

## ROAD SAFETY AUDIT - ISSUES AND CHALLENGES FROM THE MALAYSIAN EXPERIENCE

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**Abstract:** A fairly recent measure which aims to identify possible deficiencies related to road safety in various stages of implementation of any road project has been instituted in early 1997. The road safety audit covers new road infrastructure projects as well as road improvement schemes. The road safety audit procedures have been developed to include all stages of project implementation, i.e. from planning stage to preliminary design, detailed design, construction (or pre-opening) and operational stage. Amongst the pertinent issues discussed by the paper include the process itself, the appointment of road safety auditors, the accreditation system, independence and accountability, role of auditor vis-à-vis designer and others, role vis-à-vis type of contracts (such as design and tender, design and build, direct negotiation etc), payment for services rendered and other issues. The adequate and proper training of road safety auditors from amongst those experienced in design and road construction will also be emphasized.

**Key Words:** safety audit, safety auditor, safety deficiencies, crashes, road design

### 1. INTRODUCTION

The problem of road accidents in Malaysia is increasingly becoming the main concern of the general public, particularly those in relevant government agencies such as the Ministry of Transport, Ministry of Works and the Traffic Police. The issue of road accidents has always been a subject of serious discussion in the media that involves concerned citizens, academicians and members of non-governmental organisations. The huge economic loss due to road accidents is a waste and various strategies have been embarked upon to reduce the number of accidents, especially the fatal ones (Karim, M.R., 1995). In order to impress upon the public that road accidents may be prevented or reduced in severity (and not something that happen by chance), the term 'crashes' has been preferred instead of 'accidents'. Reducing the high rate of crashes and road fatalities definitely requires a multi-faceted approach focusing on measures related to education, engineering, road environment, enforcement of traffic regulations and emergency services.

Road safety audit, a fairly recent measure that aims to identify possible deficiencies related to road safety in various stages of implementation of any road projects has been instituted in early 1997. Nevertheless, road safety auditing in Malaysia was first conducted by the Roads Branch, Public Works Department, in 1994 (Marjan, J. 2002). To date more than 40 projects under the Seventh Malaysia Plan (1995-2000) have been subjected to road safety audit. The implementation of the road safety audit covers new road infrastructure projects as well as road improvement schemes. The road safety audit procedures have been developed to include all stages of project implementation, i.e. from planning stage to preliminary design, detailed design, construction (or pre-opening) and operational stage.

This paper discusses the road safety audit procedures with reference to the Malaysian experience. Issues and problems related to implementation of the road safety audit will be discussed. The pro-active approach adopted in the road safety audit is generally becoming more important as compared to the re-active approach of accident blackspot investigation. It is like the saying 'prevention is better than cure', though this may be easier said than done. The unique experiences and challenges faced in all stages of the implementation of the road safety audit process in Malaysia may be very relevant to other countries that are in the process of implementing them. Comparisons with procedures adopted in certain developed countries will also be discussed. For example, the burden and responsibility of the road safety audit is normally placed on the auditor/s who is/are usually from among engineers while in some other countries this involves a group of people from various relevant background.

## 2. BRIEF OVERVIEW OF ROAD SAFETY SITUATION IN MALAYSIA

There has been quite a rapid growth in Malaysia in terms of the level of motorisation and road infrastructure development over the past twenty-five years. The country's population doubled from just over 10.4 million in 1975 to over 23 million in 2000 with an average growth rate of about 5% per year. Within the same period the length of roads increased five folds from just above 12,000 km to almost 65,000 km. There is also a marked increase in registered vehicles during the same period from just over 1.2 million to over 10.5 million which consequently led to an increase in car ownership level from 8.2 persons per vehicle in 1975 to 2.2 persons per vehicle in year 2000 (Table 1).

Table 1. Comparison Between 1975 and 2000 Situation

	1975	2000
Population	10,438,137	23,200,000
Reg. Veh.	1,267,119	10,589,804
Road (km)	12,043	64,981
Accidents	48,233	250,417
Casualties	19,440	50,054
Fatalities	2,317	6,035
Car Ownership	8.2	2.2
Fatal/100k pop	22.2	26
Fatal/10k reg.veh.	18.3	5.7
Fatal/100km road	19.2	9.3

The increase in the level of motorisation and the degree of exposure to road accidents consequently contribute towards the increase in road accidents and fatalities. Within the span of twenty-five years the number of accidents rose by more than five-folds and the number of fatalities rose by almost three-folds (Table 1). Nevertheless, even though the fatalities per capita have not reduced (in fact it has increased from 22.2 fatalities per 100,000 population in 1975 to 26 fatalities per 100,000 population in 2000) the fatalities per 10,000 registered vehicles have improved significantly from 18.3 in 1975 to 5.7 in 2000.

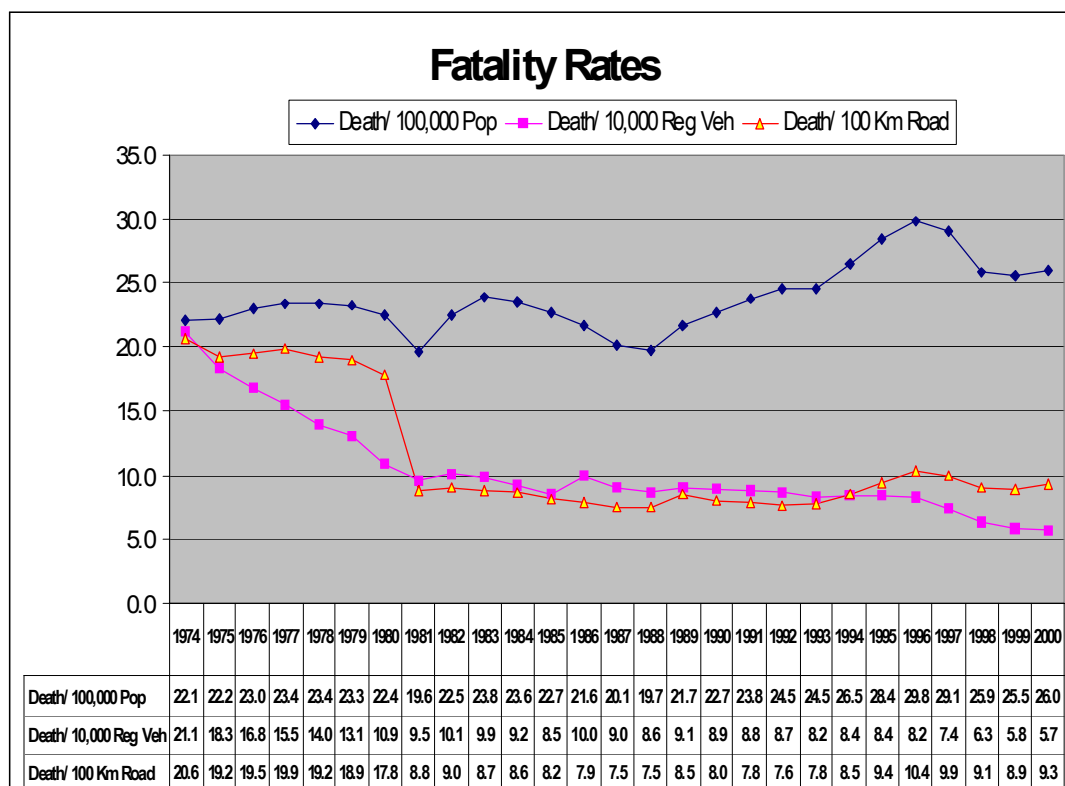


Figure 1. Fatality Rates

Motorcyclists form the highest number of fatalities amongst all road users (Figure 2). This is then followed by pedestrians and car occupants. According to the recent statistics, fatalities from motorcyclists form more than half of all road fatalities (Figure 3). This is rather alarming and the grave situation has led to various measures including aggressive campaigns and continuous enforcement being undertaken by the relevant parties. The motorcyclists have always been made a target group in safety campaigns and enforcement because of their nature of being one of the most vulnerable road users in terms of accident fatalities at present. As an indication of the seriousness of the authorities in combating the road accident problem a Cabinet Committee on Road Safety, chaired by the prime minister was established soon after the Karak Highway accident in 1990 to find ways to effectively reduce road fatalities.

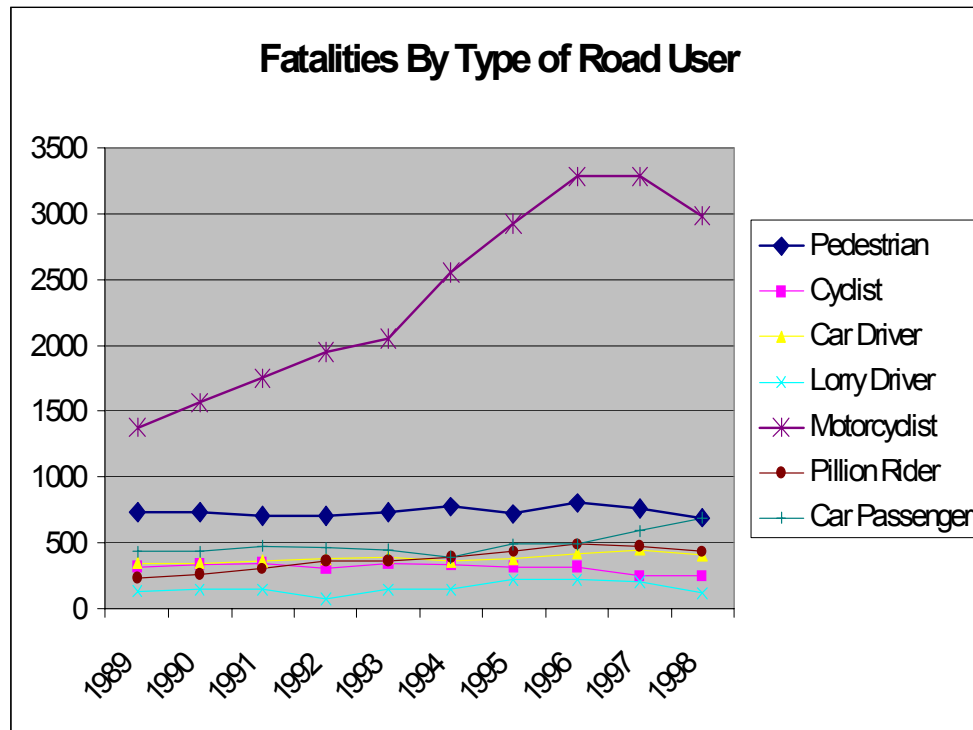


Figure 2. Fatalities by Type of Road User

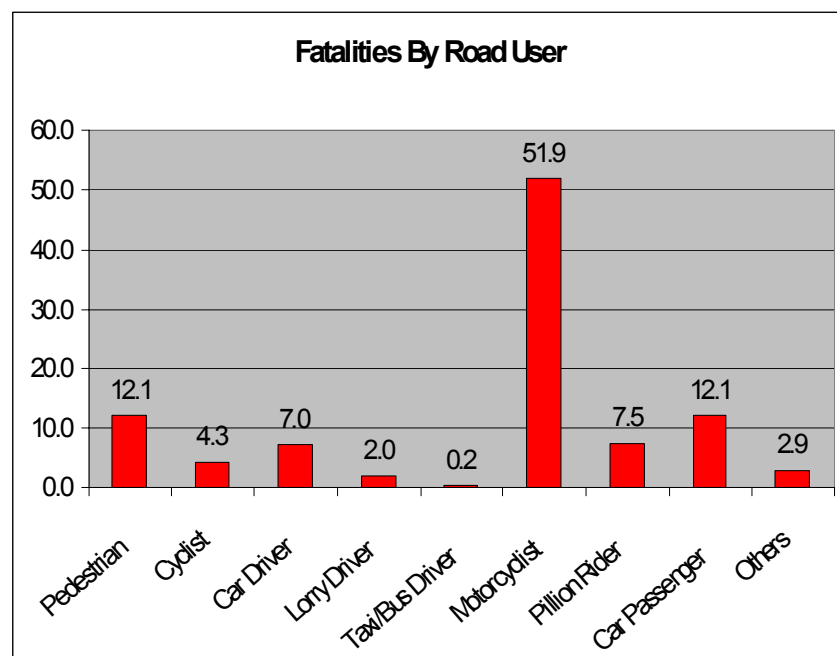


Figure 3. Fatalities by Road User Type (2000)

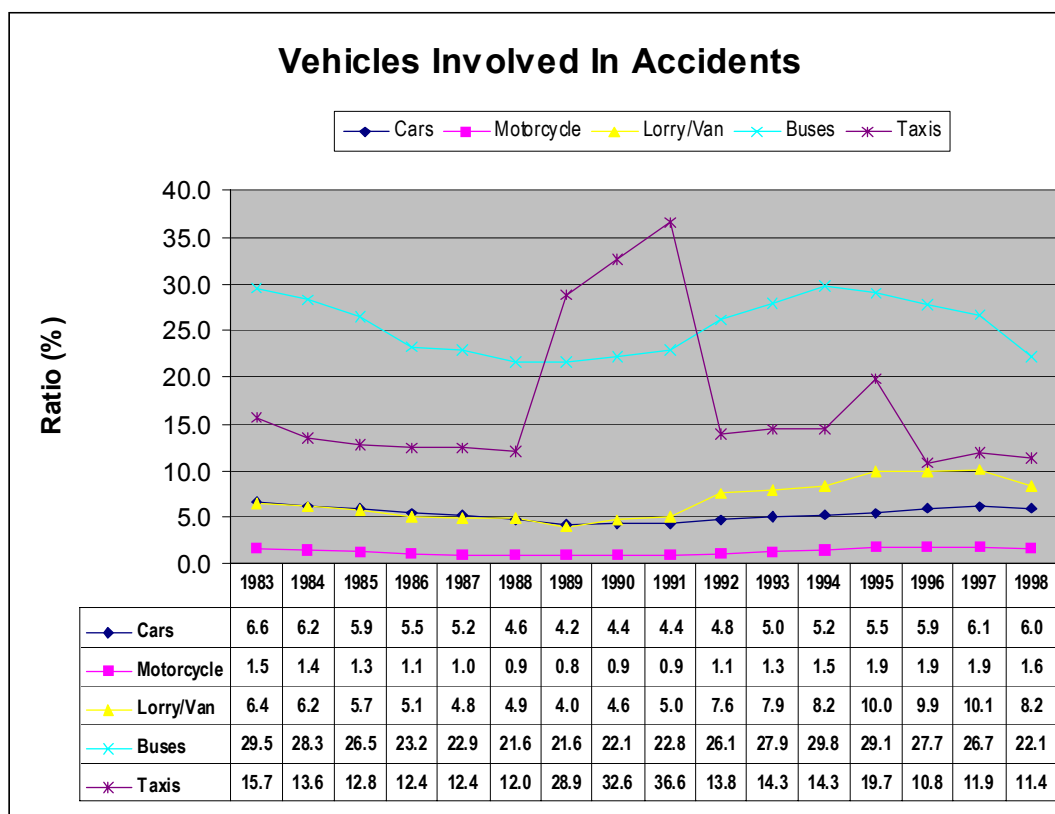


Figure 4. Vehicles involved in accidents

In terms of the types of vehicles involved in accidents the yearly statistics indicate that an alarmingly high percentage of buses are actually involve in accidents as compared to other vehicle types (Figure 4). This does not reflect well to the traveling public who prefer to take the public transport and intercity buses when they know that the chance of a bus being involved in accidents is highest amongst all vehicles. The taxis come in next except that in the period 1989 to 1991 the percentage of taxis involved in accidents is highest amongst all vehicle types. Even though the percentage of motorcycles involved in accidents is lowest (due to its large vehicle population) motorcyclists remains one of the most vulnerable in the event of a crash especially with other motorised vehicles.

### 3. ROAD SAFETY INITIATIVES AND STRATEGIES

A series of intervention programs that relate to strategic safety problems and issues was implemented in the effort to deal effectively with the situation. The basic 3Es approaches were intensified as the main thrust in the accident prevention and reduction strategies while simultaneously the injury reduction and post-crash injury reduction strategies were implemented to further reduce the level of injuries. A summary of the current strategies is shown in Table 2.

Some of the main road safety initiatives that are currently underway may be listed as follows:

- National Accident Database System. This include the development of a new accident recording system; development of a national location coding system using nodes, link,

kilometer posts and grid coordinates; development of national accident mapping system using GIS; development of a one-stop retrieval system for textual data and digital accident sketches into a comprehensive national database using MAAP and Microsoft Access software (Sohadi R.U.R *et.al.* 2002).

- Accident Prevention Program – Road Safety Audit. This involves the application of safety principles by independent qualified person(s) at various stages of project implementation so that potential safety hazard and inadequacies can be eliminated and mitigated before the road is opened to traffic.
- Accident Reduction Strategies – This includes Blackspot Treatment Program, Exclusive Motorcycle Lanes, Daytime running headlights for motorcycles, Targeted Road Safety Campaigns, New Road Transport Act (revision 1999), Integrated Enforcement.
- Injury Reduction Strategies – safety helmets for adults and children
- Post Injury Management – paramedics, trauma centers, rehab facilities

Table 2. Road Safety Planning Matrix in Malaysia

	Pre-Crash	Crash	Post Crash
Human	<ul style="list-style-type: none"> <li>• Education (eg young riders)</li> <li>• Enforcement (eg. Ops Statik, new RTA 1999)</li> <li>• Campaign (eg. Motorcycle safety campaign)</li> </ul>	<ul style="list-style-type: none"> <li>• Compliance of safety devices (eg. Proper use of safety belt, helmet wearing etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Skills of paramedics (eg. First respondent, ERP etc.)</li> </ul>
Vehicle	<ul style="list-style-type: none"> <li>• Vehicle inspection (national testing agency PUSPAKOM)</li> <li>• Crash compatibility (under-run bars etc.)</li> <li>• Vehicle standards (type approval)</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicle and riders safety features (air bags, occupant restraints, child helmets etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Ease of evacuation (better rescue tools, fast release system for helmets etc.)</li> </ul>
Environment	<ul style="list-style-type: none"> <li>• Road engineering programs (national accident database, blackspot programs and road safety audit, new standards)</li> </ul>	<ul style="list-style-type: none"> <li>• Forgiving road furniture (clear zone, crash barriers and cushions, collapsible poles etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Rehabilitation centers</li> <li>• Trauma management (injury database and surveillance)</li> </ul>

(Source: Sohadi R.U.R. *et.al.*, 2002)

#### 4. WHAT IS A ROAD SAFETY AUDIT?

In the Malaysian context, Road Safety Audit (RSA) may be defined as the formal examination of the planning, design and construction of a road project, and of the characteristics and operations of an existing road, by independent and qualified examiners, to identify any

potentially unsafe feature or operational arrangement that may adversely affect the safety of any road user (Public Works Department Malaysia, 1997). It therefore involves a formal process rather than an ad-hoc procedure and the safety audit needs to be performed at specific stages in the development of a project by suitably qualified person or group of persons independent of the planning, design and construction teams involved with the project.

The RSA process is to ensure that all road projects are capable of providing the highest practicable standard of traffic safety for all road users. The main objectives of the RSA may be stated as follows:

1. The identification of potential safety hazards on new roads, at the appropriate stage, so that they can be eliminated or treated to mitigate the adverse effects at minimum cost,
2. The identification of hazardous features of an existing road so that they can be eliminated or otherwise treated before they become accident-prone locations,
3. To ensure that the safety requirements of all road users are considered in the planning, design, construction and operation of road projects, and,
4. To reduce the overall costs of a project to the community.

RSA is known to be a “pro-active” approach towards road safety. The implementation of RSA procedures not only helps to eliminate or minimize accident causes before these are built into a project, it also helps to inculcate a road safety culture particularly amongst those directly involved or indirectly associated with the project. Even in cases when desirable changes to a design cannot be made (due to one reason or another), early detection of safety deficiencies through the RSA process often allows other mitigating measures to be considered.

## 5. THE RSA PROCESS

In general, there are five (5) stages of safety audit that can be conducted on any road project. In the case of Malaysia, the five stages are, namely,

- Stage 1: Feasibility and Planning stage.
- Stage 2: Draft (Preliminary) Design stage.
- Stage 3: Detailed Design stage.
- Stage 4: Construction and Pre-Opening stage.
- Stage 5: Operational stage or RSA of Existing Road.

During the stage 1 audit, problems related to the overall concept for a project, road network safety implications, route options, intersection and interchanges types and locations will be identified. The audit will also consider the safety implications of strategic issues such as access control and provisions for different groups of road users, particularly the vulnerable ones.

Many of the traffic engineering features are usually established during the preliminary design stage. These features such as the cross-section elements, intersection/interchange layout, traffic control options, horizontal and vertical alignment, to name a few, would have

significant effect on the safety performance of the project. RSA conducted at this stage would help ensure that unsafe features are not locked into the road design.

The detailed design stage usually involves the selection and application of standards and guides to meet the specific site conditions. The RSA at this stage would help identify those aspects in which safety has not been given high enough weighting in comparison to other competing factors. Potential hazards such as those arising from improper combination of horizontal and vertical alignments as well as other undesirable features associated with traffic signing, traffic control, street lighting, drainage, landscaping and the like would be addressed during this stage of the safety audit.

The stage 4 audit is normally done prior to the practical completion of a project just before the opening to traffic. It involves site inspections during the day and at night to observe details on actual placement of items such as guardrails, street lighting, traffic signing, landscaping and to check that the needs of respective road users meet the desired safety standards. This is practically the final stage to correct any deficiencies before the road is opened to traffic.

The stage 5 audit can be performed on either a newly completed road opened to traffic or on an existing road which is earmarked for upgrading. Auditing at this stage will help identify safety problems that arises due to normal 'wear and tear' from traffic operation as well as hazards associated with maturing landscape that may cause obstruction to traffic signs and impaired sight distance and visibility.

The general procedure of the RSA may be illustrated in *Table 2*. The step-by-step procedure may be adopted to suit the requirements of any road organization. There will be meetings at every stage of the audit to discuss the findings and recommendations of the auditors and as such decisions can be made by the client or road authority in the shortest possible time to avoid delay in project implementation whilst not jeopardising safety.

## **6. WHO ARE THE ROAD SAFETY AUDITORS?**

As RSA is a specialized task that requires specific knowledge and experience related to traffic engineering, traffic management, road user behaviour and road safety principles and practices, the person or group of persons to undertake the task would need to be suitably qualified and accredited by the relevant government agency. For the case of Malaysia, the Public Works Department (PWD) through the Road Safety Section of the Road Design Unit undertakes the role of accrediting the road safety auditors before one is appointed to perform the RSA. This is to ensure that the necessary knowledge, skills and experience required of a road safety auditor can be ascertained and a proper and thorough safety audit will be conducted.

The Road Safety Section of the Road Design Unit of the PWD in Malaysia has been involved in vetting through applications for road safety auditors and is presently considering a formal registration of these auditors. The basic requirement for accreditation currently practiced in Malaysia is such that the road safety auditor shall be an engineer who has a good understanding of traffic engineering, traffic management and the human factors involved in the driver/vehicle/road environment interaction. Experience in accident site investigation and proposing countermeasures would be advantages. Experience in the various aspects of road planning, design, construction and maintenance would also be desirable.



Table 2. Road Safety Audit Procedure

Action	Responsibility
Step 1. Preparing audit brief; Appointing the auditor(s); Appointing the independent assessor	Client / Designer / Construction Manager
Step 2. Assembling background information, Plans to be audited, other documents	Client / Designer / Construction Manager
Step 3. Initial meeting with auditor(s), Handing over of plans etc for audit, Discussions, arrangements for site inspections etc.	Client / Designer / Construction Manager
Step 4. Doing the audit, examine plans, Site inspections etc.	Auditor(s)
Step 5. Preparing the audit report	Auditor(s)
Step 6. Completion meeting (if required), Presentation and discussion of audit findings.	Client / Designer
Step 7. Deciding the action required on the audit findings	Client / Independent Assessor

(Source: Public Works Department Malaysia, 1997)

Apart from this, for the purpose of accreditation the prospective road safety auditor would also need to fulfill the following requirements:

- At least ten (10) years working experience or six (6) years working experience with post-graduate qualification.
- At least three (3) years road design experience and three (3) years of road safety and traffic engineering experience.
- Be a professional engineer registered with the board of engineers Malaysia.
- Attended a training course organized by the Road Safety Section of the Road Design Unit of the PWD or other related road agencies and obtained certificates of attendance or presented a paper related to road safety.

Apart from RSA being relatively new to the engineering fraternity in Malaysia the accreditation requirements as stipulated above apparently have aroused several reactions from the practicing engineers. Certainly at a glance the requirements seem to be restrictive while at the same time the person(s) entrusted to conduct the RSA should have the knowledge and competency to adequately execute the job.

Presently, there is only a handful of road safety auditors accredited by the Roads Branch of the PWD. As part of the effort to encourage more engineers to be involved with RSA and register as auditors, training programs have been conducted by the Roads Branch in association with the Road Engineering Association of Malaysia (REAM). The training not only focuses on producing more qualified road safety auditors but also on developing skills of

road designers to design with safety being given the emphasis it deserves. The Public Works Department engineers and technical support staff are also continuously undergoing in-house training to inculcate the safety culture in their work. Local universities are also offering elective courses on transportation engineering with road safety and road safety audit being made as major components.

## **7. APPOINTMENT OF ROAD SAFETY AUDITOR**

The current practice of appointing the road safety auditors is far from ideal as the auditor is not appointed directly by the approving authority or the road authority. Instead, the auditor is appointed by the client (consultant/contractor) after receiving prior consent from the road authority. The services of the road safety auditor will also be paid by the client instead of by the road authority and the payment will have to come from the total fees received by the client. This method of appointment of auditors has given rise to a number of shortcomings such as follows:

- The independence of the auditors may be questioned as the auditors will be torn between their professional ethics and their allegiance to their paymaster (client).
- The best interest of the government / public may not be served as the auditors may be subjected to the needs of the paymaster.
- The auditor may be appointed rather late making it difficult to implement their recommendations.

## **8. SUBMISSION OF RSA REPORTS**

The RSA reports are usually submitted within two weeks after the audit for a particular stage started. Presently, there are basically two ways in which RSA reports are submitted to the approving authority since there are no definite guidelines on this. In the first method, the auditor submits the RSA report directly to the approving authority with copies submitted to the client (consultant/contractor). In this manner, there would not be any possibility of delay or the risk of having the report being amended by a third party before it reaches the approving authority. However, this method of submission is not really favoured by certain clients who prefer to submit the report themselves to the approving authority after they have vetted through it.

The second method of submission involves the auditor submitting the RSA report to the client (consultant/contractor) who then submits it to the approving authority. This method is favoured by certain clients because they have a chance of vetting it before submitting it to the authority. However, it may cause delay in reaching the approving authority especially when there are points of disagreement that may arise out of the report.

There has been strong recommendations from the practicing auditors that the road authority should enforce the first method of submission of RSA reports in order to avoid delay in making decisions on the recommendations of the report and also to avoid any risk of having the report being amended by a third party.

## 9. FAST TRACK PROJECTS

In the effort to accelerate infrastructure development in the country some of the important and large road projects are awarded on a 'design and build' basis and this is usually done on a fast track mode. For such projects many activities are running simultaneously and there is seldom a clear cut distinction between the different stages of planning, preliminary design and detailed design. Under such circumstances, the road safety audit for the different stages 1, 2 and 3 would have to be conducted without having the usual holding points as compared to the normal design and tender projects.

The design and build or fast track projects are awarded to contractors/consortium who would then appoint the road safety auditor and pay for their services from their own allocation. In such a situation the auditor is usually placed in a difficult position where the independence of the auditor is sometimes put to question and the audit may not be as effective as it should be. Decisions have always to be made quickly and issues raised by the auditor may not be easily resolved and any delay would be costly to the client.

In order to improve the situation, whether the road project is fast track, design and build or the normal design and tender, several procedures have been proposed to the road authority, namely,

- The road safety auditor(s) should be appointed directly by the road authority to ensure their independence and professionalism is not compromised. The fees for the services of the auditor should come directly from the road authority and not being part of the client (consultant/contractor) fees.
- The appointment of the auditor(s) should be made very early at the inception of the project, preferably at about the same time as the appointment of the design consultants.
- The auditor should be allowed to get involved in all aspect of the project implementation so that safety inputs could be accommodated into the design as the project progresses.
- The auditor should be given complete sets of documents and plans to be audited progressively so that delays could be minimized.
- The auditor should be made informed or get involved in technical discussions that could have bearing on safety issues.

## 10. CONCLUDING REMARKS

Although RSA is still at its infant stage in Malaysia, the local road authority (PWD) has taken positive steps to enforce its implementation in almost all federal road projects (new roads and upgrading works) because of the strong commitment of the government and road authority to improve the level of safety on the nation's roads. Despite its relatively slow momentum initially, RSA is now generally accepted by the road engineering community as part of the requirement for the successful completion of a road project. RSA may be regarded as an important part of the quality assurance process that would bring the best possible return on

the investment of public and private funds, more so for the interest of the road users at large.

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