

## IMPLEMENTING ROAD SAFETY AUDIT IN THAILAND

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**Abstract:** Road traffic accidents in Thailand have been a major cause of injuries and loss of lives. The number of accidents and fatalities reached record highs in 1994 (102,610 crashes) and 1995 (16,727 deaths). Fatal accident statistics have remained high up to the present time: for the year 2001, a total of 77,616 crashes and 11, 652 deaths were recorded by the National Police Office. The cost of accident-related damage for 1994, as estimated by the Minister of Transport and Communications, MOTC, was 106,367 million Baht (2.6 billion US \$) or 3.41% of the country's GNP. In order to stem the high cost of accidents (over 100,000 million Baht in damages and about 12,000 deaths a year), the MOTC initiated a nationwide master plan for road safety in 1997; one of the key action area is to develop a road safety audit process for Thailand. Following a policy to establish road safety audit as a formal process in crash prevention, MOTC has commissioned the Faculty of Engineering, Prince of Songkla University and the Asian Center for Transportation Studies, the Asian Institute of Technology to undertake a research study on the road safety audit process for Thailand, and to prepare a comprehensive manual for road safety audit. This paper describes the outcomes of the research study.

**Key Words:** Road Safety Audit, Traffic Accident, Accident Prevention

### 1. INTRODUCTION

Road traffic accidents in Thailand have been a major cause of injuries and loss of lives. The number of accidents and fatalities reached record highs in 1994 (102,610 crashes) and 1995 (16,727 deaths). Fatal accident statistics have remained high up to the present time: for the year 2001, a total of 77,616 crashes and 11, 652 deaths were recorded by the National Police Office (See Table 1 and Figure 1). The cost of accident-related damage for 1994, as estimated by the Minister of Transport and Communications, MOTC, was 106,367 million baht or 3.41% of the country's GNP. In order to stem the high cost of accidents (over 100,000 million baht in damages and about 12,000 deaths a year), the MOTC initiated a nationwide master plan for road safety in 1997; one of the key action areas is to develop a road safety audit process for Thailand. A safer road environment can be established by (a) application of crash reduction countermeasures at hazardous road locations (b) accident prevention. Road safety audit is a proactive approach in dealing with road crash problem in a formal and systematic way. It is based on the principle that prevent is better than cure. It provides an effective

means to eliminate potential safety-related deficiencies on a road by identifying such deficiencies in advance and making recommendations for their elimination. A review of international practices in road safety audit was made to identify the appropriate method that would be suitable for Thailand. These include the AUSTROADS 2002 Road Safety Audit guide, the 1996 IHT Guidelines for the Safety Audit of Highways, the 1999 JKR Guidelines for the Safety Audit of Roads and Road Project in Malaysia and the 1999 University of Brunswick Transportation Group Road Safety Audit Guidelines. In the course of the study, a road safety survey was carried out on sample highways and road throughout the country to gather data and information on safety issues; a survey and analysis of key government engineers and administrators' opinions was conducted to identify issues and problems relating to the implementation of road safety audit. Two seminars were also organized in this regard, participants include practicing engineers, police and key administrators of road agencies. As part of the implementation process, important institutional issues such as accreditation of auditors and which type of organization to oversee the road safety audit process were studied and recommendations made. A Thailand Road Safety Audit Manual and A Guide for Design of Safer Roads for All Users were prepared which will be used in the training of auditors which is one of the key step towards full implementation of road safety audit in the country.

Table 1. Traffic Accidents in Thailand

Year	Bangkok			Provincial			All		
	Accidents	Fatalities	Injuries	Accidents	Fatalities	Injuries	Accidents	Fatalities	Injuries
1987	19,745	752	6,333	4,387	1,352	2,256	24,132	2,104	8,589
1988	31,175	817	9,565	4,114	1,198	3,939	35,289	2,015	13,504
1989	31,709	917	10,005	6,388	4,451	3,076	38,097	5,368	13,081
1990	33,064	949	10,701	7,417	4,816	7,551	40,481	5,765	18,252
1991	38,355	1,057	10,778	7,946	5,276	8,777	46,301	6,333	19,555
1992	46,743	983	11,025	14,586	7,201	9,677	61,329	8,184	20,702
1993	64,006	1,011	11,031	20,886	8,485	14,299	84,892	9,496	25,330
1994	72,359	1,290	18,849	30,251	13,856	24,692	102,610	15,146	43,541
1995	64,469	1,284	21,697	24,898	15,443	29,021	94,362	16,727	50,718
1996	60,308	1,069	23,314	28,248	13,336	26,730	88,556	14,405	50,044
1997	54,324	903	20,933	28,012	12,933	27,828	82,336	13,836	48,761
1998	46,800	732	18,920	26,925	11,502	33,618	73,725	12,234	52,538
1999	37,868	594	17,104	29,932	11,446	35,434	67,800	12,040	47,770
2000	43,485	1,582	23,368	30,252	10,406	29,743	73,737	11,988	53,111
2001	45,711	1,519	22,854	31,905	10,133	31,106	77,616	11,652	53,960

Source : Royal Thai Police

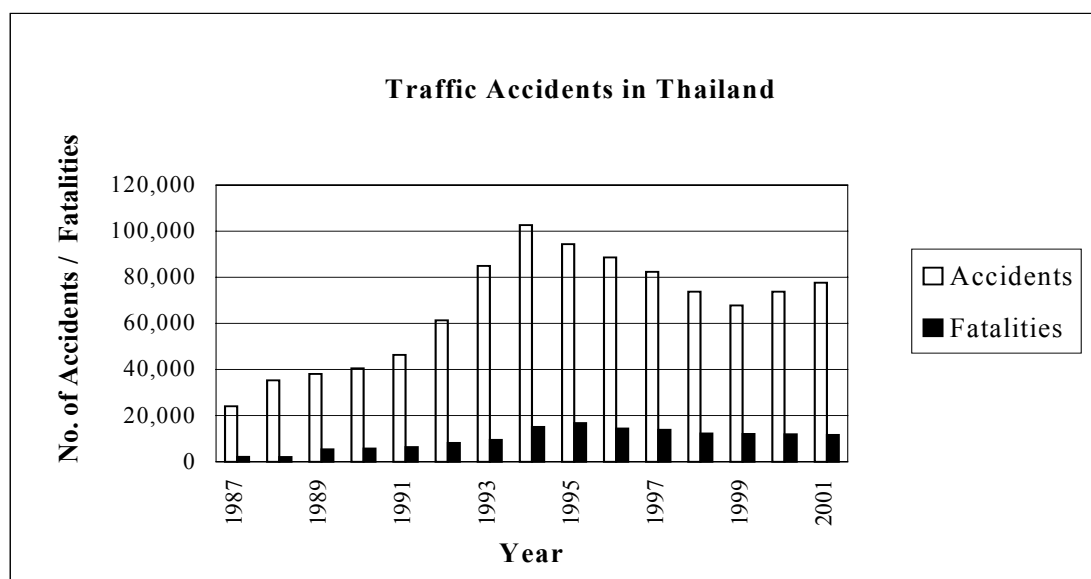


Figure 1. Traffic accident situation in Thailand

## 2. REVIEW OF INTERNATIONAL EXPERIENCE IN ROAD SAFETY AUDIT

The concept of road safety audits originated in United Kingdom during the 1980s. Since 1990 safety audit has been made mandatory on UK trunk roads and motorway schemes (IHT, 1996).

In Australia and New Zealand the practice of RSA has gained wide acceptance. Road authorities in the two countries established RSA guidelines in 1994. The revised version of the guidelines, released in 2002 was recognized as a standard in the region (Austroads, 2002).

In Canada, a formalized framework for RSA was adopted in early 1998. The United States began considering RSA in 1996 and, after a brief feasibility study period, embarked on a series of RSA pilot projects in 14 states (UNB Transportation Group, 1999). Malaysia's Public Works Authority published a set of guidelines for the conduct of RSA in 1997, based on the Australian model (Public Works Department Malaysia, 1999).

## 3. SAFETY INSPECTION OF SAMPLE HIGHWAYS AND ROADS

The Study Team carried out safety inspections on a number of sample highways and roads in five regions of Thailand, namely Central, Eastern Seaboard, Northeast, North and South. Inspections were performed during daytime and nighttime as safety conditions can vary significantly between daylight and darkness. These findings were used as examples in the writing of a 'Thailand Road Safety Audit Manual' as well as for the development of 'Guidelines for the Design of Safer Roads for All Users.' Approximately 1,574 kilometers of roadway were inspected in this exercise, representing a broad range of road types: motorway, arterial and sub-arterial roads, collector and distributor roads, and access roads.

The Study Team has identified a range of safety issues on the roads thus inspected some of the findings are summarized below:

- Sight distances are shortened by roadside objects - foliage or billboards (See Figure 2).
- Unforgiving roadside features - large trees, large pole deep trenches, damaged or incorrectly/ improperly installed guardrails (See Figure 3).
- Unsafe road geometry - sharp vertical and horizontal bends, narrowed carriageway on bridges.
- Poor traffic signing - worn - out, damaged, dislodged signs, absence of signs
- Fading road surface markings

- Distracting billboards at intersections (See Figure 4)
- Inconsistent signing - not complying to standards
- Dust and debris on carriageways
- Unsafe level difference between carriageway and shoulder of roads under constructions.
- Inadequate lighting at vulnerable areas, such as intersections
- U-turn locations without a “storage lane” next to the median (See Figure 5)
- Unsafe U-turn locations e.g. an opening located where two access tracks enter the sides of the highway, thus forming an unintended “intersection”
- Absence of safety devices or amenities for pedestrians especially at sites of high people traffic (See Figures 6, 7).
- Access tracks are obscured from sight distance.
- Makeshift openings on the median used by local people for U - turning or road crossing.
- Inadequate safeguards at road - work sites.



Figure 2. Sight distance is shortened by obscuring foliage.



Figure 3. Large pole located on curve poses a potential hazard.



Figure 4. Distracting billboards at an intersection.



Figure 5. U - turn opening without a storage lane creates potential for rear end collisions.



Figure 6. Pedestrian needs were overlooked during the design stage. Inadequate designs can put local residents at risk.



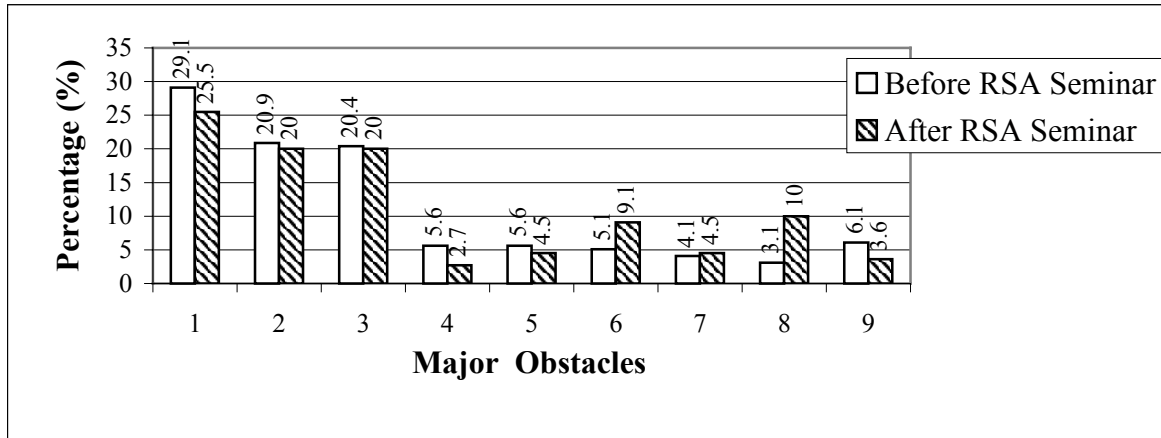
Figure 7. Permanent fixtures on the curb forcing pedestrians to stray onto the road.

## 5. OPINIONS OF THAI ROAD AUTHORITIES ON ROAD SAFETY AUDIT

Opinions of road authorities regarding the application of road safety audits were sought by the Study Team. A survey of their views and suggestions concerning RSA was conducted among organizations such as the Department of Highways, Public Works Department, Bangkok Metropolitan Administration, Department of Rural Roads, Expressway and Transit Authority as well as provincial municipalities. A second opinion probe was carried out on the attendees of a June 2002 seminar on RSA in Bangkok. The results of these surveys are summarised below.

- RSA should be performed on road projects of all sizes as accident potential exists regardless of size.
- Stages of a road development that are suitable for an audit: 1) Detailed Design stage 2) Post-opening stage or existing roads 3) Pre-opening stage. For the other stages, i.e Feasibility and Preliminary Design, almost all of the respondents did not see the necessity of a safety audit.
- Major obstacles to the adoption of RSA include: (1) the procedure not yet clearly defined (2) procedure not as yet supported by legislative powers (3) Lack of qualified auditors.

The respondents offered diverse views regarding the keys to effective application of RSA. This indicates that a number of issues would have to be addressed simultaneously. For example, clear policy requirements at the ministerial/departmental level should be established for pilot audits at the early phases of RSA introduction; the knowledge gained from these pilots can then be used for the training of new auditors; public awareness of RSA is essential for inducing a universal acceptance of the process; budgets for RSA activities should be made available. Perceived obstacles to application of road safety audit process was shown in Figure 8.



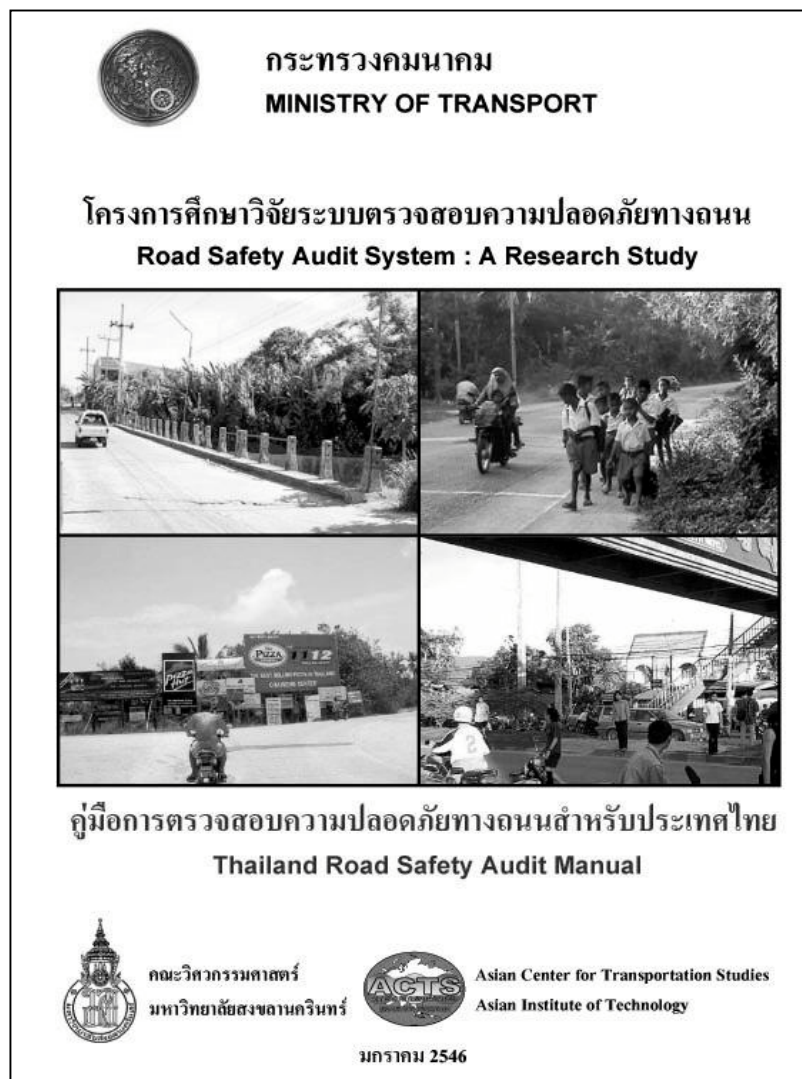
Notes:

- 1 = RSA procedure not yet well defined
- 2 = RSA procedure lacks legislative powers
- 3 = Shortage of qualified Thai safety auditors
- 4 = RSA would lengthen project duration
- 5 = RSA might conflict with established work procedures
- 6 = Reluctance of road designer to submit to audits
- 7 = Waste of money on activity of limited benefit
- 8 = Department administrators not in favour of
- 9 = Others

Figure 8. Major obstacles to the adoption of RSA

## 5. DEVELOPMENT OF THAILAND RSA MANUAL

The Study Team has developed a RSA manual for Thailand. It is based on the latest Austroads 2002 guideline, the first edition of which has been followed by many countries. Figure 9 shows the cover of the manual and its contents



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Figure 9. Thailand Road Safety Audit Manual



## **5.1 Guidelines for the Design of Safer Roads for All Users**

Based on the findings from road safety inspections and review of good practices performed by the Study Team, a publication has been produced in separate cover (see Figure 10). The “Guidelines for the Design of Safer Roads for All Users” consists of 21 chapters with a range of topics including general background, design methods, existing practices, safety principles and examples of good practice. The chapter headings are shown below:

- Chapter 1: Road Network
- Chapter 2: Design Speed
- Chapter 3: Geography and Environment conditions
- Chapter 4: Sight distance
- Chapter 5: Horizontal and Vertical Alignments
- Chapter 6: Cross sections
- Chapter 7: U-turn openings
- Chapter 8: At grade intersections
- Chapter 9: Interchanges
- Chapter 10: Roundabout
- Chapter 11: Drainage
- Chapter 12: Traffic Signal
- Chapter 13: Traffic Sign
- Chapter 14: Traffic marking and Delineator
- Chapter 15: Roadside Safety
- Chapter 16: Lighting
- Chapter 17: Parking and Bus Stop
- Chapter 18: Pedestrian and Cyclist Facilities
- Chapter 19: Access Control
- Chapter 20: Traffic Calming
- Chapter 21: Railroad - Highway Grade Crossing



**กระทรวงคมนาคม**  
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**โครงการศึกษาวิจัยระบบตรวจสอบความปลอดภัยทางถนน**  
**Road Safety Audit System : A Research Study**



**แนวทางการออกแบบถนนที่ปลอดภัยมากขึ้นสำหรับผู้ใช้งานทุกประเภท**  
**Guidelines for the Design of Safer Roads for All Users**



**คณะวิศวกรรมศาสตร์**  
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**Asian Center for Transportation Studies**  
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Figure 10. Guidelines for the Design of Safer Roads for All Users.

## 6. ACCREDITATION AND LICENSING OF SAFETY AUDITORS

### 6.1 Auditor Accreditation Systems

In countries where RSA is an established practice, an auditor must be a qualified practitioner with experience in road design, traffic engineering, safety engineering and other related disciplines. An auditor must have passed relevant training courses in addition to having maintained current knowledge of the practice. Despite the universal recognition of the skills and experience required of an auditor, most countries do not appear to have a formal accreditation system as yet.

**UK:** The UK is the original birthplace of road safety auditing. There has been considerable effort to make RSA guidelines and support systems easier to understand and use. There is training available in all aspects of road safety auditing and the process is well recognized and supported. However, there is no formal accreditation system in place for auditors.

**Australia:** Consensus reached at the 2001 Road Safety Audit Summit in Brisbane reflected the criteria below:

- Criteria for the formal accreditation of auditors are essential.
- A Senior Auditors should be required to lead the audit team.
- Registers of accredited auditors are very important

Western Australia leads the way in the accreditation of road safety auditors and is the only State at present to have a formal accreditation system and register. It has a basic set of criteria for both auditors and senior auditor accreditation, which include field experience and required attendance at a formal training course.

#### Accreditation Criteria in use by Western Australia ([www.mrwa.wa.gov.au](http://www.mrwa.wa.gov.au))

The criteria, based on those adopted by all Australian States at a Summit held in 1997 are as follows:

An Auditor shall:

- Have a minimum of five years experience in road design, traffic engineering; or closely related road safety discipline.
- Have successfully completed a training course approved and recognized by the Mainroads Western Australia.
- Certify that he/she has maintained current knowledge and experience in road safety auditing

A Senior Auditor shall:

- RSA should be performed on road projects of all sizes as accident potential exists regardless of size.
- Have a minimum of five years experience in road design, traffic engineering; or closely related road safety discipline.
- Have successfully completed a training course approved and recognized by the State Road Authority.
- Certify that he/she has maintained current knowledge and experience in road safety auditing.
- Have participated in at least five road safety audits under the guidance of a Senior Road Safety Auditor; Three of the five audits must be Stage 1, 2 or 3 Audits and another must be a Stage 4 or 5 Audit.

The persons who meet the above pre - requisites, will be registered as 'Auditors' or 'Senior Auditors', following consultation by the joint Mainroads WA/IPWEA Road Safety Audit Panel, and recommendation to the Institution of Public Works Engineering Australia (WA Division). The list is available on the MRWA web site [www.mrwa.wa.gov.au](http://www.mrwa.wa.gov.au).

**U.S.A.:** There are guidelines for Road Safety Audit available in the country. The process has been adopted in several States and by the Federal Government. There does not appear to be any formal accreditation process in any of these States as yet.

**Europe:** Apart from Denmark and Ireland, development of road safety auditing in most continental countries has been sluggish. Danish road authorities have developed a manual along the line of the UK model, and Ireland has recently systematically implemented its version of RSA.

In 1997, the European Transport Safety Council proposed to member countries to establish mandatory safety audits on major highways. Expansion of safety auditing to include all types of roads is also recommended for the future (Proctor, Belcher and Cook, 2001).

There are guidelines, produced by PIARC, which are similar to that being used in several European countries and the AUSTROADS Guidelines. While the application of Road Safety Audits is now becoming established, there does not appear to be any formal accreditation process nor a standard training regime in Europe as yet.

**Malaysia:** Road Safety Auditing is growing in Malaysia. The Malaysian RSA Guidelines are based on AUSTROADS but have been prepared to reflect the local conditions. The requirements for a person undertaking road safety audits are as follows:

- Complete a RSA course conducted by the Road Engineering Association under its training programs.
- Have Professional Engineer status from the Board of Engineers Malaysia.
- At least 10 years working experience, or 6 years if educational qualification higher than bachelor's degree.
- 3 years experience in road design, traffic and safety engineering areas.
- Have published papers at least at an international conference in road safety.

Malaysia's public works department has established a register of auditors for intra-departmental use. Auditors status in regards to external audits tend to vary from project to project.

## 6.2 Auditors' Qualification and Accreditation for Thailand

From the review of accreditation systems in use by several countries, particularly in Australia where the latest RSA 2002 Guide suggests criteria for accreditation of senior auditors for the whole country, which emphasize experience and qualification, and Malaysia where accreditation is an essential part of the RSA system, plus information derived from surveys of opinions among Thai administrators, engineers and attendees of the two seminars held in Bangkok, which clearly indicates the support for a formal accreditation of auditors, the Study Team has drawn up a suitable set of criteria for an accreditation system for Thailand, as follows:

- Two tiers of qualification:
  - Senior Auditor (team leader)
  - Auditor
- A senior auditor shall:
  - Have at least five years experience in a discipline closely related to RSA i.e. road design, road construction or traffic engineering, or safety engineering.
  - Have completed a training course approved by MOT.
  - Field experience in safety auditing is an essential criterion. A lead auditor shall have participated in no fewer than 5 audits, two of which should be design-stage audits.
  - Certify that he or she has maintained current knowledge of the discipline. This can be demonstrated by having conducted at least one audit every year, or participated in RSA training or seminar on safety engineering at least once a year.
- An auditor shall:
  - Have at least five years experience in a discipline closely related to RSA i.e. road design, road construction or traffic engineering, safety engineering, or human behaviors.
  - Have completed a training course approved by MOT.
  - Certify that he or she has maintained current knowledge of the discipline. This can be demonstrated by having conducted at least one audit every year, or participated in RSA training or seminar on safety engineering at least once a year.

## 7. RECOMMENDATIONS FOR THE ADOPTION OF RSA IN THAILAND

The Study Team made the following recommendations:

### 7.1 Legislation and Regulations Governing the Practice of Road Safety Audit

- For the short term (2003 to 2007) RSA may be introduced without specific legislative support. Safety audits may be incorporated into the policies or practices of those government agencies tasked with road safety promotion according to government's plan to reduce the level of accident-related casualties by 50% by the year 2007. For the longer term, (five years after the policy-only stage) legislation governing RSA may be required in order to enforce the practice on all types of road schemes.
- In practice for the short term, RSA may be incorporated as a requirement in certain projects, particularly in foreign aid-funded or loan undertakings. Road agencies such as DOH, Department of Rural Roads, BMA and ETA may input road safety audit in the Terms of Reference governing the design, construction and maintenance of all road and traffic works tenders.

### Which Agency Should Have the Overall Jurisdiction over RSA Practices?

- A "Committee for RSA Development and Implementation" should be appointed by MOT. Office of Transport and Traffic Policy and Planning is to act as Secretariat office of the committee.
- The responsibilities of the committee should include the following:
  - Establish RSA organizational frameworks and guidelines for implementation.
  - Oversee the consistency and direction of RSA practices in Thailand and evaluate the overall implementation.
  - Supervise safety issues relating to the design and construction of rural roads by local administrative councils, in preparation for the planned dismantling of the Department of Rural Roads which is due in five years according to the new Civil Service Reform Act.
  - Establish curricula for RSA training/workshops for the development of qualified auditors of high standards.
  - Establish a system for the formal accreditation of auditors, for example, criteria and qualifications for accreditation, issuance of auditor licenses, and the setting up of a "auditors registry."
  - Disseminate information on RSA in order to generate awareness among government agencies and the private sector of the importance of safety auditing.
  - Advise MOT to establish a system that links RSA funding with the annual budgeting of the various organizations under the ministry; and allowing for private sector participation in RSA activities.

## 8. CONCLUSIONS

The enormous social-economic and public health costs of road crashes involving some 12,000 annual fatalities and over 100,000 million Baht annual economic loss (2.6 billion US \$) has prompted the Ministry of Transport to initiate the research into the adoption of RSA process in Thailand. The research involves the review of international RSA practices as well as surveys of opinions of the country's key stakeholders in road safety. The Australian model which has been followed in many countries is considered practical and suitable for adaptation for Thailand. A system for accreditation of senior auditors and auditors has been recommended by the Study Team for implementation by the Ministry of Transport. For the short term 2003-2007, the Study Team recommends the immediate incorporation of RSA into all stages of road and traffic development projects. As for the longer term, legislation governing RSA practice may be required. The study has produced two documents: "Thailand Road Safety Audit Manual" and "Guidelines for the Design of Safer Roads for All Users" The two documents cover extensively examples of hazardous road features throughout Thailand as well as give examples of good practice from other countries. The former document will be used in the training of Thai road safety auditors. Following the completion of the research project. The Thai government has set into motion a series of training of auditors to prepare the groundwork for the adoption of road safety audit.

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