the existing road marking layout and/or its meaning				X	X	
Safety Barrier	Installation of new safety barrier				X	X	
	Upgrade to an existing safety barrier				X	X	
	Upgrade of an existing terminal				X	X	
	Replacement of an entire safety barrier installation				X	X	
Kerbing & Footpaths	Installation of kerbs in the verge and/or hard shoulder				X	X	
	Installation of kerbs in the centre of the pavement		X	X	(X)	X	
	Installation of kerbs and footpaths				X	X	
	Installation of pedestrian crossing, both informal and formal crossing points		X	X	(X)	X	
Lighting	Installation of traffic route lighting				X	X	
	Change to the lighting level and type of existing lighting				X	X	
Development	Major development, meeting the criteria in NRA Traffic and Transportation Assessment Guidelines Table 2.2	X	X	X		X	X
	Any development that is not a major development				X	X	

2. Road Safety Principles

2.1 General Safety Principles

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 collision occurrence and severity

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. TII Standard GE-STY-01024 requires the auditor to be able to produce reasoning for identified problems. The source of some of the information provided below is the Austroads Guide to Road Safety Part 6: Road Safety Audit.

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:

- a) Does the design layout create confusion or ambiguity for road users that could lead to potential road traffic collisions?
- b) Is there too much or too little information for road users?
- c) Is there too little or too much visibility, or an obstruction to road users' view?
- d) 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:

- a) provide adequate information for road users of the layout and conditions ahead;
- b) provide adequate warning of hazards or unusual layouts ahead;
- c) provide positive control of road users' passage through conflict points or unusual sections;
- d) provide a road performance that can "forgive" road users' errors or inappropriate behaviour.

Advance information and warning should be used to inform road users of the layout ahead. However, driver overload should be avoided as it may cause road users to focus too much on the unimportant data and shed vital information. Conflicting information, an overabundance of road signs or a lack of delineation can cause overload.

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

- a) provides clear, concise and phased release of road user information;
- b) provides a consistent standard of road design and traffic control;
- c) 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 road user are ignored. The vulnerable road users that need to be considered include, but are not limited to, the following:

- a) pedestrians – the old, young and those with mobility or sight impairment;
- b) cyclists – children, everyday cyclists, tourists and leisure cyclists;
- c) equestrians;
- d) 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 and convenient 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 heavy goods vehicles, buses or other specialist vehicles.

To assist in the determination and needs for all road users, it is essential that traffic data and local road 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 there are external factors in each environment which are beyond the Designer's control. This can create a situation in which a design that would be safe in one environment could be unsafe in another environment. These external 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.

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. Junction Type should be consistent throughout a route, or sections of a route with similar traffic volumes. The junction type should be appropriate for the expected mainline and turning movement flows such that risk and severity of a collision is minimised.

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. 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 tight on each entry; this ensures a slow entry and lower circulating speed and facilitates crossing pedestrians.

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 such as signs 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 less relevant.

In rural areas the principal factors affecting the safety of road links are:

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

2.4 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.

2.4.1 Cut-off former alignments

Where new road alignments create short sections of redundant links on the former alignment, these sections of “old” road can lead to serious misjudgement by drivers if they are left untreated. The width and features of the former road can mislead drivers into the belief that they are on a major route, encouraging high speeds. Such drivers will not be anticipating any road closure or road realignment leading to a new junction, and may lose control upon reaching them. Road widths should be reduced, junctions realigned, and road markings and signs replaced to reflect the change in standard of road.

2.4.2 Lane width

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.

2.4.3 Hard shoulder

On high speed links with few junctions or accesses, there is a safety benefit to be gained by the provision of a hard shoulder.

2.4.4 Parked vehicles

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

- a) parked vehicles causing physical obstructions which are sideswiped or run into;
- b) vehicles slowing down or reversing to park causing sudden braking or nose-to-tail shunts;
- c) parked vehicles which deflect oncoming vehicles into adjacent vehicle paths;
- d) parked vehicles blocking visibility for any road user;
- e) parked vehicles between which pedestrians emerge.

To reduce the risk of parked vehicles contributing to a collision it is important that designs should minimise parking in traffic lanes and hard shoulders and in proximity to junctions.

2.4.5 Roadside vegetation

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

2.5 Forgiving Roadsides

Analysis of fatal road collisions in the European Union show that 45% are single-vehicle collisions. These collisions are primarily classified as run-off-road collisions, where the vehicle leaves the road and enters the roadside. (P.4, Forgiving roadsides design guide, CEDR, November 2012)

In these collisions a high proportion of vehicles that leave the roadside go on to strike trees, fences, lighting columns, road structures or other items of unprotected street furniture.

A primary consideration when designing a road is to minimise the hazards to which the motorist is exposed. This can largely be achieved by removing the hazards from the immediate roadside through careful design. The width of land which should be kept clear of hazards so as to be available for use by errant vehicles is termed the Clear Zone. Details of Clear Zone widths are available in the TII Design Standard DN-REQ-03034.

Post and rail fences have been identified as a hazard when in close proximity to the roadside due to rails being able to penetrate a vehicle that impacts the fence. Post and rail fences within the Clear Zone should be treated as hazards and as such should be mitigated. A Post and Tension Mesh Fence Standard Construction Detail (CC-SCD-00320 & 00321) has been developed as an alternative to timber post and rail fence within the Clear Zone.

A hierarchy of treatment is set out in DN-REQ-03034 to minimise the consequence of this type of collision, and the order of preference for mitigation measures is as follows:

- a) Remove the hazard.
- b) Relocate the hazard.
- c) Re-design the hazard to reduce the risk to road users, such as by introducing a passively safe sign post.
- d) Revise the road layout or cross-section to lower the risk, such as by increasing the width of the hard shoulder, improving the road alignment, etc.
- e) Reduce impact severity, by means such as using a breakaway feature or setting a culvert flush with the existing ground.
- f) Provide a suitable safety barrier.

3. Road Safety Audit Process

3.1 Procedure on National Roads

The requirements for carrying out Road Safety Audit on national roads are described in the TII Standard GE- STY -01024.

This Section describes the Road Safety Audit process in detail, and the flowchart in Figure 3.1 shows the critical steps in the process for audits of schemes on national roads. The same process applies to all road schemes, whether designed by the Employer and/or by the Contractor. In the interest of brevity the process described here is for road schemes designed by the Employer.

3.2 Procedure elsewhere

International Standards can be found (amongst others) in the UK, Australia, New Zealand and Denmark.

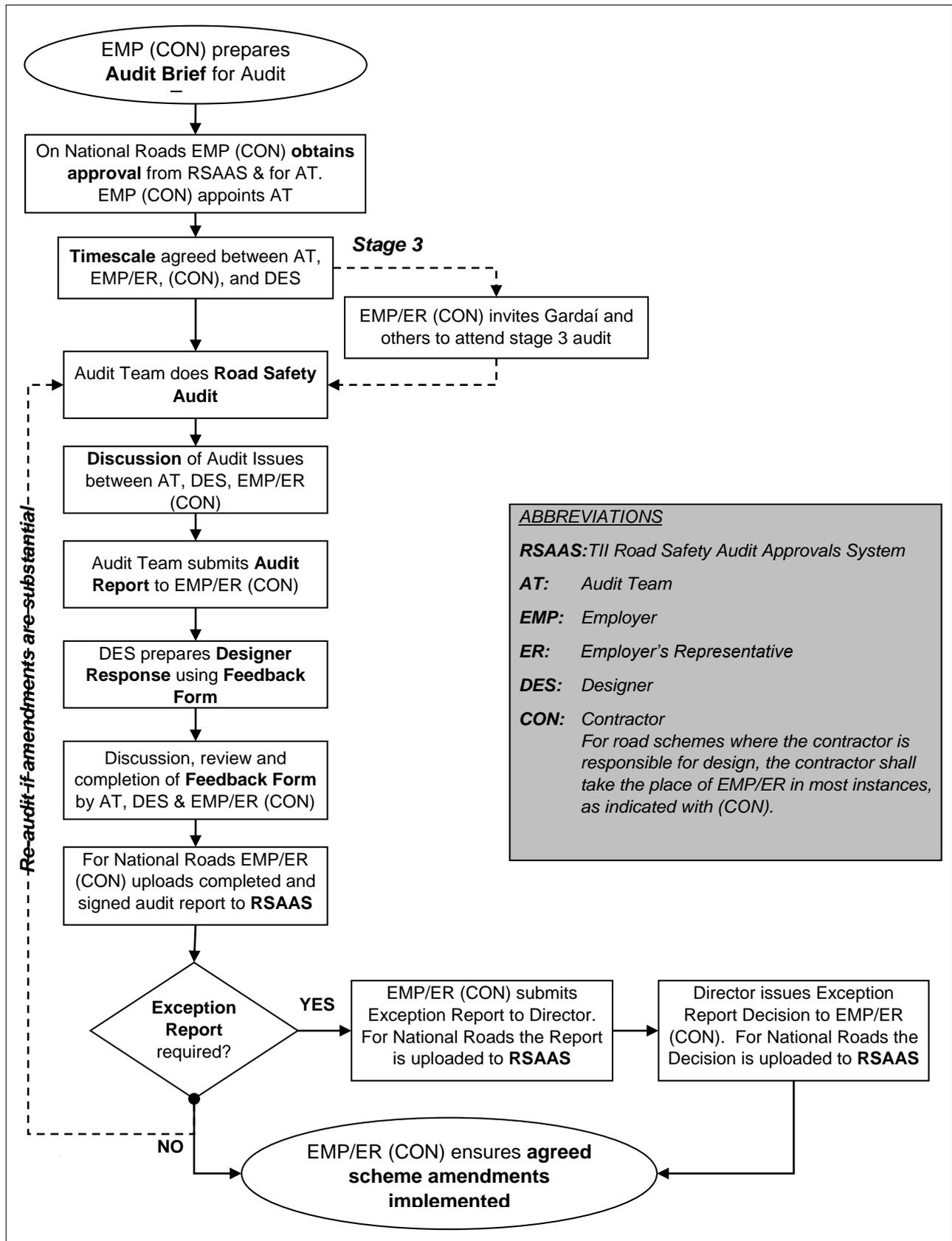
3.3 Audit Brief

The Employer shall prepare an audit brief describing the audit required and the works that it will cover.

The list below describes the necessary information that should be provided for each Road Safety Audit, where relevant.

- a) Design Brief or design report that describes the scheme and objectives;
- b) Departures from Standard;
- c) Scheme Drawings;
- d) Other scheme details, e.g. signs schedules, traffic signal staging;
- e) Collision data for existing roads affected by the scheme;
- f) Traffic surveys, including pedestrian and cycle movements, for existing roads affected by the scheme;
- g) Previous Road Safety Audit Reports and Designer Responses /Feedback Form
- h) Previous Exception Reports;
- i) Date Audit Report is required;
- j) Any other relevant information.

Figure 3.1 Road Safety Audit process flow chart for National Road schemes



3.4 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.

In most situations the Audit Team will comprise a senior person who will adopt the role of Audit Team Leader and a second person, who will be the Audit Team member.

All members of the team should have recent relevant experience of undertaking Road Safety Audits and should also have more general road safety engineering experience.

Training of Road Safety Auditors is essential and each member of the Audit Team should have attended the road safety engineering training and Road Safety Audit training courses necessary for their position in the team.

The current TII training and experience requirements for Road Safety Audit Teams are subject to change and are set out in GE-STY-01025 Road Safety Audit - Audit Team Qualifications available to download from the TII publications website.

3.5 Audit Team Approval For Schemes on National Roads

For schemes on or affecting national roads, TII approval is necessary for the Road Safety Audit team for each stage of audit completed on the scheme. It is the responsibility of the Employer to obtain approval for the Audit Team for each audit. The scheme, and each audit for that scheme, must be registered on the TII Road Safety Audit Approvals System (RSAAS) at <https://web.nra.ie/safetyaudits/>.

For each audit the Employer must seek approval through RSAAS for the proposed Audit Team. Acceptance will be of individuals, rather than of consultancy firms bidding for the work, and it should be noted that each stage of audit is a single audit. Audit Team Approval cannot be obtained for an audit before the previous stage of audit for that scheme has been completed and all full Road Safety Audit Reports, each including Feedback Form and Exception Report, if applicable, have been uploaded to RSAAS.

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.

It is recommended that where possible the same Audit Team is used throughout the scheme delivery to ensure a consistent approach.

3.6 Site Visits

A site visit shall be carried out at the first audit stage being undertaken by an Audit Team. Site visits shall also be carried out at Stage 2, unless otherwise agreed with the Employer, and always at Stage 3 and Stage 4. These shall be carried out by all members of the Audit Team at every stage requiring a site visit. The team shall 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 and Stage 4 site visits shall be made during both daylight and darkness. The Employer's Representative is responsible for ensuring that TII Road and Tunnel Safety Section (infosafety@tii.ie) is notified of the dates of the Stage 3 and Stage 4 site visits, and that representatives of An Garda Síochána and those responsible for network management are invited to attend the Stage 3 and Stage 4 site visits, and given reasonable notice to attend.

It may be necessary to make more than one site visit during the day, particularly if traffic patterns or other factors are markedly different at different times of day. A site near a school, for instance, would warrant a visit at dropping off and picking up times, as well as during less busy times.

3.7 Checklists

An example of a Road Safety Audit checklist is shown in **Appendix A**. Road Safety Auditors may use this or an equivalent list when carrying out their work. Checklists should be used intelligently, and not simply as a “tick box” system. If used, it is recommended that they are consulted at the end of the process, as an aid to confirm that no major potential safety issue has been overlooked.

3.8 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.

3.9 Methodology for Audits

Stage F is undertaken at the feasibility stage of scheme design, which corresponds with Phase 2 of project management as set out in TII Publication PE-PMG-02041 Project Management Guidelines. A Stage F audit will examine several options for a scheme and assess the potential road safety problems for each option. The Stage F audit report is in 2 parts, the first one ranking the options in terms of road safety impact, and the second part reviewing the problems of the chosen option. The report on Stage F Part 1 forms an input to the scheme's option selection process.

Stage 1 is undertaken at preliminary design stage, which corresponds with Phase 3 of project management. The recommendations from a Stage 1 audit may necessitate extra landtake that was not previously envisaged as required. Therefore completion of the Stage 1 audit, and the consequent agreed changes to the scheme design, must take place before any statutory process such as compulsory purchase.

Stage 2 is undertaken on the detailed design, when all details of the scheme are available, such as signing, drainage, safety barrier location, and staging of traffic signals. For schemes designed by the employer, this audit must take place before the tender of a construction contract. For schemes constructed under a Design & Build contract, the Stage 2 audit must take place before construction.

On smaller schemes it is often more practicable to do only one Design Stage audit, combining Stage 1 and Stage 2. As this will be the only Road Safety Audit on the design it is important to ensure that the audit team are given all the information needed to assess the scheme before it goes to construction. The level of detail in the design submitted for a Stage 1&2 audit is therefore required to be the same as that expected for a Stage 2 audit.

In practice the Design and Build model of design construction does not require a scheme to be designed in its entirety before construction can start. Design and construction of a scheme can be divided into sections, each with its own separate timeline of progress, and consequently the Stage 2 Road Safety Audit will be done a section at a time as each section is designed. The Stage 3 Road Safety Audit will also be done a section at a time as each section is constructed.

As construction progresses these separate audits should be collated, giving a final completed Stage 2 safety audit report once all design is complete and a final completed Stage 3 safety audit report once all construction is complete.

3.10 Methodology for Design Stage Audits

The following describes a suggested working method for carrying out a Design Stage Audit, at Stage F, Stage 1, the combined Stage 1 & 2, or Stage 2.

- a) The Audit Team looks through drawings and other information to understand the scheme concept.
- b) Consideration should be given to clarifying the audit brief through a meeting between the Audit Team, the Employer and the Designer, particularly on larger or more complex schemes.
- c) The Audit Team visits the site. The weather and any other relevant circumstances should be recorded.
- d) Each team member systematically and independently examines all drawings and other information provided and records any comments.
- e) The team members discuss their individual findings.
- f) 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 in the auditors own records, together with a reason stating why that issue is not to be included.
- g) One team member produces a draft audit report. The report format is discussed in more detail in 3.14 – 3.16.
- h) The other Audit Team members check the report and edit if necessary.
- i) If required, the Audit Team Leader attends a meeting with the Designer and Employer to discuss the draft report.
- j) The Audit Team submits the report to the Employer.

3.11 Methodology for Stage 3 Audits

The following describes a suggested working method for carrying out a Construction Stage Audit, at Stage 3.

- a) The Audit Team visits the site during daylight.
- b) The Audit Team drives, walks and cycles the route as appropriate.
- c) One team member takes notes of all the possible safety issues.
- d) Another team member takes photographs of all the possible safety issues.
- e) Before leaving the site a team meeting is held to ensure that the note-taker has covered all safety issues.
- f) The Audit Team visits the site during darkness; walking driving and cycling as appropriate.
- g) One team member produces a draft audit report and circulates it to all present at the site visit.

- h) As there is often pressure to open new road schemes as soon as they are completed it may be possible to provide the Employer's Representative with a copy of the notes taken during the stage 3 visit, or a brief summary list, shortly afterwards. The Employer's Representative may find it convenient to start to act upon these notes prior to receiving the formal stage 3 audit report.
- i) The report is edited following comments from the other team members and observers.
- j) If required, the Audit Team Leader attends a meeting with the Designer and Employer's Representative to discuss the draft report.
- k) The Audit Team submits the report to the Employer.

At Stage 3 it is recommended that the Employer's Representative should be available for consultation with the Audit Team as required on the day of the audit.

At any construction stage audit the organisation responsible for future road maintenance, either road authority, PPP consortium or other organisation may also want to send a representative.

The Gardaí may have specific local information and knowledge of safety issues. The Garda District Superintendent should be notified in advance of any construction stage audit and given the opportunity to either send a representative to meet the Audit Team on the day of the audit or submit comments to the Audit Team.

At Stages 3 and 4 it is the responsibility of the Employer's Representative where relevant to notify the Gardaí and other observers of the audit. The TII Road and Tunnel Safety Section should also be notified by the Employer's Representative of the proposed dates of the construction stage audits.

Observers to the construction stage audits are not part of the Road Safety Audit Team and thus do not sign the audit report, but their presence should be recorded.

In the case of greenfield road alignments, particular care should be taken in examining the tie-ins to the existing alignment, the treatments to cut-off sections of the existing alignment and any road closures, as there may be difficulty in seeing clearly how these sections will operate after road opening. For road schemes that are to have a Stage 4 audit, these areas will be seen at that stage in operation, but for those smaller schemes for which a Stage 4 audit is not required, it may be necessary to return immediately after opening to complete the Stage 3 audit by examining the tie-ins in operation.

3.12 Pre-Stage 3 Audits

For larger schemes it may be convenient to carry out a pre-Stage 3 audit shortly before completion. This is because there is often pressure to open new road schemes as soon as they are completed, and recommendations in the stage 3 audit might take some time to implement. It also might prevent costly removal or relocation of some components such as signs and safety barriers.

If the recommendations from the pre-Stage 3 audit are acted upon, then both final Stage 3 audit and implementation of its recommendations, will be less onerous.

Separate Audit Team Approval is not needed for a pre-Stage 3 as it should be performed by the approved team for Stage 3. These items can be recorded either within the Stage 3 Audit Report or as a separate pre-Stage 3 Audit Report. If these items are recorded in a separate pre-Stage 3 report, then this report must be included in the Final Stage 3 Audit Report submitted to the Designer.

3.13 Methodology for Stage 4 Audits

The following describes a suggested working method for carrying out an Early Operation Stage audit, at Stage 4.

- a) The Audit Team reviews all available information on collisions since scheme opening. It will be likely that there are no available records, but there may be information on incidents available from the organisation responsible for maintenance.
- b) The Audit Team visits the site during daylight, walking, driving and cycling the entire scheme, including affected side roads, as appropriate.
- c) The Audit Team notes any evidence of collisions or of vehicles leaving the road.
- d) The Audit Team observes road user behaviour for a period. This should be done throughout the scheme at any location that is considered critical, such as those that have been highlighted in previous Road Safety Audit reports, or those where collisions or incidents have occurred. Particular attention should be paid to the tie-ins to the existing road network at the edges of the scheme. To allow for changes in traffic flows through the day it may be necessary to make these observations at more than one visit.
- e) One team member takes photographs of all the possible safety issues.
- f) The Audit Team visits the site during darkness; walking, driving and cycling as appropriate.
- g) One team member produces a draft audit report and circulates it to all present at the site visit.
- h) The report is edited following comments from the other team members and observers.
- i) If required, the Audit Team Leader attends a meeting with the Designer and Employer's Representative to discuss the draft report.
- j) The Audit Team submits the report to the Employer.

3.14 Audit Report

After carrying out a Road Safety Audit a formal report is written. The following items should be included within the audit report:

- a) A brief description of the scheme being audited, and the audit stage;
- b) The dates when the audit was carried out (and the date of the site visit);
- c) The weather and road conditions during the site visit;
- d) A list of the Audit Team members and any other personnel attending the site visit;
- e) A series of road safety problems and recommendations for action;
- f) Graphical aids to show the location and nature of each problem; such as photographs or a snapshot of the relevant part of the design drawing;
- g) An overall plan of the scheme showing the location of each problem;
- h) A statement signed by the Audit Team members to certify that they have examined the scheme and that they are independent of the Designer;
- i) For national road schemes, the RSAAS confirmation of Audit Team approval from TII;

- j) For design stage audits, a list of all plans and other information examined;
- k) Feedback Form for completion by the Designer, Employer and the Audit Team Leader.

3.15 Audit Report Problems and Recommendations

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 Road 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 a meeting between Audit Team, Designer and Employer is used as the primary means to discuss the relative importance of issues raised within the draft report.

Recommendations should not be overly prescriptive. The Audit Team should word recommendations so that the Designer has some choice in the measures to be implemented. It is possible that the Designer can devise an amendment to the design that has not occurred to the Audit Team, yet overcomes the potential safety problem. The essential matter is not that a certain measure be implemented but that the problem be removed.

Recommendations should be as practical as possible and be appropriate in relation 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.

It must be recognised that the implementation of certain measures such as a change to design standards or policy will be outside the authority of the Designer and Employer. 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.

Sample Road Safety Audit Reports are shown in **Appendices B and C**.

3.16 Stage F Audit Report

Stage F is done in two separate parts, Stage F Part 1 and Stage F Part 2. Each part generates a report, and a Stage F report is only completed when both Part 1 and Part 2 reports are completed.

The following items should be included within the Part 1 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);
- The weather and road conditions during the site visit;
- A list of the Audit Team members and any other personnel attending the site visit;
- Each potential problem identified for each option;
- A discussion on the extent to which each problem affects each option;
- A summary, preferably in a table format, of the extent to which each problem affects each option;
- A prioritised list of the options based on preference from a road safety perspective.

The Part 2 report is written up only for the chosen or preferred option, and follows the usual format of a design stage audit report.

3.17 Designer's Response

The recipient of a Road Safety Audit report will be the Employer who, in consultation with the Designer, will have to decide whether or not to act on the recommendations contained within the report.

The Employer and Designer consider the report and the Designer, in consultation with the Employer, provides a Designer's response. The recommended form of Designer's response is a Feedback Form, as shown in Figure 3.2.

The response from the Designer shall state clearly whether each problem is accepted and whether each recommendation is accepted.

In most cases both problem and recommendation will be accepted and the Employer will instruct the Designer to make changes in response to the audit report. In the case of acceptance of a problem, yet rejection of the associated recommendation, the Designer should propose an alternative recommendation to address the problem. If it is not possible to fully address a safety issue because of external factors beyond the Employer's control then these reasons should be given, along with any alternative mitigating measures that could be implemented.

If the Designer does not accept that an issue is a safety problem at all, then reasons for this should be given.

The Audit Team then review the Designer's Response and for each rejected problem or recommendation the Audit Team Leader shall indicate on the Feedback Form whether the alternative proposal or reasons are accepted.

The Audit Team may view a problem differently in the light of new information given by the Designer in feedback. The team may also accept that an alternative recommendation given by the Designer will have a genuine safety benefit. In each of these cases the team should indicate acceptance of these reasons or alternative recommendations in the feedback form.

3.18 Re-audit

Where the agreed measures include major changes, it may be necessary to carry out a re-audit of that part of the scheme. The need for this should be discussed between the Audit Team Leader and Designer, and if it is agreed that a re-audit is necessary then this should be carried out as soon as practicable. The need for this should be rare; the TII Road and Tunnel Safety section should be consulted for advice if there is any doubt.

The audit report for the re-audit should be added to the original audit report as an annex, and any issues raised should go through the design response procedure as normal.

3.19 Exception Report

For those cases where the Designer and the Audit Team cannot agree appropriate means of addressing an underlying safety problem identified by the audit, an Exception Report must be prepared as indicated in Table 3.1.

Table 3.1: Feedback Form Responses, Requirement for Exception Report

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

The Exception Report should be prepared by the Employer. 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 Designer accepts an identified problem, but Designer 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 Designer does not accept that the identified problem exists, the Exception Report should produce some evidence as to why the problem is not valid.

While the Road Safety Auditor concentrates on road safety issues, the Employer will have to weigh up the various consequences of implementing the recommendations within the audit report.

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

- a) Large conspicuous road signs are generally a good idea from a safety point of view, but they can have an adverse effect on visual intrusion;
- b) Street lighting generally improves road safety but has implications for light pollution;
- c) Multi-lane approaches to roundabouts can have a poor safety record and do not provide for pedestrians, but will reduce traffic delays.

When writing an Exception Report, it should be noted that both the Road Safety Audit Report and Exception Report could be used in future litigation. A sample Exception Report is provided in **Appendix D**.

Exception Reports must be sent to the Director of the funding authority and Overseeing Organisation for decision. For schemes on national roads, the Exception Report is uploaded to RSAAS by the Employer.

The final decision to accept or reject the disputed problem or recommendations rests with the funding authority for the scheme. For national road schemes, this is TII.

The Exception Report Decision Form, given in Figure 3.3, must be returned to the Employer for action on the decision. It should also be distributed to all interested parties; the Designer, the Employer's Representative and the Audit Team Leader.

For schemes on National Roads the Exception Report Decision Form is uploaded to RSAAS by TII so that all reports for an individual audit are available together.

Figure 3.3 Road Safety Audit exception report decision form

Road Safety Audit Exception Report Decision Form		
Scheme:		Route No.
Audit Stage:	TII Project Ref. No (If TII scheme)	Date of Audit
Exception Report Item	Paragraph No. in Road Safety Audit Report	Decision by Director Accept or Reject Exception Report from Employers Representative

Signed: _____ Director of Overseeing Organisation: _____ Date: _____

3.20 Audit Completion

The audit stage is completed when there is a Final Completed Road Safety Audit Report and a completed Exception Report Decision Form for each Exception Report item required.

A Final Completed Road Safety Audit Report will include:

- a fully signed Audit Team Statement
- a fully completed and signed feedback form as described in 3.16.

Completion of this process for a Stage 3 audit is required prior to any new section of road being opened to traffic without the presence of temporary roadworks traffic management.

It is important to ensure that the report from each stage of Road Safety Audit is received by the relevant Project Supervisor for the Design Process for the scheme, and placed within the Safety File.

Designer, Employer's Representative and Audit Team Leader should all be provided with a copy of the Completed Road Safety Audit Report and all Exception Reports and Decisions. For national road schemes this distribution will be completed through RSAAS.

It is up to the Employer to ensure that all the finally agreed recommendations from the Road Safety Audit are implemented.

4. Road Safety Audit Issues

4.1 Costs and Benefits

The costs attributed to a Road Safety Audit can be divided into two distinct components.

- a) 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 Chartered Institute of Highways & Transportation (CIHT) found that the average time taken to complete an audit was 25 hours.
- b) 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.

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 collision 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.

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 collision 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 problems being identified by auditors.

4.2 Risk Assessment

A Road Safety Auditor may sometimes identify 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, Designer and Employer 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 Employer to help decide whether or not to implement the recommendations.

4.3 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.

If a new access is required for the development, or the Traffic and Transport Assessment indicates that an existing access or junction needs improvements, or that pedestrian or cycle facilities need improvement, then a Road Safety Audit will be required.

Many Road and Planning Authorities request 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 five stages of Road Safety Audit are summarised in Table 4/2. Whether all these stages are necessary depends on the size and impact of the development concerned.

Table 4/2: Road Safety Audit Stages

Stage F:	Preplanning, concept stage
Stage 1:	Completion of preliminary design
Stage 2:	Completion of detailed design
Stage 3:	Completion of construction.
Stage 4:	Early operation.

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.

Where a road safety audit has been carried out on a development this does not imply that all the road safety issues associated with that development have been addressed. It is essential that the Road Safety Audit process is completed, and all final recommendations of the Road Safety Audit report are implemented, in order to ensure mitigation of any safety problems identified in the audit. Discussions in preplanning and the use of planning conditions provide methods of ensuring that the development complies fully with the TII Publications road design standards and Government objectives to maintain road safety.

Conditions on a planning permission may be used to ensure implementation of the recommendations of a Road Safety Audit. Note that deferring the requirement for an Audit to a post decision planning condition is highly inappropriate and does not allow for the full road safety implications of a development to be addressed.

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

- a) 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.
- b) 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 TII Standard GE-STY-01024 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.
- c) Note; all costs associated with the implementation of the Road Safety Audit recommendations shall be borne by the developer/scheme promoter.

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

- a) The development is not permitted because following 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.

5. References

5.1 TII Publication (Standards)

TII Publications, GE-STY-01024 Road Safety Audit, 2017.

5.2 TII Publication (Technical)

TII Publications, GE-STY-01025 Road Safety Audit – Audit Team Qualifications, 2017.

5.3 Other Publications

NRA Traffic and Transportation Assessment Guidelines, 2014.

Austrroads Publications, Guide to Road Safety Part 6, Road Safety Audit, 2009

Institution of Highways and Transportation, Road Safety Audit Guidelines, 1996

Appendix A: Sample Auditor's Checklist

Sample Auditor's Checklist

Source: Road Safety Audit Guidelines, Institution of Highways & Transportation, 1996

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;

Location of junctions in relation to horizontal and vertical alignments;

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;

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 HGV drivers as well as car drivers.

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

Checklist for Stage 2 provides an appropriate aide memoire

Checklist for Stage 4 - Post-opening

General

The main emphasis is to view the scheme in operation and to inspect particularly all tie-ins and cut off roads from the viewpoint of all road users.

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

Checklist for Stage 2 provides an appropriate aide memoire.

Appendix B:

Sample Road Safety Audit Report Stage F Part 1

N101 Whitehall to Carrickhill

Stage F Part 1 Road Safety Audit

N101 Whitehall to Carrickhill

Stage F Part 1 Road Safety Audit

October 2016

Final

Page 1 of 26

Table of Contents

1.0	Introduction	3
2.0	Items arising from the audit	6
3.0	Preference of design options (Stage F Part1 Road Safety Audit)	19
4.0	Audit Team Statement	22

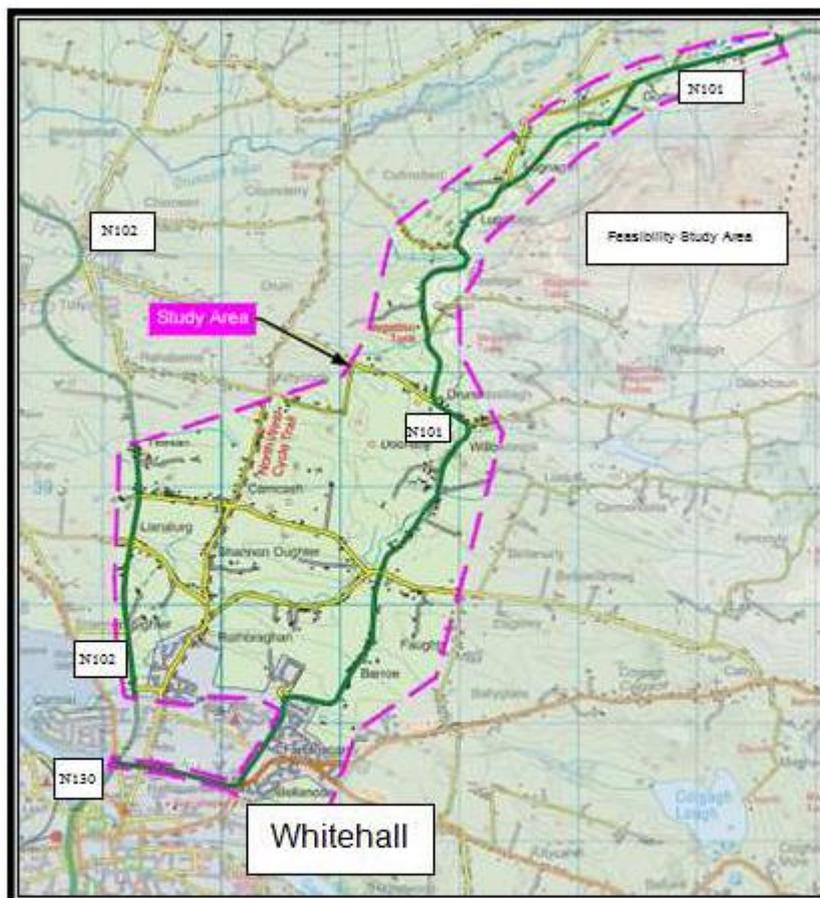
APPENDICES

Appendix A	List of drawings and other information examined
Appendix B	Approval of Safety Audit Team

1 INTRODUCTION

1.1 Location

This report describes Part 1 of a Stage F, Feasibility Road Safety Audit, carried out on the proposed N101 Whitehall to Carrickhill in Co. Blackford.



Map 1: Scheme Location

1.2 Audit Team

The audit team members were as follows:

Edward O'Connor	Woodford NRO	Team leader
Damian McGrath	Woodford NRO	Team member
Mary Hassett	Woodford NRO	Team member

1.3 Audit Information

The audit comprised an examination of the drawings supplied by Blackford County Council and one site visit. The audit site visit was carried out during the day on 20th of October 2016. The weather conditions were generally dry and bright.

This Stage F Part 1 Road Safety Audit has been carried out in accordance with the requirements of TII GE-STY-01024. The proposed route options for the scheme have been examined and this report compiled in respect of the consideration of those matters that may have an adverse effect on road safety. It has not examined or verified the compliance with any other standard or criteria. All options presented would provide a significant improvement to safety on this section of the N101. The overall number and severity of identified problems as well as overall safety considerations of each route option has advised the comparative safety ranking of these schemes in this report.

In consultation with Blackford County Council, of the eight route option/sub-options presented at public consultation in July 2016, five route options (sub-options) were reviewed under this audit.

Of the five options, two are distinctly bypass routes. All others are online realignment/improvements. The routes are designated by colour.

The routes audited are Red, Yellow, Blue, Brown and Black/Brown.

The audit team has provided an overall relative grading of these route options.

1.4 Description of scheme

The Scheme is on the N101 which links Whitehall, Porthall and Blackwood. The existing section of the N101 covered by this audit runs from Oaklane/N130/N102 junction near Ropers Bridge in Whitehall town to the county boundary with Woodford at Carrickhill. It has an overall length of approximately 10km.

The Scheme proposes an upgrade to the existing N101 route, which has poor existing geometry.

The scheme is proposed as a Type 2 single carriageway, with a two-way shared pedestrian and cycle facility alongside for certain sections. The scheme proposes pedestrian and cycle facilities wherever the proposed alignment is online, and on those offline sections where there is no viable or appropriate alternative route for cyclists and pedestrians on the existing bypassed road network.

1.5 Information provided to Audit Team

Drawings detailing the proposed route options were provided. Detail of this information is included in Appendix A. Discussions with the design team have taken place in advance and throughout the process of the audit. Five principal options were provided for review.

It is understood that the number of options in consideration by Blackford County Council has subsequently been reduced to three, but this does not affect this audit, nor its finding. This audit report presents all five routes as provided and reviewed at the time of audit.

2.1.1 Roundabout 1 Red (R1R)

Problem

Roundabout 1 is located on the N102 approximately 2.7km from the urban area / Ropers Bridge. This location is rural in character and a junction of this type might not be expected.

Hazard

Vehicles may approach this junction at high speed.

2.1.2 T-Junction 1 (TJ1R)

Problem

This junction is on an offline section of new road. This new junction may result in considerable turning movements at this location due to it being a possible alternative access to town, for traffic not wishing to bypass the town.

Currently there is congested development in the vicinity of this proposed junction. There are also direct private accesses in close proximity to the junction. These factors will provide difficulty for both safe design and construction. The local road is also unlikely to be of sufficient standard to carry this additional traffic and no details have been provided of any improvements with respect to this road. The existing connecting N101 road is also substandard and further improvements may be required on existing junctions in order to improve safety.

Hazard

Additional turning movements on the new road and incorporating existing roads and private direct accesses in the vicinity of the junction could result in head-on, rear end and right turn collisions.

2.1.3 T Junctions 3, 4, 5 (TJ3R, TJ4R, TJ5R)

Problem

T junctions 3, 4 and 5 are in close proximity to each other. From examination of the plans provided there are possible opportunities for rationalisation.

Hazard

Frequent additional turning movements, general movement across the new road and the frequency and proximity of these junctions may result in an increased risk of head-on, rear end and right turn collisions.

2.1.4 Road Closures

Problem

The new road results in the closure of 8 existing roads. At each of these there will be issues regarding see-through and safe termination.

Hazard

Unexpected terminations and see-through may result in collisions with new road embankment/cut areas, especially at night.

2.1.5 Cyclist/Pedestrian Facilities

Problem

The proposed combined Pedestrian/Cycle track and the existing cycle track on the bypassed network interface at three locations, all of which are at grade junctions, where cyclists have to negotiate crossing roads, in one case crossing the mainline.

Hazard

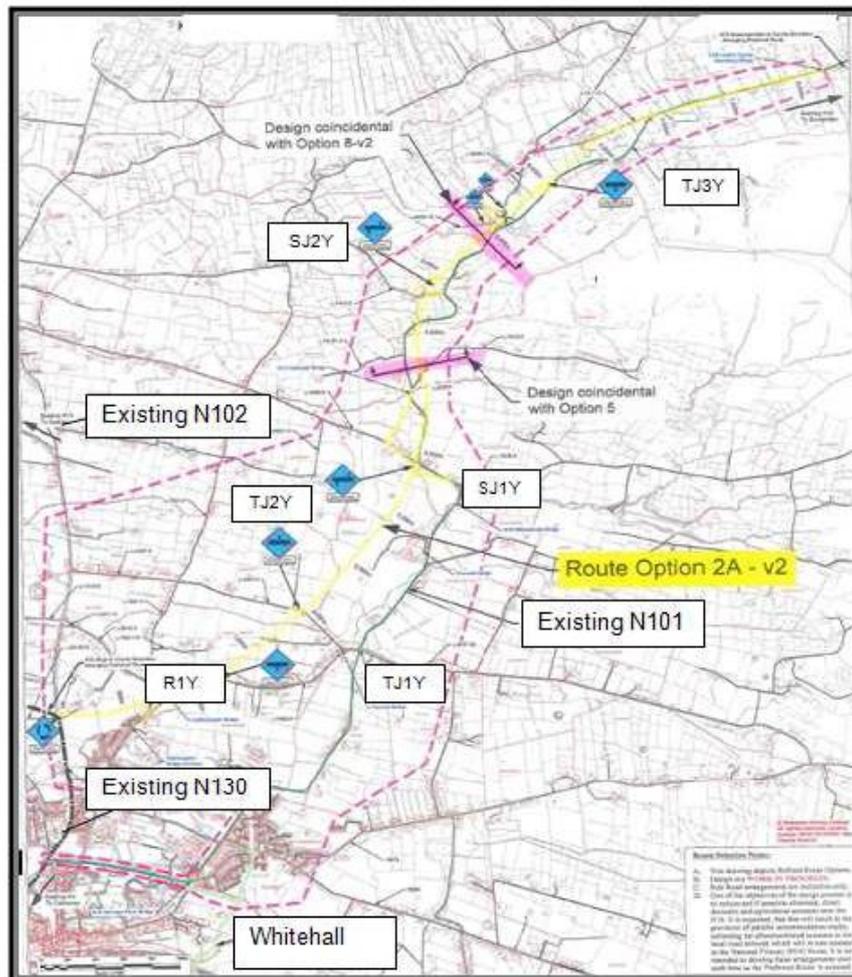
This may lead to conflict between cyclists, pedestrians and motorised road users at these locations, in particular where cyclists will have to cross the proposed new route. These conflicts are likely to result in serious injury.

2.2 Option 2: Yellow Route (Y)

The overall length is 8.2km.

The scheme includes online and offline sections. Of the 3.2km online sections, 1.7km is at the urban southern end and the remainder is at the county boundary tie-in. The plans allow for new and existing junction upgrade. 6.5km of the route is rural. There are no departures.

For the first 3km of the route, from roundabout 1 (R1Y) to Staggered Junction two (SJ2Y), an adjacent combined cycleway/ footpath facility is provided. For the remainder of the route, from Staggered Junction two (SJ2Y) to the tie in point, the existing network is used to facilitate cyclists and pedestrians.



Map 3: Yellow Route

2.2.1 N102 Approach to Roundabout 1 (R1Y)

Problem

Roundabout 1 is on the N102 and it will have a steep downhill Northern approach on N102.

Hazard

Traffic may approach this roundabout at excessive speed. This may lead to side impact collisions from overrun onto the roundabout and rear end collisions from late or sudden braking.

2.2.2 Access at Roundabout 1 (R1Y)

Problem

There is a proposed private access in close proximity to the northern access to Roundabout 1.

Hazard

This access may cause unexpected turning movements on the busy N102 resulting in side impact or rear end collisions.

2.2.3 T-Junction 1 and 2 (TJ1Y, TJ2Y)

Problem

T-junctions 1 and 2 are in close proximity to each other. The interconnection of roads to an underbridge allowing access under the bypass route and staggered junction 1 (SJ1Y) are also in this area. The spacing of these junctions is short enough for them to be rationalised and combined.

Hazard

Frequent additional turning movements and general movement across the new road may result in head-on, rear end and right turn collisions.

2.2.4 T Junctions 3 (TJ3Y)

Problem

This junction is close to the proposed staggered junction 2 (SJ2Y), and an opportunity may exist to rationalise the junctions in this area, possibly utilising junction 2 (SJ2Y).

Hazard

Frequent additional turning movements and general movement across the new road may result in head-on, rear end and right turn collisions.

2.2.5 Road closures

Problem

The new road results in the closure of 12 existing roads. At each of these there will be issues regarding see-through and safe termination.

Hazard

Unexpected terminations and see-through may result in collisions with new road embankment/cut areas, especially at night.

2.2.6 Cyclist/Pedestrian Facilities

Problem

The proposed combined Pedestrian/Cycle track and the existing cycle track on the bypassed network interface at three locations, all of which are at grade junctions, where cyclists have to negotiate crossing roads, in one case crossing the mainline.

Hazard

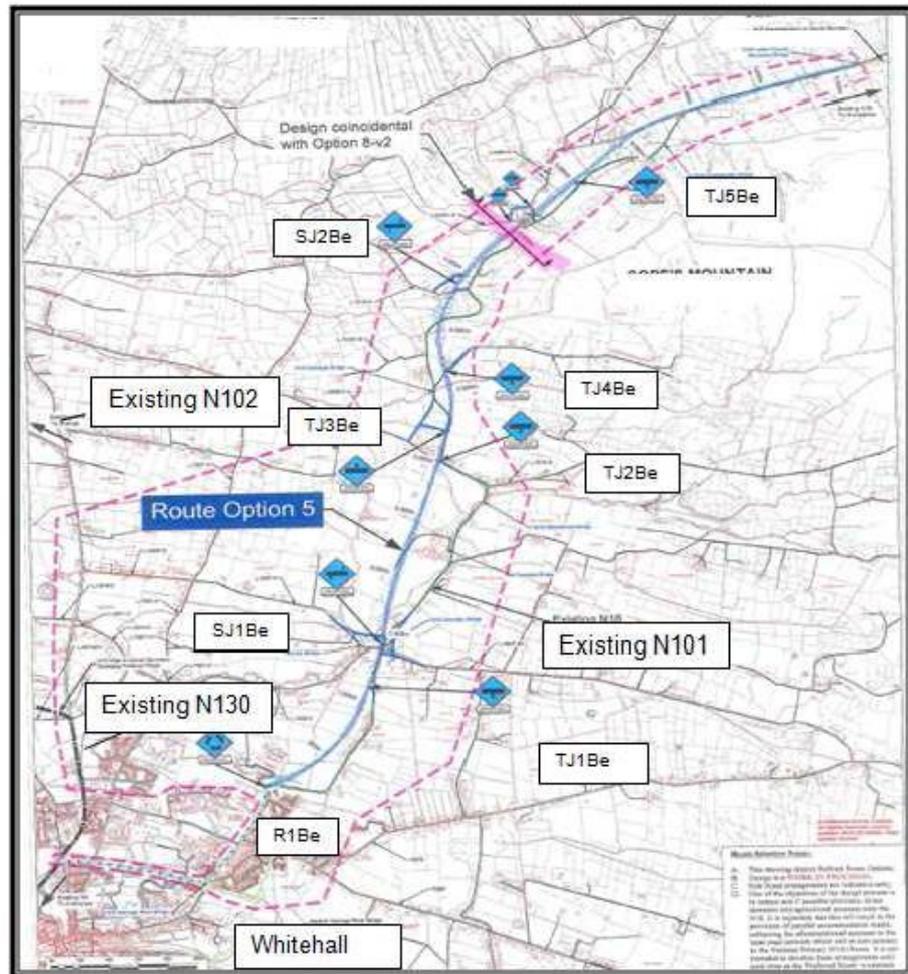
This may lead to conflict between cyclists, pedestrians and motorised road users at these locations, in particular where cyclists will have to cross the proposed new route. These conflicts are likely to result in serious injury.

2.3 Option 3: Blue Route (Be)

The overall length is 7.7km.

Approximately 6.2km is offline with 1.5km online at the tie-in with Carrickhill. The plans allow for new and existing junction upgrade. There are no departures.

The pedestrian/cyclist facility plans for the Blue Route use the existing N101 network for the first 3km of the route (from roundabout 1 (R1Be)) up to T junction two (TJ2Be), where it moves to the proposed route as an adjacent combined Pedestrian/Cycle facility up to Staggered Junction two (SJ2Be). For the remainder of the route, from Staggered Junction two (SJ2Y) to the tie in point, the cycle route returns to the existing network.



Map 4: Blue Route

2.3.1 Staggered Junctions (SJ1Be and SJ2Be)

Problem

Staggered junction 1 is at a challenging location regarding gradients; it is likely that high embankments and therefore associated safety provisions will be required in the design at this location.

Hazard

Inadequate protection measures at this location may cause traffic to leave the road or to be redirected into oncoming traffic, leading to potentially fatal injuries.

2.3.2 T-Junction 2, TJ2Be

Problem

Over a short length of the new realigned N101 there are several junctions accessing the new road. These junctions are at a spacing short enough for them to be rationalised and combined, possibly using the staggered junction 1 (SJ1Be) as the sole or principal access.

Hazard

Frequent additional turning movements and general movement across the new road may result in head-on, rear end and right turn collisions.

2.3.3 T-Junction 5 and Staggered Junction 2 (TJ5Be and SJ2Be)

Problem

These junctions are in close proximity to each other. With the additional proximity and interconnection of the existing road network in the vicinity, it appears that there are opportunities for rationalisation of these 2 Junctions.

Hazard

Frequent additional turning movements and general movement across the new road may result in head-on, rear end and right turn collisions.

2.3.4 Road closures

Problem

The new road results in the closure of approximately 13 existing roads. At each of these there will be issues about see-through and safe termination.

Hazard

Unexpected terminations and see-through may result in collisions with new road embankment/cut areas, especially at night.

2.3.5 Cyclist/Pedestrian Facilities

Problem

The proposed combined Pedestrian/Cycle track and the existing cycle track on the bypassed network interface at three locations, all of which are at grade junctions, where cyclists have to negotiate crossing roads, in two cases crossing the mainline.

Hazard

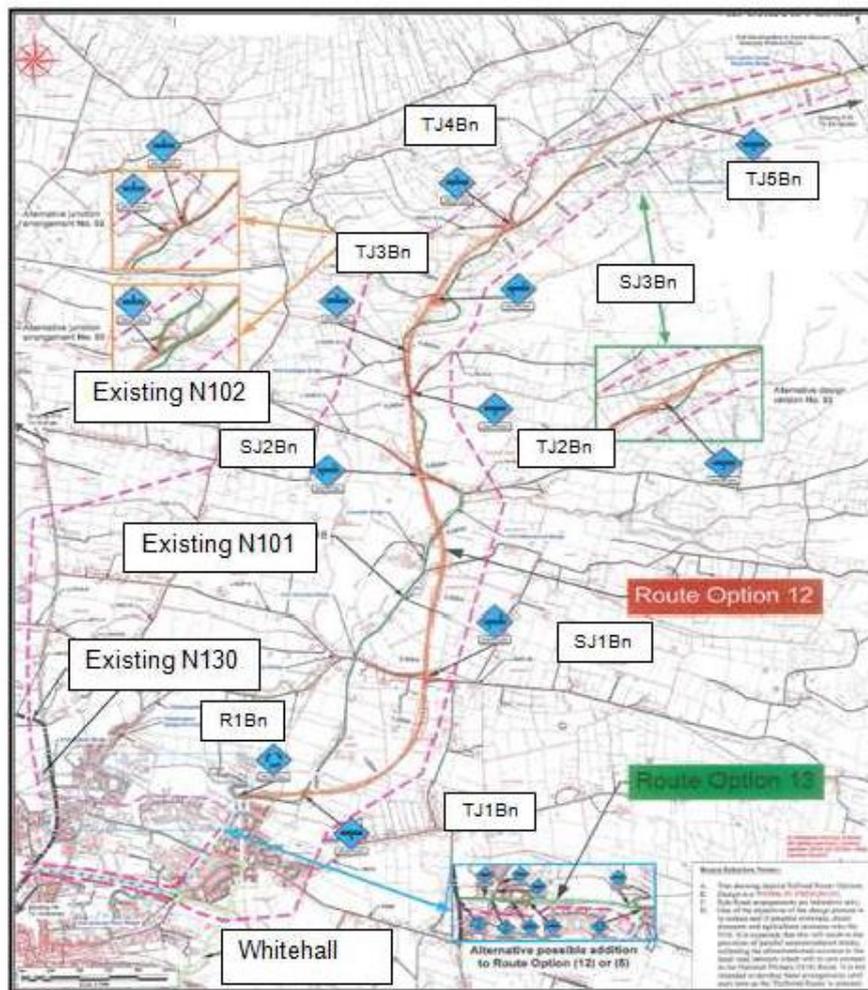
This may lead to conflict between cyclists, pedestrians and motorised road users at these locations, in particular where cyclists will have to cross the proposed new route. These conflicts are likely to result in serious injury.

2.4 Option 4: Brown Route (Bn)

The overall length is 8.3km

The scheme includes online and offline sections. Of the total length, 1.5km is online at the tie-in with Carrickhill. The plans allow for new and existing junction upgrade. There is one departure relating to the Horizontal Curve.

The pedestrian/cyclist facility plans for the Brown Route use the existing N101 network for the first 3km of the route, from roundabout 1 (R1Bn) to Staggered junction two (SJ2Bn). For the remainder of the route to the tie in point an adjacent combined cycleway/ footpath facility is provided on the proposed route.



Map 5: Brown Route

2.4.1 Staggered Junctions 3 and T Junctions 2, 3 and 4 (SJ3Bn, TJ2Bn, TJ3Bn TJ4Bn)

Problem

These junctions are all in close proximity to each other. Opportunities for rationalisation should be examined.

Hazard

Frequent additional turning movements and general movement across the new road may result in head-on, rear end and right turn collisions.

2.4.2 Road closures

Problem

The new road results in the closure of approximately 15 existing roads. At each of these there will be issues concerning see-through and safe termination.

Hazard

Unexpected terminations and see-through may result in collisions with new road embankment/cut areas, especially at night.

2.4.3 Staggered Junction 1 (SJ1Bn)

Problem

Staggered junction 1 is at a challenging location regarding gradients; it is likely that high embankments will need to be integrated into the design. Adequate protection for all road users need to be incorporated into the design at this location.

Hazard

Inadequate protection measures at this location may cause traffic to leave the road or to be redirected into oncoming traffic, leading to potentially fatal injuries.

2.4.4 Cyclist/Pedestrian Facilities

Problem

The proposed combined Pedestrian/Cycle track and the existing cycle track on the bypassed network interface at three locations, all of which are at grade junctions, where cyclists have to negotiate crossing roads, in two cases crossing the mainline.

Hazard

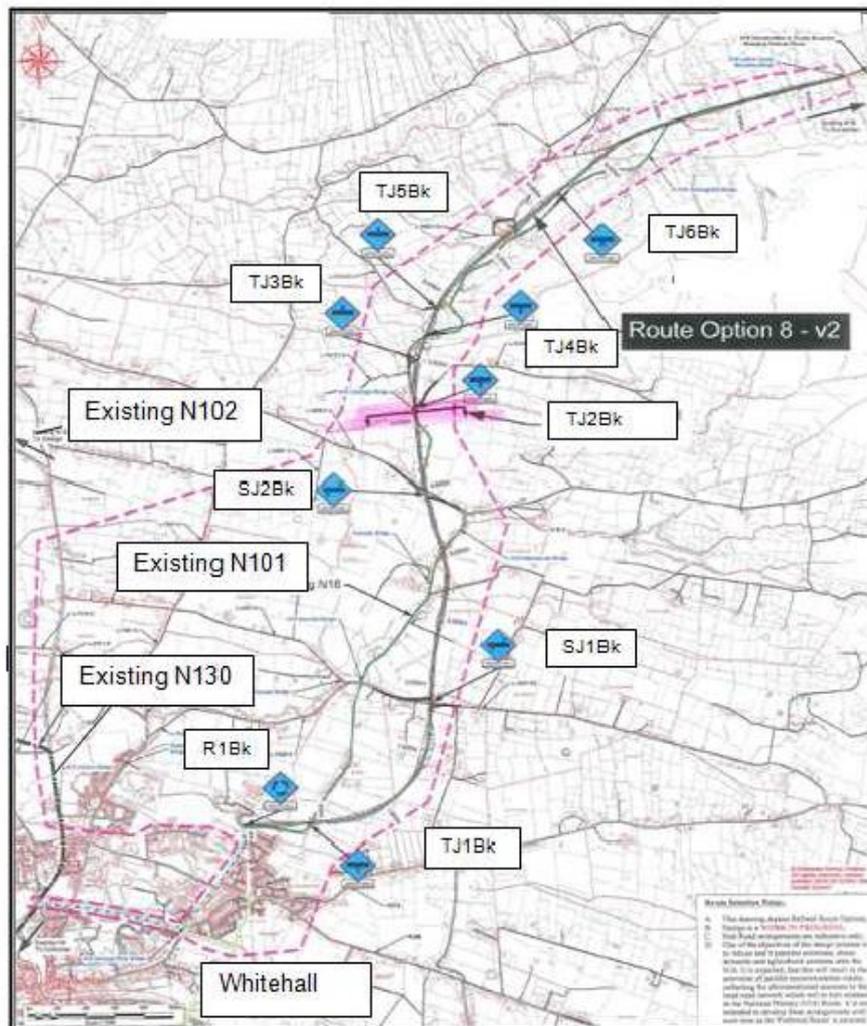
This may lead to conflict between cyclists, pedestrians and motorised road users at these locations, in particular where cyclists will have to cross the proposed new route. These conflicts are likely to result in serious injury.

2.5 Option 5: Black Route (Bk)

The overall length is 8.2km

The scheme includes online and offline sections. Of the total length, 1.5km is online at the tie-in with Carrickhill. The plans allow for new and existing junction upgrade. There are no departures.

The pedestrian/cyclist facility plans for the Black Route use the existing N101 network for the first 3km of the route, from roundabout 1 (R1Bk) to Staggered junction two (SJ2Bk). For the remainder of the route to the tie in point an adjacent combined cycleway/ footpath facility is provided on the proposed route.



2.5.1 T Junctions 4, 5 and 6 (TJ4Bk, TJ5Bk, TJ6Bk)

Problem

These junctions are all in close proximity to each other and appear to have opportunities to allow the number of junctions to be rationalised.

Hazard

Frequent additional turning movements and general movement across the new road may result in head-on, rear end and right turn collisions.

2.5.2 Road closures

Problem

The new road results in the closure of approximately 14 existing roads. At each of these there will be issues concerning see-through and safe termination.

Hazard

Unexpected terminations and see-through may result in collisions with new road embankment/cut areas, especially at night.

2.5.3 Cyclist/Pedestrian Facilities

Problem

The proposed combined Pedestrian/Cycle track and the existing cycle track on the bypassed network interface at three locations, all of which are at grade junctions, where cyclists have to negotiate crossing roads, in two cases crossing the mainline.

Hazard

This may lead to conflict between cyclists, pedestrians and motorised road users at these locations, in particular where cyclists will have to cross the proposed new route. These conflicts are likely to result in serious injury.

3 PREFERENCE OF DESIGN OPTIONS

Following on from the safety concerns outlined in the previous section this is a summary of the main points/issues identified on each option.

3.1 Red Route

The Red Route is the shortest with the least number of junctions and local/existing road closures.

The location of the roundabout 2.7km from Ropers Bridge is not ideal, it is unexpected in a rural location on a 100kph section.

Traffic to and from Whitehall town is not likely to use the red route west of Junction TJ2R, and is likely to divert to the local road network, which is not of sufficient standard to carry this additional traffic.

This option provides linkages to other strategic roads planned in the area.

This route has the shortest proposed new pedestrian/cycle facility with 3 locations where there is an interface with side roads or the existing N101 network.

3.2 Yellow Route

The Yellow Route has the least amount of T-Junctions and has one of the fewest number of road closures.

The approach to the first roundabout from the northern direction is on a steep downward gradient.

As this route is closer to the existing N101 route and Whitehall town it is more likely that traffic to and from the town will use the improved route rather than use the retained existing route.

Modifications to this route could provide similar traffic pattern to the eastern realignment options, while offering more benefits for strategic traffic when compared to the red route.

This option provides linkages to other strategic roads planned in the area.

This route proposes a mix of a new pedestrian/cycle facility and use of existing network, with 3 locations where there is an interface with side roads or the existing N101 network.

3.3 Blue Route

The Blue Route is the second shortest route and has fewer junctions than other eastern realignment options.

There are opportunities to further rationalise junctions with some link road proposals and/or utilisation of the existing network.

Detailed design of the staggered junctions, in particular SJ1Be, may present difficult challenges because of the level differences between the existing and proposed

alignments anticipated in their vicinity. There is a danger that safety might be compromised in addressing these difficulties.

This route proposes a mix of a new pedestrian/cycle facility and use of existing network, with 4 locations where there is an interface with side roads or the existing N101 network.

3.4 Brown Route

The Brown Route is the longest with the most junctions and local/existing road closures.

Many of the junctions are in close proximity to each other.

Compared to other routes there are fewer opportunities, if any, for rationalisation.

Detailed design of the staggered junction SJ1Bn, may present difficult challenges because of the level differences between the existing and proposed alignments anticipated in its vicinity. There is a danger that safety might be compromised in addressing these difficulties.

This route proposes a mix of a new pedestrian/cycle facility and use of existing network, with 4 locations where there is an interface with side roads or the existing N101 network.

3.5 Black Route

The Black Route is very similar to the brown route however with slightly fewer local/existing road closures.

There are several junctions in close proximity to each other but there appears to be some opportunity for rationalisation.

Detailed design of the staggered junctions, may present difficult challenges because of the level differences between the existing and proposed alignments anticipated in their vicinity. There is a danger that safety might be compromised in addressing these difficulties.

This route proposes a mix of a new pedestrian/cycle facility and use of existing network, with 4 locations where there is an interface with side roads or the existing N101 network.

3.6 Ranking of Route Options

The Safety Audit team carried out a full review of all relevant drawings and documents in relation to the developed route options. In addition the team visited the site.

The main safety considerations in comparing the routes at this preliminary stage included overall length, number, type and arrangement of junctions, general impact and interface with the existing network, potential design issues and other potential residual risks.

A summary of some of the comparative items reviewed is given below Table 3.1.

- The comparison of junctions is based on clustering, type and location of junctions;
 - how many junctions are clustered in close proximity (Low = fewer clusters)
 - where opportunities exist for rationalisation (Low = more opportunity)
 - whether at grade or grade separated (Low = more appropriate)
- The interface with existing network is a count of the road closures and interfaces where screening or diversion measures will be required.
- The VRU impact takes into account Length of new Pedestrian /Cycle shared facilities and no. of interfaces for pedestrian and cyclists with the existing network.
 - percentage on new route (Low = high percentage)
 - number of interface locations (Low = fewer locations)

OPTION	Ref.	Length(km) (Online)	No of Junctions	Location and Type of junction	Interface with existing network	VRU Impacts
Red	R	7.6 (4.2)	6	Medium	8	Low
Yellow	Y	8.2 (3.2)	6	Low	12	Low
Blue	Be	7.7 (1.5)	8	Medium	13	Medium
Brown	Bn	8.3 (1.5)	9	Medium	15	Medium
Black	Bk	8.2 (1.5)	9	High	14	Medium

Table 3.1 Comparative advantages /disadvantages (non-exhaustive/selected)

The audit team has concluded that the route option proposals, as provided, rank as shown in the table below in terms of road safety.

The ranking shown in Table 3.2 is purely a relative grading of the route options with respect to each other. All the proposed options represent a significant improvement to the existing poorly aligned N101 and a potential significant improvement to safety on that route.

OPTION	Ref.	RANK
Yellow	Y	1
Blue	Be	2
Red	R	3
Brown	Bn	4
Black	Bk	5

Table 3.2 OPTION RANKING

N 101 Whitehall to Carrickhill

Stage F Part 1 Road Safety Audit

4 AUDIT TEAM STATEMENT

We certify that we have examined the drawings and other information listed in Appendix A and visited the site during the day of the 20th of October 2016. We further certify that we are independent from the design team for the scheme. 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 a preferred option.

Signed EPO'Connor Edward O'Connor

date 4/11/16

signed Damian McGrath Damian McGrath

date 4/11/16

signed Mary Hassett Mary Hassett

date 4 Nov '16

N101 Whitehall to Carrickhill

Appx A

Stage F Part 1 Road Safety Audit

APPENDIX A

LIST OF DRAWINGS AND OTHER INFORMATION EXAMINED:

Final

Appx A

N101 Whitehall to Carrickhill

Appx A

Stage F Part 1 Road Safety Audit

Drawings

N101 Whitehall to Carrickhill

Route Options		101006/RSA1.1	11/08/16
Red Route, Plan and Profile	Sheet 1 of 4	101006/RSA2.1	04/08/16
Red Route, Plan and Profile	Sheet 2 of 4	101006/RSA2.2	04/08/16
Red Route, Plan and Profile	Sheet 3 of 4	101006/RSA2.3	04/08/16
Red Route, Plan and Profile	Sheet 4 of 4	101006/RSA2.4	04/08/16
Yellow Route, Plan and Profile	Sheet 1 of 4	101006/RSA3.1	04/08/16
Yellow Route, Plan and Profile	Sheet 2 of 4	101006/RSA3.2	04/08/16
Yellow Route, Plan and Profile	Sheet 3 of 4	101006/RSA3.3	04/08/16
Yellow Route, Plan and Profile	Sheet 4 of 4	101006/RSA3.4	04/08/16
Blue Route, Plan and Profile	Sheet 1 of 4	101006/RSA4.1	04/08/16
Blue Route, Plan and Profile	Sheet 2 of 4	101006/RSA4.2	04/08/16
Blue Route, Plan and Profile	Sheet 3 of 4	101006/RSA4.3	04/08/16
Blue Route, Plan and Profile	Sheet 4 of 4	101006/RSA4.4	04/08/16
Brown Route, Plan and Profile	Sheet 1 of 4	101006/RSA5.1	04/08/16
Brown Route, Plan and Profile	Sheet 2 of 4	101006/RSA5.2	04/08/16
Brown Route, Plan and Profile	Sheet 3 of 4	101006/RSA5.3	04/08/16
Brown Route, Plan and Profile	Sheet 4 of 4	101006/RSA5.4	04/08/16
Black Route, Plan and Profile	Sheet 1 of 4	101006/RSA6.1	04/08/16
Black Route, Plan and Profile	Sheet 2 of 4	101006/RSA6.2	04/08/16
Black Route, Plan and Profile	Sheet 3 of 4	101006/RSA6.3	04/08/16
Black Route, Plan and Profile	Sheet 4 of 4	101006/RSA6.4	04/08/16

Other Information

Existing Network Forecast Traffic Flows 2017 and 2037	101006/EIS4.2	May 2016
---	---------------	----------

Final

Appx A

N101 Whitehall to Carrickhill

Appx B

Stage F Part 1 Road Safety Audit

APPENDIX B

APPROVAL OF ROAD SAFETY AUDIT TEAM

Final

Appx B

N101 Whitehall to Carrickhill

Appx B

Stage F Part 1 Road Safety Audit

Thomas O'Mara
Blackford County Council
Whitehall
Co. Blackford

Date: 25/08/2016

Our Ref: 9XXXXX/52XX/Stage F

re: N101 Whitehall to Carrickhill

APPROVAL OF ROAD SAFETY AUDIT TEAM, Stage F

Dear Thomas O'Mara,

The following members of the proposed road safety audit team are approved to carry out the Stage F road safety audit of N101 Whitehall to Carrickhill.

1. Edward O'Connor - Woodford NRO - Leader
2. Damian McGrath - Woodford NRO - Member
3. Mary Hassett - Woodford NRO - Leader

A copy of all audit reports, design team response and exception reports must be uploaded through RSAAS. Successful upload of these reports and completion of the audit approval process is necessary for any further audit approval on this scheme.

Yours sincerely,

Regional Road Safety Engineer
roadsafetyaudits@tii.ie

Final

Appx B

Appendix C:

Sample Road Safety Audit Report Stage 3

N99/R100 Junction Signalisation, Coolmore, Co. Blackford

Stage 3 Road Safety Audit

N99 / R100 Junction Signalisation Phase 2 of Traffic Calming, Coolmore Co. Blackford

Stage 3 Road Safety Audit

March 2017

Final

Page 1 of 20

Table of Contents

1	INTRODUCTION	3
2	ITEMS ARISING FROM THE AUDIT	5
3	AUDIT TEAM STATEMENT	14
4	ROAD SAFETY AUDIT FEEDBACK FORM	15

APPENDICES

Appendix A **List of drawings and other information examined**

Appendix B **Approval of Safety Audit Team**

1 INTRODUCTION

1.1 Location

This report describes a Stage 3 Audit carried out on Phase 2 of the Coolmore Traffic Calming Scheme on the N99 in Coolmore, Co. Blackford. This phase of the scheme involves signalisation of the N99/R100 Junction. The scheme is located within a 50km/h speed limit section of the National Primary Road.

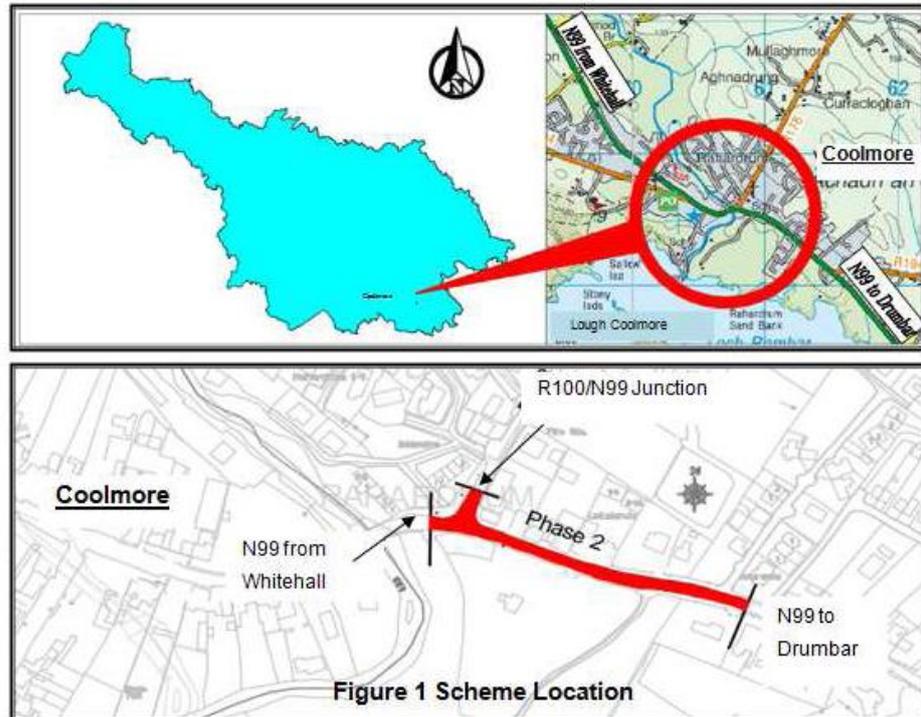


Figure 1 Scheme Location

1.2 Audit Team

The audit team members were as follows:

Mary Hassett	Woodford NRO	Team leader
Jonathon Duffy	Woodford NRO	Team member
Philip McCarthy	Blackford Co. Co.	Observer

1.3 Audit Information

The audit comprised an examination of the drawing relating to the scheme, prepared and supplied by Blackford County Council, and two site visits. The audit site visits were

carried out both at day and at night on Wednesday the 22nd March 2017. The weather conditions were dry with showers for both of the site visits. The Garda Síochána were notified prior to conducting the Audit, but no representative from Garda Síochána was available to attend.

While the scheme was completed and operational at the time of the Audit some additional lining is being proposed by Blackford County Council. This work is not yet complete but is planned for implementation imminently and the design has been examined as part of the Audit.

This Stage 3 Road Safety Audit has been carried out in accordance with the requirements of TII GE-STY-01024 – Road Safety Audit. The scheme has been examined and this report compiled in respect of the consideration of those matters that may have an adverse effect on road safety. It has not examined or verified the compliance with any other standard or criteria. The problems identified in this report are considered to require action in order to improve the safety of the scheme and minimise collision occurrence.

Each item identified in the Audit is outlined in Section 2 below, along with recommendations to mitigate the issue in question.

If any of the recommendations within this road safety audit report are not accepted, a written response is required, stating the reasons for non- acceptance.

1.4 Description of Scheme

The scheme works primarily consist of the introduction of a traffic signalled junction to control the traffic movements at a busy junction on the N99 in Coolmore, Co. Blackford.

The major elements of the works include the widening of the existing junction to provide traffic signals to control the movement of traffic. It also involves the provision of new, footpaths, stone wall, signs and lines.

1.5 Information provided to Audit team

The Signalisation of the N99/R100 Junction Drawings were provided to the audit team. Details of this information and of the Stage 1/2 Road Safety Audit are included in Appendix A.

A meeting with Blackford County Council design team took place in advance of this Audit and discussions and clarifications continued throughout the audit.

2 ITEMS ARISING FROM THE AUDIT

2.1 Lane demarcation within junction

Problem

Due to no lane demarcation within the junction, particularly on the Drumbar arm, vehicles can straddle the positions for both straight ahead and right turning traffic, failing to pass over the present loop and leading to rear end shunts, side impacts, bad positioning and confusion for drivers.



Item 2.1

Recommendation

Blackford County Council has provided drawings of proposed road markings to address this problem. See Sketch 14032017 REV A, provided in Appendix A. These proposed road markings should be provided.

2.2 Surface ironworks

Problem

Ironworks both in carriageway and on footpaths are either loose or not sitting correctly. This could lead to tripping for pedestrians and falls for cyclists or motorcyclists on the carriageway. It may also cause other vehicles to take evasive action in an inappropriate location.



Item 2.2

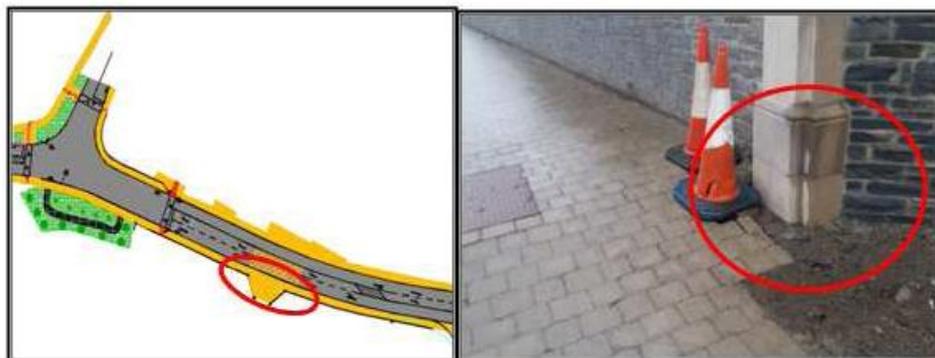
Recommendation

All ironworks should be checked and fixed accordingly. The photographs show examples only, and the check should not be confined to these locations.

2.3 Unfinished works at entrance

Problem

At entrance to Coolmore Veterinary Hospital the back of footpath tie in is not finished. This could lead to pedestrians falling or tripping at this location.



Item 2.3

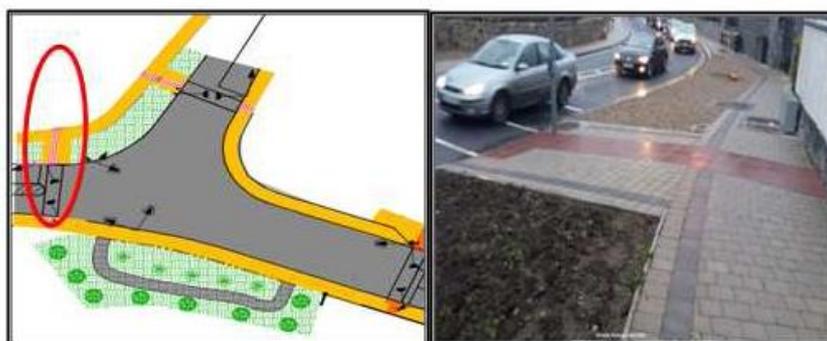
Recommendation

Tie in should be completed.

2.4 Steep gradient on footpath at crossing point

Problem

On the north side of the pedestrian crossing on the Coolmore town side of the junction the pedestrian approach to the crossing appears to have a steep decline from the footpath to the crossing point. This may cause difficulty in crossing at this point for those who are mobility impaired, leading to conflicts with vehicles on the carriageway.



Item 2.4

Recommendation

This gradient should be checked and an alternative arrangement which provides an appropriate gradient should be provided if necessary.

2.5 Height of dropped kerb

Problem

Dropped kerb is high on the Letterborough Road (R100) at the end of the west side footpath. This may lead to a trip hazard and may cause difficulty for mobility impaired pedestrians.



Item 2.5

Recommendation

It is recommended that the kerb height appropriate to pedestrian access is provided at this location.

2.6 Width of tactile paving

Problem

The tactile paving provided at the Letterborough Road pedestrian crossing is wider on the east side of the road than it is on the west side, which may lead to a visually impaired pedestrian crossing from east to west being guided into the pole for the lights on the west side.



Item 2.6

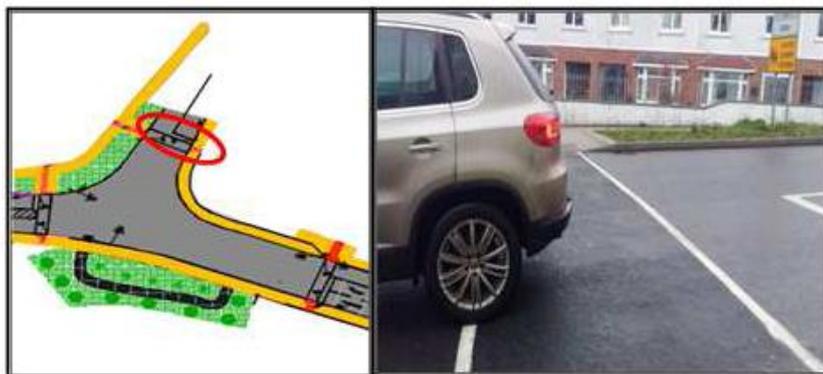
Recommendation

The tactile paving, should align crossing pedestrians towards the opposite dropped kerb. This could be achieved here by reducing the width of dropped kerb and tactile paving on the eastern kerb.

2.7 Road markings on Letterborough arm

Problem

Vehicles were observed overrunning the stop line on the Letterborough arm of the junction. This could lead to conflict with turning vehicles and or pedestrians crossings.



Item 2.7

Recommendation

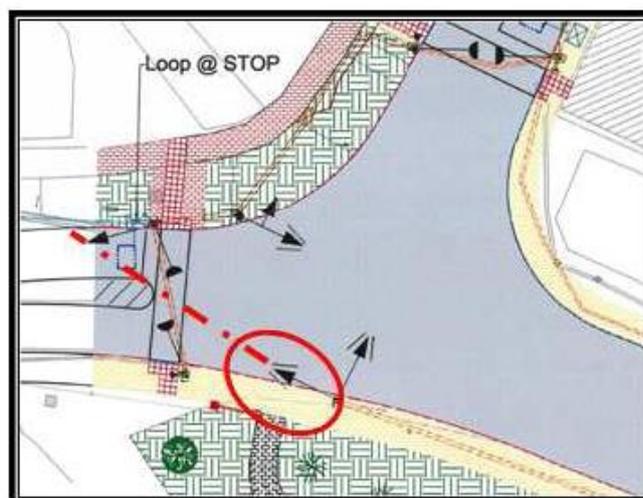
Blackford County Council has provided drawings of proposed road markings to address his problem. See Sketch 14032017 REV A, provided in Appendix A. These road markings should be provided.

2.8 Visibility of signal heads on Coolmore arm

Problem

The visibility of the signal heads on the approach from Coolmore is poor. As vehicles travel towards the junction from the west the approach to the traffic signals is on a right hand curve and on a gradient. The signal heads provided are orientated for those vehicles at the stop line for the lights. On approach to the junction from the town centre, while the vehicle is still within the bend, the secondary signal is not visible. Only the primary signal on the left hand side is visible to approaching traffic, and this signal head has the potential to be blocked by a high-sided vehicles such as an articulated lorry or a bus. This could lead to potential conflicts with other vehicles within the junction.

The Garda Síochána advised the audit team of an incident that had occurred where a vehicle travelling out of Coolmore went through a red light. The driver was apparently unaware that the junction was signalised.



Item 2.8

Recommendation

It is recommended that the visibility of the signal heads are improved for vehicles from the west, either by relocation of the secondary signal or by introduction of measures such as a mast arm mounting.

2.9 Access to filling station

Problem

The audit team stated in the Stage 2 audit that the location of the entrances to the filling station within the envelope of the traffic signalised junction is unsatisfactory. Vehicles emerging from those accesses would not be within the control of the signalisation, and would be likely to conflict with other vehicles.

The filling station is currently closed.

In the event of the filling station reopening there will be a safety issue for vehicular movements into the junction from the filling station, which are not under the control of the signalisation. These uncontrolled manoeuvres within the controlled envelope of the signalised junction will conflict with the controlled traffic movements through the junction.



Item 2.9

Recommendation

Any reopening or redevelopment of the filling station property should ensure that alternative access to the property is provided which will not conflict with traffic movements within the signal controlled junction.

3 AUDIT TEAM STATEMENT

We certify that we have examined the drawings and other information listed in Appendix A and visited the site during the day and night of the 22nd of March 2017. We further certify that we are independent from the design team for the scheme. 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 that in our opinion should be studied for implementation.

Signed:


Mary Hassett

Date:

13 July 2017

Signed:


Jonathon Duffy

Date:

13/7/17

N 99/R 100 Junction Signalisation, Coolmore, Co. Blackford

Stage 3 Road Safety Audit

4 ROAD SAFETY AUDIT FEEDBACK FORM

Road Safety Audit Feedback Form		
Scheme: Coolmore Traffic Calming Scheme, Phase 2 – Signalisation of R100 Junction		
Audit Stage: 3	Route No. N99	Date of Audit 22nd of March 2017

To be Completed by Designer				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. Only complete if recommended measure is not accepted.	Alternative measures or reasons accepted by auditors (yes/no)
2.1	Yes			/
2.2	Yes	Yes		/
2.3	Yes	Yes		/
2.4	Yes	No	The constructed gradient is the minimum possible in the available width	No
2.5	Yes	Yes		/
2.6	Yes	Yes		/
2.7	Yes	Yes		/
2.8	Yes	Yes		/
2.9	Yes	No	Blackford County Council has acquired the filling station, and any future development on the land will not require vehicular access.	Yes

Signed: F Ryan

Designer: Fiona Ryan

Date: 30/6/17

Signed: Mary Hassett

Audit Team Leader: Mary Hassett

Date: 13 July 17

Signed: Barry Rapperty

Employer: BARRY RAPPERTY

Date: 14/7/17

N99/R100 Junction Signalisation, Coolmore, Co. Blackford

Appendix A

Stage 3 Road Safety Audit

APPENDIX A

LIST OF DRAWINGS AND OTHER INFORMATION EXAMINED:

Final

Appx A

Drawings

N99 BF_076.0 (Coolmore Traffic Calming Main Street) – Phase 2 – Signalisation of N99/R100 Junction)

Drawing Numbered

14/029/Ph2/001

14/029/Ph2/002B

14/029/Ph2/523A

14/029/Ph2/1201A

Sketch 14032017 REVA (attached)

Reports

Stage 1/2 Road Safety Audit: June 2016, Audit Team Mary Hassett (Woodford NRO) & Anne Griffin (Blackford Co Co)

N99/R100 Junction Signalisation, Coolmore, Co. Blackford

Appendix B

Stage 3 Road Safety Audit

APPENDIX A

APPROVAL OF ROAD SAFETY AUDIT TEAM

Final

Appx B

*Fiona Ryan
Blackford County Council
Whitehall
Co. Blackford*

Date: 16/02/2017

Our Ref: 11XXXXX/52XX/Stage 3

re: N99 Coolmore Traffic Calming, Signalisation of R100 Junction

APPROVAL OF ROAD SAFETY AUDIT TEAM, Stage 3

Dear Fiona Ryan,

The following members of the proposed road safety audit team are approved to carry out the Stage 3 road safety audit of N99 Coolmore Traffic Calming, Signalisation of R100 Junction.

1. Mary Hassett - Woodford NRO – Leader
2. Jonathon Duffy - Woodford NRO – Member

A copy of all audit reports, design team response and exception reports must be uploaded through RSAAS. Successful upload of these reports and completion of the audit approval process is necessary for any further audit approval on this scheme.

Yours sincerely,

Regional Road Safety Engineer
roadsafetyaudits@tii.ie

Appendix D: Sample Exception Report & Decision

BLACKFORD COUNTY COUNCIL

EXCEPTION REPORT
COOLMORE TRAFFIC CALMING PHASE 2, N99/R100 JUNCTION SIGNALISATION

N99 Coolmore Traffic Calming Scheme Phase 2

Signalisation of R100 Junction

Exception Report

Road Safety Audit Report Stage 3

August 2017

BLACKFORD COUNTY COUNCIL

EXCEPTION REPORT
COOLMORE TRAFFIC CALMING PHASE 2, N99/R100 JUNCTION SIGNALISATION

1 Introduction

This report has been prepared in response to the Safety Audit feedback form following a Road Safety Audit Stage 3 carried out on Junction Signalisation works on N99 / R100 by a team from Woodford National Roads Office on 22nd March 2017.

2 Exception

This section identifies a particular issue where the designer has responded to the road safety audit's recommendations with either alternative measures or reasons for not accepting them, and that response was not accepted by the road safety audit team.

The particular issue is extracted from the Final RSA Stage 3 Report and presented here, along with a detailed explanation of the exception requested.

The full road safety audit stage 3 report is attached, for information.

RSA report ref	RSA Report Heading	Description / Response
2.4	Problem	Steep gradient on footpath at crossing point. On the north side of the pedestrian crossing on the Coolmore town side of the junction the pedestrian approach to the crossing appears to have a steep decline from the footpath to the crossing point. This may cause difficulty in crossing at this point for those who are mobility impaired, leading to conflicts with vehicles on the carriageway.
	Recommendation	This gradient should be checked and an alternative arrangement which provides an appropriate gradient should be provided if necessary.
	Problem accepted?	Yes
	Recommended measure accepted?	No
	Reasons for not accepting recommended measure.	The constructed gradient is the minimum possible in the available width.
	Alternative measures or reasons accepted by auditors?	No
	Reasons for Exception	The design is a retrofit, within the constraints of existing property boundaries and ground levels. R100 approaches N99 at a general gradient of 6% and the existing footpath was constructed in the past to provide a lower gradient as it turns from R100 into N99, making it

BLACKFORD COUNTY COUNCIL

EXCEPTION REPORT
COOLMORE TRAFFIC CALMING PHASE 2, N99/R100 JUNCTION SIGNALISATION

		<p>necessary to extend that gradient some distance along N99. Consequently, at the corner of the junction the footpath following alongside the property boundary is 950mm above the level of the road surface.</p> <p>The junction design places the road edge kerb at the pedestrian crossing point only 12m from the property boundary, and thus 10.2m from the edge of the footpath running alongside the boundary. The lateral footpath link needed to join the footpath to the crossing point at the road edge cannot be longer than 10.2m, thus necessitating a gradient of approximately 9%. It is not possible to achieve the guideline gradient of 1 in 12, or 8.3%.</p> <p>Redesign of the junction to provide for an improved gradient for the pedestrian crossing would result in an unacceptably high increase in the cost of the scheme.</p>
--	--	--

Road Safety Audit Exception Report Decision Form		
Scheme:	N99 Coolmore Traffic Calming Scheme Phase 2, Signalisation of R100 Junction	Route No. 99
Audit Stage:	3	TII Project Ref. No (If TII scheme) BD/17/XXXXX Date of Audit March 2017

Exception Report Item	Paragraph No. in Road Safety Audit Report	Decision by Director Accept or Reject Exception Report from Employers Representative
1	2.4	<p>Exception Report is Rejected.</p> <p>9% is an unacceptably high gradient for an approach to a pedestrian crossing. The guideline gradient given in the National Disability Association guidelines "Building for Everyone" is 1 in 20, and the absolute maximum is 1 in 12. The risk of an incident occurring as a result of the steep gradient, either from loss of control on the gradient or from uncontrolled crossing manoeuvres at an alternative location, is high.</p> <p>Redesign of the junction to provide for an improved gradient for the pedestrian crossing should be investigated further. For instance locating the crossing point a further 5m in front of the signal stop line would not only provide an increased distance between footpath and road edge but would also reduce the level difference, thus reducing the gradient of the link. The resulting increase in the cost of the scheme is considered necessary to provide safe and usable facilities.</p>

Signed: Jane Murphy Director of Overseeing Organisation: Jane Murphy _____ Date: 05/09/17 _____



 Ionad Ghnó Gheata na Páirce,
Stráid Gheata na Páirce,
Baile Átha Cliath 8, D08 DK10, Éire

 www.tii.ie

 +353 (01) 646 3600

 Parkgate Business Centre,
Parkgate Street,
Dublin 8, D08 DK10, Ireland

 info@tii.ie

 +353 (01) 646 3601