

Road Safety Audits of Traffic Signal Schemes

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Abstract

This paper examines the following elements of Road Safety Audits (RSAs) of traffic signal schemes:

- The background to Road Safety Audits
- Recent changes to relevant guidance (HD19/15)
- Typical problems identified within Road Safety Audits
- Comparison of RSA problems to collision records at traffic signals
- The implications for traffic signal engineers and designers

Introduction

This paper examines the background to Road Safety Audits (RSA's) and identifies the recent changes in guidance. However, it should be taken into consideration that when RSA's were introduced over twenty years ago the purpose was to reduce collision rates. Significant progress had been made in relation to collision investigation and the implementation of remedial measures. What was identified was that some of the elements being tackled within these collision remedial schemes were still being implemented in the same manner as part of new schemes. RSA's were an element to learn from this experience of collision investigation and to improve the safety of transport improvements.

Different RSA stages are required for different stages of the design process. These range from the initial Stage 1 RSA of the scheme principles to a Stage 4 RSA which examines the collision data records following implementation of a scheme.

The most useful overall guide to RSA's is the recently updated HD19/15 for Road Safety Audits on the motorway and trunk road network. This guidance includes example checklists for use by auditors. Therefore all scheme designers should be aware of the contents of this guidance so that they provide the auditors with appropriate information and also consider the items in the checklists against their scheme before they submit it to the auditor.

An element to always take into consideration is that RSA's are NOT:

- A form of design check eg against design standards/guidelines
- A critique of a design or a reflection of the quality of the work of the scheme designer
- Just a stage in the design process that has to be gone through

Equally a Road Safety Auditor has a responsibility to ensure that, amongst other things, they do **NOT**:

- Review a scheme from the view of how they would have designed it
- Identify issues that are not collision related
- Identify solutions that are inappropriate to the audit stage

Recent Changes in Guidance for RSAs

On 31st March 2015 the revised requirements and advice of HD19/15 for Road Safety Audits on the motorway and trunk road network was published. This replaced the previous requirements and guidance of HD19/03. The reasons for and background to the updating of this guidance is complex and not particularly relevant to the purposes of this paper. Therefore I have concentrated instead upon outlining what these changes in the requirements and advice are and then identifying the implications of these changes for traffic signal scheme designers and engineers.

Usefully Highways England have produced a factsheet that accompanied the publication of HD19/15 and outlined the key changes. This is included on the following page.



Publication of HD 19/15 'Road Safety Audit'.

The revised requirements and advice document (DMRB Volume 5, Section 2, Part 2) for Road Safety Audit (RSA) on the motorway and trunk road network in England, Northern Ireland, Scotland and Wales was published on 31st March 2015. This document is of particular importance to project sponsors, designers and road safety auditors as it introduces a number of changes to the previous revision (HD 19/03). Be aware that all road safety audits commissioned after the publication date must be in accordance with the revised version.

Key changes are listed below:

- Incorporation of IAN 152/11 which mandates the requirement for at least one member of the road safety audit team to hold a certificate of competency in Road Safety Audit issued by a Highways England approved provider.
- Improved guidance on which schemes require road safety audits and what is a 'like for like' replacement.
- Clearer requirements for the RSA brief with the inclusion of a template document.
- Clarification of acceptable CPD for RSA teams.
- Recommendation that site visits, in particular for Stage 3 RSA, have a maximum of six individuals present.
- Where it is formally agreed with a Highways England specialist advisor, schemes that will not impact on road user behaviour can be excluded from the RSA process without requiring a departure from standards.
- Streamlining the Stage 4 collision monitoring process – where no collisions are recorded, the project sponsor can now waive the requirement to produce an audit report.
- Specific requirements for when Stage 4 RSA site visits are necessary and confirmation that RSA team must have the same experience as for all other stages of audit.
- Clearer guidance on the RSA process, roles and responsibilities through the inclusion of flow charts and improved wording.
- A new section detailing the requirements for developer-led and third party schemes, ensuring project sponsors have oversight of the process. The Stage 1 RSA must be complete before planning consent is applied for.
- The introduction of road safety audit response reports which formalise the designer's response process.
- Greater clarity on the exceptions report process and recognition of the importance of GD 04/12 when developing decisions for exceptions reports.
- It is now a mandatory requirement to send all finalised road safety audit reports, response reports and exception reports to the roadsafetyaudit@highwaysengland.co.uk inbox.

For further information and advice please contact the document owner Nico Bentall at nicholas.bentall@highwaysengland.co.uk

There are some of these changes with HD19/15 that are likely to be more relevant to the majority of traffic signal designers/engineers than others. While I would like to recommend HD19/15 as a “thoroughly enjoyable read from cover to cover” that might be to oversell the importance and relevance of it to non-road safety auditors.

To extract the changes that are most likely to be of relevance to this audience I would suggest the following:

Clearer requirements for the RSA brief

The previous HD19/03 did actually have suggested items for inclusion within the audit brief. However, this was not reflected in the reality of the brief provided to most auditors. The majority of audits are conducted using a simple scheme drawing. The designers usually fail to provide information in relation to existing collision records, departures from standard or how the junction will operate.

Extract from HD19/15 on the Road Safety Audit Brief

Road Safety Audit Brief

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| <p>2.87. The Road Safety Audit Brief defines the scope of the Road Safety Audit to be undertaken. The Project Sponsor has overall responsibility for the Road Safety Audit Brief. However, the Design Team may prepare the Road Safety Audit Brief on their behalf. A copy of the Road Safety Audit Brief must be forwarded to the Project Sponsor for formal approval in advance of the Road Safety Audit. The Project Sponsor may instruct the Design Team to delete unnecessary items or to include additional material, as they consider appropriate. The Project Sponsor must document the reasons for deleting or adding any information to the Road Safety Audit Brief. The Project Sponsor must issue the Road Safety Audit Brief and instruct the Road Safety Audit Team when the scheme is ready to be Road Safety Audited.</p> <p>2.88. To maximise the benefit from the Road Safety Audit process, the Road Safety Audit Brief needs careful preparation and must include sufficient information to enable an efficient and effective Road Safety Audit to be undertaken.</p> |
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The point made in 2.88 is particularly relevant. An RSA is not just a process that has to be gone through begrudgingly in order to obtain a planning permission or implement a scheme. There is a reason for these audits and if we are to maximise the benefits from them then the auditors need to be provided with suitable information.

The guidance is now very clear as to what should be provided in the brief to the auditors. It provides a list of contents and even an example brief within the appendices.

Extract from HD19/15 on the Road Safety Audit Brief Contents

- 2.89. An illustrative Road Safety Audit Brief is shown in Annex E of this Standard. A Road Safety Audit Brief should contain the following:
- a) A description of the proposed Highway Improvement Scheme clearly identifying its objectives.
 - b) Scheme drawings showing the full geographical extent of the scheme and including the areas beyond the tie-in points.
 - c) Details of determined and pending Departures and Relaxations from Standards, and/or the Design Strategy Record(s) where they have been produced for an improvement to an existing motorway or trunk road.
 - d) Clear identification of the elements of the scheme proposals included within the scope of the Road Safety Audit to be undertaken and also those elements of the scheme that fall outside of the scope, including strategic decisions. The Road Safety Audit Brief should clearly identify where the scope of the Road Safety Audit has been extended to allow consideration of strategic decisions.
 - e) General scheme details, to help give an understanding of the purpose of the scheme and how the layout will operate, including design speeds, speed limits, traffic flows, forecast flows, queue lengths, NMU flows and desire lines (including NMU Context and Audit reports undertaken in accordance with HD 42/05 (DMRB 5.2.5)). Also details of any environmental constraints on the design and how these may have affected any strategic decisions made.
 - f) Details of any safety risk assessments undertaken as part of the design process (on the Strategic Road Network in England these will be undertaken with reference to GD 04/12 “Standard for Safety Risk Assessment on the Strategic Road Network” (DMRB 0.2.3)).
 - g) Any other relevant factors which may affect road safety such as adjacent developments (existing or proposed), proximity of schools or retirement/care homes and access for emergency vehicles.
 - h) The Road Safety Audit Brief should identify if the location of the Highway Improvement Scheme should be visited at a particular time of the day (e.g. peak traffic periods or beginning or end of the school day).
 - i) For on-line schemes and at tie-ins, the previous 36 months personal injury collision data in the form of ‘stick plots’ and interpreted listings. The personal injury collision data should cover both the extent of the scheme and the adjoining sections of highway.
 - j) At Road Safety Audit Stages 2 and 3, details of any changes introduced since the previous Road Safety Audit stage.
 - k) Any changes in the Highway Improvement Scheme that are not shown on the design or As-Built drawings.
 - l) Plans using an appropriate scale for the Road Safety Audit Team to mark up for inclusion in the Road Safety Audit Report.
 - m) Previous Road Safety Audit Reports, Interim Road Safety Audit Reports, Road Safety Audit Response Reports and Exception Report(s)

- n) Contact details of the Maintaining Agent to whom any identified maintenance defects should be notified (by telephone and immediately confirmed in writing for serious defects) separately from the Road Safety Audit Report (see paragraph 2.105).
- o) Details of the appropriate police contact.
- p) Details of any site access arrangements including any specific health & safety requirements such as inductions, Personal Protective Equipment and vehicle livery requirements.

Changes to the Stage 4 RSA Process

A significant change in relation to Stage 4 RSAs is that if no personal injury collisions have occurred in the vicinity of the scheme over the monitoring period then a formal Stage 4 report is not required. This decision would need to be made by the project sponsor and formally recorded.

Developer Led and Third Party Organisation Led Schemes

The guidance contains further information on how RSAs should be applied to developer-led schemes. The relevant section from the guidance is provided below, but of particular relevance to this paper are the following:

- A Road Safety Audit must be undertaken before planning consent is applied for
- The responsibility of the Project Sponsor in relation to Exception Reports

Extract from HD19/15 on Developer Led and Third Party Organisation Led Schemes

2.54. The design and Road Safety Audit process for developer-led and third party organisation-led Highway Improvement Schemes can vary from the process for Overseeing Organisation promoted Highway Improvement Schemes. Most significantly, the scheme may be designed by an organisation working for the developer or third party organisation rather than an organisation working for the Overseeing Organisation. The developer-led scheme will be submitted for planning approval to the local planning authority and, where there are highway implications, the highway or road authority will be consulted. The following paragraphs provide additional requirements and guidance for all organisations involved in the Road Safety Audit of developer-led and third party organisation led Highway Improvement Schemes.

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| 2.55. | Where developer-led schemes or third party organisation-led schemes will result in Highway Improvements Schemes (as defined in paragraph 1.20) on the motorway and trunk road network, the contents of this Standard must be followed for all Stages of Road Safety Audit. |
| 2.56. | The Road Safety Audit Team approval and appointment must follow the process set out in paragraphs 2.70 to 2.75 of this Standard. As with highway or road authority promoted schemes, the Overseeing Organisation responsible for the affected motorway or trunk road is responsible for ensuring that the developer-led or third party scheme complies with the Road Safety Audit procedure as detailed in this Standard. |
| 2.57. | A Road Safety Audit Brief must be prepared and issued in accordance with paragraphs 2.87 and 2.88 of this Standard for all Road Safety Audit Stages (see Annex E). |
| 2.58. | A Stage 1 Road Safety Audit (or combined Stage 1 & 2 Road Safety Audit where there has been no preliminary design) must be undertaken before planning consent is applied for. |
| 2.59. | The process of issuing and considering the draft Road Safety Audit Report identified in paragraphs 2.102 to 2.106 of this Standard must be followed for both developer-led and third party led schemes for all Road Safety Audit Stages. Once the Road Safety Audit Report has been finalised, the scheme Designer is responsible for producing a Road Safety Audit Response Report in accordance with paragraphs 3.1 and 3.2 of this Standard. |
| 2.60. | At all Road Safety Audit Stages, recommendations made in the Road Safety Audit Report that impact on the motorway or trunk road network must be either incorporated into the design, included within the constructed scheme or dealt with by means of Exception Report(s) to the satisfaction of the Overseeing Organisation Project Sponsor and Director. In the case of the Stage 1 Road Safety Audit Report (or combined Stage 1 & 2 Road Safety Audit Report), recommendations must be accommodated or Exceptions Reports produced to the satisfaction of the Overseeing Organisation Project Sponsor and Director prior to planning consent being given. |
| 2.61. | At all stages the Project Sponsor is responsible for the production of any Exception Reports. Typically the Project Sponsor will request that the developer or third party organisation produces the Exception Report(s) on their behalf. The Exception Report(s) must be produced to the satisfaction of the Overseeing Organisation's Project Sponsor and Director, for elements of the scheme on the motorway or trunk road network. The Exceptions Report(s) must be agreed with the Overseeing Organisation's Project Sponsor and Director prior to the scheme progressing to the next stage. |

RSA Response Report and Exception Report

Chapter 3 of the guidance contains detailed information on the RSA Response Report and Exception Report processes. This information identifies clearly how the RSA report should be considered and the responses to the problems raised dealt with. Again, in addition to the description of the process and guidance there is an example Road Safety Audit Response Report within the appendices of the guidance.

Extract from HD19/15 on Developer Led and Third Party Organisation Led Schemes

3.1. It is the Project Sponsor's responsibility to ensure that all problems raised by the Road Safety Audit Team are given due consideration. To assist with this, the Design Team must prepare a Road Safety Audit Response Report to the Road Safety Audit Report at the Stage 1, Combined 1 & 2, Stage 2 and Stage 3 Road Safety Audits.

- 3.2. An illustrative Road Safety Audit Response Report is shown in Annex K. The Road Safety Audit Response Report should include the following:
- a) A summary of the scheme, the Stage of Road Safety Audit, the document reference and date of the Road Safety Audit Report it considers.
 - b) Full consideration of each problem and recommendation raised in the Road Safety Audit Report.
 - c) The Road Safety Audit Response Report should reiterate each problem and recommendation made, followed by a suggested Road Safety Audit response from the Design Team. The Road Safety Audit Response Report should include the problem location plan provided in the Road Safety Audit Report.
 - d) The Road Safety Audit Response Report should, for each problem and recommendation, do one of the following:
 - accept the problem and recommendation made by the Road Safety Audit Team;
 - accept the problem raised, but suggest an alternative recommendation, giving reasoning for the alternative recommendation or;
 - disagree with the problem and recommendation raised, giving appropriate reasoning for rejecting both the problem and recommendation.
 - e) Details of the representatives from the Design Team who prepared the Road Safety Audit Response Report.

3.3. The Design Team Leader shall send a draft Road Safety Audit Response Report to the Project Sponsor for consideration. Where the Project Sponsor agrees an amendment to a response with the Design Team Leader, this amendment shall be incorporated into the final Road Safety Audit Response Report. If a Project Sponsor is unsure about the contents of a Road Safety Audit Response Report they must formally consult with an appropriate Specialist from the Overseeing Organisation.

- 3.4. It is possible that the Project Sponsor may not be able to agree all the responses with the Design Team Leader. In this situation the final Road Safety Audit Response Report should identify this difference of opinion.
- 3.5. The Road Safety Audit Response Report should be issued to the Project Sponsor within 1 month (or an alternative timescale as agreed with the Project Sponsor) of the Design Team receiving the finalised Road Safety Audit Report.

3.6. The Project Sponsor must provide a copy of the final Road Safety Audit Response Report to the Road Safety Audit Team Leader for their information.

Typical problems identified within Road Safety Audits

The first point to make regarding any problems identified within an RSA report is that they should relate to road safety. An RSA is not a design check or an opportunity for the auditors to suggest design improvements. Each problem identified within the RSA should include not only a location and description of the problem, but also the type of collision likely to occur. The auditors are advised that if they cannot associate a collision type with a problem they are considering, then it may not be appropriate to include that problem within the RSA report.

Each problem must be followed by a recommendation that is proportionate and viable. HD19/15 advises that the recommendations should avoid wording such as “consider”, “must” and usually the word “monitor”.

Problems Raised in RSA's

There have been some studies of the types of issues which are raised within RSA reports. These studies have had to categorise the problems raised into broad groups in order to quantify the frequency with which that problem is identified within an RSA.

A TMS study (1997 to 1999) of 113 RSA's identified the following common problems as being raised.

Common Issues Raised in General RSA's (TMS Study 1997-1999)		
Rank	Description of Problem	% of Total
1	Inadequate road signs	13.6
2	Inadequate markings/studs	10.3
3	Visibility to signs/signals restricted	5.3
4	Inadequate tactile paving	4.7
5	Lane width/number restricted	4.2

A smaller, but more recent study by Surrey County Council identified the following common problems

Common Issues Raised in General RSA's (Surrey CC Study 2008)			
Rank	Description of Problem	% of Total	TMS Rank
1	Inadequate road signs	18.8	1
2	Inadequate markings/studs	8.9	2
3	Inadequate tactile paving	8.9	4
4	Unsafe crossing point for pedestrians	5.1	7
5	Drainage problems/location of gullies	4.8	22

It should be noted that these studies relate to RSA's generally and are therefore not specific to traffic signal schemes.

Problems Raised in RSA's for Traffic Signal Schemes

In order to understand what types of issues are raised within RSA reports of traffic signal schemes I have examined and discussed the subject within Waterman and with some of the various local authorities which we work with. These discussions with a number of local authority officers and a qualitative review of the issues identified within RSAs undertaken by Waterman has identified the following as the most common RSA issues for traffic signal control schemes:

- Visibility of signal head obscured/limited
- See through effect at the junction
- Tactile paving incorrect
- Poor road surface/covers and likelihood of skidding
- Unusual operating arrangements, such as a give way left turn or untypical staging arrangement

Due to the nature of the information obtained it is not possible to provide a percentage breakdown for issues raised at RSAs for traffic signal schemes. However, it is clear that there are some common elements and some differences between the types of issues raised at RSAs for such schemes when compared to the results observed for RSAs generally.

Comparison of RSA Identified Problems with Collision Types

It is useful initially to consider the type of recorded collisions which occur in the vicinity of traffic signals. Personally I find the 'Literature Review of Road Safety at Traffic Signals and Signalised Crossings' by TRL (November 2009) to provide a useful overview and a variety of relevant data.

This Literature Review identifies the following in relation to collision types at three and four arm traffic signal controlled junctions.

Table 4: Percentages of collisions and collision severity by type at 3- and 4-arm signal-controlled junctions on 30mph UK roads

	% of collisions		Severity of collisions (% fatal or serious)	
	3-arm	4-arm	3-arm	4-arm
Single vehicle	7.6	8.9	20.0	16.9
Approaching	21.6	8.8	6.7	7.8
Right angle	-	13.4	-	29.5
Principal right turn	15.8	26.7	16.0	18.5
Other turns	12.3	9.7	16.2	15.1
Other vehicle	11.2	4.4	18.4	14.2
Pedestrian	34.6	28.1	25.9	24.3
Total	100	100	17.9	20.0

It is clear that the most common collision type involves pedestrians. Approximately one third of the collisions recorded at the traffic signal junctions involved pedestrians. The severity of these collisions involving pedestrians is also more severe than the average level of severity at traffic signal junctions, with approximately one quarter of collisions being of fatal or serious severity. Around 60% of serious and fatal pedestrian injuries that occur at signals were found to be linked to the pedestrians not using the crossing correctly (eg crossing without a green man signal).

The difference between three and four arm signal controlled junctions in terms of percentage of collisions by collision type is quite revealing. Right angle collisions are those between two vehicles going

ahead, which impact at right angles. Therefore, this can only occur at four arm junctions. As is to be expected, the severity of such collisions is high.

The principal right turn collision is where a right turning vehicle collides with a vehicle from the opposite approach. The increase in the percentage of such collisions at four-arm junctions when compared to three-arm junctions is probably a reflection of the increased movements that can result in this type of collision.

The difference in the proportion of collisions on the approach to the junction between three and four-arm junctions is noticeable. These collisions are primarily rear-shunts (and some lane changing) in nature.

It is difficult to compare the types of problems identified within RSA's of traffic signal junctions with the types of collisions which are recorded at traffic signal junctions. This is due to the difficulty of determining what type of collision some of the RSA problems identified would result in. For example, the issue of limited forward visibility of a signal head could contribute towards a variety of collision types, such as rear shunts, pedestrians or another vehicle within the junction.

However, it is clear that some problems raised within RSA's do not relate well to recorded collisions at traffic signal junctions. Most noticeable among this list would be issues relating to the tactile paving. From my experience of collision data analysis I cannot recall any occurrences of collisions having as a primary cause an issue relating to the tactile paving that is/is not provided.

Conclusions

This paper has identified the recent changes to advice and guidance for the undertaking of RSA's due to HD19/15. It has also identified the problems/issues that are most commonly identified within RSA's generally and also specifically in relation to traffic signal schemes. However, the most common types of recorded collision at signal controlled junctions are then identified. This shows that there is not necessarily a clear relationship between the types of collisions which occur at such junctions and the issues which are most commonly identified within RSA's.