

# Application of Road Safety Audits to Urban Streets

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## ABSTRACT

This paper provides insights into road safety audits (RSAs) and their application. The objective is to provide an overview of the road safety audit process and to describe the applicability of road safety audits in evaluating safety deficiencies on existing urban roads and streets. The focus is to use an RSA in the safety review process. This application helps to demonstrate the value added by using RSAs. The major potential gain, however, lies in integrating the process into the planning of new facilities and the design and construction of improvement projects. The RSA of an existing facility, however, provides an assessment of existing facilities only from the safety point of view. The emphasis is on the prevention of potential crashes.

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## INTRODUCTION

One of the newest tools in the arsenal of transportation safety specialists to address safety deficiencies is the road safety audit (RSA). Road safety audits have been used successfully in Great Britain, Australia, and New Zealand for a number of years. In 1996, the Federal Highway Administration (FHWA) sponsored an international scanning tour to Australia and New Zealand with the goal to “review and document international efforts to enhance highway safety through implementation of safety audit initiatives” (1).

Since the international scanning tour, the use of road safety audits in the United States and Canada has expanded. An excellent example is the Pennsylvania Department of Transportation initiative to conduct pilot road safety audits. Local United States jurisdictions and the government of British Columbia are also beginning to promote the use of RSAs. Both the Institute of Transportation Engineers and the Transportation Research Board have established committees and/or task forces to evaluate the applicability of road safety audits in North America. In October 1999, a web page devoted to road safety audits will be established under the joint sponsorship of FHWA and the Institute of Transportation Engineers (ITE).

Road safety audits have the potential to be particularly beneficial to local governments in systematically addressing safety deficiencies on their road and street

networks. The use of this tool also has the potential to help in protecting agencies from tort liability as it establishes a record of the organization's safety agenda.

## WHAT IS A ROAD SAFETY AUDIT?

A road safety audit, as defined by Austroads, the Australian counterpart to the American Association of State Highway and Transportation Officials (AASHTO), is “. . . a formal examination of an existing or future road or traffic project or any project which interacts with road users, in which an independent, qualified examiner reports on the project's accident potential and safety performance” (2). The key parts of this definition are: (1) a formal examination, (2) done by an independent, qualified examiner, and (3) restricted to safety issues.

It is important to note that a road safety audit is not: (1) a means of rating or ranking a project, (2) a check against compliance to standards, (3) an accident investigation, (4) a redesign, or (5) an informal process (3).

## STAGES OF AN AUDIT

Road safety audits are conducted at the following points in the project:

- *Stage 1: Feasibility (Planning) Stage*

Feasibility stage audits are done when the project is under development. These audits evaluate options such as route locations, layouts, treatments, interchange locations and type access control, impacts on the existing road network and other features.

- *Stage 2: Draft Design Stage*

At this stage, sometimes referred to as the preliminary design stage, general design standards are evaluated. Horizontal and vertical alignment, intersection and interchange type and layout, sight distances, lane and shoulder widths, superelevation, and provisions for pedestrians and bicyclists are some of the factors considered at this stage.

- *Stage 3: Detailed Design Stage*

All elements of the final design should be in place at this time. This stage audit reviews the final geometric design features, traffic signing and marking plans, lighting plans, landscaping, intersection and interchange details, provisions for special users such as elderly pedestrians, handicapped, cyclists, drainage, guardrail and other roadside objects.

- *Stage 4: Pre-Opening Stage*

This is a final check prior to opening to ensure that the safety concerns of all road users have been addressed and that hazardous conditions have been eliminated. This audit should include both day and night checks, evaluations in wet and dry weather, and for driving, riding, and walking, if appropriate.

- *Stage 5: Existing Roads Audit*

These audits are performed on existing facilities to see if the safety needs of road users are currently being served. It recognizes that the use of a roadway may change over time. The Stage 5 audit may be performed on a road section just opened to traffic to evaluate its performance or it can be used to identify safety deficiencies on existing roads.

Typically, resources do not permit the auditing of a project at all stages. However, it is recognized that “. . . the earlier a road is audited within the design and development process, the better” (2).

## CONDUCTING AN AUDIT

As set forth in the definition, a road safety audit is a formal process that requires that a step-by-step procedure be followed. The steps in conducting an audit are as follows:<sup>3</sup>

1. *Select the Road Safety Audit Team*

An independent auditor or team of auditors should be selected so the design is viewed with “fresh eyes.” Safety engineering skills and experience are a must. The benefit of having an audit team, if the project is of sufficient scope, is that diverse backgrounds can be brought to bear on the problem and that cross-fertilization of ideas can occur during the group discussions.

The auditors are selected by either the designer or the client.

2. *Provide the Background Information*

The designer or client provides relevant information to the audit team. This typically includes a statement of the expected outcomes from the audit, design standards that were used, traffic volumes, crash records, plans and drawings, and other pertinent documents.

3. *Hold a Commencement Meeting*

The designer or client calls the commencement meeting to discuss pertinent information and concerns and to turn over relevant data to the auditor(s). At this meeting, the purpose of the audit should be discussed as well as the roles of the auditor(s) and the project manager.

4. *Assess All Documents*

The audit team reviews all documents to record initial impressions. Areas which may have safety problems are identified. The designer/client should be contacted if any questions arise. The auditor(s) should use relevant checklists to help identify potential safety problems. The use of checklists is discussed in a subsequent section.

5. *Inspect the Site*

The auditors need to visit the site during all audits. Ideally, both day and night inspections should take place. This inspection is conducted concurrently with the review of documents. The site visit should include adjacent roadways that transition into the site. The views of all potential road users—motorists, pedestrians, and cyclists—should be incorporated into the review. Checklists should be used during the inspection.

6. *Write the Road Safety Audit Report*

The audit report identifies safety deficiencies and contains recommendations for corrective actions. The recommendations focus on the direction of possible solutions rather than indicating the exact nature of a solution. All safety issues that require immediate attention should be identified. The report is a “stand alone” document by an independent reviewer(s); a draft report for comment by the designer/client is not required.

7. *Hold a Completion Meeting*

The audit team should present their findings to the designer/client at a completion meeting. At this time, the independent auditor(s) should explain their recommendations and answer any questions for suggestions to alleviate the problems that were identified. The results need to be presented in a proactive, positive manner rather than as a criticism of the proposed design, plan, or construction program.

#### 8. *Write a Response to the Audit Report*

The designer/client should prepare written responses to all audit recommendations. This response document, sometimes called a “Corrective Action Report,” is part of the formal audit process and should be signed by a responsible official. This report should include a response to each recommendation in the audit report identifying: those that are accepted indicating the corrective action to be taken; those that are rejected; those that are accepted “in principle”; and those solutions which only address part of the problem will be implemented.

#### 9. *Implement the Agreed Changes*

Changes that have been identified in the response to the audit report are then implemented by the designer/client. A written record is important for future reference.

#### 10. *Feed Back the Knowledge Gained*

The knowledge gained from the audit process should be fed back into the design process. This is the final step in the audit process. This feedback should include feedback to other projects, feedback to the design profession, feedback into revised standards, and feedback to the auditor(s). The projects audited should be monitored for one to three years to determine if the audits were successful.

It is important to note that the first three and the last three steps are the responsibility of the designer/client and the middle four steps are the responsibility of the audit team.

### **CHECKLISTS: THE “HEART” OF THE AUDIT PROCESS**

A key part of the audit process is the evaluation of the project using relevant checklists. The checklists, which can be paper forms or in a computerized “expert system,” are the primary means to aid in the identification of safety problems. They help the auditor to consider most factors and provide a reminder of potentially overlooked safety issues. They are not to be used by just running through the lists and marking off items; they should focus the evaluation on specific issues to be included in the audit. Separate checklists have been developed for audits at each stage in the process. The *Stage 1–Feasibility Stage* checklist addresses items “in principle” while the *Stage 5–Existing Roads* checklist focuses on the manner in which design has been translated into practice. Figure 1 is part of the checklist provided in the *Austroroads Guide (2)* for reviewing existing roads.

Many agencies have developed their own checklists to serve specific purposes. Figure 2 is an example of a checklist developed for use by local agencies for conducting a safety audit of roadway surface conditions for unpaved rural roads. Figure 3 is part of a checklist for auditing bicycle facilities.

### **THE ISSUE OF STANDARDS AND ROAD SAFETY AUDITS**

It is important to note that a road safety audit is not simply a check that the design conforms to standards. The application of standards and guidelines does not assure that adequate safety is provided. Standards are developed for many purposes, some of which do not contribute to enhanced safety. While standards provide a framework used to initiate a design, they may be out of date, not applicable to the circumstances in the design, not address the complexities of a given situation, or, in combination, may result in

**Stage 5  
Existing Roads**  
**Checklist 5.2**

**Alignment  
and  
Cross  
Section**

Item	Issues to be Considered	Check	Comments
<b>1</b> Visibility, sight distances	Is sight distance adequate for the speed of traffic using the route?  Is adequate sight distance provided for intersections, crossings (e.g. pedestrian, cyclist, cattle, railway) etc.?		
<b>2</b> Design speed	Is the horizontal and vertical alignment suitable for the (85th %ile) traffic speed? If not: (a) Are warning signs installed? (b) Are advisory speed signs installed? Are the posted advisory speeds for curves appropriate?		
<b>3</b> Overtaking	Are adequate overtaking opportunities provided?		
<b>4</b> Readability by drivers	Are there any sections of roadway which may cause confusion e.g.: (a) Is alignment of roadway clearly defined? (b) Has disused pavement (if any) been removed or treated? (c) Have old pavement markings been removed properly? (d) Do streetlight and tree lines conform with the road alignment?		
<b>5</b> Widths	Are all traffic lane and carriageway widths, including bridges, adequate?		
<b>6</b> Shoulders	Are shoulder widths appropriate (e.g. for broken down or emergency vehicles)? Are shoulders trafficable for all vehicles and road users? Is the shoulder crossfall sufficient to provide proper drainage?		
<b>7</b> Batter slopes	Are the batter slopes and table drains safe for run off vehicles to traverse?		

**FIGURE 1 Partial checklist for Stage 5 audit: Existing roads (2).**

	Yes	No	N/A	COMMENTS
<b>RURAL ROAD SAFETY AUDIT – UNPAVED ROAD ISSUES (1 of 1)</b>				
<b><u>ROADWAY SURFACE</u></b>				
Is the road surface free of defects which could result in safety problems (e.g. loss of steering control)?		✓		<i>Some rutting &amp; potholes, but not a serious safety concern.</i>
Is the road surface free of areas where ponding or sheet flow of water occur resulting in safety problems?	✓			
Is the road surface free of loose gravel/fines which may cause safety problems (control, visibility, etc.)?	✓			
Are changes in surface type (e.g. pavement ends) free of drop-offs / poor transitions?			✓	<i>Edge Drop-off at end of pavement</i>

**FIGURE 2 Sample checklist for Stage 5 audit of a rural road roadway surface.**

an unsafe design. For example, a design for roadway drainage may include a fixed object structure that is placed in the roadway clearzone.

**LIABILITY ISSUES**

Safety audits should be considered part of an agency’s road safety plan. One element is the treatment of hazardous locations or “blackspots” that have been identified based on crash history or citizen’s complaints. Road safety audits focus on correcting problems before they occur.

Table 5.1 *Bicycle Safety Audit Checklists*

***Bicycle Safety Audit for Existing Facilities***

Date \_\_\_\_\_ Day of Week \_\_\_\_\_  
 Time \_\_\_\_\_ Weather \_\_\_\_\_  
 Project \_\_\_\_\_ Location \_\_\_\_\_  
 Name of Auditor \_\_\_\_\_

FACILITIES		YES	NO	PHOTOS	COMMENTS
1	Is a designated bike lane/way provided for bicyclists when warranted by volumes?				
2	Is the bike lane of adequate width for the number of bicycles utilizing the path?				
3	Are pedestrian sidewalks of adequate width for the number of pedestrians utilizing the path?				
4	Is the bike lane fringe free of obstructions (benches, curbs, sign posts, utility poles) that would reduce effective bike lane width?				
5	Is there an adequate buffer at bike lane edge that is flush with adjacent lands (in order to avoid a bicycle tire from getting caught and the bicyclist losing control)?				
6	Is effective clear zone provided for recovery should a bicycle leave the traveled way?				
VISIBILITY		YES	NO	PHOTOS	COMMENTS
1	Is sight distance from bike lane unobstructed at curves?				
2	Are adequate stopping sight distances provided for bicyclists?				
3	Are sight distances adequate so bicyclists can check for intersecting traffic flows?				

**FIGURE 3 Partial checklist for Stage 5 audit of a bicycle facility.**

Some concerns have been raised that the use of safety audits would increase an agency’s liability. This issue was examined in detail in the *Austrroads Guide* (2), in the *British Guide* (4), and also in New Zealand (1). While it is acknowledged that legal systems in these countries differ from that of the United States, safety audits are a reasonable approach to improving safety and should not be considered an admission that a problem exists. Would an agency increase its liability if it rejects an audit recommendation and an accident occurs? Not necessarily, as the plaintiff would still need to prove negligence and that the problem was ignored after being put on record. The identification of “potential safety areas” should be even less problematic than the identification of “hazardous locations” in the Highway Safety Planning process now used by states.

**AUDITS OF EXISTING ROADWAYS BY LOCAL AGENCIES**

Local agencies can integrate road safety audit concepts into their overall safety programs by auditing existing roadways. In New Zealand, detailed procedures for auditing existing roadways have been developed.<sup>5</sup> These procedures include descriptions of the audit process, checklists, and a sample audit. Separate processes are recommended for urban and rural roadway networks. They have published reports of actual audits conducted by local agencies using these procedures (6, 7).

Research to adapt the road safety audit methodology for existing roadways to specialized cases, bicycle facilities, rural local roads, and local city streets has been

completed at the University of Wyoming. The purposes of these projects were to identify the value of the RSA process and to tailor the audits to specific types of projects.

### **Bicycle Safety Audit**

A bicycle safety audit was conducted on the University of Wyoming campus. It is a prototype for a procedure that could be used for other bicycle and pedestrian facilities. The audit process was based on the general guidelines for conducting road safety audits as described in the *Austrroads Guide* (2). The audit focused on general facility design, visibility, alignments, travel surface, signing, marking, issues associated with the multi-use path, and other types of bicycle areas. A special checklist was developed for the audit. The auditor was a person independent of the designer who was familiar with applicable standards and bicycle safety issues.

The project demonstrated that the road safety audit methodology was transferable to bicycle safety audits and that the procedures represent a viable, proactive approach for improving bicycle and pedestrian safety.

### **Existing Rural Local Road Audit**

Adapting road safety audits to rural local roads poses some unique challenges. Typically these agencies do not have the financial resources nor the engineering expertise to address all the details as set forth in the *Austrroads Guide*. In addition, much of the roadway network is composed of low volume roads, both paved and unpaved. Alignments and cross sections commonly do not provide the same level of safety as on main highways. These agencies need to balance safety objectives with convenience, protection of the environment, and cost.

Checklists tailored to the problems most often encountered on rural local roads were developed. These were based on findings by the National Association of County Engineers which stated that high frequency problems on county roads include malfunctioning traffic signals, sign defects, roadside hazards, deficient guide/guardrails, shoulder maintenance, road surface maintenance, roadway and intersection geometry, snow/ice control, and removal of highway debris.

Given the limited resources available to rural local agencies, the feasibility of conducting audits by using a team of independent safety specialists was limited. The approach that is being evaluated is an audit using a team composed of the county road superintendents from neighboring counties. Their skills in identifying safety issues and improvements are being compared to those of an independent team of safety professionals. These audits pinpointed several safety deficiencies and validated the checklists as being practical and useful in ensuring that key safety issues are identified and that issues of independent auditor skills are more clearly described.

### **A Safety Audit of an Existing Intersection**

A pilot audit was conducted at a recently constructed local intersection in Memphis, Tennessee. Figures 4–7 illustrate the plan and profile for the intersecting streets. The reconstruction extended Southern Avenue to the west. Because of the relatively steep



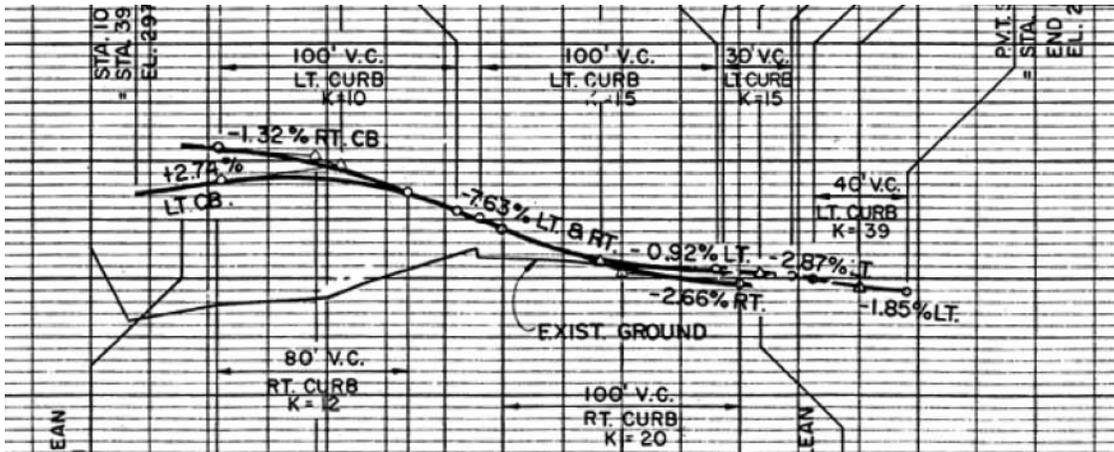


FIGURE 6 Profile view: McLean Avenue.

grade on the approach at the stem of the tee, vehicles on McLean pull past the location of the painted stop bar to gain improved visibility. Vehicles turning left from Southern Avenue into the stem of the tee, especially large trucks, are not able to see the roadway and perform their turning maneuvers beyond the channelized right turn island.

An audit at this location indicated problems with guardrail locations, vegetation, island design, and stop bar and stop sign location.

**SUMMARY**

This paper has provided an overview of the road safety audit process and its elements. Examples of the application of road safety audits and procedures to tailor the process to local audit issues in the United States were provided. Procedures used to tailor the process to conduct road safety audits of existing local road conditions are believed to be essential for use by local agencies to begin a positive safety improvement program.

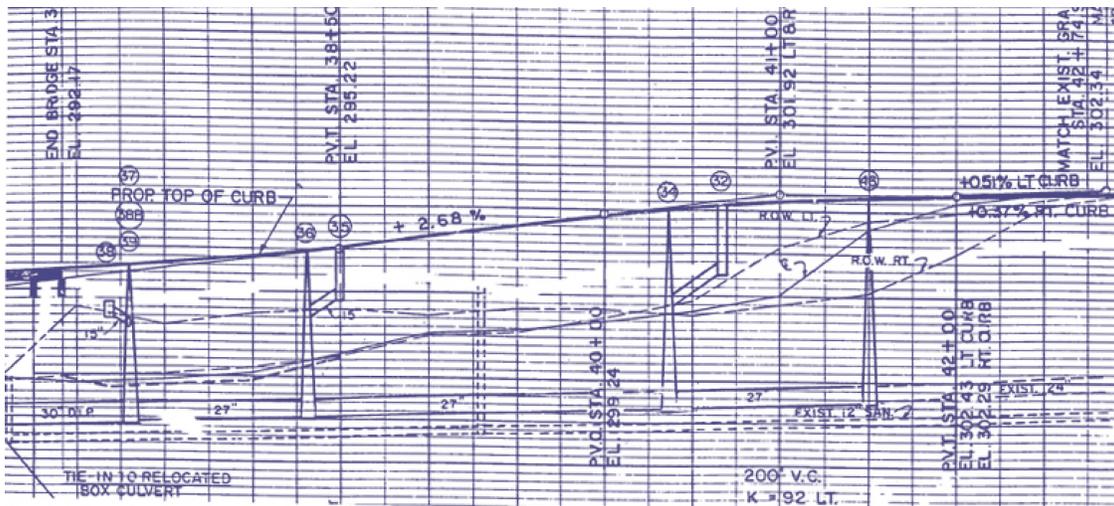


FIGURE 7 Profile view: Southern Avenue.

The process was found to be valuable in identifying roadway deficiencies and a potentially important component of an agency's safety strategy. The process was adaptable to local conditions by modifying it to fit local resources and the specific needs of the local agency.

## REFERENCES

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