گەشتێکی دیراسەیی بۆ پراکتیزەکردنی بەڕێوەبردنی سەلامەتی ڕێگاوبان

تێبینیم کردوە کە سەلامەتی ڕێگاوبان لە کوردستاندا بە شێوەیەکی بەرچاو لە خوار ئاستی ستانداردەکانی سەلامەتی ڕێگاوبانی دنیای ئەمڕۆدایە کە وایلێهاتوە ژمارەی قوربانیانی کارەساتی ڕێگاوبان بە ڕێژەیەکی بەرچاو ونەخوازراو لە سەروو ئاستی ڕێپێدراوەوەیە.

هەڵبەتە هۆکارەکانی ئەم ڕووداوانە تەنها لەیەک فاکتەردا گردنابێتەوە. لێ، سەلامەتی ڕێگاوبانی یەکێکە لە گرنگترین ئەو فاکتەرانەی کە لەبەرچاو نەگیراوە و وەکو پێویست پراکتیزە نەکراوە لە کوردستاندا.

بە حوکمی ئەوەی کە بۆ خۆم لە وولاتێکی وەکو ئەمریکادا دەژیم و لە بواری پیشەکەی خۆمدا وەکو ئەندازیارێکی شارستانی لەوێ کاردەکەم بە باشمزانی ئەم دیراسە زانستی و پراکتیکە بخەمە بەردەستی ئەندازیارانی کورد کە تیمێکی سەر بە دەزگای ڕێگاوبانی فیدراڵی لە ئەمریکا بۆ پێشخستنی سەلامەتی ڕێگاوبان لە ڕێگەی سەردانی کۆمەڵێک وولاتی پێشکەوتووی وەکو یابان، ئوستراليا و نیوزیلەندە تویژینەوە و لێکۆڵینەوەیان لەسەرکردوە و کە لە ماڵپەری دەزگای ڕێگاوبانی فیدراڵی لە ئەمریکادا بڵاوکراوەتەوە.

ئەم تیمە، جگە لەسەردانکردنیان بۆ ڕێگاوبانە گرنگەکانی ئەو وولاتانە، سەردانی کەسانی حکومی، ئەکادیمی وخاوەن شارەزاییان کردوە و گفتوگۆ و ئافتنیان لەتکیانداکردوە بۆ گەیشتن بە ئەنجامێکی باش و بۆ دەوڵەمەندکردنی تویژینەوەکەیان.

ئەم دیراسەیە بەری ڕەنج و تێکۆشانی کۆمەڵێک زانا، لە ڕووی خوێندن و لە ڕووی شارەزاییەوە، دەربارەی ڕێگاوبان وبەڕێوەبردن و بەڕێوەبردنی سەلامەتی ڕێگاوبانی، کۆمەڵێک ئەندازیار، کۆمەڵێک تەکنیکی، تویژەرو پشکنەر و کۆمەڵێک بەرپرسی حوکومی لە بواری کارگێڕی، بەڕێوەبردن، تویژینەوە و ئەندازیارە کە لە کۆمەڵێک وولاتی پێشکەوتووی وەکو یابان، ئوستراليا و نیوزیلەندەدا دیراسەی لەسەرکراوەو سەرباری ئەوەی کە ماندوبوون و توانا و ووزەیەکی زۆری تیدا سەرفکراوە، بڕێکی زۆر پارەیشی تێچووە.

هەر یەکە لەو سێ وولاتە پێشکەوتنی بەرچاویان بەدەستهێناوە لە بواری سەلامەتی ڕێگاوباندا و لەسایەی داڕشتنی پلانی ستراتیجی بۆ دروستکردنی ڕێگاوبان بە شێوەیەکی سەلامەت توانیویانە ببنە خاوەن ڕێگاوبانێکی باش و سەلامەت کە ژیان و سەلامەتی هاووڵاتیانیان پارێزراوتر بێت و مارە ڕووداوەکانی ڕێگاوبان و قوربانیانی ڕووداوەکانی ڕێگاوبان بگاتە نزمترین ئاست.

هەڵبەتە وەکو هەموو شتێکی دیکە، دەکرێت ئەم دیراسەیە بەو شێوەیە کەڵکی لێوەربگیرێت کە لەگەڵ بارودۆخ، باری ئابووری، ئاووهەوا،شێوە و سروشتی کوردستان و کەڵچەری کوردستاندا بگونجێت.

وە گومانیشی تێدانیە کە بۆ ئەوەی کە ئەندازیاری کورد توانای ئەوەی هەبێت کە هەوڵی چاککردنی ڕێگاوبانی ئێستای کوردستان بدات، پێویستی بە هاریکاری فرەلایەن هەیە کە لە پێش هەمووياندە هەر یەک لە حوکمەتی هەرێم و حوکمەتی عێراقە کە دروستکردنی ڕێگاوبان وچاککردنەوەی ڕێگاکانی ئێستا لە کۆتاییدا بە قازانجێکی گەورە بۆ هەردوو لایان دەگەڕێتەوە چونکە لەکاتێکدا ڕێگاوبان بە شادەماری ئابووری وولات لە قەڵەمدەدرێت، ژیانی هاووڵاتیان بەهاترین سەرمایەی وولاتەکەیە.

هیوادارم ئەندازیارانی کورد ئەمەندە کاتیان هەبێت کە نەک هەر کەڵک لەم دیراسە دەوڵەمەندە وەربگرن، بەڵکو کڵێشەی ئەم دیراسەیە بەکاربهێن بۆ ئەوەی کە خۆیان دیراسەی چڕوپڕ بە ئەنجام بگەیەنن کە نەک هەر خزمەت بێت بۆ کوردستان، بەڵکو وەکو ئەم دیراسەیە خزمەت بگەیەنێت بە مرۆڤایەتیش.

لەگەڵ ڕێزدا

ئەندازیاری شارستانی : لوقمـان محەمەدسالّح محەمەد

٢٠١١/٧/٧

FHWA Study Tour for Highway Safety Management Practices in Japan, Australia, and New Zealand

June ١٩٩٥

Notice

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official policy of the Department of Transportation.

The metric units reported are those used in common practice by the persons interviewed. They have not been converted to pure SI units since, in some cases, the level of precision implied would have been changed.

The U.S. equivalents to the foreign currency amounts appearing in this report are based on the rates of exchange in effect during the time of the study tour.

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This report does not constitute a standard, specification, or regulation.

FHWA Study Tour for
Highway Safety Management Practices
in Japan, Australia, and New Zealand

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Table of Contents

Appendices

List of Tables

Executive Summary

This summary highlights the findings of a U.S. study team that examined safety management practices in Japan, Australia, and New Zealand. Sponsored by the Federal Highway Administration (FHWA), this trip was conducted between June ١٠ and June ٢٦, ١٩٩٤. The purpose of the trip was "... to assess Safety Management Systems (SMS) in the three countries, their programs or components and technologies of SMS activities, including people, vehicles, and roads; compile the information; and identify effective strategies for implementation in the United States of America."

The team met with a variety of officials who were responsible for or involved in major highway safety activities in their countries. Without exception, the team was received with gracious hospitality by every host organization and official. We are very pleased to have been so well hosted. We are also very appreciative of the amount of professional preparation and effort provided by these people and their organizations. Much has been learned from each of the three countries.

Major Findings

Each of the countries visited has accomplished impressive safety gains over the past decades. Death rates and frequencies have been on a steady decline for a substantial period of time. However, at the time of the team's visit there was some indication of a modest increase in fatalities in two of the three countries. It is certain that efforts are being made to continue the longer-term downward trend.

While considerable diversity exists in the highway transportation environment within and among the three countries, each has programs that approach highway safety in similar philosophical and managerial styles. Each embarked on aggressive national safety campaigns in the ١٩٩٠s, employing some level of strategic planning in formulating their safety programs. Highlighted findings emphasize approaches that may be adapted to current highway safety management systems in the United States.

Japan

Three organizations are responsible for the majority of highway safety activities in Japan. They are the Ministry of Construction (MOC), the Ministry of Transport (MOT), and the National Police Agency (NPA). Each has specific responsibilities, but they also coordinate and cooperate with each other through memorandums of understanding and similar agreements.

Not surprisingly, Japan is investing in information technology to achieve quantum gains in highway safety. One of these initiatives, the Advanced Highway Safety System, has three phases, one of which is currently in pilot installation. This phase, called the Guidelight System, warns approaching vehicles of potential danger where alignment obstructs sight distance. Sensing devices installed within the roadway environment are used for detection.

MOC, MOT, and NPA, along with the Japan Automobile Manufacturer's Association, the Japan Federation of Economic Organizations (private businesses), and the Marine and Fire Insurance Association of Japan, founded the Institute for Traffic Accident Research and Data Analysis (ITARDA) in ١٩٩٢ as a semi-governmental organization that conducts traffic research and data analysis. ITARDA's research relates to specialized themes in order to contribute to the development of traffic accident analysis methods as well as develop traffic safety measures in various fields. ITARDA is entrusted with a wide range of traffic accident analysis work by the national government, local communities, universities, and private companies. Its task is to promote and improve the efficiency of the traffic safety measures adopted by these organizations.

Australia

Australia began to observe an increase in traffic fatalities in July ١٩٩٣, after a substantial period of decreases. In response, the National Road Safety Action Plan was launched in June ١٩٩٤ as a cooperative effort involving all levels of government, road safety bodies, health agencies, police, the vehicle industry, motorist organizations, vehicle manufacturers, and community organizations. This action plan is linked to the action plans created by all states and territories via the guidance of the National Road Safety Strategy.

The state of New South Wales (NSW) relies heavily on technology in addressing its heavy vehicle safety problem. Heavy vehicles are involved in ١٥ percent of traffic crashes annually in NSW. Safe-T-Cam is a video-imaging technology system designed to identify heavy vehicle license plates in traffic. In the short term, the Road and Traffic Authority plans to use this system to monitor speed and hours of service and coordinate this information with the random safety check teams deployed throughout the state.

In the state of Victoria, the speed camera project is considered one of the more effective safety countermeasure programs. Cameras, strategically installed on major arterials, photograph speeding vehicles. Prints of the violating vehicle are analyzed, and tickets are mailed to offenders. Approximately ٦٠,٠٠٠ violations are issued annually. The benefit/cost ratio calculated for this program is ten to one, and community support for this program is said to be strong.

The organization, administration, and implementation of road safety programs in both Australian states could be case studies and role models for a State's implementation of a Safety Management System in the United States. While the NSW and Victoria road authorities have the statutory responsibility for road safety, they make extensive use of consultative processes to set targets and achieve progress in the interest areas of their safety stakeholders.

New Zealand

Transport policy in New Zealand has undergone significant change during the last decade. The government has aggressively pursued a policy of devolution and privatization. Major elements of government regulation have been removed or refocused, and most aspects of the system have been redeveloped around the concept of greater individual responsibility within a more commercial framework.

New Zealand approaches road safety in much the same management style as Australia. The most important aspect of New Zealand's strategy is the corporate approach to responsibility with its cost-effective performance requirements of the road safety project results. The Land Transport Safety Authority (LTSA), in its new private agency structure, develops safety standards in partnership with industry and the public and is accountable to stakeholders to ensure compliance with the standards.

New Zealand employs a safety audit process to review road designs and surveillance of existing roads. The goals are to minimize the risk and severity of accidents that may be created by the road project at the site and on the adjacent network, minimize the need for remedial work after construction, reduce the whole-life costs of the project, and improve awareness of safe design practices. LTSA intends to utilize the safety audit process in its vehicle and driver safety initiatives.

Conclusion

The technologies employed, such as Japan's Guidelight System for advanced warning of motorists in blind curves and speed cameras and safety audits in both Australia and New Zealand, are transferrable to the United States. In fact, some of these technologies have been transferred and are now being piloted in the United States.

However, the most significant finding, with potential for high-benefit payoff in the United States, is the networking method employed in Australia and New Zealand. All relevant highway safety stake-holders are included in the process of decision making to develop and implement local, State, and national highway safety programs.

The success of Safety Management Systems mandated by the Intermodal Surface Transportation Efficiency Act of ١٩٩١ (ISTEA) depends on coordination of the major stakeholders in road safety programs at all levels of government. As observed in New South Wales, Victoria, and in Canberra, the capital, Australia's process is effectively institutionalized at national and state levels.

١. Introduction

١.١ Background

The Intermodal Surface Transportation Efficiency Act of ١٩٩١ (ISTEA) mandates that each State implement a Highway Safety Management System by October ١٩٩٦. Several States are nearing full implementation of the provisions of this requirement, making implementation issues of foremost concern.

Given the diversity in highway safety management practices throughout the United States and the complexity of implementing a broad-based management approach to the highway safety problems in the Nation, it has become important to examine other countries' highway safety management systems and practices to seek timely ideas that may prove beneficial if implemented in the United States.

In June ١٩٩٤, a U.S. study team visited Japan, Australia, and New Zealand, sponsored by the Federal Highway Administration, Office of International Programs. The purpose of the trip was "... to assess Safety Management Systems (SMS) in the three countries, their programs or components and technologies of SMS activities, including people, vehicles, and roads; compile the information; and identify effective strategies for implementation in the United States of America."

١.٢ Scope and Method

Focus of the study team was on determining potential applicability to the United States of Japanese, Australian, and New Zealand experiences in highway safety management. A survey instrument was developed for this purpose and sent to the host countries in advance of the trip (see Appendix A).

Highway safety officials from top management to those responsible for implementation of highway safety initiatives provided presentations and were interviewed on these topics. (A list of those met is in Appendix B.) Site visits were documented and observations were made as to the management implications of practices of these three governments as they pertain to roads, drivers, and vehicles. All officials contacted were extremely helpful in providing the information requested.

Members of the study team took responsibility for assigned site visit reporting. Daily, throughout the trip, as the reports were completed, they were distributed to the remaining team members for review and comment. The reports were then revised to reflect any corrections or modifications required.

Several weeks after returning, the team held a briefing of initial findings for FHWA management, and comments received were incorporated into the draft study report. This draft was sent to each team member for final comments and to ensure that major highlights each team member judged important were considered for inclusion in the report.

The resulting report was submitted to the editorial process of the Transportation Technology Evaluation Center (TTEC) at Loyola College. Officials in each host country were provided a draft report for their review and comments. Changes resulting from hosts' comments are reflected in the final report submitted by TTEC to FHWA for publication.

١.٣ Team Members

The study team is composed of representatives of government at the Federal and State levels, academia, and the private highway safety community. The team members are as follows:

Joseph Bared, Research Engineer Safety and Traffic Operations
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٢. Study Background

Highway safety management in the United States is best understood through a brief historic perspective on the recent development of Federal highway safety management. This perspective focuses on key Federal highway acts that marked the initiation and development of present highway safety programs and practices and on the necessity for close, cooperative working partnerships among Federal, State, and local highway safety officials.

٢.١ Highway Safety

Federal concern for highway safety parallels the historic development of modern U.S. highway systems. At the beginning of the twentieth century, the industrial revolution produced motor vehicles in considerable numbers. This caused a sharp increase in the demand for intercity and rural road improvements. Federal and State governments came to realize that road financing and construction were matters for their concern.

Following World War II, Americans began to enjoy unprecedented prosperity and mobility. Automobiles became a central feature of American culture, contributing to and reflecting changes in the economy with its rising per capita incomes, its suburbanization of cities, and the construction of the Interstate Highway System. These changes are dramatically reflected in the most basic transportation statistics. Registered motor vehicles in the United States increased from ٣١ million in ١٩٤٥ to ١٩٣ million in ١٩٩٢. Actual mileage of motor vehicle travel is even more dramatic. In ١٩٤٥ Americans traveled ٢٥٠ billion vehicle miles; by ١٩٩٢ this increased to ٢.٢ trillion vehicle miles. However, an undesirable result of this enhanced mobility has been the number of people killed in traffic crashes over these years, increasing from ٢٨,٠٠٠/year in ١٩٤٥ to ٤٠,٠٠٠/year today.

The Highway Safety Act of ١٩٦٦ required States to develop a Highway Safety Plan that was intended to be a systematic approach to highway safety problem resolution. In this regard, the United States has gained experience with safety management systems for

over ٢٥ years, and with a great deal of success. The Highway Safety Act of ١٩٦٦ set the framework for safety initiatives that reduced the highway death toll from over five deaths per ١٠٠ million vehicle miles of travel to under two today.
Concern today is for management of the transportation infrastructure, with highway safety as an integral component. ISTEA established a systematic base for managing the transportation infrastructure. This is illustrated by the interrelationship of the transportation management systems mandated by ISTEA and the need to coordinate and integrate all transportation improvement programs of the past into a unified, cohesive effort.
In this manner, ISTEA set the stage for a new era in transportation management. Environmental considerations alone have introduced a new set of managers in the policy and implementation phases. Requirements for long-range development plans for States and metropolitan areas and for transportation management systems have changed the planning and decision structure and introduced new players in the decisionmaking process.
One of the six management systems required by ISTEA is the Highway Safety Management System. This management process, the subject of the scanning tour, will have a monumental impact on the way government officials at all levels manage highway safety.

٢.٢ Demographics of the Study Countries

Japan

Japan is a densely urbanized island nation, with a land mass equivalent to that of New Zealand or California and a population of ١٢٤ million. Four islands, Honshu, Shikoku, Kyushu, and Hokkaido, contain the major population centers; however, over two-thirds of Japan is mountainous. The road system consists of ١.١ million kilometers (km), of which ٤٧,٠٠٠ km are national roads, ١٢٩,٠٠٠ km are prefectural (state) roads, and ٩٤٠,٠٠٠ km are local roads.
Australia
Australia's land mass is similar in area to that of the continental United States. Australia's population is about ١٨ million, with the majority of the people living on the coasts. Seventy percent live in ten cities, with ٤٠ percent living in two east coast cities, Sydney and Melbourne. There are ٨١٠,٠٠٠ km of roads in the transportation system. Only ١٨,٥٠٠ km are national roads, ١٥٢,٠٠٠ km are the responsibility of the states and territories, and the remaining ٦٣٩,٥٠٠ km are designated as local roads.

New Zealand

New Zealand, as mentioned earlier, is similar in size to both Japan and California. Its ٣.٥ million people are concentrated in the northern of two major islands, with the majority of people residing in Auckland and Wellington, the capital city. Of New Zealand's ٩٢,٣٠٠ km of roadway, ١٠,٤٠٠ km are fully funded by Transit New Zealand, a Crown agency.

United States of America

For comparative reference, the U.S. population is approximately ٢٦٠ million. The road system consists of ٦٨,٣٩٥ km of Interstate highways; ٢٤٩,٤٤٠ km are under consideration as a National Highway System (including the Interstates), about ١.٥ million km are State primary and secondary highways, and about ٤.٨ million km are highways under local jurisdiction (see Tables ١ and ٢).

Profiles	Australia	Japan	New Zealand	USA
Population (millions)	١٨	١٢٤	٣.٥	٢٦٠
Area (sq. km.)	٧,٨٠٠,٠٠٠	٣٧٨,٠٠٠	٢٧٨,٠٠٠	٩,٣٧٣,٠٠٠
National Roads (km)	١٨,٥٠٠	٥٣,٠٠٠*	١٠,٤٠٠	٣٠٩,٠٠٠
State Roads (km)	١٥٢,٠٠٠	١٢٩,٠٠٠	N/A	١,٥٠٠,٠٠٠
Local Roads (km)	٦٣٩,٥٠٠	٩٤٠,٠٠٠	٨١,٩٠٠	٤,٨٢٨,٠٠٠

Table ١: Comparative Road Demographics
* ٦,٠٠٠ kilometers are classified as national expressways.

Fatality Rates	Australia	Japan	New Zealand	USA
per ١٠,٠٠٠ vehicles	١.٩	١.٤	٢.٩	٢.٠
per ١٠٠,٠٠٠ pop.	١١.٢	٩.٢	١٨.٥	١٥.٤
per ١٠٠ mil. vkmt*	١.٣	١.٧	N/A	١.١

Total Fatalities	١,٩٧٧	١١,٤٥١+	٦٤٦	٣٩,٥٠٠

Table ٢: Comparisons of Countries' Road Fatalities in ١٩٩٢

* Total motor vehicle kilometers traveled.

+ This number is based on a criterion that the person died within ٢٤ hours of the crash. All other countries use a ٣٠-day rule.

٣. Safety Management in Japan

٣.١ Organizational Structure

The Japanese highway transportation mission statement is succinctly expressed in one word: michi. The literal meaning of michi is "way," but the Japanese road authorities have expanded this meaning beyond the creation of a physical way on which people walk and vehicles run. It includes, in their words, a "...way for people to meet and find comfort, a way to enjoy the stimulation of our cities, and a way to enhance rich scenery." The philosophical approach of Japan's highway community strives to balance ancient traditional culture with modern, highly advanced transportation technology.

Unlike Europe, North America, and China, Japan did not have a tradition of horse-drawn carriage traffic during the middle ages. Until the reign of the Emperor Meiji in the late ١٨٠٠s, Japan's road system was designed for the passage of people and horses. But by the end of the nineteenth century, roads that had been beautifully maintained in terms of scenery and structure started to deteriorate under the burden of horse-drawn and human-powered vehicles.

Since ancient times Japan's transportation development has been restricted by mountainous topography, many rivers that crisscross the islands, and the sea that encircles them. Until the Meiji Era, the Japanese traffic network consisted of overland routes for people and horses. Sea routes were used for goods that could not be transported by land.

During the Meiji Era the government gave top priority to the development of transportation by sea and rail, in an attempt to catch up with the more advanced Western nations. Road networks were somewhat ignored. It was not until after World War II that Japanese roads acquired a modern character. The number of motor vehicles increased rapidly. At the close of World War II the number of motor vehicles in Japan was estimated to be ١٣٠,٠٠٠, but by ١٩٥١ the total number of vehicles reached ٥٠٠,٠٠٠. It then doubled to one million by ١٩٥٣ and doubled again to two million by ١٩٥٧. The age of motorization had arrived forcefully in Japan, but the road network was in terrible condition. Only ٢٣ percent of the first-class national highways within the most essential trunk road network were paved.

In ١٩٥٤, Japan embarked on a major initiative to improve its road network through three-year road improvement programs that were later increased to five-year improvement programs. Thus, real road development policies began in the ١٩٥٠s. Steady promotion of the first ١١ of these road improvement programs was evident in the improved network infrastructure (see Figure ١). This contributed to rapid economic growth. Japan's growth within the global economy has encouraged its development of a modern transportation network.

Japan adopted a constitutional monarchy in ١٩٤٧, similar to the British parliamentary model. Legislative power is vested in the National Diet, which, like the Parliament, consists of upper and lower houses. Executive power is vested in a cabinet comprising a prime minister and ministers, the majority of whom must be civilian and from the Diet. The prime minister must be a member of the Diet and has the power to appoint and remove ministers.

Japan has ٤٧ prefectures (states) headed by governors, three special districts for densely populated areas such as Tokyo, and municipalities headed by mayors. These governments are not sovereign entities and most depend on central government subsidies.

٣.٢ Roads

The Road Law of Japan (Law no. ١٨٠ of ١٩٥٢) is the basic law of road administration. It sets forth a wide range of articles and guidelines related to roads, such as designation and approval of routes, road administration, structure, maintenance, and cost sharing. While the Road Traffic Law (Law no. ١٠٥ of ١٩٦٠) was enacted to eliminate dangerous road conditions and to promote smooth and safe traffic flow (which is the administrative responsibility of the National Police Agency), it also provided for the administration of roads as public property, contributed to the development of transportation, and promoted public welfare. Roads are classified into four distinct categories: national expressways, national highways, prefectural roads, and municipal roads.

National expressways and designated sections of national highways are administered by the Ministry of Construction (MOC). Non-designated sections of national highways are administered by governors of the prefecture or mayors of the designated cities. Prefectural roads are administered by the prefectures or designated cities, and municipal roads are administered by the municipality (see Table ٣).

In addition, the Road Law provides for proxy of authority in certain instances. Management of the designated sections of national highways may be delegated to a prefectural governor or the mayor of a city, with the exception of maintenance, repair, and disaster rehabilitation.

A Road Council in MOC was established under the Road Law to ensure fair administration of roads and consider road policies from a comprehensive point of view. This council is made up of several academics and representatives of regional governments.

Classification **Length in Service**

National Expressways	٦,٤٠٣ km
National Highways	٤٧,٠٠٠ km
Prefectural Roads	١٢٩,٠٤٠ km
Municipal Roads	٩٣٩,٥٩٢ km

Table ٣: Road Classification in Japan

Road building in Japan is primarily the responsibility of MOC. Under a Special Measure Law for Road Improvement enacted in ١٩٥٢, Japan began its toll road system. This law allowed MOC to delegate the design, construction, operation, and maintenance of its expressways to four public corporations. The largest of the four, the Japan Highway Public Corporation, was established in ١٩٥٦ and manages ٤,٨٦٠ km of expressway, ٨٦ percent of the total. Metropolitan Expressway Public Corporation, Hanshin Expressway Public Corporation, and Honshu-Shikoku Bridge Authority were established to undertake the construction of toll road systems in the Tokyo metropolitan area, and Kinki region, and the bridge project linking Honshu and Shikoku, respectively.

٣.٣ Traffic Safety

With the rapid development of road networks through the five-year road improvement programs, Japan experienced a period of high economic growth during the ١٩٦٠s. Continued economic growth spurred further road improvements and increased traffic demand. Registered motor vehicles increased in number by ١٩٠ percent, from ٢٨ million in ١٩٧٠ to ٨١ million in ١٩٩٢, and licensed drivers increased by over ١٤٠ percent, from over ٢٦ million in ١٩٧٠ to ٦٤ million in ١٩٩٢.

Traffic fatalities peaked at ١٦,٧٦٥ in ١٩٧٠ and began to decrease through the ١٩٧٠s to a low of ٨,٤٦٦ traffic deaths in ١٩٧٩. This decrease is attributed to an aggressive road improvement program, especially in the areas of sidewalk improvements for pedestrians and bicyclists, traffic signs and markings, road lighting, and signal light improvements for vehicle traffic. Traffic fatalities predominantly involved pedestrians and bicyclists, thus the priority given to sidewalk improvements during the ١٩٧٠s. But since ١٩٧٩, traffic fatalities have been rising, with ١١,٥٤١ people killed in ١٩٩٢. Under investigation are recent increases among drivers and passengers and during evening hours. Also being studied is a sharp rise in fatalities among senior citizens.

٣.٤ The Ministry of Construction

Of the three organizations responsible for safety, MOC is the organization responsible for construction, rehabilitation, and maintenance of Japan's road system. Its highway safety responsibility is primarily for physical road improvements, but it cooperates with the Ministry of Transport (MOT) and the National Police Agency (NPA) in safety campaigns. MOT and NPA are discussed in the next two sections.

A major safety improvement program was enacted in ١٩٩١, during the ١١th five-year plan. It includes a comprehensive safety improvement policy and the establishment of an accident analysis center, in cooperation with other related ministries. Emphasis is placed on safety for senior citizens and the disabled.

A division of MOC, the Public Works Research Institute, consists of ١٣ departments engaged in basic and applied research directed toward solving technical problems related to the construction of public works projects.

Aggressive road safety planning through the ١٩٧٠s was prompted by the increasing number of traffic deaths. A well-defined system for identifying and treating sections of roadways with abnormally high accident frequencies, known as black spots, was established in ١٩٨٨ as part of the five-year plan for Traffic Safety Facilities. The data base that provides the information scan for the initial analysis is a combined file of traffic accidents provided by NPA and road traffic census data gathered by MOC through a survey instrument. Accident data for ٦٩٤,٠٠٠ cases in ١٩٩٢ include the following information:

- Accident conditions data--level of damage, site, time and date, road shape, surface conditions, accident type, weather.
- Parties involved--vehicle type, gender, age, license type, action at time of accident.
- Road traffic census data, covering all roads with a classification of prefectural road or above (approximately ١٨٠,٠٠٠ km), include the following:
- Traffic volume--according to vehicle types, times of day, working days or holidays.
- Road conditions--number of lanes, width, presence of sidewalks and median strips, number of intersections.
- Origin-destination surveys.
- Peak-time travel speed surveys.

MOC's Public Works Research Institute provides a macroscopic analysis for identification of roadway locations with high-frequency accident occurrences for the road administration, which then conducts an indepth investigation of such sites. The Research Institute then conducts further analysis pertaining to the development of effective counter-measures. After review of these research findings, the road administration determines which counter-measures to implement, and the Research Institute conducts evaluation studies of policy considerations and effective improvement strategies of the selected safety countermeasures. Through this process, ٨,٣٠٧ km of the ١٨٠,٠٠٠ km of roads studied were found to be black spots; ٤.٨ percent accounted for approximately half the total accidents.

Recent trends indicate that increases in speeds of traffic, the presence of large and heavy vehicles, and the ages of drivers have contributed to the need for improvements in a variety of traffic facilities and devices, especially safety fences (guard rails), road illumination, traffic signs, and road markings. Crash testing and driving simulators are used to research the effectiveness of the various devices (see Figures ٢ and ٣).

The highway driving simulator is computer assisted and used to help evaluate highway safety designs by measuring drivers' reactions in many situations. The simulator produces geometric layout, horizontal and vertical alignments, lane widths, and shoulder width. In a recent project, simulation helped evaluate alternative widths of a new tunnel design.

Several additional Research Institute initiatives are directed toward safety, efficiency, and road comfort through the integration of advanced technology with roads and vehicles. These research endeavors are conducted within the Advanced Road Transportation System (ARTS). One ARTS initiative is the Advanced Highway Safety System, which has three phases:

١. Warning. The projects under test in this phase warn approaching vehicles of potential danger using sensing devices installed within the roadway environment. One project uses flashing lights installed on guard fences on the outside of horizontal curves to warn opposing traffic of approaching vehicles where alignment obstructs sight distance. Another utilizes variable message signs at T-intersections to warn drivers of vehicles approaching on the intersection's other legs. This phase was implemented beginning in the ١٩٩٤B٩٥ construction program and is called the Guidelight System.

٢. Warning plus automatic braking control. This phase will initiate automatic braking of a vehicle approaching imminent danger and is expected to be implemented in or after ١٩٩٧.

٣. Warning plus automatic steering control. This phase will take control of the vehicle in imminent danger and is anticipated to be implemented in ١٥ to ٢٠ years.

٣.٥ The Ministry of Transport

Japan's MOT is responsible for formulating policy for transportation safety, whether by land, sea, or air. It attempts to create a balance between the safety requirements of the various transportation modes to meet the needs of the economic community and the people.

Primary highway safety responsibilities of MOT are the specifications of vehicle inspection, repair, recall system, environmental measures, and vehicle registration. In this regard, its responsibilities are similar to those of the National Highway Traffic Safety Administration in the United States.

Also, MOT pursues development of technology aimed at a new transportation system and the maintenance of traffic safety. Concerns are for new equipment concepts as well as for innovations enabling practical applications.

A safety standards advisory unit used by MOT is the Council for Transport Technology. Composed of private and public officials from government, private industries, and universities, this group utilizes a safety information data base developed by ITARDA (see Section ٣.٧), performs safety research and analysis, and recommends various technical measures pertaining to vehicle safety design that MOT may consider applying as standards. This process has recently been used for standards adopted for large motor vehicles. Some of the implemented standards pertain to rear and side underride protection, underside mirrors, anti-lock braking systems, and side illumination.

Industry must adhere to standards, but only after a transition period to enable compliance. If sanctions become necessary, they are in the form of restrictions on marketing of vehicles that are not in compliance. Safety design standards are applied to new vehicles; however, existing vehicles are sometimes affected.

The Maintenance Service Division within MOT is responsible for licensing vehicle maintenance service businesses. Maintenance service businesses inspect motor vehicles through MOT-approved diagnostic centers that check brakes, drivetrain components, and other safety features. Unsafe vehicles must be repaired for continued operation.

Inspection facility designs and equipment must meet MOT criteria. There are over ٨٢,٠٠٠ inspection stations in the nation, of which ٧٢,٠٠٠ are approved to inspect heavy vehicles. Truck inspections are conducted periodically through company fleet inspection facilities and are monitored through a self-certification process. Inspection requirements for trucks and buses are more stringent than those for passenger vehicles.

Japan requires all motor vehicle operators to perform self-checks of vehicles before operation. Such procedures are part of the educational component of licensing. Periodic inspections--monthly for trucks and buses and every six months for passenger vehicles--ensure detection and correction of deteriorated operational features.

An interesting program administered by MOT is the Maintenance Supervisor System, which requires certification of a responsible company official to ensure that the company's fleet meets inspection requirements. Certification is conferred by a maintenance supervisor after an MOT examination. This process is audited randomly by MOT. Although a few States in the United States have similar systems, the differences here are its national scope and the fact that one certified person is responsible for the entire fleet's safety inspection requirements.

Standards are also applied to companies by MOT to ensure that drivers are fit to operate their vehicles. Company operations managers are responsible for setting schedules that do not burden the driver either physically or mentally. An operation manager checks odometer and tachometer readings after each completed trip to ensure that the driver abided by the safety rules regarding rest periods and driving hours.

Beyond its national licensing exam for operation managers for truck and bus companies, MOT conducts audits of compliance with requirements at the truck and bus companies. MOT investigates reports of accidents where there may be evidence of overload or driver fatigue and, if either was a factor, sends an auditor to inspect the company.

Average and maximum driving times for truck and bus drivers are established by the Ministry of Labor. Maximum driving hours per day are ١٣, which include office or paper work. A driver may drive only four continuous hours and then must stop to rest. Truck and bus drivers may drive only ٤٦ hours per week.

Findings of all MOT inspections and audits are disseminated to all truck and bus companies as an educational strategy to prevent traffic accidents. Auditors are placed in MOT land transport offices in each of the ٤٧ prefectures and the three special districts.

٣.٦ National Police Agency

Japan's central police agency is NPA. In addition to regular police activities, it is responsible for traffic control, congestion management, highway safety management, driver licensing, traffic enforcement, and signaling controls. By contrast to police organizations in the other countries visited, NPA is responsible for the maintenance and operation of the nation's traffic control systems.

Within each prefecture, the police agencies are divided into districts, and each neighborhood has a local police station called a koban. Prefecture and local police are under the jurisdiction of NPA and follow the standards and procedures established by NPA. They are, however, autonomous in their day-to-day operations.

One of NPA's primary considerations is traffic flow and safety. It is concerned with the increasing number of automobiles and congestion, which lead to increased accidents. Analysis supporting traffic management decisions relies on sources of information such as the data NPA collects and compiles on traffic accidents and violations. Because regional and local police are under NPA's jurisdiction, uniform data elements are collected throughout Japan. Prefectures may collect additional data elements for their own use.

Accumulated data enable NPA to attribute a decrease in pedestrian fatalities to the construction of more crosswalks and enhanced signaling. Concern for the increasing number of fatalities among senior citizens is building, and data continue to be examined.

NPA data show that highway enforcement and violations are increasing. Data suggest that the improved performance and speed of cars have been factors in the increase in vehicle occupant fatalities. Exceeding the speed limit is the leading moving violation and accounts for ٢٧ percent of violations issued.

In response to its findings, NPA has initiated road traffic management programs in three areas: education, engineering, and enforcement. With respect to education, NPA conducts biannual safety campaigns and programs for a greater national awareness of traffic safety. NPA is responsible for driver fitness and, as part of its driver efforts, it conducts programs for commercial vehicle drivers. Engineering initiatives include acoustic control signals, delayed crossing times for the disabled, wrong-lane vehicle detectors, and overspeed restraining systems such as photo radar.

Within the realm of enforcement, NPA conducts random inspections of vehicles on the street and conducts truck inspections during its semiannual safety campaign. Information gathered from these random inspections and from accident data enables NPA to evaluate its practices with regard to the items checked through the periodic inspection program and the inspection interval.

Figure ٤ illustrates programs in each of the three areas and shows the highway safety programs conducted by MOT and MOC.

A Traffic Control Center (TCC) is managed and operated by each Prefectural Police Headquarters to collect and process real-time traffic information for dissemination to highway users to aid their driving. The system in the Tokyo region includes ١٠٠ video cameras, ١٣,٠٠٠ ultrasonic vehicle detectors, and various automatic vehicle identifiers and incorporates information acquired from patrol cars and the public. In addition, during morning and evening rush hours, the Tokyo Metropolitan Police Department has two helicopters that collect traffic information.

Data are analyzed and updated every five minutes by the TCC computers installed in the Prefectural Headquarters. The processed information is distributed to motorists by ١,٨٥٠ variable message signs, centralized signal controls, and ٢٥٠ roadside radio broadcast centers nationwide. Variable message signs, in addition to emergency information, indicate travel time information to upcoming exits. More than just a single location, the nationwide system contains a headquarters center and similar centers in ٧٥ major cities. In smaller cities are ٥٥ subcenters that provide mostly signal control instead of the full services noted above. All centers are linked and share relevant information (see Figures ٥ and ٦).

Under development led by NPA was an Advanced Mobile Traffic Information and Communication System, which provided two-way communications with cars. Information on traffic conditions, travel time, availability of parking, and location of major facilities was given to motorists on their LCD panel in the car via Tele-Terminal (٨٠٠ MegaHertz cellular radio). About ٤٠٠ automobiles participated in the demonstrations between ١٩٨٨ and ١٩٩٢.

A Communication Command Center (CCC) has been established by each Prefectural Police Headquarters to respond to emergency calls from the public and to dispatch assistance. Tokyo's center receives ٢,٠٠٠ calls a day, half of which pertain to traffic-related problems. Tokyo Metropolitan Police staff respond to telephone calls, verify locations, and dispatch police or emergency-response assistance. In ١٩٩٣, response time was ٤.٥٤ minutes. The busiest time for calls is between ١٠ p.m. and ٢ a.m. In cases where the emergency call contains traffic-related information, CCC staff convey it to TCC staff by telephone. However, an automatic transfer between the two centers is being achieved in some prefectures that have established direct communications links.

Tokyo Metropolitan Police Department[١٠]

Current plans include Universal Traffic Management Systems (UTMS) that use infrared technologies, one of the Intelligent Transportation Systems (ITS) technologies to improve the traffic control system and inform motorists of traffic conditions. Included will be automatic vehicle detection and two-way communications. The following five subsystems will be integrated into a core control system:

- Mobile Operation Control Systems (MOCS) for management of taxis, trucks, and emergency vehicles.
- Dynamic Route Guidance Systems (DRGS) to provide optimal routes to drivers.
- Advanced Mobile Information Systems (AMIS) to advise drivers on traffic congestion, accidents, road construction, and estimated travel time to destinations.
- Public Transportation Priority Systems to give priority to buses and high-occupancy vehicles.
- Environment Protection Management Systems to reduce noise, gas emissions, and other traffic pollution.

In July ١٩٩٤ NPA demonstrated the first full-scale experiment of AMIS, DRGS, and MOCS in Yokohama and Kawasaki in the Kanagawa Prefecture near Tokyo. NPA expressed interest in establishing a working relationship with FHWA to share information, technologies, and ideas on UTMS and ITS.

٣.٧ Institute for Traffic Accident Research and Data Analysis

ITARDA is another traffic accident research and analysis organization available to MOC, MOT, and NPA. It is a semi governmental public service organization legislated by the Road Traffic Law, established in ١٩٩٢, for traffic research and data analysis as a collaborative effort by MOC, MOT, NPA, the Japan Automobile Manufacturer's Association, the Japan Federation of Economic Organizations, and the Marine and Fire Insurance Association of Japan. It promotes and improves the efficiency of the traffic safety measures adopted by these organizations, and it conducts research on specialized themes in order to contribute to the development of traffic accident analysis methods and traffic safety measures in various fields.

ITARDA conducts a wide range of traffic accident analysis work by the national government, local communities, universities, and private companies. Research activities are either independent or assigned. Assigned research is requested by one of the sponsoring organizations and is funded by the requesting agency. Sponsoring agencies supply the necessary data for an integrated highway safety data base covering the entire highway system. Files for accidents and traffic are acquired from NPA, the road file from MOC, and the vehicle file from MOT. These data are supplemented, where necessary, by relevant industry data.

٤. Safety Management in Australia

٤.١ Organizational Structure

Australia is a vast country similar in size to the continental United States. It stretches across three time zones, from the Indian Ocean in the west to the Pacific Ocean in the east. Contrary to its outback image, Australia is one of the most urbanized societies in the world. The majority of its ١٨ million people live in coastal urban centers. Seventy percent live in ten cities, with ٤٠ percent living in Sydney and in Melbourne on the southeast coast.

Larger Australian cities are generally expansive, with development typically evolving by gradual growth toward outer residential areas. This development, which frequently places large distances between residential and work locations, creates heavy dependence on private transport and limits reliance on public transit.

Australia's Commonwealth Government is similar to that of the United States. The Federal Parliament is bicameral, its two governing bodies being the Senate and the House of Representatives. Twelve Senators from each of the six states and two from each territory are elected for six-year terms, with half of the body elected every three years. Apportionment of the ١٤٨ members of the House of Representatives is approximately by the population of each of the states and territories.

The leader of the political party, or coalition, that wins control of the majority of seats in the House of Representatives is designated as the Prime Minister. The Prime Minister and the Cabinet, all elected members of Parliament, exercise control over the executive branch of the federal government and are responsible to the Parliament. General elections are held every three years.

Each of the six states is headed by a Premier, who is the leader of the party with the majority of seats in the lower house in the state legislature. Australia has two self-governing territories, the Australian Capital Territory and the Northern Territory. Canberra, the capital city, is located in the Capital Territory, a region specifically designed to accommodate the federal government and similar to the political construct of the District of Columbia in the United States.

٤.٢ Roads

Australia's national transportation agency, the Department of Transport and Communication (DTC), is centralized but has little oversight responsibility in the states or territories. States and territories provide the primary legislative and administrative force in the nation's transportation programs, with technical assistance from various transportation organizations. Broad minimum national standards are set by DTC with the transport agencies of the six states and two territories. As described below, additional input is sought from Austroads, the Australian Road Research Board (ARRB), and the National Road Transport Commission (NRTC).

This report is based on scanning team findings during visits to DTC in Canberra and to state road authorities in New South Wales (NSW) and Victoria.

Australia's road network is one of extremes. It includes freeways and bridges comparable to the finest in the world, as well as thousands of kilometers of unsealed rural roads. There are ٨١٠,٠٠٠ km of roads in Australia, with ٨٠ percent of road use occurring on less than ٢٠ percent of the network.

Australia's constitution gives its state and local governments the fundamental responsibilities for roads in Australia (see Table ٤). Therefore, a Ministerial Council has been established in the interest of setting consistent policies and standards among the states. The council consists of the Ministers of Transport from the Commonwealth and each of the six states and two territories.
The council operates in two ways. On matters referred by NRTC, it deliberates, and a majority vote sets policy. An inter-government agreement between all parties requires each to follow the policy adopted, though this is not legally enforceable. For matters referred to the Ministerial Council by other bodies, it operates in a collegial manner where decisions are made largely by consensus; dissenting states are not required to follow policies adopted.
NRTC is a three-member support group for the council. A quest for uniformity in formulating heavy vehicle road prices, vehicle safety standards, road traffic codes, and other safety codes led to its formation in January ١٩٩٢. It provides information, research, and drafts road-related laws for the council's consideration.

Class of Road	NSW	Victoria	Other States	Total
Federal	٣,٠٢٨	٩٧٤	١٤,٤٩٨	١٨,٥٠٠
State	٣٦,٣٢٢	٢١,٧٧٢	٩٣,٩٠٦	١٥٢,٠٠٠
Local	١٤٤,٨٨٩	١٣٨,٣٨٤	٣٥٦,٢٢٧	٦٣٩,٥٠٠
Total	١٨٤,٢٣٩	١٦١,١٣٠	٤٦٤,٦٣١	٨١٠,٠٠٠

Table ٤: Government Responsibility for Australian Roads (km)

Input to NRTC is derived from several transportation advisory groups and other consultative mechanisms. For example, the vehicle standards advisory group is composed of federal and state representatives, industry, and consumer groups.
The road code advisory group involves users and police representatives. The dangerous goods advisory group comprises transport agencies, occupational safety groups, and the chemical industry.
NRTC drafts road law for presentation to and consideration of the council. Upon approval, the draft must pass through the parliaments of each state and territory, as well as that of the Commonwealth. The states are compelled to repeal conflicting local laws, under the inter-government agreement. While road laws are enacted at the state level, the federal government is solely responsible for the safety regulation of imported vehicles.
Austroads, established in ١٩٨٩, provides government and industry with a primary resource for information and advice on national road-related issues. Its focus is primarily on road and road transport policy, road use management, business efficiency, road technology, and the environment. Austroads is similar in organization and function to the American Association of State Highway and Transportation Officials in the United States. It is governed by a council comprising the chief transport executives from each of the six states and two territories and senior executives from the Federal Department of Transport, the Australian Local Government Association, and Transit New Zealand.
ARRB is a nonprofit research company providing national focus for road research in Australia. Research results are disseminated broadly to appropriate public and private organizations, scientists, engineers, and specialists involved in road design, location, construction, and maintenance. ARRB is financed primarily by Australia's federal, state, and territorial road transport authorities.

٤.٣ Traffic Safety

In ١٩٨٩ the Federal Office of Road Safety (FORS), in cooperation with all states and territories, adopted a ten-point National Road Safety Package in conjunction with a road hazard elimination program. It agreed to provide A$٢٧٠ million (US$٢٠٥ million) over three years to eradicate the worst of the hazardous locations or black spots on Australia's roads. Funding to the states and territories was conditional on their agreement to implement the ten points. In total, ٣٢٠٠ black spots were treated. The additional countermeasures of the ten-point package were as follows:

- A national blood-alcohol concentration limit of ٠.٠٥.
- Introduction of a single national license for heavy truck and bus drivers.
- National uniform speed limits.
- Speed limiters for heavy vehicles.
- Zero blood-alcohol limits for young drivers and heavy vehicle drivers.
- Increased enforcement of random breath testing.
- Compulsory use of bicycle helmets.
- Graduated licensing for young drivers that extends the learning period so that drivers can gain valuable on-road experience.
- Increased enforcement of seat belt and child restraint use.
- Introduction of daylight running lamps for new motorcycles sold after January ١, ١٩٩٣.

Although several of these initiatives were not in place at the inception of the plan, these measures are considered the catalysts for dramatic reductions in the road death toll. Fatalities dropped by ٣٠ percent from ٢,٨٠١ in ١٩٨٩ to ١,٩٤٦ in ١٩٩٣, and there was a ٣٠-percent reduction in serious injuries.

An upward trend in traffic fatalities since July ١٩٩٣, however, has prompted new safety initiatives. A National Road Safety Strategy and a linked National Road Safety Action Plan, launched in June ١٩٩٤, have been created as a cooperative effort involving all levels of government, road safety bodies, health agencies, police, the vehicle industry, and motorist and community organizations. All states and territories have developed their own action plans linked to the National Road Safety Strategy.
The National Road Safety Strategy is Australia's first national approach by federal, state, and local governments, as well as industry and community groups, to reduce traffic fatalities. Forty-seven national, state, and local organizations took part in its development. It is anticipated that the integration of the strategy into individual safety programs will save over ٣,٠٠٠ lives and prevent up to ١٥٠,٠٠٠ casualties in the next ten years. Economic benefits are projected at A$١.٥ billion (US$١.١ billion) a year.
Objectives of the National Strategy are to be achieved by methods such as the following:

- Coordination and involvement of all agencies. This promotes the best use of resources and increases community participation in road safety decision making.
- Stakeholder commitment. A partnership of governments, police departments, motorist associations, industry, and community groups developed the strategy and reached agreement on ways to measure its success.
- Cost-effectiveness. All stakeholders are required to set priorities for funding and other resources for road safety programs on the basis of their cost- effectiveness and their contribution to the overall objectives of the strategy.
- Research and development. New and better ways of achieving traffic safety are needed. Gaps in existing data bases will be eliminated. Stakeholders are encouraged to coordinate their research and development activities, and to share findings, avoiding costly duplication.

٤.٤ New South Wales

New South Wales established its Road and Traffic Authority (RTA) in ١٩٨٩, combining the previous departments of Main Roads, Motor Transport, and Traffic Authority. There are approximately ٢٠٠,٠٠٠ km of public roads in NSW.
RTA has an interest in ٣٩,٣٠٠ km of roads and is directly responsible for ١٦,٩٠٠ km of national and state roads. Federal funds finance the ٢,٩٠٠ km of national roads, and the ١٤,٠٠٠ km of state roads are funded by NSW. An additional ١٩,٩٠٠ km of regional roads in NSW are funded by regional road councils and RTA. There are ١٦٠,٠٠٠ km of local roads funded largely by the local road councils with assistance from the federal and state governments.
National highways and state roads, while comprising less than ٢٠ percent of NSW roads, carry about ٣٦ billion vehicle kilometers of travel annually, ٧٥ percent of the total. RTA's annual budget for its responsibilities on the road network is about A$١.٨ billion (US$١.٤ billion).

Traffic Safety

In NSW the road death toll climbed steadily from the mid-١٩٤٠s to the late ١٩٧٠s, peaking at ١,٣٨٤ in ١٩٧٨. Introduction of random breath testing for use in drunk driving enforcement and other factors such as more widespread use of seat belts, child restraints, and motorcyclist helmets helped reduce this toll to ٧٩٧ traffic deaths in ١٩٩٠. Despite this improvement, RTA forecasts that road crashes will cause over ١٠٠,٠٠٠ serious injuries (deaths and hospitalizations) and cost over A$٢٠ billion (US$١٥ billion) during the ١٩٩٠s. This is primarily due to the growth of the population and anticipated growth in travel.
NSW's Ministry of Roads adopted a strategic plan, Road Safety ٢٠٠٠, in concert with the National Road Safety Strategy, to reduce traffic accidents and the resulting expense. Research indicated that implementation would reduce the number of fatalities and serious injuries by ٢٥ percent of ١٩٩٠ levels by the end of the century. The strategy is to develop and coordinate the participation of every sector of the NSW safety community in an integrated approach to road safety.
Road Safety ٢٠٠٠ is based on four central concepts:

- Community Involvement. Grassroots ownership and participation in road safety improvement efforts must be nurtured and relied upon from plan formulation through evaluation of results.
- Transport and land use planning. Road safety must be a major priority in the planning and management of transport and land use.
- Safer people, roads, and vehicles. Programs and research must focus on the road user, roads and traffic, vehicles and equipment, and after-crash response and care.
- Coordination. An integrated framework for road safety planning and action must be developed.

Whereas these concepts provide a structure in which all stakeholders can see their roles in the management of the statewide road safety programs, a more detailed Road Safety Action Plan is being developed to pull together the range of programs and actions being planned and implemented by the many public and private agencies and organizations involved in road safety in NSW. In keeping with the strategic planning paradigm, NSW has established the mission and objectives core of the plan and is now engaging in tactical operational considerations.
It appears beneficial that RTA, the lead agency in the NSW road safety plan, is a decentralized organization. Its programs and services are provided through five regional offices across the state, which facilitates communication, especially at the local level.
RTA realized from the outset that to be successful in carrying out the Road Safety Action Plan it needed the cooperation of all organizations with vested interests in road safety. This philosophy prompted establishment of the Road Safety Advisory Council. The council advises RTA on the Road Safety ٢٠٠٠ plan and its implementation. It has representatives from a range of public and private road safety stakeholder organizations throughout NSW. Member organizations are as follows:

- Attorney-General's Department

- Australian Institute of Traffic Planning and Management
- Department of Health
- Department of School Education
- Department of Transport
- Insurance Council of Australia
- Local Government and Shires Association
- Motor Accidents Authority
- National Roads and Motorists' Association
- Police Services
- Roads and Traffic Authority

The council helps clarify opportunities for coordination and cooperation as the implementation of Road Safety ٢٠٠٠ progresses. An annual stakeholders' forum is planned to review achievements and discuss future directions.

Making the best use of scarce resources is a cornerstone of the safety strategy, making economic effectiveness the key criterion in assigning priorities and selecting programs. Figure ٧, taken from the Road Safety ٢٠٠٠Strategic Plan, presents benefit/cost ratios (BCRs) for various safety improvement measures. Organization and implementation by NSW for Road Safety ٢٠٠٠ appears to be an excellent case study for a state's implementation of a Safety Management System in the United States. Whereas it is true that RTA has the statutory responsibility for road safety in NSW, its extensive use of consultative processes enables the setting of broadly endorsed targets. Greater prospects for ultimate success are fostered by the process's sensitivity to the interest areas of all safety stakeholders.

Communication, coordination, and cooperation in implementing the Road Safety ٢٠٠٠ plan are achieved through various road safety advisory councils, planning task forces, and strategic alliances at the state, regional, and local levels. These groups receive strategic safety data from RTA to assist their planning of road safety initiatives. Implementation groups and task forces receive crash data for identification and analysis of problem levels. Although the analysis techniques practiced are not new to U.S. safety professionals, there is instructional value for SMS development in the United States. Extensive inclusion of stakeholders groups is impressive, but so is the comprehensiveness of the NSW planning process. Road safety audits, for example, are treated in NSW as but one component of the Road Network Development Strategy, one of ten strategies in the road Environment Area of NSW's Road Safety ٢٠٠٠ plan.

Program	BCR
Random breath testing	١٤:١
Roundabouts	٧:١
Removing roadside hazards	٦:١
Motorcycle rider training and testing	٧:١
Speed cameras	١٢:١
Improved delineation on rural highways	١٤:١
Rural overtaking lanes	٥:١ to ١٠:١

Australian road safety programs. BCRs from various sources.

Actions being taken by NSW to counteract accidents range from fundamentals of intersection design to high-technology video imaging. One of the more successful road safety actions is the installation of roundabouts (traffic circles) at intersections with high accident frequencies. Preliminary findings indicate a ٦٣-percent reduction in fatal accidents and a ٤٥-percent reduction in injury accidents, possibly the result of greater driver attentiveness. NSW also makes extensive use of technology to address heavy vehicle safety problems.

Heavy vehicles are involved in ١٥ percent of traffic crashes annually. Safe-T-Cam is a video-imaging technology system designed to identify heavy vehicles' license plates in traffic. In the short term, RTA plans to use this system to monitor speed, location, and hours of service and coordinate this information with the random safety check teams deployed throughout the state. Goals are to reduce the extremes of speed in traffic and driving-hours violations by truck operators. RTA projects that reducing the extremes three percent will result in saving five lives and seven serious injuries each year.

Another use of technology is the Truckalyzer, an automated portable dynamometer that measures commercial vehicle brake and front suspension performance and screens for vehicle weights (see Figure ٨). Inspection also includes general checks of the vehicle safety systems. RTA staff reports that in ١٩٨٨, ٧٠ percent of commercial vehicles had defects, and of those, ٢٢ percent had major defects. In ١٩٩١B٩٢, ٦٥ percent of vehicles had defects and ١٥ percent had major defects. These figures are for the regular targeted inspections. In ١٩٩٣, random checks of vehicles found ٥٥ percent had defects and ٩ of the ٥٥ percent had major defects.

٤.٥ Victoria

Victoria is Australia's second smallest state in area but the second largest in population. It has ١٢٠,٠٠٠ km of roads, approximately three million vehicles, and a similar number of drivers. Ninety percent of freight is transported by road, and approximately ٩٥ percent of trips made by people involve road travel.

Victoria's Roads Corporation, VicRoads, is a statutory corporation serving as the transportation agency for the state. It was established in July ١٩٨٩ by merging the Road Traffic Authority and the Road Construction Authority. VicRoads operates four core businesses: Road Safety, Traffic and Road Use Management, Road Systems Management, and Registration and Licensing. Each is the responsibility of a General Manager reporting through the Deputy Chief Executive to the Chief Executive. VicRoads' programs are generally delivered by seven regions, reporting through the Director, Regional Services and seven major projects reporting through the Director, Major Projects. These are supported by various internal design services reporting through the Director, Production Services or by external consultants or contractors.

Senior managers are engaged by an employment contract with performance measures developed through consensus. If standards are not met, employment may be terminated with four weeks' notice.

Through recent privatization, VicRoads went from a supply or full road construction and maintenance enterprise to one of functional management. Management skills are emphasized to ensure that the outsourced functions are meeting service delivery performance measures. This approach changed the organizational culture from basic engineering to customer-oriented business groups. Over ٥٠ percent of the design function is contracted and about ٩٠ percent of the maintenance function is now outsourced.

Traffic Safety Agencies

Three public agencies are charged with the development of road safety initiatives in Victoria: VicRoads, Victoria Police, and the Traffic Accident Commission (TAC). These agencies, along with the Department of Health and the Monash University Accident Research Center (MUARC), provide the leadership and direction for the road safety program.

VicRoads

VicRoads has a central role in road safety, with direct responsibility forstatewide road safety policies and strategies, driver education and licensing, and vehicle standards and registration, as well as safety on the principal road network. VicRoads safety programming also works in concert with the national Road Safety Action Plan.

Major operational programs of VicRoads are the study and development of countermeasures to address black spots, formal safety audits, and the use of speed cameras. Projects undergo economic analysis to ensure that the projects with the best returns on investment, as measured by benefit/ cost ratios, receive priority.

Primarily a police responsibility, the speed camera project is considered one of the more effective safety countermeasure programs in Victoria. Cameras strategically installed on major arterials photograph speeding vehicles. Prints of the violating vehicle are analyzed and tickets are mailed to offenders (see Figure ٩). Approximately ٦٠,٠٠٠ violations are issued annually. The benefit/cost ratio calculated for this program is ١٠ to ١.

Victoria Police

Victoria Police are active participants with VicRoads, TAC, and MUARC in planning and programming traffic safety initiatives for Victoria. The police agency is divided into ١٧ regions, each headed by a commander.

They are, for the most part, autonomous police agencies within their regions. Headquarters staff must communicate and coordinate the state's traffic enforcement initiatives with each region, and the regional commanders work closely with community councils to develop and implement local traffic safety programs. Victoria Police are working toward developing road safety performance measures similar to those used by VicRoads. Likewise, such measures will be incorporated into the regional commander's job performance evaluation, along with measures such as accident rate, percentage of alcohol-related fatalities, and speed-related accidents.

In ١٩٨٩, in response to significant increases in traffic accidents, Victoria Police participated with VicRoads in a major planning meeting on traffic safety. In ١٩٩١, this new initiative led to a formally established working group for Victoria called the Road Safety Coordinating Council. It includes senior representatives from VicRoads, Victoria Police, TAC, and MUARC.

To establish highway safety priorities and countermeasures through a consensus-building process, participants in the council agree to commit program staff and resources to specific aspects of the countermeasures developed. Victoria Police focus traffic enforcement on drunk driving, speeding, and seat belt use. Enforcement is coordinated with TAC public education campaigns, primarily through television public announcements.

One of Victoria Police's major programs is the use of anti-drunk-driving enforcement vehicles, which have become known as "booze buses." Staffed to conduct random breath tests, they are deployed around the state and are well marked and lighted to create a visible enforcement presence in the community. Random breath tests, numbering in the thousands annually, are coordinated with public announcement commercials to educate the public on the impact and effects of drunk driving.

Initial test results indicated that ١ in ٤٠٠ persons tested were registering a positive presence of alcohol. Recent test results indicate an improved ratio of ١ in ٧٠٠. However, for targeted enforcement at night the ratio drops to ١ in ١٠٠ tested, and for specific enforcement targets such as concerts and festivals the ratio was as low as ١ in ٢. If readings exceed ٠.٠٥ blood-alcohol content, the driver's license is suspended for a period depending on the level over the ٠.٠٥ limit.

Victoria Police attempt to balance enforcement with deterrence. While they measure success through increased compliance of the motoring public, they also target enforcement and direct resources to high-problem areas and times of day, such as weekend nights.

Traffic Accident Commission

TAC is a government-established insurance agency that provides the mandatory accident health insurance for all Victoria drivers and is an active participant in Victoria's road safety program. Over the past few years TAC has contributed millions of dollars toward the purchase of booze buses, speed cameras, and television safety commercials.

Currently, a major TAC initiative is the use of five public education television commercials, developed and produced by TAC, to support traffic safety improvement. The commercials are based on intensive market research, through the use of focus groups, to target very specific safety problems:

- Drunk driving among youth.
- Speeding by young drivers.
- Lack of concentration and attention by young drivers.
- Rural population driving characteristics.
- Fatigue in passenger car drivers.

These commercials are unique in that they are highly emotive and include graphic accident scenes depicting severe injury, are broadcast during prime time, and are paid for by TAC. It was emphasized that Victoria Police coordinate their enforcement efforts with the television commercial broadcasts. Surveys indicate over ٩٥-percent community support of the commercials and a ١٠٠-percent level of recognition of the campaign among the community.

An underlying premise is that an effective public education campaign must focus clearly on key issues, have sufficient funding, be creative, collaborate with other groups, and combine education with enforcement. TAC believes short-term advertising alone has little impact on changing behavior. The aim of the program is to combine education, enforcement, and engineering solutions to achieve road safety.

Victoria's success in road safety, as demonstrated by the dramatic reduction in fatalities from ٧٧٦ in ١٩٨٩ to ٣٩٦ in ١٩٩٢, can be attributed to effective use of strategy and implementation. Within and beyond planning, emphasis in the strategic approach is on implementation, providing adequate opportunity for all stakeholders to be involved, monitoring performance, and providing objective feedback to the community and the stakeholders.

Victoria's safety management structure utilizes various inter-disciplinary organizations to identify problems, develop counter-measures, set priorities, and implement projects. Organizations that agree to be involved in this process must commit resources, implement projects, and agree not to lobby against projects selected through the strategic planning approach. People brought together in project groups must have and are granted authority to carry out decisions flowing from the process.

Road safety priorities are set through this strategic approach, and responsibilities are assigned and disseminated to all interested parties. Road safety strategy progress reports are also published and disseminated, updating programs and noting progress made for the period covered.

٥. Safety Management in New Zealand

٥.١ Organizational Structure

New Zealand is similar in size to both Japan and California. Its ٣.٥ million people are concentrated in the northern of two major islands, with the majority of those in the cities of Auckland and Wellington, the nation's capital. Of New Zealand's ٩٢,٣٠٠ km of roadway, ١٠,٤٠٠ are fully funded by Transit New Zealand, a Crown agency.

The most important aspect of New Zealand's strategy is the corporate approach to responsibility and the cost-effective performance requirements of the road safety project outcomes.

Crown entities are government corporations headed by general managers responsible to Crown Authorities. Each transport authority operates much like a corporate board of directors, is an independent body appointed by the government, and is directly responsible to the Minister of Transport. The Ministry of Transport sets policy for the various transport modes and reports to the minister. It monitors standards for the various authorities on behalf of the minister.

Like many industrialized nations, in the late ١٩٦٠s and early ١٩٧٠s, New Zealand had centralized many functions of transportation into a monolithic organization, the Ministry of Transport, which was the principal government department responsible for managing the country's transportation system and for the enforcement of transport law. As the organization grew in size, several dysfunctional characteristics became evident. The most pressing of these were its staffing and financial management. A chronic deficit position forced heavy borrowing. External contributing factors during this period were the country's economic recession and a general dissatisfaction with government services.

This combination of circumstances prompted the passage of the State Sector Act of ١٩٨٨. This act provided for the restructuring of government organizations into Crown agencies, state enterprises headed by chief executives and operated much like a business in the private sector. The Ministry of Transport was one of the organizations restructured under the act's provisions.

Within this new structure, the Ministry of Transport, representing the Minister of Transport, continues to have ultimate responsibility for the efficiency and safety of the nation's transportation system. It therefore monitors the final products of all the stakeholders involved. Contract monitoring with the stand-alone transport authorities is based on records of achievement.

Transport policy in New Zealand underwent a period of significant change over the past decade as the government aggressively pursued a policy of devolution and privatization. Major elements of federal government regulation have been removed or refocused, and most aspects of the system have been redeveloped around the concept of greater individual responsibility within a more commercial framework.

٥.٢ Roads

Transit New Zealand (TNZ) is responsible for the control and management of state highways and provision of financial assistance for local roads. With headquarters offices in Wellington and seven regional offices throughout the country, TNZ puts together its National Land Transport Programme.

Based on proposals prepared by local authorities throughout New Zealand, the National Land Transport Programme determines how TNZ's budget is allocated among local roads, safety, public transport, state highways, research, industry training, and administration. Work on local roads and public passenger transport is managed by local authorities and regional councils with financial assistance from TNZ, while state highways are managed directly by TNZ. Standards for the measurement of performance by TNZ are set in a formal Statement of Intent that must be approved by the Minister of Transport.

Transit New Zealand does not use its own staff to carry out work on state highways, but contracts out to other companies on a competitive basis. Also, control of some state highway management functions has been delegated to local authorities. TNZ has direct responsibility for the ١٠,٥٠٠-km national highway system and contributes approximately one-half of the cost associated with the remaining ٨٢,٠٠٠ km of local roads (Table ٥).

Region	State Roads	Local Roads	Total
North Island	٥,٥٩٦	٤٦,٧٦٦	٥٢,٣٦٢
South Island	٤,٨٤٢	٣٥,١٠٣	٣٩,٩٤٥
Total	١٠,٤٣٨	٨١,٨٦٩	٩٢,٣٠٧

Table ٥: New Zealand Road Summary (km)

٥.٣ Traffic Safety

Three organizations have major highway safety responsibility in New Zealand: Transit New Zealand, the Land Transportation Safety Authority, and the New Zealand Police. However, the process of devolution and privatization is spreading responsibilities to local governments and private stakeholders.

For its population, New Zealand has the highest death toll of the three countries under review. However, New Zealand also showed significant improvement in its death toll numbers over the past several years, from ٧٢٩ traffic deaths in ١٩٩٠ to ٦٤٦ deaths in ١٩٩٢, an ١١-percent reduction. Because of safety efforts now under way, New Zealand may be able to continue this trend without the kind of reversals exhibited in Japan and Australia.

٥.٤ Transit New Zealand

TNZ's primary safety functions are in the area of physical road improvements such as the following:

- Improving intersections.
- Constructing and maintaining signs, guard rails, and median barriers.
- Installing traffic signals, pedestrian crossings, and bicycle ways.
- Erecting roadside marker posts.
- Improving dangerous sections of road.
- Supporting accident reduction and accident investigation studies.
- Assessing the effectiveness of remedial roadwork.

TNZ uses a process similar to those used in Japan, Australia, and the United States to identify black spots (which can include whole routes and areas) and develop cost-effective countermeasures. Benefit/cost ratios are calculated for use in setting implementation priorities.

TNZ works with LTSA to improve specific road sites where investigations suggest that road conditions are a factor in crashes. TNZ also employs a safety audit process to review road designs and for surveillance of existing roads. At the design stage, the goals are to minimize the risk and severity of accidents that may be created by the road project, both at the site and on the adjacent network; to minimize the need for remedial work after construction; to reduce the whole-life costs of the project; and to improve awareness of safe design practices.

٥.٥ Land Transport Safety Authority

LTSA was established as a Crown agency in August ١٩٩٣, taking over most of the functions of the former Land Transport Division of the Ministry of Transport. In this role it develops safety standards in partnership with industry and the public and is accountable to stakeholders for ensuring compliance with the standards. The chief executive of LTSA reports to a board of three members appointed by the Minister of Transport.

LTSA administers the National Road Safety Plan that coordinates and gives direction to the road safety activities of organizations throughout New Zealand. It also oversees the annual funding plan for road safety activities carried out by the New Zealand Police, local authorities, and community groups. Current funding provides NZ$١٢٠ million (US$٧٥ million) for traffic enforcement, NZ$٩ million (US$٥.٦ million) for road safety education, and NZ$٢٨ million (US$١٧.٤ million) for the administration of the Land Transport Fund. LTSA intends to utilize the safety audit process in its vehicle and driver safety initiatives.

٥.٦ New Zealand Police

New Zealand Police is a public governmental agency that enforces most road safety laws, investigates road crashes where charges may be involved, and conducts driver license testing services as an agent of LTSA. New Zealand Police provides an enforcement presence for special campaigns against high-risk behavior in conjunction with LTSA publicity and promotion activities and also enforces the rules regarding heavy vehicle licenses, weight limits, load security standards, and driver hours. The agency provides investigative reports on traffic accidents and develops traffic safety enforcement systems. As a major road safety stakeholder, New Zealand Police provides input into the National Road Safety Plan.

٥.٧ Cooperative Relationships with Australia

New Zealand approaches road safety with much the same intent and management style as Australia. As mentioned earlier, TNZ is a member of Austroads and New Zealand's LTSA works with the National Road Transport Commission and state and federal road agencies on road safety policies. The main characteristics of both governments' safety approaches are similar, though New Zealand's transport activities are more privatized than Australia's.

٦. Major Findings and General Conclusion

Each of the three countries visited has a unique national character and governmental constitution, so it is remarkable that they have many similar highway safety initiatives. This may be due to their economic similarities and interactions as modern industrial economies in which movements of people, goods, and services are so intricate. Although comparisons of the United States, Australia, and New Zealand may seem obvious to Americans, primarily because of the common English language and law origins, Japan also shares in this commonality by its democratic government structure, its emergence as a technological leader, and the development of its modern transportation network since the late ١٩٤٠s.

The major transferable safety management finding of this trip is that the management philosophy observed in all three countries is that of networking and building of consensus among stake-holders--government, industry, and citizen groups working together in a search for solutions to traffic safety problems. Use of planning and the Deming-inspired approach to quality management are in evidence in all three countries. Although tremendous diversity exists in the highway transportation environment within and among the three countries, each has programs that approach highway safety in similar philosophical and managerial styles.

Each of the three countries has experienced impressive safety gains over the past decades. Death rates and frequencies have been on a steady decline, with Australia and Japan showing modest increases in fatalities in recent years. This evidence has prompted all three nations to pursue safety management with new energy and new ideas. Each country's new national safety campaign employs some level of strategic planning in formulating its safety programs. Each attempts cooperation among safety stakeholders. Each is employing fact-based, information-driven evaluation methods.

Highlighted below are findings that the research team believes to be adaptable to the highway Safety Management Systems approach in the United States.

٦.١ Japan

 Japan is investing in information technology to achieve quantum gains in highway safety. For example, its Advanced Highway Safety System is now testing the intersection Guidelight System to warn approaching vehicles of potential danger where alignment obstructs sight distance. Sensing devices installed within the roadway environment detect problems.

 Another unique program, administered by MOT, is a Maintenance Supervisor System that requires certification of a responsible company official to ensure that the company's fleet meets inspection requirements. Certification is conferred as a result of an MOT examination of the maintenance supervisor. This approach is distinct from systems in a few States in the United States in that it is national in scope, and one person is designated as responsible for the entire fleet's safety inspection requirements.

 A similar program addresses driver safety in fleet operations. Company operations managers are responsible for setting schedules that do not burden drivers, either physically or mentally. By reading odometers and tachometers, the operations manager checks drivers after each completed trip to verify that they abided by the regulations regarding rest periods and driving hours.

 ITARDA's initiative is unique in that its activities provide both independent and assigned research. This duality permits separation of general-interest research from more client-specific work. The client-specific assigned research is conducted in response to requests by a ministry or a public or private organization and is funded by the requesting agency. Another feature is that all the sponsoring agencies supply the necessary data for an integrated highway safety data base. NPA provides accident data MOC provides road data, and MOT provides vehicle data. These data are supplemented, in certain cases, with relevant industry data. ITARDA also acts as an information clearinghouse.

 The findings of all MOT inspections and audits are disseminated to all truck and bus companies as an educational strategy targeted toward prevention of traffic accidents. MOT has a land transport office in each of the ٤٧ prefectures and the three special districts, with at least one auditor in each.

٦.٢ Australia

 A Ministerial Council is established in the interest of setting consistent policies and standards among the states. It is made up of the ministers from each of the six states and two territories, a small group facilitating rapid decision making.

 FORS, in cooperation with all states and territories, adopted a ten-point National Road Safety Package in ١٩٨٩. FORS provided A$٢٧٠ million (US$٢٠٥ million) over three years to eradicate the worst black spots on Australia's roads, but funding to states and territories was conditional upon their agreement to implement the ten points.
 A National Road Safety Action Plan was launched in June ١٩٩٤ to implement the previously developed National Road Safety Strategy. It is a cooperative effort involving all levels of government, road safety bodies, health agencies, police, the vehicle industry, motorists' organizations, vehicle manufacturers, and community organizations. The strategy and action plan are responses to an upward trend in the death toll observed since July ١٩٩٣. All states and territories have developed their own action plans linked to the National Road Safety Strategy.

New South Wales

 New South Wales is making extensive use of technology to address its heavy vehicle safety problems. Heavy vehicles are involved in ١٥ percent of traffic crashes annually. Safe-T-Cam is a video-imaging technology system designed to identify heavy vehicle license plates in traffic. Computer-imaging technology determines the speed of the vehicle and records its location and time for hours-of-service checks. In the short term, RTA plans to use this system to monitor speed and hours of service and to coordinate this information with the random safety check teams deployed throughout the state. Its goals are reduction of extremes in speeds within the traffic stream and driving hours violations by truck operators. RTA projects that by reducing the extremes ٣ percent will result in saving five lives and seven serious injuries each year. Nonlinearities of the statistical distribution do not permit easy extrapolation for other percentages of reduction, but as evidence accumulates such estimates will be possible.

Victoria

 Major operational programs of VicRoads are the study and development of counter-measures to address black spots, use of formal safety audits, presentation of thematic television safety commercials coordinated with police enforcement initiatives, and the use of speed cameras. Economic analysis is done to ensure that the projects with the best benefit/cost ratio receive priority.

- The speed-camera project is considered one of the more effective safety countermeasure programs in Victoria. Cameras strategically installed on major arterials photograph speeding vehicles, prints of the violating vehicle are analyzed, and tickets mailed to offenders. About ٦٠,٠٠٠ violations are issued annually. Benefit/cost ratio is calculated at ١٠ to ١.

٦.٣ New Zealand

 New Zealand approaches road safety with much the same management style as Australia. The most important aspect of New Zealand's strategy is the corporate approach to responsibility and the cost-effective performance requirements of the road safety project outcomes. The Land Transport Safety Authority has primary responsibility for road safety. It develops safety standards in partnership with industry and the public and is accountable to stakeholders for ensuring compliance with the standards.
 New Zealand employs a safety audit process to review road designs and surveillance of existing roads. The intent is to minimize the risk and severity of accidents that may be created by the road project at the site and on the adjacent network, minimize the need for remedial work after construction, reduce the whole-life costs of the project, and improve awareness of safe design practices. LTSA intends to utilize the safety audit process in its vehicle and driver safety initiatives.

٦.٤ General Conclusion

Many of the findings listed above are exemplary as successful safety programs in operation in each of the countries. Where feasible, the U.S. Department of Transportation should encourage States and local governments to adopt and implement these strategies in their highway safety programs.

The major finding of the study team with direct implication for safety management in the United States is the strategic matrix management approach observed in Australia. This substantial initiative is national in scope and is led by a consortium of road safety stakeholders at national, state, and local levels of public and private organizations.

The National Road Safety Strategy was developed by federal, state, and local governments, as well as industry and community groups, to reduce fatalities and serious injuries. Forty-seven national, state, and local organizations took part in its development. It is anticipated that the integration of the strategy into individual safety programs will save over ٣,٠٠٠ lives and up to ١٥٠,٠٠٠ casualties over the next ten years. Economic benefits are expected to total A$١.٥ billion (US$١.١ billion) per year. Organization and implementation for road safety in Australia may serve as a case study or role model for the implementation of a Safety Management System by a State in the United States. While the New South Wales and Victoria road authorities have the statutory responsibility for road safety, they make extensive use of a consultative process to set targets and achieve progress in the interest areas of their safety stakeholders.

In Japan, Australia, and New Zealand the team encountered evidence of success through planning coupled with cooperating stakeholders to provide inspiration for implementing Safety Management Systems.

٧. Acknowledgments

Special acknowledgment is due all the host transportation ministries, researchers, and private firms for their gracious hospitality and for sharing their experience and time with the scanning team.

Thanks also go to FHWA, Office of International Programs, for technical assistance and funding of this effort.

Particular acknowledgment is due the Transportation Technology Evaluation Center (TTEC) at Loyola College in Maryland for its coordination of the team and production of this report.

Finally, special thanks are given to TTEC's liaison offices, Uyehara International Associates and Roaduser Research, Pty. Ltd., for arranging the meetings, planning the travel, and escorting the team.

Appendix A: Highway Safety Management Systems Questionnaire

The following survey was developed by team members to facilitate the information gathering so essential to a satisfactory scanning tour investigation. It also will facilitate assignments for note taking during the tour, with the understanding that while individual(s) are assigned specific areas, all team members should take notes, as feasible, for all issues covered, especially those of personal interest.

Structure of Highway Safety Organization(s)

What is the authority base of the organization(s), legislative or executive?
How does the authority base fit into the country's formal organization setting, and what are its formal links with other highway safety organizations, government or private?
In what way does coordination with local or regional planning organizations or authorities occur?
What is the frequency of meetings or communication between the organizations involved?
May we have an organizational chart showing persons we will be meeting highlighted?

Highway Safety Funding Sources

Do categorical funding sources exist?
What techniques or procedures are used to allocate resources among the various safety programs?
Is there a national funding source? A local funding source? Are they connected or coordinated?

Safety Goals and Evaluation

How does the highway safety agency establish safety goals and ensure their achievement?
Is there a formal process for goal achievement?
Do you identify and investigate potentially hazardous roadway locations and features?
How do you assess and select alternative countermeasures?
Do you conduct safety design reviews of all highway projects, new construction, and reconstruction? If so, how?
What determines maintenance or placement of safety appurtenances, highway elements, and operational features?
Do clear roadside policies and practices exist?
Are there work zone safety practices for workers, pedestrians, and motorists in construction areas?
In what way do you determine safety needs of special user groups, such as commercial motor vehicles, older drivers, small passenger cars, pedestrians, bicycles, and motorcycles?
Please describe your alcohol highway safety programs, occupant protection programs, emergency medical services, and selective enforcement programs.
What are your methods for determining priority of projects to be implemented? Are economic analysis methodologies such as cost/benefit analysis used?
Are accident rates and severity factors considered?
Are there government public education programs to promote safety?
What are the roles of private groups (both industry and safety associations) in highway safety?
Are safety program activities targeted toward the commercial (heavy) vehicle population, such as regulation of size and weight, and safety audits of drivers, vehicles, and companies that own and operate these vehicles?

Expertise of Staff Involved in Safety Programming

What are the requisite training and skills?
Which disciplines are preferred?

Information Systems Used in Safety Analysis

Please describe information systems used in safety analysis, including characteristics of automated systems such as the following:

- Integrated data bases.
- Ease of data retrieval and access.
- Timeliness and accuracy of data.
- Standard accident reporting formats.
- How data are collected and recorded and by whom.
- Linkages between highway safety automated files (i.e., driver's files, vehicle files, roadway and accident files).

Monitoring and Evaluation Methodology

What are your routine monitoring mechanisms?
What type and frequency of program evaluation do you employ?
Are performance measures incorporated into program design?
Are successes and failures noted?

Application of Advanced Technologies in Highway Safety

How is Intelligent Transportation Systems (ITS) technology envisioned for use to reduce traffic accidents and their severity?
Are global positioning systems (GPS) used in accident location identification?

Are geographic information systems (GIS) now in place or planned in the foreseeable future?
Are there other planned uses of advanced technology to address the traffic accident problem?

Appendix B: Host Representatives

Following is a list of officials who participated in the scanning tour on highway safety management systems to Japan, Australia, and New Zealand, June ١٠B٢٦, ١٩٩٤.

Japan

Ministry of Construction-Mr. Nobuyuki Kitani, Deputy Director, Planning Division of the Road Bureau-Mr. Shinri Sone, Chief Road Safety Section ,Public Works Research Institute-Dr. Takashi Iijima, Director General- Mr. Tetsuo Matsumura, Research Coordinator for Traffic Safety-Mr. Takuya Seo, Chief, Traffic Safety Division-Mr. Makoto Nakamura, Chief Traffic Engineering Division-Mr. Ryutaro Oishi, Coordinator for International Research Cooperation, Institute for Traffic Accident Research and Data Analysis-Mr. Shinichi Nagakura, Director-Mr. Masaru Inoue, Manager External Relation and Publicity Section-Mr. Kouzo Maeda, Senior Research Engineer, Research Division-Mr. Hiroshi Makishita, Manager Research Section-I, Research Division, National Police Agency-Mr. Masao Umezawa, Assistant Director Traffic Planning Division-Mr. Kenichi Aoyama, Assistant Director Traffic Control Division, Metropolitan High-Speed Road Public Corporation-Mr. Norio Hayashi, Director Tokyo Bay Underground Tunnel Engineering Office-Mr. Noa'aki Tanioka , Engineering Planning Division Engineering Department-Mr. Shinichi Egawa, Deputy Director Engineering Planning Division, Engineering Department, Japan Highway Public Corporation-Mr. Toshikazu Asano, Submanager Traffic Management and Safety Division, Tokyo Metropolitan Government-Mr. Iwao Yamaguchi, Deputy Director Safety Facilities Division Bureau of Construction-Mr. Motoo Kato, Deputy DirectornSafety Facilities Division-Mr. Mitsukuni Saito, Safety Facilities Division-Mr. Fumiya Shimura, Safety Facilities Division-Mr. Shigeru Imai, Safety Facilities Division Ministry of Transport-Mr. Hiroshi Asai, Director International Planning Division Transport Policy Bureau-Mr. Tetsushi Miyake, Director Office of International Affairs Engineering and Safety Department, Road Transport Bureau-Mr. Jun Masui, Deputy Director Operation Safety and Environment Division, Engineering and Safety Department Road Transport Bureau-Mr. Aikida Takahashi, Mr. Ryosuke Itazaki, Maintenance Service Division

Australia

Department of Transport
Mr. Stephen Ward, Advisor to The Honorable Neil O'Keefe, MP Parliamentary Secretary, Transport Mr. Peter Makeham, First Assistant Secretary and Director Federal Office Road Safety
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Endnotes