

INITIATIVES FOR  
IMPROVING ROAD SAFETY  
PHASE I



Asia-Pacific  
Economic Cooperation

**COMPENDIUM OF  
ROAD SAFETY INITIATIVES**

Road Safety Experts Group  
Transportation Working Group  
Asia-Pacific Economic Cooperation  
2004

INITIATIVES FOR  
IMPROVING ROAD SAFETY  
PHASE I

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ROAD SAFETY INITIATIVES**

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# EXECUTIVE SUMMARY AND RECOMMENDATIONS

## ROAD SAFETY IN ASIA PACIFIC

Road transportation safety is becoming a critical issue in the Asia Pacific Region since road accidents directly cause loss of life, personal suffering and property damages. Indirectly, it impacts the efficiency and performance of the transportation network, and affects the quality of life of all residents of the Asia Pacific Region. With the rapid economic growth experienced by the Region in the past decades, some of the Member Economies are experiencing high rates of growth in motorized transports. As a result, road safety casualties are growing compared to other regions of the world.

The economic impact of road collisions in the Asia Pacific Region could adversely impact the social and economic well-being and development of the Region. APEC recognized the importance of road safety in the region, and appointed the Road Safety Expert Group to focus specifically on road transport safety issues.

## APEC'S INITIATIVES TO IMPROVING ROAD SAFETY

One of the major objectives of the Asia Pacific Economic Cooperation (APEC) is to facilitate trade among member economies. Road transportation is an essential element in moving people and goods as part of a region-wide, inter-modal transportation system. To adequately fulfill their economic and social roles, *road transportation systems must be safe, efficient and reliable*. The APEC economies have realized that improving road transportation safety is not only essential in promoting the quality of

life but it is also of utmost importance to the trade industry in the Asia-Pacific region.

The importance of road transportation safety was first brought up at the 11<sup>th</sup> APEC Transportation Working Group (TPT-WG) meeting in Seattle, United States. Subsequently, at the 12<sup>th</sup> TPT-WG Meeting, Chinese Taipei proposed to establish the Road Safety Experts Group (RSEG) to facilitate the exchange of road safety information and to develop a systematic approach to the road transportation safety initiatives in the APEC region. Under the leadership of Chinese Taipei, RSEG has consequently conducted two initial projects.

The first project focussed on collecting information regarding existing safety practice and strategies and collision data collected by each APEC Member Economy.

The second project identified twelve major road safety issues in the APEC Region. Subsequently, a comprehensive survey was conducted to identify and compile a range of counter-measures from the APEC Member Economies that deal with these problems.

The "12" Major Road Safety Issues in APEC Economies were as follows:

- Best way to collect and share data
- Road infrastructure improvements
- Roadside slope management
- Speeding
- Impaired driving
- Vehicle overloading
- Seatbelts/helmets usage
- Pedestrian safety
- Safety of older people
- Community approach
- Black-spots
- Raise society awareness

While recognizing that individual Economies' road safety problems and the approach to resolve those problems may not coincide, RSEG suggested that the common characteristics and solutions can be analyzed and developed as recommended initiatives to be implemented by all APEC Member Economies. To that end, RSEG designed a three-phased approach to meet its overall goal of developing better road safety packages for all APEC economies as follows:

**Phase I** - develop a *compendium of best road safety initiatives* for APEC Member Economies to improve road transportation safety in the Region.

**Phase II** - develop *individual action plans for voluntary Member Economies* based on the initiatives developed in Phase I.

**Phase III** - conduct a *pilot program* involving both public and private sectors to implement low-cost highly effective measures for improving road safety in voluntary Member Economies.

This report concerns Phase I. The purpose of this report is to:

1. Provide a "best practice" compendium of low-cost, highly-effective road safety initiatives; and,
2. Identify organization roles, partnership models and funding sources, including the opportunities for cooperation with the private sector and non-government organizations to improve the performance of road safety programs in APEC economies.

## **A SYSTEMATIC APPROACH TO ROAD SAFETY**

While one of the specific objectives of this project was to '*...suggest initiatives to*

*improve road transportation safety in the APEC Region according to the common directions and possible resources...*', the diversity amongst the 21 APEC Member Economies would indicate that 'commonality' must be interpreted in this context to have a broader meaning than a simple "one-size-fits-all" approach.

A safety management approach is proposed based on the safety management model adapted from the Organisation for Economic Co-operation and Development's (OECD) road safety planning approach. This process is illustrated below.

### **Road Safety Management Process**



### **Establishing a Safety Vision**

The first step in the process is to identify a road safety vision. The purpose of establishing a vision is to ensure that road safety has a prominent place in transport policy. A good vision should motivate road

users, politicians and those responsible for road safety to work towards achieving the vision.

### **Situation Analysis**

The next step is to perform an analysis to determine which of the identified major problems may exist in an economy. This is an important step because it directly impacts the initiatives that are adopted and can help prioritize the initiatives.

### **Goal Setting**

Goal (target) setting is a valuable tool to increase the effectiveness of road safety program development and leads to improved road safety. Goals will generally be more specific than the vision statement noted above. They can be determined using a “top down” process based on idealistic objectives, or a “bottom up” approach using realistic objectives. In practice, a blend of these two approaches is often used.

### **Building the Road Safety Program – A “Portfolio” Approach**

A “portfolio approach” is proposed as a means of identifying the most appropriate road safety initiatives to address the problems identified in the Situation Analysis stage.

The optimal strategy is to employ a range of proven measures - a portfolio - aimed at road users, vehicles and road infrastructure. The objective is to decrease risks of collisions (i.e., collision frequency and severity).

The key to advancing road traffic safety with respect to APEC economies is that the initiatives adopted:

- Are effective within a relatively short time;

- Can be supported by “internal” resources and/or cooperative arrangements and able to attract non-governmental funding support;
- Are highly visible to the public;
- Can be replicated and sustained;
- Can be monitored and evaluated.

Selecting the optimal mix of measures to include in any economy’s road safety portfolio critically depends on the overall approach. In this regard, there are two broad alternatives - a comprehensive approach; and a selective approach.

A comprehensive approach is generally recommended since it will yield superior results. Such approach requires linkages between the planning process, use of technology, traffic education, enforcement and data collection and information sharing and may thus be better suited in more advanced economies.

In cases where resource limitations restrict the ability to implement and monitor a comprehensive program, a selective approach may be prudent in the short term. Such a program may focus on one of the Major Safety Issues and select one or more prominent initiative. This could then be a stepping stone to generate “early winners” and build awareness and support for a more comprehensive program in the long term.

### **Monitoring and Evaluation**

Finally, the road safety program must be monitored and evaluated, based on the targets set earlier in the process. The results of the monitoring and evaluation are important tools that assist an economy to:

- Ensure that the program achieves the staged goals and objectives;
- Determine any modifications necessary to achieve the desired results;
- Provide public and political feedback;



- Continue to generate awareness and interest in road safety; and,
- Provide impetus for expanding the road safety program in the economy.

## **FUNDING AND MANAGING ROAD SAFETY**

One component of the study is the formulation of recommended practices for funding and managing road safety, presented in *Sections 4 and 5*.

The various funding opportunities for road safety programs are identified in *Section 4*. Each potential funding source is briefly discussed and preliminary pros and cons are provided. It is expected that one or more of the funding sources could be adopted in Phases II and III of the project for volunteer Member Economies.

The management of road safety, including the roles of the public, private and non-governmental organizations (NGO's), and the partnership opportunities are also discussed in detail. Their key roles and responsibilities are identified for this project such that they could be used as a checklist for phases II and III of the project where they will be examined in details for the volunteer economies when developing the road safety plans. The roles and responsibilities of the public sector, private sector and NGOs checklists are summarized in *Section 5* of the report.

## **COMPENDIUM OF ROAD SAFETY INITIATIVES**

The complete Compendium of Road Safety Initiative is presented in *Section 6* of this report as a stand-alone component for ease of further reference.

The compendium addresses the consolidated major safety issues. For each issue, the compendium provides:

- a **description**, mainly based on the APEC documentation supplemented by the study team's input;
- the **range of road safety initiatives** categorized into Engineering, Enforcement (including judiciary initiatives), Education (including training) and Policy;
- examples of **"good practices"** from the APEC member economies and other sources, when available; and,
- documented **"empirical evidence"** in support of recommended initiatives as reported in various sources.

## **RECOMMENDATIONS**

It is thus suggested that APEC, as a leading organization, lever its credibility, resources and "internal" expertise to influence and advocate the implementation of road safety initiatives for the Member Economies.

The results of this study, namely the Compendium of Road Safety Initiatives and the principles for Managing and Funding Road Safety, can form the foundation of a systematic approach for implementing road safety initiatives that can be recommended to Member Economies wishing to enhance their road safety programs.

The proposed approach can be readily tailored to meet the specific needs of a particular economy in Phases II and III.

Lastly, it is recommended that APEC consider holding a workshop at the Annual Transportation Working Group meeting to disseminate the information contained in this report, and to solicit volunteer member economies to proceed to Phase II of the project.

# INTRODUCTION

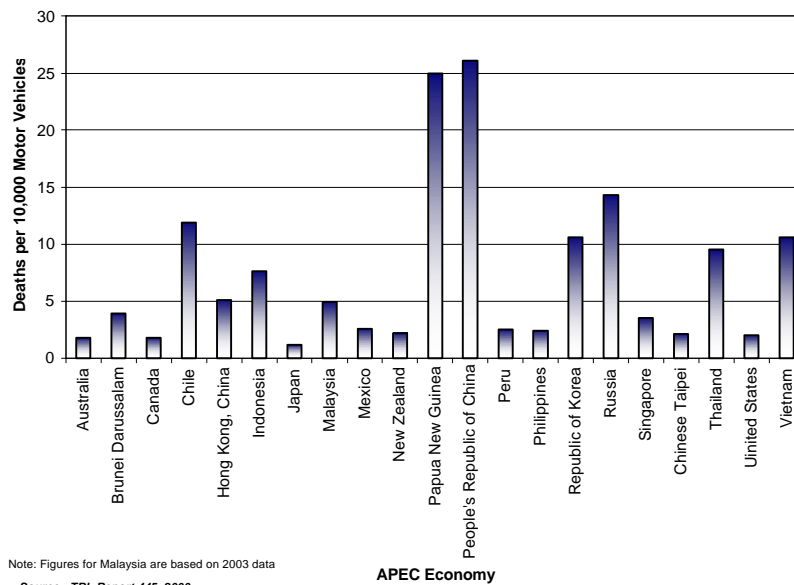
## ROAD SAFETY IN ASIA PACIFIC

Road transportation safety is becoming a critical issue in the Asia Pacific Region since road accidents directly cause loss of life, personal suffering and property damages. Indirectly, it impacts the efficiency and performance of the transportation network, and affects the quality of life of all residents of the Asia Pacific Region.

With the rapid economic growth experienced by the Region in the past decades, some of the Member Economies are experiencing high rates of growth in motorized transports. As a result, road safety casualties are growing compared to other regions of the world. For example, the number of road accident deaths in the People’s Republic of China increased from 94,000 in year 2000 to 106,000 in year 2001<sup>1</sup>. The World Health Organization (WHO) estimated that by the year 2020,

road accidents would be the third leading cause of deaths globally. Road collisions are already the leading cause of injury-related disability<sup>2</sup>.

The Global Road Safety Partnership<sup>3</sup> (GRSP) estimated that the Asia-Pacific Region accounted for 44 percent of global road deaths with only around 16 percent of the world’s motorized vehicle fleet. It was estimated that in 1996, approximately 222,000 people were killed in road collisions, and over 5.5 million were injured in APEC Member Economies. For example, the economic costs of road collisions in Korea was estimated to be approximately US\$12,561 million (1997 value), and is the equivalent of 2.6 percent of the Gross National Product. The comparative risk in the 22 APEC Member Economies are shown in the following figure, using the annual number of road deaths per 10,000 registered vehicles as a performance measure. There is a significant variation amongst the economies, ranging from a low of 1.2 deaths per 10,000 vehicles to a high of 26.1 deaths per 10,000 vehicles.



<sup>1</sup> Figure obtained from Asian Development Bank, [www.adb.org/Projects/PRCRoadSafety/facts.asp](http://www.adb.org/Projects/PRCRoadSafety/facts.asp)

<sup>2</sup> World Health Organization, *A 5-Year WHO Strategy for Road Traffic Injury Prevention*, 2001.

<sup>3</sup> Transportation Research Laboratory Report 445, “Estimating Global Road Fatalities”, 2000.

The economic impact of road collisions in the Asia Pacific Region could adversely impact the social and economic well-being and development of the Region. A recent study<sup>4</sup> by the Asian Development Bank estimated road accidents cost to the ASEAN<sup>5</sup> countries is at over \$11 billion annually. APEC recognized the importance of road safety in the region, and appointed the Road Safety Expert Group to focus specifically on road transport safety issues.

### PROJECT BACKGROUND

One of the major objectives of the Asia Pacific Economic Cooperation (APEC) is to facilitate trade among member economies. Road transportation is an essential element in moving people and goods as part of a region-wide, inter-modal transportation system. To adequately fulfill their economic and social roles, *road transportation systems must be safe, efficient and reliable*. The APEC economies have realized that improving road transportation safety is not only essential in promoting the quality of life but it is also of utmost importance to the trade industry in the Asia-Pacific region.

The importance of road transportation safety was first brought up at the 11<sup>th</sup> APEC Transportation Working Group (TPT-WG) meeting in Seattle, United States. Subsequently, at the 12<sup>th</sup> TPT-WG Meeting, Chinese Taipei proposed to establish the Road Safety Experts Group (RSEG) to facilitate the exchange of road safety information and to develop a systematic approach to the road transportation safety initiatives in the APEC region. Under the leadership of Chinese Taipei, RSEG has consequently conducted two initial projects.

The first project focussed on collecting information regarding existing safety practice and strategies and collision data collected by each APEC Member Economy. This was done by way of surveying and comparing the collected information of each Member Economy.

#### **Results of the Phase I Survey**

Traffic accident data recorded by APEC members is similar, however, the definition of data varies significantly, making comparisons of accident statistics between countries and data sharing difficult.

The second project identified twelve major road safety issues in the APEC Region. Subsequently, a comprehensive survey was conducted to identify and compile a range of counter-measures from the APEC Member Economies that deal with these problems.

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<sup>4</sup> Asian Development Bank, *Technical Assistance for Road Safety in the Association of Southeast Asian Nations, December 2002.*

<sup>5</sup> The Association of Southeast Asian Nations (ASEAN) comprises Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.

**The “12” Major Road Safety Issues in APEC Economies**

The main road safety issues in the region were categorized as follows:

- Best way to collect and share data
- Road infrastructure improvements
- Roadside slope management
- Speeding
- Impaired driving
- Vehicle overloading
- Seatbelts/helmets usage
- Pedestrian safety
- Safety of older people
- Community approach
- Black-spots
- Raise society awareness

The survey found that most economies have road safety initiatives to address specific problems. The most recognized problem is aggressive or improper driving behaviour. Other common problems encountered are pedestrian and motorcycle safety. Only two economies said they have no road safety program and most programs have a designated council (committee) responsible for nation-wide road safety.

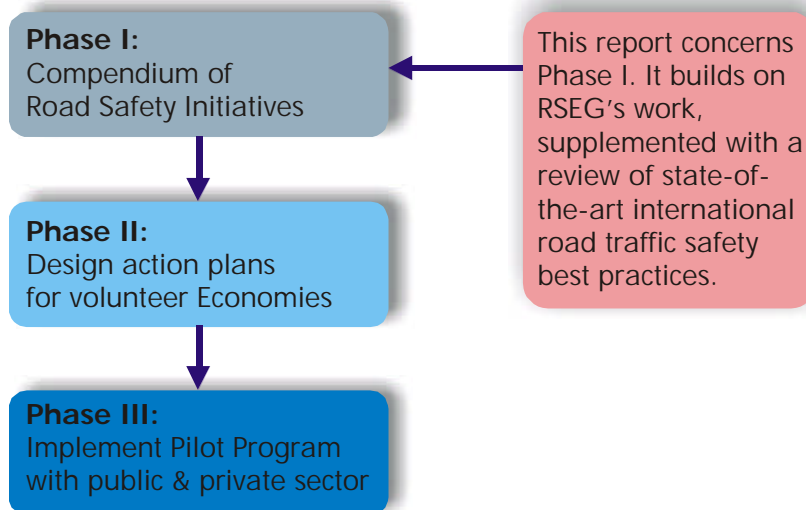
**PROJECT CONTEXT**

While recognizing that individual Economies’ road safety problems and the approach to resolve those problems may not coincide, RSEG suggested that the common characteristics and solutions can be analyzed and developed as recommended initiatives to be implemented by all APEC Member Economies. To that end, RSEG designed a three-phased approach to meet its overall goal of developing better road safety packages for all APEC economies as follows:

**Phase I** - develop a *compendium of best road safety initiatives* for APEC Member Economies to improve road transportation safety in the Region.

**Phase II** - develop *individual action plans for voluntary Member Economies* based on the initiatives developed in Phase I.

**Phase III** - conduct a *pilot program* involving both public and private sectors to implement low-cost highly effective measures for improving road safety in voluntary Member Economies.



## ORGANIZATION OF THE REPORT

This report contains the following sections:

Section 1	Introduction
Section 2	Summary of Study Activities and Results
Section 3	A Systematic Approach to Road Safety
Section 4	Funding Road Safety Initiatives
Section 5	Managing Road Safety
Section 6	Compendium of Road Safety Initiatives

*The purpose of this report is to*

1. Provide a “best practice” compendium of low-cost, highly-effective road safety initiatives; and,
2. Identify organization roles, partnership models and funding sources, including the opportunities for cooperation with the private sector and non-government organizations to improve the performance of road safety programs in APEC economies.

# SUMMARY OF STUDY ACTIVITIES AND RESULTS

## METHODOLOGY

To accomplish the study purpose, the following steps were completed:

- In-depth review of the APEC studies;
- Matching the APEC reported initiatives to the 12 major safety issues;
- Addition of relevant initiatives based on other sources;
- Evaluation of the complete set of initiatives;
- Compilation of the “Compendium of Road Safety Initiatives”;
- Formulation of principles and recommendations for funding and managing road safety initiatives; and,
- Development of an implementation strategy for APEC Economies.

## REVIEW OF THE APEC DOCUMENTATION

As mentioned in the introduction, the two key documents produced by the RSEG under the guidance of Chinese Taipei were:

- *Final Report For Phase I Questionnaire Of Road Safety Experts Group*, Chinese Taipei, November 2002; and,
- *Survey of Countermeasures for Improving Road Transportation Safety in the APEC*, Chinese Taipei, November 2002

*Phase I questionnaire* was designed to review the existing road safety strategies and collision data reporting systems of APEC member economies. The questionnaire contains four parts and deals with

- the existing road transportation safety strategies in each economy;
- the data items, categories and their definitions recorded in the traffic collision investigating reports;
- information published periodically at a nationwide level (e.g., annual traffic collision reports); and,
- general road safety statistics and other related information for each economy, such as the total number of collisions, population data, number of households, vehicles and drivers, highway length, etc.

*Survey of Countermeasures* surveyed the APEC Economies on specific countermeasures pertinent to the 12 major safety issues. Prompted by a questionnaire, each participating economy detailed their various safety programs and noted safety initiatives. Eleven member economies (Australia, Canada, Japan, Republic of Korea, Mexico, New Zealand, Papua New Guinea, Peru, Singapore, Chinese Taipei and Thailand) provided input into this document.

This information was summarized by Chinese Taipei and was a primary source for the development of the *Compendium of Road Safety Initiatives*, as reported in this study.

## DISCUSSION ON THE APEC DOCUMENTATION

The documentation prepared by the RSEG is particularly comprehensive and contains most of the necessary information required to complete *Phase I*. Further, it was concurred that there can only be limited marginal benefits from collecting additional data and that the remaining efforts should be focussed in organizing and refining the existing information to suit the study purposes.

The focus was thus directed towards:



- Ensuring the clear organization of the information to help formulate an effective road safety strategy;
- Providing a strategic direction in defining “best practices”;
- Evaluation of the initiatives to fit APEC objectives;
- Packaging the Compendium of Road Safety Initiatives;
- Identifying funding, organizational and partnership issues; and,
- Making recommendations on an implementation plan.

### ACTIVITIES RELATED TO THE MAJOR PROBLEMS

This section describes the activities undertaken towards the development of the Compendium of Road Safety Initiatives.

#### Matching Initiatives to the Major Safety Issues

For each of the 12 identified issues, the originally documented APEC initiatives were grouped under the **engineering, enforcement, education and policy** categories.

Through this exercise, it was decided that certain modifications were necessary to the original APEC grouping of the 12 road safety issues.

“Collision Data” and “Raising the Safety Awareness” are deemed to be essential to any road safety plan and, being recognized as unique, did not fit the proposed tabulation by category.

Issue 2 (Road Network & Safety Facilities) and Issue 10 (Accident Black Spot Approach) were consolidated under one heading – Safer Road Infrastructures. Issue 8 (Pedestrians Safety) and Issue 9 (Elderly Safety) were also consolidated under one heading – Vulnerable Road Users Safety.

Subsequently, additional road safety initiatives were added as appropriate for each of the eight remaining safety issues based on the state-of-the-art international experience and practice.

The final list of the road safety initiatives for each of the APEC major safety issues was then subjected to an evaluation process.

#### Evaluation Process

It was the intention of the study to evaluate the abovementioned set of initiatives in order to highlight the “best practice” applications for inclusion in the compendium. To that end, it was necessary to use a systematic approach to clearly and consistently define “best practice” in the APEC context.

First, it is evident that the main goal of the TPT-WG is that the selected initiatives should foremost meet APEC longer-term objectives of improving road safety in the region.

Second, it is recognized that there are significant discrepancies between the Member Economies that impose significant challenges to recommending a uniform road safety strategy. As a result, this report proposes a strategic approach to these challenges and the evaluation criteria were tailored to that approach.

Last, it is accepted that the results may be most useful to economies where road safety programs are not fully developed at this time.

#### Strategy for Defining the Evaluation Criteria

In the APEC context detailed above, it is surmised that “best practices” are those initiatives that encourage participation of

## SECTION 2: Summary of Study Activities & Results

member economies by fulfilling the following key success factors:

- Demonstrate effectiveness in a relative short time;
- Attract funding from non-governmental agencies;
- Provide high visibility/profile to the public at large;
- Can be replicated and sustainable;
- Can be supported (technically) internal resources and/or;
- Can benefit from cooperative arrangements between member economies through exchange of “know-how” information – this may also stimulate economic exchanges;

- Are both pro-active and re-active in practice; and,
- Can be monitored and evaluated for the benefit of all Member Economies.

### Resulting Evaluation Criteria

The resulting evaluation criteria, agreed on at the 22<sup>nd</sup> TPT-WG Meeting in Busan, Korea, were developed based on the strategic “key success factors” and are presented in the table below. Note that each criterion has “degrees” of achievement, and these were considered through the evaluation process. The criteria are summarized in the table below.

### EVALUATION CRITERIA DEFINITIONS

Evaluation Criteria	Definition
Cost-effectiveness	The initiative has to demonstrate that it will provide a positive return on investment
Timeline of implementation and results	The initiative can be implemented and can demonstrate benefits in a relatively short time
Affordability	The initiative is not cost-prohibitive
Replicable	The initiative has a high degree of likelihood to be implemented in a greater number of member economies
Sustainability	The initiative requires minimal efforts to remain successful over extended period of time
Acceptability	The initiative must be most likely acceptable to the local community/society. This includes such factors as political support and respect of local laws
Feasibility	The initiative requires average skill level for implementation and/or there are good indications that expertise is available to and from APEC members.
Proven results	The initiative has achieved proven success in either APEC countries or elsewhere.
Measurable	The results of an initiative can be measurable using primary indicators (i.e. before-after accident data) or secondary indicators (i.e. compliance rate) of road safety



### Results of the Evaluation

Using the above criteria, an evaluation matrix was developed to evaluate each initiative against all the evaluation criteria. During the evaluation, it became evident that all the road safety initiatives will meet some of the evaluation criteria and that overall, there were insufficient reasons to discard the initiatives. Although most of the enforcement and education initiatives lacked empirical evidence to support their effectiveness, it was concluded that road safety awareness and success could only be achieved through a holistic approach. Also, it was immediately evident that relevant activities related to policies, education and training must be in place in order to advance safety in the APEC economies.

**The evaluation therefore confirmed that, in aggregate and having been validated through a rigorous evaluation process, the road safety initiatives undertaken by the APEC economies as documented by the RSEG, are relevant.**

The results of the evaluation further indicate that APEC region as a whole has access to a significant amount of road safety expertise and “know-how” to effectively address the major road safety issues in the region.

There remains the key role of APEC as an organization to disseminate this information and for Member Economies to tailor these initiatives to meet their objectives (in **Phase II**). *In Section 3*, a systematic approach for achieving these objectives is proposed.

### FUNDING AND MANAGING ROAD SAFETY

One major component of the study is the formulation of recommended practices for funding and managing road safety, presented in *Sections 4 and 5*. The various funding opportunities for road safety programs are identified based on previous APEC work

and additional international experiences. Each potential funding source is briefly discussed and preliminary pros and cons are provided. The management of road safety, including the roles of the public, private and non-governmental organizations (NGO's), and the partnership opportunities are also discussed in detail.

### COMPENDIUM OF ROAD SAFETY INITIATIVES

The complete Compendium of Road Safety Initiative was finalized subsequent to the evaluation process and is presented in *Section 6* of this report as a stand-alone component for ease of further reference.

The compendium sections dealing with *Collecting and Sharing Collision Data* and *Raising the Attention of Society to Road Safety Problems* provide an expanded discussion on those issues. It was previously stated that both **collision data** and **public awareness are essential elements of a safety program** and, as such, could not be categorized as “issues”.

The remaining sections of the compendium addresses the consolidated eight major safety issues. For each issue, the compendium provides:

- a **description**, mainly based on the APEC documentation supplemented by the team's input;
- the **range of road safety initiatives** categorized into Engineering, Enforcement (including judiciary initiatives), Education (including training) and Policy;
- examples of “**good practices**” from the APEC member economies and other sources, when available; and,
- documented “**empirical evidence**” in support of recommended initiatives as reported in various sources.

# A SYSTEMATIC APPROACH TO ROAD SAFETY

## FOREWORD

While one of the specific objectives of this project was to ‘...*suggest initiatives to improve road transportation safety in the APEC Region according to the common directions and possible resources...*’, the diversity amongst the 21 APEC Member Economies would indicate that ‘commonality’ must be interpreted in this context to have a broader meaning than a simple “one-size-fits-all” approach.

The array of socio-economical, political, demographical, geographical and climatic conditions present in the APEC Economies cannot be overstated. This diversity is clearly reflected in the range of road safety initiatives and programs in the APEC region. Consequently, there are significant differences in how road safety is or can be planned and managed in the various economies.

While this project has successfully identified a comprehensive range of road safety initiatives, funding mechanisms and organizational responsibilities that could address the major road safety issues in the region, it was also recognized that a ‘common’ road safety “package” is neither possible nor practical.

Thus, Chinese Taipei’s proposal to ‘...*facilitate the interchange of road safety information and to develop a systematic approach to the road transportation safety initiatives in the APEC region...*’ has been adopted as the guiding principle in developing an implementation strategy. It is thus suggested that APEC, as a leading organization, lever its credibility, resources and “internal” expertise to influence and

advocate the implementation of road safety initiatives for the Member Economies.

To this end, the results of this study, namely the Compendium of Road Safety Initiatives and the principles for Funding and Managing Road Safety, can form the foundation of a systematic approach for implementing road safety initiatives that can be recommended to Member Economies wishing to enhance their road safety programs. The proposed approach can be readily tailored to meet the specific needs of a particular economy in Phases II and III.

## A MODEL FOR ROAD SAFETY MANAGEMENT

The proposed approach is based on the safety management model adapted from the OECD’s road safety planning approach. This process is illustrated below.

### Road Safety Management Process



## SECTION 3: A Systematic Approach to Road Safety

An effective safety management process is a critical element in addressing road safety problems. Only with good management process in place will those responsible for road safety be able to develop and implement effective road safety measures.

### Establishing a Safety Vision

The first step in the process is to identify a road safety vision. The purpose of establishing a vision is to ensure that road safety has a prominent place in transport policy. A good vision should motivate road users, politicians and those responsible for road safety to work towards achieving the vision.

#### *For Example*

Canada's Vision 2010 is to have the "safest roads in the world."

The vision should be clear, simple, easy to communicate and incorporated into the political and societal mindset. It should reflect an economy's common safety philosophy and be part of a broader policy framework that supports economic efficiency.

### Situation Analysis

The next step is to perform an analysis to determine **which of the identified major problems** may exist in an economy. This is an important step because it directly impacts the initiatives that are adopted and can help prioritize the initiatives.

For this purpose, it is useful to categorize the safety problems based on their root cause because it will help target the initiatives at the main problem areas. The major road safety issues may therefore be viewed as shown in the following Table.

ROAD USERS	<ul style="list-style-type: none"><li>• Speeding</li><li>• Impaired driving</li><li>• Seatbelt/helmet use</li><li>• Vehicle overloading</li><li>• Vulnerable users (pedestrians, elderly)</li></ul>
ROAD	<ul style="list-style-type: none"><li>• Road infrastructure</li><li>• Cut slope</li></ul>
VEHICLE	<ul style="list-style-type: none"><li>• Vehicle overloading</li></ul>

Particular attention should be devoted to analyzing problem areas in the road infrastructures, longer-term trends in fatality and injury crashes, and consideration be given to a separate review of urban and rural areas.

Exposure data should also be analysed (e.g., passenger-km, vehicle-km or surrogate measures such as population and the number of registered vehicles) to get an appreciation of trends in collision risks

It is also worthwhile analyzing broader factors which may influence the eventual road safety program. This may include: the state of the economy (i.e., growing economies are likely to have rising traffic volumes and hence higher exposure levels); data deficiencies and sharing of data and knowledge with those responsible for safety within the economy; and the manner in which road safety planning and implementation is carried out.

### Goal Setting

Goal (target) setting is a valuable tool to increase the effectiveness of road safety program development and leads to improved road safety. Goals will generally be more specific than the vision statement noted above. They can be determined using a "top down" process based on idealistic objectives, or a "bottom up" approach using realistic objectives. In practice, a blend of these two approaches is often used.

### **For Example**

Some countries such as Australia set specific goals in terms of fatalities (e.g., 5.6 per 100,000 population), while others such as Canada set reductions (e.g., 30% reduction in fatalities by the year 2010).

It is worth considering setting the target as “less than “*n*” fatalities per 100,000 population” rather than a specific number of fatalities to convey the message that any road fatality is unacceptable. Targets can also be set for other parameters such as serious injuries or property damage, and for specific road user groups such as the elderly and pedestrians.

### **Building the Road Safety Program – A “Portfolio” Approach**

A “portfolio approach” is proposed as a means of identifying the most appropriate road safety initiatives to address the problems identified in the Situation Analysis stage.

Many investors know that success often depends on diversification to reduce risk and increase returns. This is accomplished in the investment world by using a portfolio of different investments. The same principle, or “*portfolio approach*” is equally relevant to road safety.

The optimal strategy is to employ a range of proven measures - a portfolio - aimed at road users, vehicles and road infrastructure. The objective is to decrease risks of collisions (i.e., collision frequency and severity).

The key to advancing road traffic safety with respect to APEC economies is that the initiatives adopted:

- Are effective within a relatively short time;
- Can be supported by “internal” resources and/or cooperative arrangements and able to attract non-governmental funding support;
- Are highly visible to the public;
- Can be replicated and sustained;
- Can be monitored and evaluated.

Selecting the optimal mix of measures to include in any economy’s traffic safety portfolio critically depends on the overall approach. In this regard, there are two broad alternatives - a comprehensive approach; and a selective approach.

A comprehensive approach is generally recommended since it will yield superior results. Such approach requires linkages between the planning process, use of technology, traffic education, enforcement and data collection and information sharing and may thus be better suited in more advanced economies.

In cases where resource limitations restrict the ability to implement and monitor a comprehensive program, a selective approach may be prudent in the short term. Such a program may focus on one of the Major Problems and select one prominent initiative, such as, for example, a speeding program. This could then be a stepping stone to generate “early winners” and build awareness and support for a more comprehensive program in the long term.

To assist those Member Economies that would select a more condensed version of a road safety plan, the summary tables at the end of this section provide guidance regarding selected initiatives from the *Compendium* that best meet the five criteria stated above and can be the “early winners” in that process.

### Monitoring and Evaluation

Finally, the road safety program **must be monitored and evaluated**, based on the targets set earlier in the process. This is a significant component of a road safety program that is often neglected or under-funded. The results of the monitoring and evaluation are important tools that assist an economy to:

- Ensure that the program achieves the stated goals and objectives;
- Determine any modifications necessary to achieve the desired results;
- Provide public and political feedback;
- Continue to generate awareness and interest in road safety; and,
- Provide impetus for expanding the road safety in the economy.

## SECTION 3: A Systematic Approach to Road Safety

ENGINEERING	ENFORCEMENT	EDUCATION (INCL. TRAINING AND PUBLICITY)	POLICY
<b>Safer Road Infrastructure</b>			
<ol style="list-style-type: none"> <li>1. Implement black-spot programs</li> <li>2. Implement road safety countermeasures</li> <li>3. Implement road safety audits</li> </ol>	<ol style="list-style-type: none"> <li>1. Review of legislation and targeted enforcement</li> </ol>	<ol style="list-style-type: none"> <li>1. Training of practitioners</li> </ol>	<ol style="list-style-type: none"> <li>1. Support and Develop best practice guidelines and standards</li> <li>2. Establish multi-year programs for black spots improvements</li> </ol>
<b>Roadside Slope Management</b>			
<ol style="list-style-type: none"> <li>1. Undertake routine maintenance of the roadside</li> <li>2. Measures to protect errant vehicles from roadside hazards</li> <li>3. Measures to protect the road and the roadside from water (drainage)</li> <li>4. Measures to advise public of significant conditions</li> </ol>		<ol style="list-style-type: none"> <li>1. Training of practitioners in the appropriate sciences.</li> </ol>	<ol style="list-style-type: none"> <li>1. Policies regarding regular maintenance of road prism and roadside</li> <li>2. Provide opportunities for maintaining adequate skill levels</li> </ol>
<b>Speeding</b>			
<ol style="list-style-type: none"> <li>1. Appropriate speed limits</li> <li>2. Speed limiting geometric features</li> <li>3. Speed governors or limiters</li> </ol>	<ol style="list-style-type: none"> <li>1. Focussed campaign targeted at high risk locations</li> <li>2. Automatic or traditional speed enforcement measures</li> <li>3. Graduated fines</li> </ol>	<ol style="list-style-type: none"> <li>1. Speedwatch</li> <li>2. Police training in use of new technology</li> </ol>	<ol style="list-style-type: none"> <li>1. Redirect revenue from traffic fines to traffic safety initiatives</li> </ol>
<b>Impaired Driving</b>			
<ol style="list-style-type: none"> <li>1. Alcohol ignition interlock device program</li> </ol>	<ol style="list-style-type: none"> <li>1. Focussed campaigns</li> </ol>	<ol style="list-style-type: none"> <li>1. Training of police in the use of alcohol testing equipment</li> <li>2. Training courses for servers of alcohol</li> <li>3. Education in schools for teenagers</li> </ol>	<ol style="list-style-type: none"> <li>1. Establish low BAC level with severe consequences.</li> <li>2. Zero tolerance for new/probationary drivers</li> </ol>

## SECTION 3: A Systematic Approach to Road Safety

ENGINEERING	ENFORCEMENT	EDUCATION (INCL. TRAINING AND PUBLICITY)	POLICY
<b>Vehicle Overloading</b>			
<ol style="list-style-type: none"> <li>1. Parking and loading restrictions</li> <li>2. Height/width checkpoints on routes</li> <li>3. Warning signs at particularly prone locations for heavy vehicle overturning</li> <li>4. Height/width signs on structures</li> <li>5. In-vehicle weigh devices</li> </ol>	<ol style="list-style-type: none"> <li>1. Implement 'manual' or automated weigh-in-motion check points</li> <li>2. Dedicated motor carrier enforcement units/police</li> <li>3. Annual inspection of safety and structural features of vehicles</li> </ol>	<ol style="list-style-type: none"> <li>1. Initiatives to inform motor carriers of potential damage to roads and safety impacts (vehicle stability)</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that there is adequate legislation in place against vehicle overloading</li> <li>2. Legislation i.e. vehicle modifications</li> <li>3. Legislation to remove financial incentives to overload</li> <li>4. Legislation to assign liability to owners</li> </ol>
<b>Seatbelt &amp; Motor Cycle Helmet Usage</b>			
<ol style="list-style-type: none"> <li>1. Seatbelt systems</li> <li>2. Establish minimum standards for the crashworthiness of helmets</li> </ol>	<ol style="list-style-type: none"> <li>1. Campaign aimed at seatbelt / Helmet enforcement</li> <li>2. Graduated Fines</li> </ol>	<ol style="list-style-type: none"> <li>1. Educate police the importance of seatbelts and helmets</li> </ol>	<ol style="list-style-type: none"> <li>1. Mandatory use of seatbelts and motorcycle helmets</li> </ol>
<b>Vulnerable Road Users Safety</b>			
<ol style="list-style-type: none"> <li>1. Implement proven countermeasures</li> <li>2. Provide basic infrastructure &amp; pedestrian-friendly infrastructures</li> <li>3. Implement road safety audits for roadway design</li> </ol>	<ol style="list-style-type: none"> <li>1. Enforcement campaign aimed at drivers and pedestrians</li> <li>2. School zones</li> </ol>	<ol style="list-style-type: none"> <li>1. Safe Routes to School</li> <li>2. Training of Planners and Engineers</li> </ol>	<ol style="list-style-type: none"> <li>1. Setting the goal of improving vulnerable road user safety as a priority</li> </ol>
<b>Community Approach to Reduce Road Related Injuries</b>			
<ol style="list-style-type: none"> <li>1. Area-wide traffic calming</li> <li>2. Black Spot programs with community input</li> </ol>		<ol style="list-style-type: none"> <li>1. Safe Route to School</li> </ol>	<ol style="list-style-type: none"> <li>1. Develop community road safety strategies</li> </ol>



# FUNDING ROAD SAFETY INITIATIVES

## INTRODUCTION

Road safety funding is often scarce and limited as reported by many of the APEC economies. The question of road safety funding deserves as much attention as developing a good portfolio of road safety initiatives. Without secure and sustainable funding, road safety initiatives may not succeed. Past experience indicated that numerous interventions designed to improve road safety have failed due to the lack of sustainable funding. Thus, identifying and securing sustainable funding is a fundamental element in all road safety initiatives.

**Government** has an important funding role because of its obligation to provide for the safe and efficient movements of people and goods. More innovative practices suggest that public sector funding for road safety should not be restricted to the road authority. Education, health and justice departments all have potential funding roles. Health ministry involvement tends to be post-crash, but this expenditure may be better spent on preventative measures. There is growing recognition that traffic collision casualties should be treated as a disease, and this is reflected by the World Health Organization (WHO) formulating a 5-year Strategy for road traffic injury prevention in 2001.

While sustainable funding is critical, it does not guarantee the effectiveness of road safety activities. Public funding allocations from general revenues are most effective when there is a strong political commitment, legal backing, good planning and targeted delivery of measures at priority safety problems. Governments can raise the

priority of road safety by promoting a clear understanding of the total cost of road crashes to their citizens and economy and identifying the value of preventative measures in reducing these costs.

### *World Health Organization Strategy*

The WHO developed a 5-year Strategy for Road Traffic Injury Prevention in 2001. The Strategy is focused on three areas: epidemiology, prevention and advocacy.

**Epidemiology** include: data collection & monitoring; research; capacity building; and strengthening the links between environment, mobility and safety.

**Prevention** include: intervention for vulnerable road users; package knowledge on prevention strategies for low & middle income countries; provide guidance to manage road safety efficiently and sustainably; and develop new knowledge for intervention.

**Advocacy** include: raise public awareness; promote inter-sectoral approach to traffic injury prevention in low to middle income countries; promote road safety research; and advocate for resources for road traffic injury prevention.

Although governments are usually responsible for road safety planning and programs, many of the economic costs of road crashes are borne by the private sector. Consequently, **there is an economic incentive for private sector involvement** because of the potential monetary gain resulting from safety improvements. In the United Kingdom, for example, a detailed study suggested that private sector financing exceeded public expenditure on road safety. **Road users** also have a direct role. User charges can be levied through fees for



drivers, vehicle licenses and road taxes to support road safety initiatives that would ultimately benefit the road users.

Dedicated road safety funding is rare. The main exception is remedial works such as treating collision black spots. Best practices demonstrate that funding is most effective when responsibilities are generally divided as follows:

- **Public sector:** the provision of highway infrastructure, education and law enforcement should be a basic government service and thus financed through the government budget.
- **Road users:** should pay the costs of crash risk reduction (e.g., establish and maintain driver/vehicle standards); black spot programs (e.g., user tariffs); publicity campaigns; education; enforcement equipment; and research (e.g., through levies on insurance premiums).

### POTENTIAL FUNDING SOURCES

The main sources of financing road safety initiatives are:

- General Tax Revenues
- Earmarked Taxes
- Levies on Insurance
- Road Funds
- Private Sector Sponsorship

A brief discussion is provided for each funding source, and its pros and cons are also provided. Each APEC economy would need to review and evaluate its own situation and decide what funding mechanisms are best suited for applications to its economy.

### General Tax Revenues

General tax revenues are part of the budget of public sector agencies (e.g., transport ministry, road department, etc...) derived from general government tax revenue. There is general indication that this traditional source of road safety funding is becoming limited and scarce, and appears to be dwindling due to other government priorities.

**Pros:** Traditional revenue source for road safety funding.

**Cons:** Typically suffer from a general shortage of finance. As well, due to the wide distribution to various government agencies, it is sometimes difficult to identify the allocated resources to improving road safety, and resulting in the lack of coordination amongst agencies.

### Earmarked Taxes

Earmarked taxes typically involve assigning a specific tax for a designated purpose (e.g., improving road safety). A recent review conducted by the Global Road Safety Partnership indicated this funding sources is uncommon, but suggested that enforcement generated revenues (traffic fines) be allocated to support enforcement initiatives. The revenues raised from such fines must be related to the costs of the increased enforcement and promoted as a way of charging the offending road user for the costs imposed on others (otherwise it will be viewed as another tax).

#### *Examples of Earmarked Taxes*

In Western Australia, one-third of red-light and speed camera fines are collected into a Road Trauma Trust Fund to finance a variety of road safety programs. Several states in the United States use traffic fines to partially fund enforcement training.

**Pros:** Dedicated revenue source. However, if tied-in with traffic fines, it may experience decline as a result of better enforcement. It would be more acceptable if the funds involve “extra” payments by road users making the spending “neutral” with respect to the budget. For example, use traffic fines to support enforcement activities.

**Cons:** Perceived to be taking money away from the government’s budget (general revenue), therefore funding available to other sectors have to be reduced to balance the budget.

### Vehicle Insurance Levies

Vehicle insurance levies are collected by adding a levy or surcharge to compulsory insurance premiums to fund road safety initiatives. Insurance levies are a form of road user safety fee providing an ongoing, predictable source of revenues. They may also act as a financial incentive to drive safely. Since auto insurance companies cannot control the increasing costs of medical bills and auto repair, it is in their best interest to invest money to reduce crashes and subsequent claims costs.

The effectiveness of this type of surcharge depends on public acceptance. Care must be taken in adding surcharges to insurance premiums because of the risk of evasion in economies where mandatory insurance is not widely accepted. Economies wishing to introduce new levies will likely require legislative changes (e.g., to make third-party motor vehicle insurance compulsory for all drivers). If the levy is collected by a private sector body such as an insurer, legal changes may also be needed to make it possible for a government body to accept funds from an outside agency.

Besides funding, insurance companies offer the potential to share business and marketing skills to assist in addressing road

safety problems. Countries such as Canada, Australia and Finland have found significant advantages from investing in road safety because the benefits in terms of reduced claims (fewer crashes) often outweigh the amounts invested.

#### **Examples of Insurance Levy**

In the State of Victoria, Australia, a road safety levy was originally set as 3% of third-party insurance premium. The levy has been increased to 10%, or about \$20 per vehicle. A trust fund was established that has invested more than AUS \$240 million over the past six years on the support of community road safety, crash prevention, research and other areas.

Other countries such as Finland, which is thought to be the first country to use insurance premiums to finance road safety, set a 1% levy and raise \$8 million/year for education and publicity campaigns.

Korea collects an insurance levy dedicated towards the operating costs of the Korea Road Traffic Safety Association (RTSA).

The key components for successful involvement of the insurance industry are:

- **Legislation:** requires mandatory third-party motor insurance on all drivers with about 5-10% of the premium (as a levy) for road safety;
- **Enforcement:** road safety funds based on insurance premiums will need enforcement of motor vehicle insurance regulations;
- **Promotion:** active partnerships should be sought to involve the industry in promoting road safety in insurance policies and the direct organization of safety campaigns.

**Pros:** Incentive for insurance companies to help reduce crashes, and subsequently reduce claims costs. The levies provide additional funding outside of government revenues and involve private sector partnerships and participation.

**Cons:** Needs to be accepted by the public and insurance companies. In lower income countries, there may be a problem with the number of unlicensed and uninsured motorists, and resulting in less revenue as well as adding to the insurance costs. One way to address this is by the introduction of a fuel levy to pay for third party insurance premiums that cover all victims.

### Road Funds

Road funds are collected through road user charges and revenues are dedicated to finance road development and maintenance (e.g. road safety). The charges may take the form of fuel levies, vehicle registration fees, vehicle license fees or direct charges (e.g. toll). This funding source provides a dedicated stream of revenues for government road departments and avoids more restrictive public budgeting procedures.

Road fund allocation methods should provide for road safety engineering and be subject to endorsement by road user representatives (e.g., through an autonomous Road Fund Board). Transparent accounting procedures are important to monitor the use of funds and report on road user charges dedicated to road safety.

**Pros:** Provides a dedicated and sustainable funding source.

**Cons:** May not be politically acceptable if no road fund is already set up. The funding allocation depends on the overseeing agency whether road safety is perceived as a priority.

#### **Example of Road Funds**

New Zealand's Land Transport Fund is generated from road user charge, fuel excise tax, and vehicle registration and license fees. The fund meets central government's contribution to transport funding through Transfund, and road safety initiatives managed by the police and the Land Transport Safety Authority (LTSA).

A portion of the fund is dedicated for the cost of operating the LTSA, and police road safety enforcement. The remainder of the fund is dedicated for road spending under Transfund New Zealand and carries out road safety engineering improvements amongst other things.

### Private Sector Sponsorship

Government should actively seek and encourage **private sector sponsors** in financing relevant road safety activities. Corporate donations used to support road safety can help private businesses to benefit their corporate images, increase market shares or brand product as "safe". Common examples are oil companies, transport operators, and especially the motor

#### **Examples of Private Sector Sponsorship**

Fiji's National Road Safety Council (NRSC) and the Austrian Road Safety Council receives a percent of their income from insurance companies. The Insurance Institute of Highway Safety (IIHS) in the United States is funded by the motor insurance industry. Australia's Transport Accident Commission (TAC), South Africa's Road Accident Fund and Canada's Insurance Corporation of British Columbia (ICBC) donate or dedicate a percentage of its premium income to road safety activities and programs. Typical funding level not more than 10% of the premium income.

## SECTION 4: *Funding Road Safety Initiatives*

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insurance industry. Too often the role of insurance providers is limited to the post-crash stage with costly crash claim compensation. More attention should be focused on **crash prevention** given that the insurance industry bears the majority of costs of road crashes.

Another form of private sponsorship also comes from the auto insurance industry and involves “partnering” with road agencies to improve high crash locations through infrastructure improvements. The ultimate aim of the insurance companies is to reduce crash occurrence, and therefore claims costs. A number of North American insurance companies (both publicly and privately owned) have partnered with road agencies to improve collision black spots. Funding are provided either fully or partially by the insurance companies for the implementation of infrastructure improvements. This type of insurance company programs typically focuses on low-cost highly effective engineering measures for short to medium term results.

The public private partnership is a win-win situation for both the public and private sector. The public sector (the road agency) is able to address more road safety issues within a budget year, or divert part of the funding to other program areas. The private sector is able to achieve a good return on their road safety investment, and result in paying less claims. The keys to success includes:

- Involve insurance industry on the national road safety policymaking body;
- Insurance industry needs to work in collaboration with other road safety organizations rather than independently;
- Show actual benefits from the implementation of road safety programs.

**Pros:** Involves private sector participation and secure additional funding source for road safety initiatives.

**Cons:** Funding may not be sustainable.

### ***Examples of Public-Private Partnership***

In British Columbia, Canada, the Insurance Corporation of British Columbia (ICBC) is a crown corporation that provides basic auto insurance coverage for motorists in the province. ICBC invests CAD\$10 million each year in engineering improvements through its Road Improvement Program by partnering with the provincial and local governments. The latest evaluation results showed that ICBC achieved a 4.7:1 return on their investments on the road safety engineering improvements. ICBC also spends a significant amount in publicity and education programs.

In the United States, a number of private insurers started programs inspired by the success of the ICBC program. State Farm Insurance Company in the United States, a private insurer, operates a “Dangerous Intersection” program by providing seed money to participating road agencies to address local black spots, as well as funding for physical improvements at the ten worst locations. AAA Michigan, another private insurer, operates a Road Improvement Demonstration Program in Michigan State. It is a public/private partnership designed to enhance traffic safety by reducing the frequency and severity of crashes at high-risk urban signalized intersections. AAA Michigan estimated that by providing US\$2 million investments it leveraged US\$25 million in federal, state, county and city economic development and safety funds at targeted high-risk locations.

## MANAGING ROAD SAFETY

Safety management seeks to reduce the number and severity of road-related crashes. The key to success is to coordinate and focus the activities of several different individuals and organizations on a common problem in an integrated manner.

Creating and/or strengthening effective institutional relationships among organizations with an interest in road safety is important (e.g., police, highway engineers, educators, fleet operators, hospital administrators). However, the importance of personal relationships should not be overlooked to help overcome institutional barriers to more integrated management and programs. When diverse safety interests are able to work together, a sense of team spirit and accomplishment begins to emerge. This will ensure more efficient use of limited resources and produce better ongoing results.

### ORGANIZATIONAL MODELS

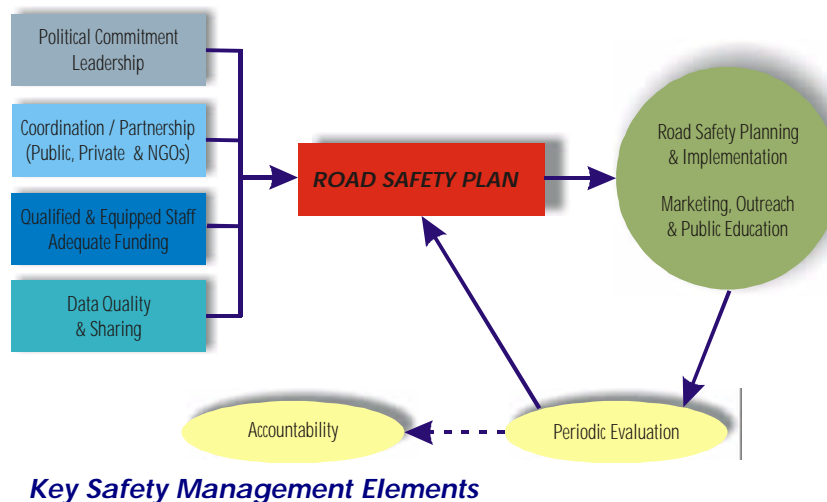
Road safety management is often associated with some sort of lead agency or a national

coordinating body such as a Road Safety Council. Regardless of the management structure, it should be recognized that coordination is extremely important at the working level. In the case of the lead agency management approach, the lead agency is typically a road authority or the police. Coordination is possible and effective under a lead agency approach. This is predominant in many countries today and may include regional representation such as is done in Canada.

In the case of a coordinating body approach, a multi-sectoral committee is typically elected or appointed to form a Road Safety Council (RSC). Best practice suggest that RSC linked to an agency with both executive powers and an advisory role would provide much stronger influence over actions within at least one agency.

Typically, the RSC reports directly to the road authority (typically the agency with the most direct influence over various aspects of road safety). The RSC typically identifies the scope of programs and plans to be approved by government.

Regardless of the management approach, a number of key elements are integral to the success of any road safety actions. These key elements are illustrated below.





There is a trend towards including road safety in public health, injury prevention and public/transport safety policy. Such integration into wider policies has consequences for the definition, management, and the implementation of road safety strategies. It also affects the involvement of stakeholders and the choice of local structures for coordinating actions. Irrespective of the organizational model chosen, a **central road safety office is required** with adequate financial and technical resource backing.

Other examples of best practices are that the lead responsibility for road safety must be defined and accepted by the key organization. The next priority should be to develop a good bi-lateral working relationship between traffic police and roads authorities.

### **PUBLIC SECTOR ROLE**

Most countries have a national government organization responsible for road safety, usually the Transport Ministry or an agency. The preferred lead organization is the highway authority which is responsible for the development, construction, operation and maintenance of the highway system. Usually though, the road infrastructure, vehicle and driver aspects of safety are kept organizationally distinct within the national agency and sometimes the relationships are specified in law.

It is common for different safety agencies within a country to develop safety programs independently of one another because organizational barriers preclude integrated planning and implementation. It is advisable to coordinate activities through regular inter-agency meetings and/or joint committees at the local, regional or national level. Progress will also be achieved more rapidly by getting the responsibility for road safety first accepted by one or more of the key implementing organizations.

The public sector includes the following agencies that may contribute to road safety initiatives:

- Government
- Education Providers
- Police and Enforcement Agencies
- Health Agencies
- Road Authorities and Highway Agencies
- Driver Training / Licensing Bodies
- Judiciary

### **PRIVATE SECTOR ROLE**

Consultative working groups and technical committees should be established to promote the active participation of business in developing road safety policy and strategies. Treating private business as a key partner is likely to yield superior road safety strategies by bringing valuable financial discipline, innovation and management skills. Business is likely to support a wide range of road safety measures, particularly driver training and vehicle inspection. Some best practices for enhancing private sector participation are:

- Engage interested parties in developing the strategy;
- Encourage the adoption of best practices in risk management, including driver training;
- Use health and safety legislation to ensure that fleet operators adopt responsible road safety practices with respect to employees and other road users;
- Match potential sponsors for road safety programs to built long-term commitment and sustainable benefits;
- Invite the business community to sponsor awards/competitions to promote road safety.

The private sector includes the following agencies that may contribute to road safety initiatives:

- Media
- Insurance Industry
- Alcohol and Hospitality Entertainment Industry
- Vehicle Manufacturers and Importers
- Transport Industry

### **NON-GOVERNMENTAL ORGANIZATIONS (NGOs) ROLES**

NGOs are any non-profit organizations that are independent from government. NGOs are typically funded through, in whole or in part, charitable donations and voluntary service. The advantages of including NGOs in road safety initiatives are:

- Strong grassroots links
- Field-based experience
- Ability to innovate and adapt
- Process-oriented approach
- Participatory methodologies and tools
- Long-term commitment and emphasis on sustainability
- Cost-effectiveness

The NGOs include the following agencies that may contribute to road safety initiatives:

- Communities and Local Organizations
- Motoring Associations
- Research Organizations/Universities

### **SUMMARY**

The success of any road safety improvement strategy will depend on the collaborations of a multitude of government agencies, the private sector and non-governmental organizations (NGOs) to deliver education, enforcement and engineering based road safety initiatives. These agencies and

organization has their unique roles and responsibilities to improve road safety. It is therefore imperative that the key roles and responsibilities are identified for this project such that it could be used as a checklist for phases II and III of this project where they will be examined in details for the volunteer economies when developing the road safety plans.

**The roles and responsibilities of the public sector, private sector and NGOs checklists are summarized in the following tables.**

## SECTION 5: *Managing Road Safety*

PUBLIC SECTOR	PRIVATE SECTOR	NON- GOVERNMENTAL ORGANIZATIONS
<p><b>Government</b></p> <ol style="list-style-type: none"> <li>1. Provide leadership and a framework for the development and implementation of effective road safety policies.</li> <li>2. Provide high standards of accountability in meeting road safety objectives and to ensure the effective use of resources.</li> <li>3. Provide funds for road safety programs that maximize benefits.</li> <li>4. Take a leading role in coordinating the road safety effort of all relevant agencies and community groups within their particular administrative area. These activities should be consistent with a National Road Safety Plan, and coordinate activity across all relevant agencies in that geographic area.</li> <li>5. Ensure that planning of local facilities and residential areas effectively takes account of the road safety needs of the community.</li> <li>6. Where possible, fund and implement road safety programs and initiatives.</li> <li>7. Ensure effective policies for the control and enforcement of liquor laws.</li> </ol>	<p><b>Media</b></p> <ol style="list-style-type: none"> <li>1. Enhance community awareness and understanding of the causal factors and real costs of road crashes.</li> <li>2. Support road safety initiatives through responsible and objective reporting.</li> <li>3. Influence societal changes which lead to a reduction in unacceptable driver behaviour and poor attitudes.</li> <li>4. Discourage advertising which glamorizes and/or promotes unsafe practices and products.</li> <li>5. Actively encourage safer practices and products.</li> </ol>	<p><b>Communities and Local Organizations</b></p> <ol style="list-style-type: none"> <li>1. Provide support and leadership for road safety campaigns and initiatives.</li> <li>2. Demonstrate a concern for the number of road deaths occurring and a commitment to foster improvements.</li> <li>3. Persuade various communities to accept a greater participatory role in road safety improvements.</li> <li>4. Work with other organizations in providing road safety education/publicity and other road safety programs.</li> </ol>



## SECTION 5: *Managing Road Safety*

PUBLIC SECTOR	PRIVATE SECTOR	NON- GOVERNMENTAL ORGANIZATIONS
<p><b>Education Providers</b></p> <ol style="list-style-type: none"> <li>1. Make a formal commitment to promote effective road safety education in schools and pre-schools so that appropriate behaviour is fostered from early age.</li> <li>2. Develop links between schools and other agencies, such as the road authority, local road safety committee and police, in relation to road safety.</li> <li>3. Assist in the life-long education of road users.</li> </ol>	<p><b>Insurance Industry</b></p> <ol style="list-style-type: none"> <li>1. Assist in the development, sponsorship and funding of crash prevention programs.</li> <li>2. Provide premium incentives as a means of encouraging and rewarding safer behaviour.</li> <li>3. Provide feedback to government and regenerative crash trends and outcomes to assist in the further development of road safety policy.</li> <li>4. Provide feedback to automobile manufacturers on deficiencies and potential for improvements.</li> </ol>	<p><b>Motoring Associations</b></p> <ol style="list-style-type: none"> <li>1. Promote road safety amongst their memberships by providing up-to-date and relevant information on traffic laws, safe driver behaviour and techniques, road conditions, maintenance procedures and vehicle safety.</li> <li>2. Support, promote and sponsor effective road safety initiatives and campaigns.</li> <li>3. Provide membership feedback to government and industry on road safety policy and new initiatives.</li> </ol>
<p><b>Police and Enforcement Agencies</b></p> <ol style="list-style-type: none"> <li>1. Improve road user behaviour and vehicle standards through a balance of education,</li> <li>2. Encouragement and effective enforcement strategies.</li> <li>3. Maximize enforcement effectiveness using proven enforcement systems and technology.</li> <li>4. Maintain a high level of expertise in crash/casualty reporting.</li> <li>5. Focus on high-risk behaviours and use casualty and crash data to identify locations and where police enforcement could minimize such unsafe behaviours.</li> </ol>	<p><b>Alcohol and Hospitality Entertainment Industry</b></p> <ol style="list-style-type: none"> <li>1. Adopt responsible standards of alcohol serving and host responsibility programs, especially for young adults.</li> <li>2. Assist patrons in monitoring alcohol consumption, for example, through the use of coin-operated breath testers and better labeling of alcoholic content of beverages.</li> <li>3. Promote the consumption of low-alcohol beverages in preference to higher proof drinks.</li> <li>4. Advertise and promote alcohol responsibility.</li> </ol>	<p><b>Research Organizations/Universities</b></p> <ol style="list-style-type: none"> <li>1. Ensure that there is a balance between research on basic and applied topics.</li> <li>2. Ensure that road safety research is of high quality, timely and that its implications are identified and promoted.</li> <li>3. Ensure the development of high quality databases.</li> <li>4. Evaluate effectiveness of measures implemented to ensure cost effective expenditure.</li> <li>5. Provide reliable research results and knowledge against which policy decisions can be made.</li> </ol>

**SECTION 5: *Managing Road Safety***

<b>PUBLIC SECTOR</b>	<b>PRIVATE SECTOR</b>	<b>NON- GOVERNMENTAL ORGANIZATIONS</b>
<p><b>Health Agencies</b></p> <ol style="list-style-type: none"> <li>1. Ensure development of effective emergency medical/services.</li> <li>2. Advise patients on their fitness to use the road, including the effects of prescribed drugs and medication on road user performance.</li> <li>3. Provide feedback from injury assessment to improve vehicle occupant protection and road safety policy.</li> <li>4. Provide health promotion road safety programs.</li> <li>5. Liaise with other practitioners in the road safety field to avoid duplication of effort.</li> </ol>	<p><b>Vehicle Manufacturers and Importers</b></p> <ol style="list-style-type: none"> <li>1. Improve crashworthiness features of vehicles including enhanced occupant protection</li> <li>2. Progressively introduce in-vehicle crash avoidance technology.</li> <li>3. Adopt an advertising code which promotes the safety features and safety performance of vehicles and their responsible use.</li> <li>4. Discontinue importation of crashed vehicles. Such crashed vehicles must be repaired/restored in the originating country before being imported.</li> <li>5. Only vehicles under five years old to be imported and all vehicles to undergo a mandatory vehicle roadworthiness inspection before being permitted to use on public roads.</li> </ol>	

PUBLIC SECTOR	PRIVATE SECTOR	NON-GOVERNMENTAL ORGANIZATIONS
<p><b>Road Authorities and Highway Agencies</b></p> <ol style="list-style-type: none"> <li>1. Adopt effective and safe traffic management measures in planning transport and land-use developments.</li> <li>2. Pay particular attention to the safety requirements of people with disabilities, older people, children, pedestrians, bicycle riders and other non-motorized road users in the planning task.</li> <li>3. Improve the safety performance of the road network by ensuring that planning, design, construction and maintenance places a high priority on safety outcomes.</li> <li>4. Apply crash reduction and crash prevention techniques to create safer road networks for the future.</li> <li>5. Review and safety audit existing, rehabilitated and new roads to eliminate unnecessary hazardous locations and misleading/absent markings.</li> </ol>	<p><b>Transport Industry</b></p> <ol style="list-style-type: none"> <li>1. Adopt responsible freight forwarding and driving schedules which permit adequate rest breaks and promote driver safety.</li> <li>2. Prevent the abuse of alcohol and drug stimulants and promote healthy lifestyle habits amongst drivers.</li> <li>3. Ensure high standards of vehicle, mechanical safety, and load stability and security.</li> <li>4. Enhance industry professionalism and safety through improved fleet management.</li> </ol>	

## SECTION 5: *Managing Road Safety*

PUBLIC SECTOR	PRIVATE SECTOR	NON- GOVERNMENTAL ORGANIZATIONS
<p><b>Driver Training/Licensing Bodies</b></p> <ol style="list-style-type: none"> <li>1. Require all learner vehicles to display signs.</li> <li>2. Equip learner and novice drivers with the necessary skills, attitudes and behaviour needed to drive safely on our roads.</li> <li>3. Maintain and foster a high standard of driver training, instruction and professionalism.</li> <li>4. Promote and foster the upgrading of driving skills amongst drivers, particularly drivers of heavy and public service vehicles.</li> <li>5. Establish an Association and enhance industry professionalism by developing a Code of Providers teaching materials, Driving Instructors training programs, etc., for their members.</li> </ol>		
<p><b>Judiciary</b></p> <ol style="list-style-type: none"> <li>1. Treat results of traffic crashes in similar vein as other felonies.</li> <li>2. Make punishment appropriate and swift.</li> </ol>		
<p><b>All Organization</b></p> <ol style="list-style-type: none"> <li>1. Develop internal safety policies for their staff including host responsibility.</li> <li>2. Promote safe practices in fleet operation.</li> <li>3. Larger fleet operators can encourage staff to participate in defensive driving courses, and where feasible, sponsor or buy in defensive driving courses for own staff at own premises.</li> </ol>		
<p><b>Individual Road Users</b></p> <ol style="list-style-type: none"> <li>1. Attain a greater understanding, awareness, and practice of safe behaviour and skills.</li> <li>2. Make a personal commitment to improve road safety by adopting more courteous and considerate road behaviour and demonstrating care for the safety of others.</li> </ol>		

*Note: This table has been adopted from the World Bank paper on "Roles and Responsibilities Of Different Organizations In Tackling Road Safety", <http://www.worldbank.org/transport/roads/safety.htm>.*

**BUILDING PARTNERSHIPS**

In the rapidly changing world of today’s society, the closely-tied economic relationships between the public and private sectors and the increasing importance placed on the environment are blurring the traditional boundaries between the public sector, the private sector and NGOs. The three sectors are becoming more interdependent, and the objectives of one sector can often only be achieved in partnership with participants from the other sectors. Road safety has received demonstrable success by creating partnerships amongst the three sectors.

In road safety, the various forms of potential partnerships between the public sector, private sector and NGOs and their potential roles are summarized in the following figure.



**Potential Road Safety Partnerships**

Given the social and economical diversity of the APEC economies, rather than imposing a rigid definition of tri-sector partnership in this compendium, criteria where partnerships may be successful are provided for guidance and reference. Various forms of partnerships are discussed, and the formation of potential partnerships will

require careful assessments of the local organizations’ various characteristics.

Best practice suggested the following typical attributes of a successful tri-sector partnership:

- A **process is needed to** build mutual understanding, fosters mutual respect, and focuses on joint problem solving and relationship management to form tri-sector partnerships. The process is divided into four stages: partnership exploration, partnership building, partnership maintenance, and partnership completion. **A set of agreements is typically designed for the partnership to deliver on** shared expectations and some type of joint action programs. These agreements may range from voluntary arrangements to formal contracts between equal parties.
- The collaboration amongst the public sector, private sector and NGOs is significant because it **pools resources and risk** and builds on core complementary competencies. The result is ‘added value’ to what each party could achieve alone.

The potential benefits of for each sector includes:

**For Public Sector:** Government plays a fundamental role in providing basic services such as road safety to society. The partnership provides governments with a mechanism to improve the effectiveness of its road safety programs, and for promoting a greater sense of responsibility amongst other partners as well as accountabilities. It will help raise the awareness of road safety to society.

**For Private Sector:** Private sector businesses may seek to fulfill their social responsibilities, and they need access to a

wider range of skills. Through partnerships, the private sector would be able to achieve some of their goals which would otherwise be impossible. For example, private insurance companies who want to reduce traffic related crashes would not be able to do that without the cooperation of the road authorities. It enables the private sector to receive clear benefits, and provides a more sustainable framework in delivering road safety initiatives.

**For NGOs:** Partnerships increases public participation, and could leverage increased commitments from the public and private sectors. NGOs could achieve their goals more easily through the expertise provided by the other sectors.

Partnerships may not be the best practice in all circumstances and at all times, and the partnering approach may not be always the most appropriate. Past experience suggested that partnerships should be avoided when:

- The risk/cost exceeds the potential benefits
- The initiatives or activities do not require skill sets from other sectors
- The partnership is irrelevant to the organization's core activities
- There is a lack of high level commitment
- One of the partners expect unrealistic or quick results
- There are significant conflict/grievance between organizations that has not been resolved
- Alternative approaches have not been fully considered

Partnerships tends to be more successful when the following criteria are met:

- The partnership activities would provide added value for all parties
- The partnership activities require resources from all parties
- Alternative approaches are less effective

- Certain level of flexibility and compromise are expected between parties
- Some capacity for negotiation
- One or more party that would champion the partnership process
- Some existing process where the partnership building can be integrated

The partnering process is divided into four distinct steps:

### **STEP 1. Exploration:**

- Secure internal champion to drive the process
- Conduct an internal assessment of the needs, interests, costs, risks, and benefits of partnership
- Consult with possible partners to identify the 'theme' of the partnership and gauge the expectations and roles of potential partners
- Develop a negotiation strategy that allows flexibility in how to achieve the goals

### **STEP 2. Building:**

- Build consensus amongst partners to develop mutual respect and agree on specific commitments, roles, and responsibilities guided by the mediation of a partner or third party
- Strengthen the capacity of partners to implement their commitments and roles

### **STEP 3. Maintenance:**

- Measure the impact of the partnership
- Pursue ongoing communication amongst partners
- Evaluate the terms of the partnership in response to internal and external constraints or opportunities
- Assess whether each partner's objectives are being achieved

### **STEP 4. Completion**

- Determine when a work plan is completed and decide on an exit strategy from the partnership
- Assess whether each partner's objectives have been achieved
- Evaluate the partnership and the sustainability of its results

Not all partnerships are the same, and may involve increasing levels of responsibilities. Some partnerships may work better in an informal relationship, others would work better when the relationship is formalized. The various degrees of partnerships in an increasing degree of involvement are:

- No relationship
- Informal Dialogue
- Formal Dialogue
- Informal Partnership
- Formal Partnership

**SECTION 6:  
COMPENDIUM OF  
ROAD SAFETY INITIATIVES**

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## COLLECTING AND SHARING COLLISION DATA

### RESULTS OF THE APEC SURVEY

It is evident that the majority of APEC's Member Economies collects and uses similar data sets. However, it was concluded that data could not be "integrated" throughout APEC for sharing, primarily due to differences in:

- reporting and collection mechanisms
- reporting definitions

### APEC COLLISION DATA

In the APEC context, collision data combined with additional complimentary information, can be used for the purpose of:

- a. Monitoring the safety performance of the road network in member economies using several global indicators such as:
  - collisions per million vehicle kilometres (by severity)
  - collisions per million population
  - collision frequencies (by severity)
- b. Identifying problems and target countermeasures to address specific problems. For this purpose, more detailed data is required and should, as a minimum, comprise of some or all of the following:
  - collision location
  - collision type
  - location description (road type, number of lanes, rural or urban, intersection, etc.)
  - collision cause

- time of collision
- weather
- light/dark conditions
- direction of travel
- vehicle type
- number of vehicles involved/number of injuries

In both cases, **it is imperative that the data is uniformly collected and stored by each individual APEC economy.** This will ensure stability of the data over time and allow appropriate use of the data for:

- before-and-after comparisons
- setting improvement priorities
- monitoring performance over time
- other uses

However, uniformity of the data between APEC economies is not necessary. Given the current discrepancies between member economies, **efforts to create uniformity are not recommended, and in fact, would be detrimental.** This is because any changes in the definitions or classifications will result in the loss of valuable historical data (i.e., detrimental to the stability of data over time). Furthermore, there may be a significant number of legal aspects particular to each member economy that may prevent changes to the data (e.g., licensing, estate management, insurance, culture and religion, etc).

#### ***Example of Good Practice***

New Zealand recently developed the Crash Analysis System and the Land Transport Safety Authority (LTSA) provides input where appropriate into police training relating to the recording of crash details on the Traffic Crash Report form. Appropriate feedback is provided to the police on the quality of information and also given to LTSA engineers on coding and recording.

## **RECOMMENDATIONS**

Should APEC be interested in monitoring road safety progress in various member economies, it is suggested that:

- APEC establish key monitoring parameters of interest such as collision frequencies, collision severity, population, kilometres of road, etc.;
- each member economy has up-to-date information on these parameters or that these parameters can be collected within a set time-frame;
- monitoring criteria be established;
- individual base values be established for each criteria, for the “start date” (for example, the values in 2003) and for each member economy that will be monitored;
- **monitoring be made for each economy, relative to the base values.**

Specific collision information should be maintained by member economies for target countermeasures such as those recommended in this report.

It is generally accepted that collision data is imperfect. Errors include a lack of accuracy (particularly related to location coding), incomplete forms, under-reporting, and lack of timeliness. In collecting collision data, the following collision data characteristics are desirable:

**Complete technical information.** It is desirable that the collision records contain the complete set of technical information reported by the police, including location, date, time, weather, light, pavement, collision type, possible contributing factors, severity, vehicle type and travel direction.

**Up-to-date data.** It is desirable that the collision data is as up-to-date as possible. Preferably, the most recent data should be no more than one-year old.

**Police-attended collision reports.** Collision reports prepared by the police at the collision site are considered more reliable than self-reported collision reports or insurance claims reports.

**Verified collision data.** It is desirable to obtain collision data from management systems that include quality control to check and verify basic information.

## **SAFER ROAD INFRASTRUCTURE**

### **PROBLEM DESCRIPTION**

With limited resources available, heightened environmental impact awareness and sometimes inadequate planning and design, or the lack of knowledge, new roadway constructions are full of compromises. Often facilities being constructed would not be constructed to the “safest” possible standard due to various compromises, and may result in safety hazards being inadvertently introduced and affecting the safety of the road users.

Achieving a safer road network and safer traffic facilities – or safer road infrastructure – relates, to two closely related initiatives:

- Safer practices in the planning and design of new facilities; and,
- Implementation of remedial measures to existing facilities (including the “black-spot” approach to reduce collisions, among other measures).

### **PLANNING AND DESIGN INITIATIVES**

#### **Safety Conscious Planning Initiatives**

There is a growing need to address road safety at the transportation planning level. The idea is to promote the explicit considerations of road safety in transportation. Once planning decisions are made, the opportunity to address fundamental road safety issues such as exposure, land use, mode choice may be lost. Based on a review of the member economies’ responses, the following “safety conscious planning” topics were identified.

- Network and land use planning, combining road planning with land use decisions;
- Promoting alternate modes (walking, cycling, transit, etc.);
- Road classification planning; and,
- Development-led planning (e.g., Traffic Safety Impact Assessments of development projects).

These topics would require significant inter-agency cooperative research efforts, and they remain in the embryonic stages of development even in the most motorized countries in the world. However, the development of these safety conscious practices would provide an opportunity for the less mobilized economies to “do it right the first time”, rather than repeating the mistakes of the more mobilized countries.

#### **Implement Road Safety Audits**

A road safety audit is a process for systematically checking the safety of road transportation projects, based on sound road safety engineering principles and undertaken from the road users’ perspectives. A road safety audit provides an independent assessment of the “anticipated” safety performance of a road transportation project at predetermined intervals by road safety specialists.

Road safety audit is not a complete solution to the road safety problem. It does not replace other road safety strategies that road agencies may be undertaking. It is an additional tool that road authorities can use to further reduce the frequency and severity of collisions. A road safety audit is not an opportunity to redesign a project or evaluate different options, nor a check for adherence to design guidelines.

Road safety audits are best suited to explicitly address road safety issues during the project planning and design stages.

**Empirical Evidence**

A study by Surrey County Council in the U.K. indicated that the audited projects had on average one casualty per year less than the unaudited ones.

A Danish Road Directorate pilot study of 13 projects showed an estimated 147% First Year Rate of Return for conducting safety audit. The audit costs were 0.5% of the total construction costs.

A study by the Transport Research Laboratory in the U.K. of 22 safety audited projects suggested a saving per project of £11,000 if changes were made at the design stages rather than making the changes after completion in response to safety problems. The average cost of each audit was £2,000.

New Zealand found that a detailed series of safety audits on a scheme could give a benefit-cost return in crash savings of at least 20:1 on the audit cost.

In Canada, the Insurance Corporation of British Columbia conducted a pilot program of auditing 19 projects for local governments. The benefit-cost analysis indicated that road safety audits achieved an overall benefit-cost ratio of at least 4.1:1 over a 2-year period using average insurance claims costs.

Australia recently evaluated the effectiveness of road safety audits, and evaluated 9 design projects. Austroads found that of the nine design stage audits assessed, the benefit cost ratio of implementing the recommendations from individual audits ranged from 3:1 to 242:1.

During the planning and design stages, road safety issues can be addressed before the infrastructure is built, and has proven to be more cost-effective than addressing collisions after they occur.

**ENGINEERING INITIATIVES FOR EXISTING INFRASTRUCTURE**

The treatment of collision black spot (collision-prone) locations through engineering countermeasures is covered in this section. Specific treatments such as speeding and pedestrians are dealt with in separate sections.

**Black Spot Programs**

Collision black spot approach to reducing collisions is primarily an engineering and infrastructure oriented strategy.

**Example of Good Practice**

Japan established the Institute for Traffic Accident Research and Data Analysis (ITARDA) for investigation and analysis of collision data. Japan has identified 3,200 collision black spots on trunk roads, and special emphasis has been placed on the “Urgent Measures for Accident Black Spots” since 1996. While the number of fatal collisions decreased by 8.8% nationwide from 1996 to 1999, the number of fatal collisions at the collision black spots where improvements were undertaken in the same period had been reduced by 30%.

Collision Black Spot Programs have been proven to be one of the most effective ways to reduce traffic related collisions. Numerous programs around the world have

demonstrated positive results, with significant achievements in reaching their goals of reducing the frequency and severity of collisions. **It is recommended that APEC recognize this approach as one of the top priorities in its initiatives to improve road safety.**

A number of issues can be addressed for black spot programs. Some introductory guidance on the following critical steps of a black spot program follows.

1. **Data Collection / Management:**

Traditionally Black Spots were identified through historical collision data collected by police agencies. Typically the road authority would manage and warehouse the data.

2. **Identification of Black Spots:**

Various identification quantitative techniques are used for identification:

- Frequency Measure
- Rate Measure
- Frequency-Rate Method
- Severity Method
- Confidence Interval Technique
- Rate Quality Control Method
- Collision Prediction Models

However, in light of the possible lack of quality data in some member economies, qualitative methods such as risk assessments using road safety audits could be used.

3. **Selecting the Appropriate Infrastructure Based Countermeasure:**

Once the problems are identified by analyzing the collision data and other traffic data, appropriate countermeasures are selected to address the identified problems. Some of the key road safety countermeasures and their potential effectiveness are described in details in *Appendix A*.

**Data Management Systems**

The collision data are typically prepared by the police or are self-reported to the police. Reports that are prepared by the police are generally considered to be of higher quality and reliability. There are many different collision data management systems in use, and the systems can be categorized as:

1. **Minimal Systems** – Typically uses manual retrieval, and records are stored in paper format. Data analysis tends to be tedious and time consuming.
2. **Basic Systems** – These systems are typically stand-alone PC-based, and may use some sort of commercial database. Data retrieval is easy, but lacks any automated function for analysis.
3. **Complete Systems** – These systems could be either stand alone PC-based or linked to the agency’s network with other data systems. The data fields are more comprehensive and automated report generation and analysis is possible. These systems tend to require customized software, and may require some training.
4. **Advanced Systems** – These systems tend to be accessible from the agency’s network, and are run by customized software. Data retrieval would require training, and most reporting and analytical tasks could be automated and very flexible. In some cases, they may offer linkages to a geographic information system and offer some diagnostic capabilities.

Road agencies should have, as a minimum, Basic or Complete Systems in order to efficiently manage road safety programs. Larger agencies such as provincial transportation ministries are more likely to use Advanced Systems. Road agencies should aim to have a collision data management system that can efficiently store, retrieve, and sort collision records.

#### 4. **Conduct Economic Evaluation and Programming:**

This step will aid the road authorities to prioritize and programme the implementation of road safety countermeasures at black spot locations. Benefit-cost analysis is typically used for this purpose, and common analysis methods include benefit-cost ratio, and first year rate of return.

#### 5. **Implementation:**

It is essential that road safety countermeasures be implemented correctly. It is recommended that road safety audits be conducted on the final design before the countermeasures are implemented.

#### **Empirical Evidence**

In New Zealand, 2,100 black spot sites had been identified and improved since the implementation of collision black spot program started. According to an evaluation in 1997, the collisions at improved sites had been reduced by 28%.

### **Implement Road Safety Countermeasures**

An important initiative of this strategy is the implementation of low-cost, highly effective road safety countermeasures for roadway infrastructures. Over the past 30 years, a number of “proven” road safety countermeasures have been established. These countermeasures can be categorized as follows:

#### **Road Segments:**

- cross-section
- roadside
- horizontal and Vertical Alignment
- operational
- others

#### **Intersections/Junctions:**

- geometric
- operational
- pedestrians
- railway Crossing

A range of feasible road safety engineering countermeasures is provided in *Appendix A*.

## **EDUCATION INITIATIVES**

### **Training of Practitioners**

In order to maintain a sustainable effort to develop the road safety culture among APEC economies, training courses based on the five guidelines discussed below should be developed and taught.

### **Develop Best Practice Guidelines and Standards**

A road safety culture is the basis of any sustainable road safety effort. This culture needs to be developed first and foremost at the practitioner’s level (i.e., same people who plan, design, operate, construct and maintain the roadway infrastructure). Hence, this initiative focuses on developing “safety conscious” best practices for the practitioners. Once best practices guidelines or standards are in place, extensive training is required to educate practitioners about the state-of-the-science of road safety engineering.

It is envisioned that a series of five “Best Practice” **guidelines** that encompass the project life cycle of roadway infrastructures can be developed for member economies as follows:

- **Transportation Planning** (e.g. roadway classification, techniques to prioritize upgrades, land use planning, etc.);
- **Geometric Design** (e.g., cross-section, road alignment, etc.);



- **Traffic Operations** (e.g., traffic control devices, traffic signals, etc.);
- **Construction and Maintenance** (e.g., work zone safety, etc.);
- **Road Safety Audits** (e.g., a proactive measure to address road safety by eliminating potential hazards during the planning and design stages of new roadways).

### **Example of Good Practice**

In Canada, under the auspices of a national, multi-modal, multi-jurisdictional organization (the Transportation of Canada), a number of roadway engineering manuals and guidelines that implicitly contain road safety elements were recently updated and published. They include:

- Manual of Uniform Traffic Control Devices for Canada;
- Pedestrian Crossing Control Manual;
- Geometric Design Guide for Canadian Roads;
- Canadian Guide to Neighbourhood Traffic Calming;
- Canadian Road Safety Audit Guide; and
- Canadian Guide to In-service Road Safety Review.

Best Practice guidelines should incorporate empirical evidence and heuristics derived from crash reduction potential of improvements such as those presented in *Appendix A*.

## **POLICY INITIATIVES**

### **Establish Multi-Year Programs**

As noted, the Black Spot program is one of the most effective ways to reduce traffic collisions. The Black Spot Program needs to be a multi-year program to be successful, with dedicated funding and political support

from all levels of government and other agencies. Typically, the multi-year program is administered by a lead agency with support from other agencies.

### **Support in Development of Best Practices**

Policies should be in place in the various agencies to support the development and adoption of safety conscious design and planning principles. Further, encouraging the practitioners can also be supported in policies to include training, workshops, seminars, etc.

### **Review of Legislation and Targeted Enforcement**

This effort entails the review of the motor vehicle regulations to determine whether the regulations can be changed to improve traffic safety. For example, the requirements for traffic signal installation, the provision of STOP signs, etc. In addition, rules of the roads that have high non-compliance rates should be identified and either reviewed for relevancy or higher penalties imposed for deterrence.

Targeted enforcement campaigns could then be designed to address the safety issues. For example, running red lights may be identified with high non-compliance, and targeted enforcement campaigns using red light cameras could be implemented. Other infrastructure related enforcement campaigns might include jaywalking, vehicles yielding to pedestrians, STOP violations, etc.

## **ROADSIDE SLOPE MANAGEMENT**

### **PROBLEM DESCRIPTION**

Roadside slope management covers a relatively broad spectrum of conditions such as:

- The physical stability of the roadside (cut or fill) including erosion, rock fall, landslides, etc. It can result in the presence of dangerous debris on the road, and road closures;
- The hazardous nature of the roadside form for motoring traffic. For example, sharp rock faces and high embankments could aggravate the consequences of a motor vehicle collision;
- The potential collapse of the road due to water seepage or geotechnical faults; and
- The loss of friction of the road surface due to the presence of water and debris.

### **ENGINEERING INITIATIVES**

#### **Databases of Roadside Conditions**

An inventory and database of the roadside and road conditions should be developed to assist in evaluating the magnitude of the problem, setting priorities for remedial work and identifying long-term action plans. The inventory can be done in various degrees of sophistication, from simple site observations made by experts to GIS and satellite imagery. The sites requiring further detailed investigation can be identified. Such a program will also address some of the liability issues, as demonstrated in parts of Canada and the US.

#### **Measures to Remedy Deterioration of Cut and Fill Areas**

Remedial work is likely the most desired solution. However, such work is often expensive and requires long-term planning and funding. There are a significant number of “hard” countermeasures successfully applied by member economies such as flattening of slopes, rock removal and “rounding”, grassing and vegetation, hydro-seeding, berms, gabions, meshing, improved drainage, etc.

The appropriate applications are dependent on a number of variables such as geotechnical, environmental and climatic conditions and these should be selected on a location specific basis.

#### **Measures to Advise the Public of Significant Conditions**

This includes implementation of public advisory systems for significant conditions through fixed or variable signing, radio advisory, highway patrols, maintenance crews, etc.

#### **Measures to Accommodate Occasional Debris**

The presence on the roadway of occasional debris may be minimized by maintaining a clear roadside, the presence of paved or compacted shoulders, implementation of retaining devices (barriers, nets, etc.) and presence of drainage channels.

#### **Measures to Protect the Road and the Roadside from Water Damage**

Appropriate drainage systems can prevent a number of stability and road collapse issues. As with other “hard” engineering measures these need to be location specific and take

into account a number of variables such as soil and climatic conditions.

### **Example of Good Practice**

In Thailand, the Department of Highways designated a Committee on the Erosion and Land Slide Control for Highway Maintenance in 1996. The Committee's mandate is to coordinate all local personnel, activities and transfer of technology on slope protection works, and to evaluate the results. Since the establishment of the committee, more than 122 damaged slopes caused by erosion and landslide on 28 highway have been investigated and redesigned by the Committees. In 1999, 266 local personnel were trained in the techniques of dealing with erosion and land slides by the Committee.

### **Measures to Protect Errant Vehicles from Roadside Hazards**

When the removal/remedy of hazardous roadside is not feasible, the implementation of warning/advisory signs, roadside barriers and roadside delineation are successful and cost effective tools to prevent/protect errant vehicles from impact with the roadside.

Preventing vehicles from parking/stopping in unstable areas can be used to minimize exposure.

### **Measures to Improve Road Surface in Case of Water/Debris**

Surface grouting can be used to increase surface friction on sections of the road prone to presence of surface water or debris.

### **Undertake Routine Maintenance of the Roadside**

Routine schedule maintenance is paramount in the early identification of potential problems, clearing debris, maintaining drainage systems, and maintaining the road and the roadside.

## **EDUCATION INITIATIVES**

### **Training of Practitioners in the Appropriate Sciences**

Training of practitioners should include soil, geotechnical, environmental and climate sciences. Exchanges of expertise between the member economies is considered an effective way to promote knowledge and to share expertise and experience on appropriate measures to address this issue.

## **POLICY INITIATIVES**

### **Policies Regarding Regular Maintenance of Road Prism and Roadside**

The responsible agencies should adopt regular maintenance policies.

### **Provide Opportunities for Maintaining Adequate Skill Levels**

Agencies should maintain the necessary technical skills and provide opportunities for continuous training and exchange of information.

### **Dedicated Technical Team to Address the Roadside**

The establishment of dedicated technical maintenance and control teams has proven effective in addressing these issues.

## **SPEEDING**

### **PROBLEM DESCRIPTION**

Speeding is one of the most significant and dangerous types of aggressive driving. All other types of aggressive driving, for example, following too closely are further accentuated by speed. The faster a vehicle is travelling, the greater the distance it needs to stop, thus increasing the risk and severity of collisions. Research has indicated that excessive speed is a major contributing factor to a significant proportion of crashes. There is also overwhelming evidence to suggest that lower speeds result in less collisions of lesser severity.

From a legal standpoint, an unsafe speed is any speed that exceeds the posted limit. Drivers need to learn to observe road, weather and traffic conditions to determine the most appropriate travel speed. Safety initiatives should focus on driver behavioural modifications through a co-ordinated effort of engineering, education and enforcement.

### **ENGINEERING INITIATIVES**

#### **Speed Limiting Geometric Features**

Driver behaviour may be modified through changes in the physical environment by changes incorporated in the design and construction of roadway infrastructure, including features such as:

- chicanes,
- road narrowing
- traffic circles
- roundabouts
- gateway treatments at speed transition areas
- other traffic calming devices (e.g., humps, cushions, tables, etc.)

#### **Appropriate Speed Limits**

Setting appropriate speed limits to the road environment that meet driver expectations and reducing speed differentials are important measures. For example, setting too low speed limits on an 'evident' rural environment, albeit in a designated urban area, may lead to 'speeding' in legal but not rational terms. Similarly, a low speed limit in a highly urbanized and commercial area will most likely be well understood and respected by drivers.

A proven companion of this measure which is highly effective is the use of advisory speeds at locations such as curves, transition sections, structures, pedestrian areas, etc.

#### **Road and Roadside Features to Promote Lower Speeds**

Several measures have been tested to try and give visual cues to drivers to deter speeding. These are mostly subliminal messages and their effectiveness is not completely proven. For example:

- Transversal line markings to give the impression of high speed;
- 'Narrowing' of the travel lanes (either the use of actual narrower lanes or moving the edge lines to give the impression of a narrower lane)
- Roadside vegetation or other elements to reduce the visual width of the road;
- Reduced sight distance before intersections to promote stopping.

#### **Planning and Design Measures**

These are measures related to matching the road form (cross sectional elements) to the adjacent land use. This is based on the premise that the visual space created by the land use will promote selection of adequate speeds by drivers.

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## Speed Governors (Limiters)

The speed governor or limiter is a device that limits the top speeds of vehicles to a predetermined value. In-vehicle speed limiters have substantial potential for enforcing speed limits.

There has been very little evaluation conducted to date on their effectiveness. However, it appears that there is considerable opposition to introducing such systems. The issues include loss of freedom, government monitoring, effect on driving style, driver boredom, effect on vehicle emissions, impact on motorcycles and other two-wheelers, the setting of speed limits, etc.

### **Examples of Good Practice**

The Singapore Land Transport Authority requires that buses, trucks, and heavy load vehicles have to be fitted with speed limiters to ensure that drivers do not exceed the legal speed limits.

Speed limiters on heavy vehicles are also required in the European Union, and Australia.

## ENFORCEMENT INITIATIVES

### Focussed Campaign Targeted at High Risk Locations

Speed deterrent campaigns must be focussed and targeted to be effective. A complete analysis of locations and corridors with high-speed crashes should pinpoint appropriate enforcement locations.

In Australia, it was found that "random" deployment of speed enforcement also has the potential to achieve substantial crash reductions across a wide area: by creating

the expectation that speeding offences might be detected and punished "anywhere, any time".

A speed limit tolerance needs to be set to ensure consistency in enforcing the speed limit. This can pose a dilemma. If it is too low (less than 3km/h above the limit) drivers will complain about unfairness since many speedometers are not 100% accurate. If it is set too high, a higher "artificial" speed limit may result. Typically the tolerance is set at 10 km/h. Prohibiting the sale and use of radar detectors should be considered.

### Speed Enforcement Measures

For drivers the deterrence comes from the potential risk of being caught, and there are generally two different types of enforcement—*covert enforcement* which tends to be done through electronic ticketing, such as speed cameras, and *overt enforcement* where police presence is obvious.

For covert enforcement deployment there are two alternatives: *permanent (fixed) sites* and *mobile sites*, or combination of both. The use of "dummy" cameras as part of camera rotation could be used to increase cost-effectiveness.

### **Empirical Evidence**

The "Speed Camera" program in New Zealand was evaluated and the evaluation suggested a 23% reduction of collisions at urban locations, and a 11% reduction at rural locations. Hidden speed cameras under a trial program showed a 19% reduction of injury collisions.

Typical enforcement sites are schools, construction and hospital zones and collision black spots.

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## **S.T.E.P. Campaigns**

Selected Traffic Enforcement Campaigns (S.T.E.P.) have proven to be a very effective strategy in addressing several issues. This type of campaign begins with a 2 to 3 week period of information for road users about the particular issue. This can be accomplished through mass media advertising and/or community initiatives. This is followed by 2 to 3 weeks of intense police enforcement for the issue. The progress is monitored and the number of crashes, tickets and feedback are typically provided in a follow up campaign.

### ***Example of Good Practice***

Essential elements of effective speed enforcement include:

- A strategic alliance between relevant agencies (road, justice, finance, traffic, etc...) is essential.
- Specific and quantified goals regarding reduction in speed and crashes or victims within a certain timeframe should be developed.
- Enforcement should be sustainable, rather than treated as ad hoc.
- Combination of enforcement with education of, and communication with, road users is essential.
- Exchange of knowledge and experience of speed enforcement across "borders" will improve the effectiveness and efficiency of the enforcement.

## **Graduated Fines**

A severe and graduated scale of traffic fines has proven to be a good deterrent in modifying driver behaviour. Some of the keys to a graduated fining system include:

- Severe financial fines with graduated scale;
- Possible suspension or loss of driver's license for repeat offenders;
- Repeat offenders undergo mandatory testing or training; and
- Probationary periods for repeat offenders with severe consequences.

## **Judiciary**

It is vital that the judiciary treat traffic offences (speeding, impaired driving, etc...) seriously, in fact in a similar vein as other felonies. Punishments need to be appropriate and swift. Some countries have established "traffic courts" with specially trained judges and dedicated counsel that are well aware of the potential consequences of traffic offences.

## **EDUCATION INITIATIVES**

### **Driver Training Programs**

Driver training programs (mandatory or volunteer) with component on consequences of excessive speeds are possible countermeasures. However, the effectiveness of these programs are not clear.

### **Speedwatch**

Speedwatch is a community-based volunteer program designed to help reduce speed-related crashes by raising public awareness of the actual speed drivers are travelling. Volunteers use portable radar equipment and an electronic digital board to monitor speeds in neighbourhoods, particularly near school zones and playgrounds. Drivers get instant feedback on their speed displayed on the reader-board as they pass.



Speedwatch helps address traffic and speeding problems through:

- Creating public awareness about road safety;
- Community action to address speed-related problems;
- Collection of speed-related data;
- Assisting police to determine speed problem locations; and
- Community based initiatives with volunteers and “speed-reader” boards indicating speed of driver

***Empirical Evidence***

Experience in Canada has shown that more than 70 per cent of drivers who are travelling 10 km/h over the speed limit slow down when they see a speed-reader board.

- Making speeding an unacceptable behaviour; and
- Understanding the relationship between speeding, crashes and severity

**POLICY INITIATIVES**

**Redirect Revenue from Traffic Fines to Traffic Safety Initiatives**

This initiative provides a dedicated revenue source for funding traffic safety initiatives, and helps reduce public perceptions that any speed enforcement campaign are a “cash grab” by the government. It also helps governments in showing their commitment to improve traffic safety.

**Police Training in the Use of New Technology**

For the effective deployment of automatic speed enforcement devices, the police (or enforcement agency) need to be trained in the correct and appropriate use of these devices.

**Media Campaigns**

Media campaigns can be conducted to advertise the consequences of excessive or inappropriate speeds. Campaigns should be undertaken to increase the perception to drivers that they will be caught and penalized for speeding.

**Educate Teenagers**

Intervention programs can be targeted at teenagers before they obtain their driver’s license. The goals of such programs are:



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## **IMPAIRED DRIVING**

### **PROBLEM DESCRIPTION**

Impaired driving includes driving under the influence of alcohol or drugs, and driver fatigue. Impaired driving remains a significant cause of fatalities and serious injuries in many APEC economies.

In the past ten to twenty years significant progress has been made in some countries where drinking and driving has become socially unacceptable. The responsibilities to enforce impaired driving laws and to help reduce impaired driving crashes generally rests with a number of government and non-government agencies. However, enforcement is of limited value unless the appropriate legislation and sanctions are in place to deal with offenders. Most current law enforcement activities do not deter hard-core drinkers.

Similar to the speeding problem, this issue requires driver behavioural modifications through co-ordinated engineering, enforcement and education efforts.

### **ENGINEERING INITIATIVES**

#### **Alcohol Ignition Interlock Device Program**

The use of In-vehicle Alcohol Ignition Interlock Devices (AIID) is an option. First introduced in the 1980s, alcohol ignition interlocks are electronic devices that connect to a vehicle's ignition and other control systems. They are activated by a breath alcohol-testing device that measures the blood alcohol concentration (BAC) of the driver. Ignition is prevented if the driver's BAC exceeds the pre-set limit. The device forms an integral part of an AIID program. Intoxicated drivers issued a license suspension automatically come under the

purview of a Review Board and may be required to appear before the Board prior to reinstatement. The Board has the authority to assign offenders to the interlock program as a condition of license reinstatement. Offenders can also volunteer for the program as a means to obtain early reinstatement. To volunteer for the interlock program, eligible offenders must have served a minimum period of license suspension (at least three months) and have completed all other conditions of reinstatement (all fines, fees, and programs) before applying. Once accepted into the program, the interlock is installed for a minimum of six months or until the end of the original period of suspension, whichever is longer.

#### ***Empirical Evidence***

According to a study by the Traffic Injury Research Foundation based in Canada, the re-arrest rate among offenders with an ignition interlock is as much as 90 per cent lower than for those driving without one. A University of Maryland study in 1997 found that interlocks reduced the risk of alcohol traffic violations within the first year by about 65 per cent. The province of Alberta in Canada, also, has found that interlocks reduce the likelihood of a relapse of impaired driving.

### **ENFORCEMENT INITIATIVES**

#### **Focussed Campaign**

Enforcement campaigns must be focused and targeted. For drivers the deterrence comes from the potential risk of being caught, so police visibility is vital. Compulsory breath testing has proven to be successful in many countries, where the Police stop every vehicle during appropriate hours using road blocks and require the driver to provide a breath sample.

**Example of Good Practice**

Canada initiated the Strategy to Reduce Impaired Driving 2001 (STRID 2001), a program involving all provincial and territorial jurisdictions in Canada. The goal of STRID 2001 is to reduce by 20% of road users killed and seriously injured in crashes involving drinking drivers. The core elements of the STRID 2001 program include enforcement and awareness, legislative and communications initiatives. Some of the principal initiatives within the core elements of STRID 2001 that are carried out in selected jurisdictions include:

- enforcement and awareness campaigns which focus on drinking and driving during holiday periods;
- mandatory education program for first time offenders, increased suspension periods for subsequent offenders ranging from 3 years for second time offenders to life time suspensions for 3<sup>rd</sup> convictions, with an option to reduce the suspension to 10 years if ignition interlock and treatment are introduced;
- introduce increased fines or vehicle-based sanctions such vehicle impoundment or seizure for suspended drivers caught driving;
- plan/develop communications to promote and increase the visibility of STRID 2001;
- the implementation of server training programs as a condition of establishments maintaining their liquor license;
- information and education campaigns directed at police, crown prosecutors and the judiciary about the severity of the impaired driving problem;
- implement administrative license suspensions if drivers are over the legal BAC limit, at some lower BAC limit or refuses a breath/blood test;
- remove exemptions for work permits;
- introduce mandatory assessment and treatment for drinking-driving offenders.

Since the STRID 2001 program commenced, there has been a 13.3% decrease in the percent of fatally injured drivers who had been drinking and a 9.5% decrease in the percent of those seriously injured.

**S.T.E.P. Campaigns**

See Speeding.

**Judiciary**

See Speeding.

**EDUCATION INITIATIVES**

**Education in Schools for Teens on the Consequences of Impaired Driving**

This measure is for education in schools for teens on the consequences of impaired driving. Information is presented to schoolchildren, especially teenagers,

regarding the dangers of drinking and driving or being a passenger in a vehicle driven by a driver that has been drinking. This can fit well into health education in schools.

**Rehabilitation Courses for Repeat Offenders**

Rehabilitation courses can be offered for repeat offenders and effectiveness enhanced using the AIID program.

***Empirical Evidence***

Evaluation of the rehabilitation courses offered in the United Kingdom indicated that those who do not attend a rehabilitation course are three times more likely to re-offend than those who do.

**Training Courses For Servers of Alcohol in Detecting Impaired Drivers**

Training courses for servers of alcohol in detecting impaired drivers have been tried in some countries with some degree of success. Other similar programs encourage “host responsibility” by ensuring that the organisers of parties or social events consider making sure their guests have a safe ride home, removing the keys from impaired drivers or supplying drivers with non-alcoholic drinks.

**Training of Police in the Use of Alcohol Testing Equipment**

Training of police in the proper use of alcohol testing equipment is essential to the successful prosecution of drivers caught drinking and driving.

**Media Campaign Advertising Consequences of Driving Impaired**

Media campaigns advertising the consequences of driving impaired remain one of the main tools to educate the driving population. Some campaigns focus on the possible loss of driving privileges as a deterrent.

**Designated Driver Programs**

Designated driver programs may encourage the public to designate drivers who do not consume alcohol. Some programs also encourage the public to use alternative modes such as taxis or public transit.

**POLICY INITIATIVES**

**Establish Low BAC Level with Severe Consequences**

Many countries have had successes in establishing a low Blood Alcohol Count (BAC) particularly in the area of novice drivers. Attention needs to be paid to specific country celebration dates since these often focus around the consumption of alcohol.

**Zero Tolerance for New/Probationary Drivers**

Some of the more successful countries in dealing with drinking and driving have established a “zero” tolerance of alcohol for new and probationary drivers.

# **VEHICLE OVERLOADING**

## **PROBLEM DESCRIPTION**

Vehicle overloading refers to a number of conditions:

- Excessive loading of vehicles (e.g., more than the manufacturer’s weight limit, the pavement tolerance limit, license permit, etc.);
- Carrying loads at heights or widths that result in unstable vehicle performance;
- Transport of dangerous goods;
- Carrying unsecured loads;
- Carrying an excessive number of passengers (e.g., more than the capacity of the vehicle)
- Carrying passengers in vehicles unsuitable for transport of persons (e.g., in the back of lorries).

## **ENGINEERING INITIATIVES**

### **Dedicated Truck/Commercial Routes**

Truck/commercial routes can be assigned that are safe for use by heavily loaded traffic, with appropriate geometrics and signing introduced. Similar treatments can be applied to the transport of dangerous goods. This will also limit the movement of heavy trucks from residential or commercial areas or other routes where movement of truck may be undesirable.

### **Parking and Loading Restrictions**

Parking and loading restrictions may be introduced primarily for dangerous goods transport. This helps eliminate interference with other traffic (e.g., avoiding sight visibility restrictions for pedestrians).

### **Height/Width Checkpoints on Routes**

Height/width checkpoints (“gates”) are physical barriers that can be implemented before bridges, at highway accesses, etc.

### **Warning Signs at Prone Locations for Heavy Vehicle Overturning**

Static or dynamic warning signs can be introduced at locations where heavy vehicles may overturn. The determination of appropriate locations requires analysis of collision or other data to determine the specific locations. Advanced technologies have been piloted with various degrees of success in some countries using weight-in-motion (WIM) to activate warning signs.

### **Height/Width Signs on Structures**

Signs can be placed on bridges and other structures indicating the maximum height/width to prevent loads from either damaging the structures and/or being dislodged at impact with the structure.

### **In-Vehicle Weigh Devices**

In-vehicle axle-weigh devices can indicate the current load and put the onus on the vehicle/operator to ensure adequate loading of the vehicle (this could be also checked by enforcement agencies).

## **ENFORCEMENT INITIATIVES**

### **Implement ‘Manual’ or Automated Weigh-In-Motion Check Points**

Weigh-scales may be introduced at strategic points in the network to deter overloading. This initiative would require a detailed

review of the local network to prevent overloaded vehicles from “rat running”, and may require co-ordinated enforcement efforts.

### **Dedicated Motor Carrier Enforcement Units/Police**

Dedicated motor carrier enforcement units, either from the police or government agencies is highly desirable.

#### ***Example of Good Practice***

In Peru, a Specialized Agency for Roads Maintenance was created in 1993. One of the functions of the Agency was to control and regulate the vehicle weights. In 1999, two stationary vehicle weighting stations were constructed at the main entry to the country, and 9 mobile weighting units were deployed along the National Road Network. As a result of the introduction of the weighting stations and mobile units, 93% of the freight transporters adapted their vehicles based on the new regulations.

### **Annual Inspection of Safety and Structural Features of Vehicles**

Annual inspections of certain type of vehicles can ascertain compliance with safety requirements (e.g., integrity of load securing devices, maximum number of seats, breaking capabilities, etc.)

### **Judiciary**

See Speeding.

## **EDUCATION INITIATIVES**

### **Initiatives to Inform Motor Carriers of Potential Damage to**

### **Roads and Safety Impacts (Vehicle Stability)**

Educational campaigns (pamphlets, training seminars, informational packages at licensing offices, etc.) can be used to inform of the potential damage to infrastructure and the potential safety issues rising from vehicle overloading.

## **POLICY INITIATIVES**

Legislation is a primary prerequisite to effectively address the issues relating to vehicle overloading. Unless legislation is in place, economies have no recourse in preventing these conditions. Legislation may include limits/constraints as follows:

- Limit the allowable weight per axle;
- Prohibit/limit modifications allowed to be made to certain type of vehicles;
- Limit/remove financial incentives for vehicle overloading;
- Assign liability to owner/operators; and
- Regulate driver licensing to assign the requirements for transporting goods (and the maximum load/vehicle type, dangerous goods), and/or passengers (by number of passengers, type of vehicle, routing, etc.).

# SEATBELT & MOTORCYCLE HELMET USAGE

## PROBLEM DESCRIPTION

### Seat Belts

Wearing a seat belt is one of the most important protective mechanisms available to adult vehicle occupants in the event of a crash. Seat belts reduce the risk of occupants striking the interior of the vehicle, colliding with another passenger or being ejected. **It is estimated that the correct use of a lap/shoulder belt system reduces the likelihood of death in a motor vehicle crash by 50 percent.**

To provide the best protection, the lap belt must be snug and low over the hips, while the shoulder belt must be worn over the shoulder and across the chest – never under the arm or behind the back. It has been noted that in some APEC countries, imported vehicles are actually stripped of their safety equipment, such as seat belts. This should be addressed through legislation.

### Motorcycle Helmets

Motorcycle helmets are one of the most important safety devices a motorcyclist has to protect themselves from head injuries. A motorcycle lacks the crashworthiness and occupant protection characteristics of an automobile. Helmets absorb a portion of the impact that would otherwise impact the head and the brain. Helmets can reduce head injuries but should not be a trade off for safe driving.

## ENGINEERING INITIATIVES

### Seatbelt Systems

Automatic seatbelt fastening systems can be introduced. It should be noted that this has been tried in North America and Europe but has met with little success.

### Establish Minimum Standards for the Crashworthiness of Helmets

It is essential that the helmets being sold in the APEC economies meet a minimum level of crashworthiness.

## ENFORCEMENT INITIATIVES

### Campaign Aimed at Seatbelt/Helmet Enforcement

Enforcement in this area can be combined with other enforcement campaigns. For example, when setting up roadblocks to enforce drinking and driving, the police officers could also check for seatbelt and helmet usage.

### S.T.E.P. Campaigns

See Speeding.

### Judiciary

See Speeding.

## EDUCATION INITIATIVES

### Media Campaigns to Promote the Use of Seatbelts and Helmets

Focused media campaigns to encourage the use of seatbelts and helmets can be delivered through one of the following methods:

- National advertising campaign

- Local community awareness campaign
- School based programs
- Focusing on urban areas

### Educate Police on the Importance of Seatbelts and Helmets

A major difficulty in enforcement is to convince the police to dedicate adequate resources to enforce seatbelt and helmet usage. For some police forces, these are seen as low priority issues. Educating the police by using collision statistics and identifying the consequences of not wearing seatbelts or helmets may be helpful in overcoming this difficulty.

### POLICY INITIATIVES

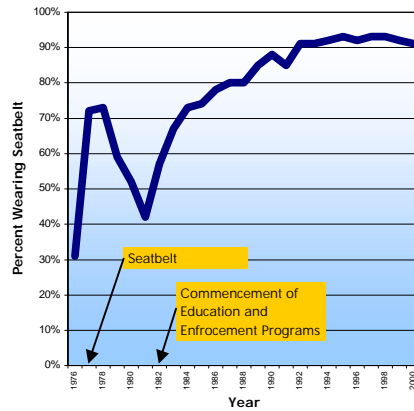
#### Mandatory Use of Seatbelts and Motorcycle Helmets

Most countries have some form of seatbelt and motorcycle helmet legislation. This is a priority and without legislation there can be no enforcement. Even those countries that have legislation often have too many exemptions. Best practices should be that the country should have “primary” seatbelt and helmet legislation to enable a police officer to stop and give a violation ticket to offenders.

#### Examples of Good Practice

In Australia, Canada, and New Zealand, through legislation (introduced in the 1970's), education, and enforcement, the seatbelt usage and helmet-wearing rate are close to or above 90%.

#### Seatbelt Wearing Rate in British Columbia, Canada



Source: Insurance Corporation of British Columbia



## VULNERABLE ROAD USERS SAFETY

### PROBLEM DESCRIPTION

Making it safer and more convenient for people to walk is a key part of any transportation strategy. Such a strategy must include improving conditions for vulnerable road users—**pedestrians, elderly people and children**—and encouraging them to protect themselves.

Vulnerable road users are typically over represented in fatal and serious injury crashes. Thus, the vulnerable road users group deserves particular attention in traffic design and management from a road safety perspective. In addition, safe facilities are required to promote alternate modes such as walking if the region is to succeed in managing future traffic growth.

Children and the elderly are particularly vulnerable to injury risk. Children lack the necessary skills to follow the rules of the road. Their concept and perception are quite different from that of adults. The elderly are more vulnerable to injury when struck by a vehicle. Pedestrian collisions tend to occur mostly between intersections, in particular for children. Collisions involving the elderly tend to occur more at intersections since older pedestrians tend to cross there. As well, the elderly tend to walk slower, or may have physical disabilities that compound the problems when crossing an intersection.

### ENGINEERING INITIATIVES

#### Implement “Proven” Countermeasures

A large number of pedestrian facilities may be used to improve pedestrian safety at specific locations. A matrix providing specific pedestrian safety countermeasures for various types of pedestrian collisions is provided in Appendix B.

Other proven countermeasures aimed at improving pedestrian safety related to the road infrastructure are also discussed in the Safer Road Infrastructure Section. These include infrastructure-based facilities that have a proven track record in improving road safety (i.e., reducing collisions).

#### Basic Infrastructure Improvements and Pedestrian- Friendly Infrastructure

It should be recognized that basic infrastructure for pedestrian safety such as the construction of sidewalks, footpaths, basic pedestrian crossing treatments, signing and pavement markings, curb ramps, textured /coloured walkways should be included in road authority planning and programming. These facilities are safety enhancements that could promote walking and provide the “basic” facilities for the road network. They should be incorporated into the building of any new infrastructure. As well, individual programs could be arranged with set funding to construct these facilities on an annual basis.

#### Pedestrian Facilities Addressing Special Needs

These are facilities that should be provided at locations where special needs people are present, or can be applied as an area-wide implementation. For example, elderly, children, physically challenged, visually challenged, etc.

The range of countermeasures includes (and is not limited to):

- Adjust timing of traffic signals for elderly pedestrians and drivers;
- Warning signs of the presence of a special needs road user;
- Larger fonts on traffic signs for older drivers and pedestrians;
- Audible signals for the visually challenged;
- See-through guard rail design to enhance visibility for children and drivers;
- Curb ramps and refuge island design for wheelchair users.

### Implement Road Safety Audits for Roadway Design

One of the major aims of a road safety audit is to address the road safety of ALL road users. By implementing road safety audits for the design and construction of new transportation projects, the safety of vulnerable road users are addressed proactively.

### Community Zones

Community zones should be introduced where a whole residential area is treated with a combination of traffic calming devices and speed reduction measures to make a safer and more pedestrian-friendly neighbourhood.

### Pedestrian Malls or Shared Facilities

At locations where there is a heavy concentration of pedestrian activities conflicting with vehicular movements, it may be desirable to create pedestrian malls or special shared facilities. Pedestrian malls are usually closed to traffic permanently or during certain times of the day and day of week. Shared facilities have features that promote pedestrian activities without completely restricting vehicular access, however, restricting the vehicular speeds

through the introduction of traffic calming devices.

#### *Empirical Evidence*

In Japan, the Seven-year Traffic Safety Facilities Improvement Program (1996-2002) initiated the "Community Zoning Projects" to improve safety and calm traffic in residential areas. These projects involved the introduction of vehicle speed limit by the police, and the use of speed humps and road narrowing to force drivers to slow down. A before-and-after evaluation of 21 sample projects suggested the number of casualties decreased by about 10% and that of injuries involving bicycles and pedestrians by about 30%.

### Improve Vehicle Design

This measure encourages government to work with the automobile manufacturers to improve vehicle design in lowering the severity of crashes with pedestrians (e.g., in the design of the front bumper).

## ENFORCEMENT INITIATIVES

### Enforcement Campaign Aimed at Drivers and Pedestrians

Any effective enforcement campaign needs to target drivers and pedestrians who each share some responsibility for the safety of pedestrians on our streets. For example, vehicles yielding to pedestrians at intersections or pedestrian jaywalking could be enforced.

Small reductions in urban travel speeds can markedly reduce the number of fatal pedestrian crashes. Both speed limits and speed enforcement are important elements to consider in setting up enforcement initiatives.

***Empirical Evidence***

In Australia, a detailed study of fatal pedestrian crashes in Adelaide found that 32 per cent of pedestrians who died would probably have survived if the vehicle that hit them had been travelling 5 km/h slower before the crash, while one in ten pedestrian would not have been hit at all (the driver would have been able to stop in time).

The State of Victoria started intensive speed camera enforcement, accompanied by intensive publicity, in 1990. There was a 42 per cent reduction in pedestrian deaths in Victoria in that same year.

**School Zones**

A lower speed limit should be established at school zones during school hours, followed by vigorous police enforcement to improve safety for children and pedestrians. Such zones need to be well signed, and sometimes painted with children’s footprints to guide children to use designated crossing facilities. A focused enforcement campaign at the start of the school year can also help remind drivers to slow down and raise awareness.

**EDUCATION INITIATIVES**

**School Programs for Children**

Pedestrian safety programs should be part of the educational program for children at young ages. This involves developing a curriculum as part of the education.

**Safe Routes to School**

Training of parents and teachers for safe routes to school has been deployed in numerous countries with great success. Safe routes to school strategies are effective ways

for parents, teachers and children to learn about pedestrian safety.

**Education Reminders for Elderly Pedestrians**

For elderly drivers, volunteered driving refresher course and road tests can be introduced. Alternately, the mandatory re-licensing of drivers may be required once a certain age limit is reached.

**Media Campaign Aimed at Drivers and Pedestrians**

Focussed media campaigns aimed at vulnerable road users safety should focus on:

- Stressing the importance of “being seen” using reflective clothing;
- Respecting the rights of pedestrians;
- Looking out for children;
- Yielding right-of-way to pedestrians;
- Dangers of jaywalking;
- Walking on rural roads.

**Training of Planners and Engineers**

Transportation planners and engineers are traditionally trained to design for and accommodate the automobile. The safe accommodation of vulnerable road users is often forgotten or ignored. Professional development seminars can be used to emphasize to planners and engineers the importance of vulnerable road users safety.

***Example of Good Practice***

Singapore provides a number of useful measures to address child pedestrian traffic safety:

- (1) School zone scheme  
Implement school zone scheme near primary schools. Automobiles are required to slow down when passing through these areas. Highly-reflective signs, including the painting of “footprints” are used to guide children to use designated crossing.
- (2) Signalized pedestrian crossing  
Provide signalized pedestrian crossing at areas near schools, and to educate and encourage children using these crossings.
- (3) Participation of the communities and parents  
Involve communities and parents in promoting children’s safety, for instance, parents being traffic wardens during school starting and dismissal hours.
- (4) Police instruction  
Police conducts safety talks at schools to educate children on safe crossing habits and traffic rules. A Road Safety Park is also opened for schools to bring the children to participate in safety games and to understand traffic rules and regulation.

“worthwhile” projects to accommodate motor vehicles.

## **POLICY INITIATIVES**

### **Setting the Goal of Improving Vulnerable Road User Safety as a Priority**

Vulnerable road user safety will require an explicit commitment from the government as one of the top priorities in improving road safety. Otherwise these initiatives will not achieve their desired objectives since resources are typically diverted to more

# **COMMUNITY APPROACH TO REDUCE ROAD RELATED INJURIES**

## **PROBLEM DESCRIPTION**

One of the major challenges to promote and improve traffic safety at the community level is lack of participation of community representatives. Sometimes consideration of the community qualities for effective improvements is omitted. As a result, the introduction of certain community traffic safety improvements may introduce unintended traffic problems due to this lack of participation.

There is also a general lack of coordination between various agencies to improve traffic safety. Sometimes, it results in detrimental traffic safety conditions. The lack of partnership and consensus building mechanisms further exacerbates this problem.

At the community level, it is vitally important that the engineering, enforcement and educational efforts are co-ordinated to contribute to the success of any traffic safety initiatives. Thus, the initiatives identified to address this problem typically encompass all three E's of traffic safety and would require some consensus building in their successful implementation.

## **ENGINEERING INITIATIVES**

### **Area-Wide Traffic Calming**

Local communities are encouraged to participate in formulating an area-wide traffic calming scheme to improve traffic safety and livability in the neighbourhood. This requires that local police, community

groups, engineers and planners work together in addressing and solving the issues. Furthermore, it also promotes a spirit of co-operation.

### **Black Spot Programs with Community Input**

One of the main tasks of a Black Spot program is the identification of crash-prone locations. It may be desirable that local communities be encouraged to provide input to this important task since the local residents are usually most familiar with local traffic safety issues. Engineers working on Black Spot programs should be encouraged to communicate with the residents to determine the root causes of problems and to develop countermeasures acceptable to the community.

#### ***Empirical Evidence***

In Japan, area-wide infrastructure development efforts in residential areas involving the creation of community roads and mixed pedestrian-vehicular road will be made by road management operators in conjunction with zoning regulations through the Police. As well, general Traffic Safety Checks will be implemented with the participation of the regional population and road users themselves in order to promote road safety. These efforts will be shared between the administrative authorities and the citizens resulting in a heightened awareness of traffic safety by the road user. At the Mitaka Renjyaku area, the number of traffic crashes has been reduced by 60% in 1997 compared with in 1995.

## **EDUCATION INITIATIVES**

### **Safe Route to School**

See Vulnerable Road Users Safety.

### **Speedwatch**

See Speeding.

## **POLICY INITIATIVES**

### **Develop Community Oriented Road Safety Strategy**

A community needs to identify priorities to address various traffic safety problems and use engineering, enforcement and educational resources to assist the community with a road safety strategy. In the United Kingdom, this effort was piloted in the “Safer City” program in Gloucester. This approach made use of the three E’s of road safety in developing its strategy to reduce traffic collision related injuries and involved extensive consensus building.

One way to establish community outreach is through the use of road safety officers or co-ordinators. These officers serve as the liaison between the community and the government and often provide the catalyst required to effectively address certain road safety issues. In any event, an effective community oriented road safety strategy requires strong leadership and commitment from the public sector.

By establishing a National Road Safety Plan with national targets, the national government can often encourage the participation of regional and local governments to establish their own plans in support of the national plan and address local issues. Funding from the national government is often helpful in the encouragement.

#### ***Example of Good Practice***

Canada has a successful experience establishing community road safety organizations.

Firstly, road safety advisory agencies or interagency committees in selected communities were established. The efforts of these committees focus on such regional and seasonal issues such as school bus safety, school patrol safety, bicycle and pedestrian safety, winter driving behaviors, proper use of child restraints, drive home services for impaired drivers, holiday traffic jams and other initiatives aimed at encouraging individuals to take responsibility for road safety in their community. These successful programs are promoted to similar communities nation wide.

Another successful community initiative was the establishment of ‘speed watch’ or ‘community safety zones’, where communities are provided with speed monitoring equipment to monitor speeds in their communities. In the case of recorded excessive speeding activities, the police would provide speed enforcement.



# **RAISING THE ATTENTION OF SOCIETY TO ROAD SAFETY PROBLEMS**

## **PROBLEM DESCRIPTION**

In order to raise the attention of society to road safety problems, all the organizations that can play a role should be included and encouraged to promote the ideals and the objectives of road safety.

## **PUBLIC SECTOR**

The public sector includes the following agencies that can help in developing and delivering road safety initiatives:

- Government
- Education Providers
- Police and Enforcement Agencies
- Health Agencies
- Road Authorities and Highway Agencies
- Driver Training / Licensing Bodies
- Judiciary

## **PRIVATE SECTOR**

The private sector includes the following agencies that can help in developing and delivering road safety initiatives:

- Media
- Insurance Industry
- Alcohol and Hospitality Entertainment Industry
- Vehicle Manufacturers and Importers
- Transport Industry

## **NON GOVERNMENTAL ORGANIZATIONS (NGO'S)**

The NGO's include the following agencies in developing and delivering road safety initiatives:

- Communities and Local Organizations
- Motoring Associations
- Research Organizations/Universities

For a discussion on roles and responsibilities, see the section on Managing Road Safety.

A critical factor in raising the attention of society to road safety is that initiatives receive high-level policy commitments from the various players. Other key factors are:

- Establish high level leadership, including the political will to succeed
- Establish a National Road Safety Council (NRSC)
- Establish a national road safety plan
- Provide adequate and dedicated funding
- Provide adequate technical and administrative expertise
- Establish national road safety goals/targets
- Establish accountabilities for contributing to the shared targets
- Provide mechanisms to review safety priorities
- Initiate collaborative road safety initiatives
- Co-ordinate public/private/NGOs efforts
- Establish community-oriented programs
- Undertake a comprehensive public education campaign
- Include a road safety awareness element in every safety intervention



## PART J: *Raising the Attention of Society To Road Safety Problems*

### **Example of Good Practice**

New Zealand has been working towards covering the entire range of road safety interests by using two approaches:

- a robust safety management framework;
- a holistic approach to road safety interventions.

#### *Safety management framework:*

A robust safety management framework includes:

- high level leadership, including the political will to succeed;
- high level advocacy and national coordination arrangements (e.g. in New Zealand through the National Road Safety Committee);
- the specification of safety performance, including shared targets (e.g. in New Zealand through the Strategic Result Areas and the National Road Safety Plan);
- the expression of accountabilities for contributing to the shared targets (e.g. in New Zealand through the National Road Safety Plan and the National Road Safety Advisory Group);
- established safety funding processes, with well developed community participation (e.g. in New Zealand through the New Zealand Road Safety Programme); and
- mechanisms to review safety priorities (e.g. in New Zealand through the LTSA's Safety Directions Programme).

#### *Holistic approach to road safety interventions:*

Another key to raising attention/culture is to seek to include a road safety awareness element in every safety intervention. Interventions should include (as shown in the Table):

- people safety, vehicle safety and road safety;
- primary (before crash), secondary (in/during crash) and tertiary (after crash) interventions.

ROAD SAFETY INTERVENTIONS			
	Primary (before crash)	Secondary (in/during crash)	Tertiary (after crash)
People safety (driver, passenger, motorcyclist, bicyclist & pedestrian)	Education: e.g. know the Road Code Training: e.g. industry oriented Attitudes & Behaviour: e.g. don't drink and drive; avoid fatigue & distractions Driver licence regime Conspicuous clothing: bicyclists, pedestrians Enforcement: of laws e.g. speed Demand restraint: e.g. promote public transport	Behaviour: use of seat-belts	Trauma management: Emergency services Medical treatment Rehabilitation: physical, vocational, social
Vehicle safety	Engineering: design standards e.g. brakes; road worthiness; visibility; intelligent transport system vehicle incident detection Enforcement: of WOF requirement	Engineering: impact protection e.g. air bags	Engineering: vehicle salvage & restoration; in-vehicle 'black box'
Road Safety	Engineering: delineation; road geometry; surface condition; visibility; seal width; shoulders; separating modes of transport; road safety audit Exposure reduction: e.g. strategies to reduce traffic congestion Planning: e.g. accesses to arterial routes	Engineering: sealed shoulders; safety barriers; frangible poles	Engineering: intelligent transport system network incident detection

**Appendix A**  
**Range of Engineering Safety Countermeasures**

*Appendix A*  
*Range of Engineering Safety Countermeasures*

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The road safety countermeasures and their applications and effectiveness were identified from the following documents:

1. Ogden, K.W., Safer Roads: A Guide To Road Safety Engineering, Avebury Technical, 1996.
2. TMS Consultancy, Road Safety Engineering Manual, RoSPA, 1992.
3. ITE, The Traffic Safety Toolbox: A Primer On Traffic Safety, 1999.
4. DTLR, A Road Safety Good Practice Guide, First Edition, June 2001.
5. Transportation Association of Canada, The Canadian Guide to In-Service Road Safety Reviews, Final Draft Report, 2003.

## A. ROAD SEGMENTS: CROSS SECTION

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Widen Lane Width	Pattern of run-off road and/or sideswipe crashes	High speed roads	15% to 45% of all crashes
Narrow Lane Width	Speeding	Low speed urban roads	10% of all crashes
Widen Shoulder	Run-off road, head-on, out-of-control crashes	Rural roads	15% to 45% of all crashes; 20% to 30% of run-off road crashes
Pave/Seal Shoulder	Run-off road, head-on, out-of-control crashes	Rural roads	25% of all crashes
Flatten Side Slope	Run-off road crashes; Severe side slopes reduce possibility of recovery	Rural roads	10% to 15% of all crashes
Widen Clear Zone	Run-off road and fixed object crashes	Rural roads	35% to 55% of all crashes; 60% to 80% of off-road and fixed object crashes
Median Concrete Barrier	Head-on, overtaking crashes	High speed roads	50% to 60% of head-on crashes 40% to 60% of overtaking crashes
Correct Road Super-elevation	Run-off road, head-on crashes at horizontal curves	High speed roads	40% to 60% of run-off road, head-on crashes
Road Dieting / Space Reallocation	Speeding; Overtaking, lane changing, rear-end crashes	Urban collector & minor arterial roads	20% to 30% of all crashes

## B. ROAD SEGMENTS: ROADSIDE

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Roadside Barriers	Run-off road crashes	High speed rural roads; Road segments with severe side slopes or steep drop off	40% of fatal crashes and 20% of injury crashes; 80% to 100% of run-off road crashes; possible increase in overall crash frequency due to other crashes introduced by barrier
Crash Cushions / Attenuators	Fixed object crashes; Aims to reduce crash severity	Roadside fixed objects (e.g. structures, utility post); highway gore areas	30% to 40% of injury run-off road crashes; 60% of fatal run-off road crashes
Breakaway Devices/ Frangible Posts	Reduce severity of run-off road crashes	Roadside fixed objects (utility, sign posts)	30% to 40% of run-off road injury crashes
Widen Bridge or Culvert	Run-off road crashes with bridge/culvert structures or abutments	Bridges and culverts	30 to 50% of run-off road fixed object crashes
Roadside Rumble Strips / Profiled or raised lane edge line	Driver inattention; Run-off road crashes	Rural or High speed locations	35% to 60% of run-off road crashes
Relocate Roadside Hazard	Fixed object crashes	Roadside fixed objects	20% to 50% of all crashes
Removal of Roadside Hazard	Fixed object crashes	Roadside fixed objects	40% to 50% of all crashes

### C. ROAD SEGMENTS: HORIZONTAL AND VERTICAL ALIGNMENT

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Climbing Lane	Steep vertical grades, high volume of truck traffic; Overtaking, lane changing, run-off road, head-on crashes	Rural highways with significant volume of trucks	30% of all crashes
Flatten horizontal curve	Run-off road crashes at horizontal curves	Approaches to tight horizontal curves	Varies and depends on degree of curve; 10% to 85% of all crashes
Reflectorized Guide Posts and Delineation	Run-off road crashes at horizontal curves	Approaches to tight horizontal curves	30% to 40% of run-off road crashes
Speed Advisory Signs (can be enhanced with “sunburst” signs)	Run-off road, head-on crashes	Incompatible road geometry and operating speeds	20% to 40% of run-off road and head-on crashes
Transverse Road Markings / Rumble Strips	Run-off road crashes at horizontal curves	Approaches to tight horizontal curves	30% of all crashes

## D. ROAD SEGMENTS: OPERATIONAL

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Signal Progression	Congestion related crashes (e.g. rear-end, lane changing etc...)	Congested urban or suburban arterial corridors with closely spaced traffic signals	30% to 40% of all crashes
Increase Road Capacity	Congestion related crashes (e.g. rear-end, lane changing etc...)	Locations with high crash history attributed to long vehicle delays; need to account for increase in traffic volumes	15% to 20% of all crashes; not accounted for increased traffic volumes
Parking Regulations / Restrictions	Crashes involving parked vehicles or vehicles parking	Urban arterial roads	15% to 50% of all crashes
Change Angle Parking to Parallel Parking	Crashes involving parked vehicles or vehicles parking	Urban arterial roads	40% of parking related crashes
Signing and Pavement Marking Improvements	Situations / locations where driver confusion and driver expectation not met; poor guidance; inadequate signing	Urban and rural locations	10% to 50% of all crashes
Passing Lane	Overtaking, lane changing and head-on crashes; driver frustration due to delays	Two-lane rural roads	25% to 40% of all crashes
Speed Zoning	High speed related crashes; run-off road crashes	Transition areas between various road forms, land use, classifications	5% to 30% of all crashes
Access Control / Management (e.g. consolidate driveways, close median openings, frontage roads, etc...)	Access –related crashes (rear-end, lane changing, turning crashes)	Urban and suburban arterial roads	50% to 60% of access related crashes
Slippery Road Sign	Roadways with significant crashes on wet pavement (e.g. overpass, bridges, etc...)	On approaches to bridges, overpass etc...	10% to 50% of wet road crashes
Skid Resistant Pavement / Surfacing	Wet pavement related crashes; rear-end, vehicle loss of control crashes	Urban roadways	25% of total crashes



## E. ROAD SEGMENTS: OTHER

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Route Lighting	Night time visibility problem; night time crashes	Urban and suburban roadways	10% to 40% of all crashes
Reduce Speed Limit	Speeding, run-off road crashes; need to work in conjunction with police enforcement	All road segments	20% to 40% of all crashes
Traffic Calming Schemes	Vehicle short-cutting, speeding; crashes with vulnerable road users	Community / Neighbourhood; Area-wide	40% of all crashes; not accounting for crash migration
Pedestrian Sidewalk	Vehicle-Pedestrian crashes	Urban and Suburban areas	10% to 30% of pedestrian crashes

## F. INTERSECTIONS: GEOMETRIC COUNTERMEASURES

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Intersection Channelization (add turn lanes, realign turn lanes, etc..)	Crashes related to turning movements	All intersections	15% to 25% of all crashes
Acceleration and deceleration lane	Lane changing crashes at intersections	High speed intersections	40% to 60% of lane changing crashes
Stagger Intersection	Rear-end and head-on crashes	Unsignalized intersections	55% to 70% of all crashes
Improve Intersection Angle	Limited sight distance and certain turning movements are difficult; Right angle, rear-end crashes	Intersections with less than 70 degree angle	35% of all crashes
Relocate Intersection from Horizontal Curve	Limited sight distance for crossing traffic; right angle, rear-end crashes	High speed intersections	50% of all crashes
Close Road	High volume of conflicting traffic	Blackspot locations	50% to 80% of all crashes
Center Median / Traffic Island	Vehicles overshooting, head-on crashes	High speed intersections	20% to 30% of all crashes
Sight Distance Improvements	Right angle and/or turning crashes	All intersections, locations where objects (e.g. tree, street furniture, etc...) limit sight distance	15% to 50% of all crashes

## G. INTERSECTIONS: OPERATIONAL COUNTERMEASURES

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Skid Resistant Pavement / Resurfacing	Wet pavement related crashes; rear-end, vehicle loss of control crashes at intersection approaches	All intersections	25% of total crashes
Pavement Marking Guidance Lines	Crashes involving vehicles encroachment onto adjacent or opposing travel lanes	Large or skewed intersections	5% to 35% of all crashes
Transverse Pavement Markings	Speeding, vehicles approaching intersection too fast; rear-end crashes	Rural intersections with large spacings between intersections	40% to 60% of all crashes
Lighting	Night time crashes	Likely at rural intersections	75% of night time crashes
Turn Restrictions	Turning movement related crashes	All intersections; apply with caution due to potential migration problem	40% of all crashes (not accounting for collision migration)
Advance “Intersection Ahead”, “STOP Ahead”, “Signal Ahead” Signs	Rear-end, right-angle crashes	Hidden intersections, long distance between intersections, rural high speed intersections	30% to 35% of all crashes
Remove On-street Parking near Intersection	Right-angle, rear-end crashes due to parked vehicles limiting sight distance	All intersection	30% to 35% of all crashes
Modern Roundabout	Reduce severity of crashes, high occurrence of right-angle and turning related crashes	Preferably low speed intersections	35% to 65% of all crashes; 30% to 75% of injury and fatal crashes
Modify Traffic Signal (Larger Signal Display; Relocate Signal Heads; Additional Signal Heads; Signal Backplates)	Rear-end and angle crashes	Signalized intersections	10% to 20% of all crashes
Advance Warning Flasher	Rear-end and angle crashes	Signalized intersections w/ limited visibility, High speed intersections	10% to 25% of all crashes
Remove Unwarranted Signals	Traffic control is inappropriate for location,	Signalized intersections,	30% to 55% of all crashes

*Appendix A*  
*Range of Engineering Safety Countermeasures*

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
	driver frustration leading to non-compliance; rear-end and right angle crashes	Review on a case by case basis	
Optimize Signal Operations	Crashes related to intersection delays	Signalized intersections	10% to 20% of all crashes
Actuated Signal Operations	Crashes related to intersection delays	Signalized intersections	10% to 20% of all crashes
Adequate Intergreen Time (Amber and All-red)	Right-angle and rear-end crashes	Signalized intersections	10% to 15% of all crashes
Signal Progression	Congestion related crashes (e.g. rear-end, lane changing etc...)	Congested urban or suburban arterial corridors with closely spaced traffic signals	30% to 40% of all crashes
Protected Turning Phases to Separate Conflicting Movements	Turning related crashes	Signalized intersections with high volumes of conflicting movements	25% to 560% of all crashes
Red light camera	Right-angle crashes	Signalized intersections with high non-compliance rate	30% to 40% of right-angle crashes
New Traffic Signal	Right-angle crashes	Unsignalized intersections with high delays; may result in more rear-end crashes	25% to 35% of all crashes; 45% to 60% of right-angle crashes; 20% to 70% increase in rear-end crashes
STOP or Yield/Give Way Signs	Right-angle crashes	Uncontrolled intersections; possible increase in rear-end crashes	30% to 40% of all crashes
Overhead Flashing Light (operate in conjunction with STOP sign)	Right-angle crashes	STOP controlled intersections	30% of all crashes

## H. PEDESTRIAN-FOCUSED COUNTERMEASURES

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Pedestrian Indicators (signal heads) at Signalized Intersections	Vehicle-pedestrian crashes	Signalized Intersections	20% to 30% of pedestrian related crashes
Pedestrian Refuge	Locations that require long crossing distance	Intersections and mid-block locations	20% to 60% pedestrian crashes
Pedestrian Fencing / Guardrail	High volume of pedestrians jaywalking	Mid-block, between intersections	30% to 50% of pedestrian related crashes
Marked Pedestrian Crosswalk / Zebra Crosswalk	Vehicle-pedestrian crashes	Intersections and mid-block locations	10% to 50% of pedestrian related crashes
Curb Extension / Bulb Out	Locations that require long crossing distance; vehicle-pedestrian crashes	Intersections	30% to 50% of pedestrian related crashes
Pedestrian Signals	No crossing gap for pedestrians; vehicle-pedestrian crashes	Intersections and mid-block locations	10% to 70% of pedestrian related crashes
Lighting at Pedestrian Crossing	Night time vehicle-pedestrian crashes	Pedestrian crossings	20% to 30% of pedestrian related crashes
Pedestrian Grade Separation	Vehicle-pedestrian crashes	Pedestrian crossings with high pedestrian volumes; high speed locations	70% to 90% of pedestrian related crashes

## I. RAILWAY CROSSING COUNTERMEASURES

COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
Grade Separation	Train-vehicle crashes	At-grade railway crossings with high volumes of conflicting train and vehicle movements	100% of train crashes 40% to 60% of fixed object (crossing furniture) crashes
Barriers / Gates	Train-vehicle crashes	At-grade railway crossings with high volumes of conflicting train and vehicle movements	70% to 90% of train crashes 10% to 40% increase in fixed object (crossing furniture) crashes
Vertical & Horizontal Alignment Improvements	Train-vehicle crashes	Location with visibility problems	30% to 70% of train crashes 30% to 80% of fixed object (crossing furniture) crashes
Flashing Lights	Train-vehicle crashes	At-grade railway crossings	10% to 80% of train crashes 20% to 30% of fixed object (crossing furniture) crashes
Improve Guidance through Crossing	Train-vehicle crashes	Locations with vehicle encroachment problems	20% to 30% of train crashes 20% to 30% of fixed object (crossing furniture) crashes
Lighting at Crossing	Night time train-vehicle crashes	Rural crossings	10% to 20% of train crashes 20% to 30% of fixed object (crossing furniture) crashes
Warning Signs	Train-vehicle crashes	Inconspicuous railway crossings	10% to 20% of train crashes 10% to 20% of fixed object (crossing furniture) crashes

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**Appendix B**  
**Pedestrian Safety Countermeasures**



## PEDESTRIAN SAFETY COUNTERMEASURES

Countermeasures Collision Type	Barrier: Median	Barrier: Roadway/Sidewalk	Barrier: Street Closure	Bus STOP Relocation	Crosswalk: Intersection	Crosswalk: Midblock	Diagonal Parking: 1-way Street	Grade Separation	Facilities for Handicapped	Lighting: Crosswalk	Lighting: Street	One-way Streets	Retroreflective Materials	Safety Islands	Sidewalk/Pathway	Signal: Ped. (Shared)	Signal: Ped. (Delayed)	Signal: Ped. (Separated)	Signal: Traffic	Signs and Markings	Urban Ped. Environment	Vehicular Traffic Diversion
Dart-out (first half)	●	●				●	●														●	●
Dart-out (second half)	●	●				●	●					●		●							●	●
Midblock Dash	●	●				●								●							●	●
Intersection Dash					●			●		●	●			●				●	●		●	
Turn-Merge Conflict								●										●	●			
Turning Vehicle								●										●	●			
Multiple Threat								●		●	●					●	●	●	●		●	
Bus STOP Related				●																	●	
School Bus STOP Related				●																		
Ice Cream Vendor																					●	
Trapped					●			●						●	●	●	●					
Backup																						
Walking on Roadway		●									●		●		●						●	
Result Vehicle-Vehicle Crash																					●	
Hitchhiking											●		●									
Working in Roadway																					●	
Disabled Vehicle Related																					●	
Nighttime Situation										●	●		●									
Handicapped Pedestrians									●													

Source: ITE Traffic Safety Toolbox

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