



Initiatives for Improving Road Safety Phase 1: 2nd Progress Report

Asia Pacific Economic Cooperation (APEC)
Transportation Working Group

Prepared by:
G. Ho Engineering Consultants
August 18, 2003

Consultant Study Team:

Geoffrey Ho, P.Eng.
Julian Rozental, P.Eng.
David Colledge
Mavis Johnson



**INITIATIVES FOR IMPROVING ROAD SAFETY – PHASE 1:
2nd PROGRESS REPORT**

TASK NO.	TASK	Date
1	Proposal submitted	January 24, 2003
2	Project Award: APEC Secretariat	March 3, 2003
3	Project Award: Project Overseer	March 4, 2003
4	Contract Negotiation with APEC	March 2003
5	1 st Study Team “Brain Storming” Session to prepare detailed Work Plan	March 6, 2003
6	Prepare Detailed Work Plan for submission	March 19, 2003
7	Travel Arrangements to Attend RSEG Meeting on Apr 7, 2003 in Singapore	Cancelled
8	Prepare 1 st Progress Report for submission	March 19, 2003
9	Prepare Apr 7, 2003 Presentation to RSEG	Cancelled
10	TPT-WG RSEG Meeting in Singapore	Cancelled
11	TPT-WG RSEG Meeting in Bangkok Thailand	Cancelled
12	Project Work Plan circulated to RSEG for input & comments	May 2003
13	Approval of Work Plan by Project Overseer	June 5, 2003
14	Work Plan Task 1: Review of Background Material and Additional Data Collection	Completed
15	Work Plan Task 2: Matching Safety Initiatives to Safety Issues and Evaluation	60% Completed
16	2 nd Study Team Workshop to review findings and discuss evaluation criteria	August 6, 2003
17	Prepare 2 nd Progress Report & Findings	August 18, 2003
18	Commence Travel to Busan Korea for RSEG Meeting	August 29, 2003
19	Present findings at RSEG Meeting and Discussion	September 2, 2003

The findings to date are included in this progress report.



**ASIA PACIFIC ECONOMIC COOPERATION (APEC)
TRANSPORTATION WORKING GROUP
INITIATIVES FOR IMPROVING ROAD SAFETY**

Draft Findings Document

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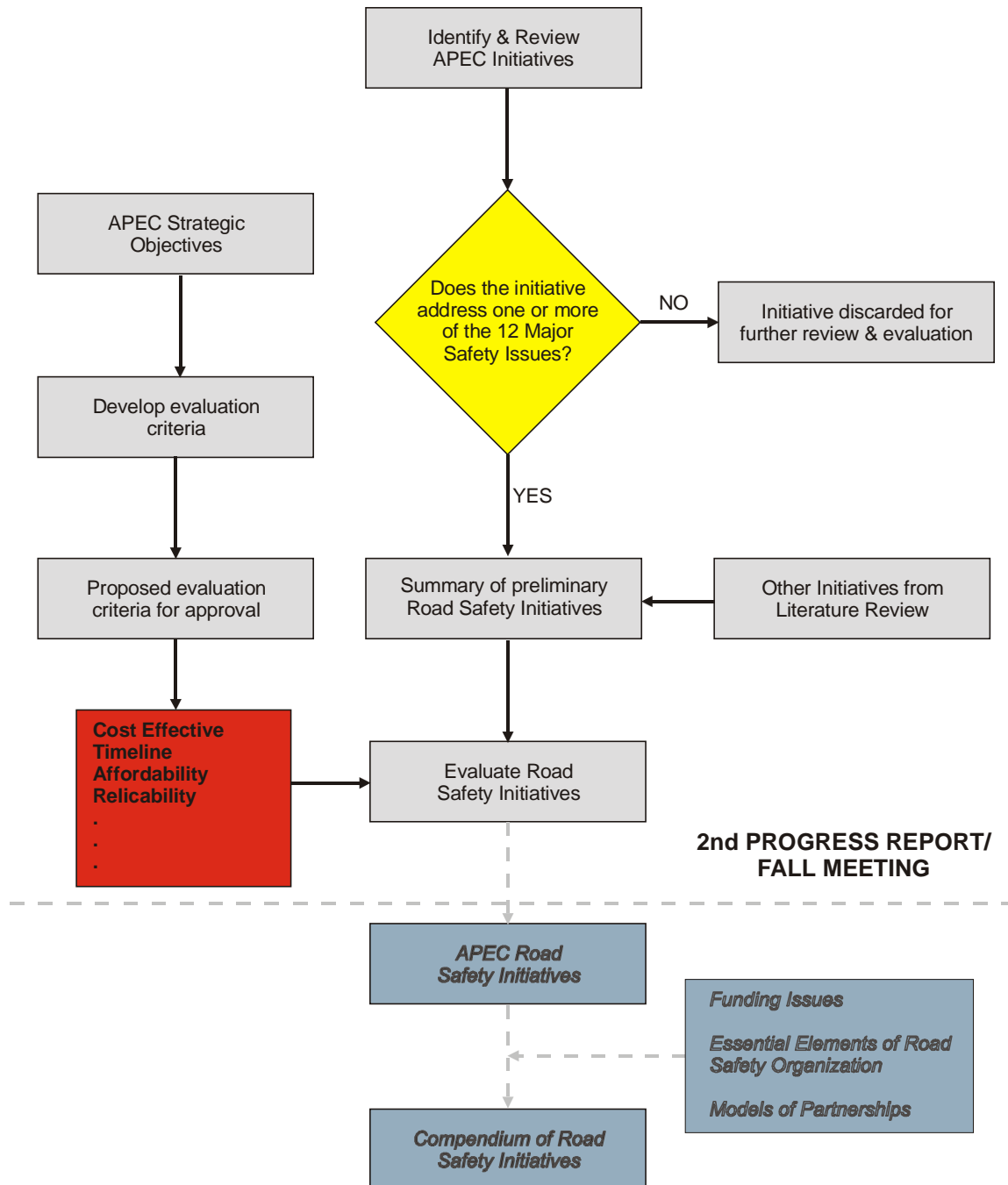
Section 1

The Major Road Safety Issues

1. Best way to collect and share accident data,
2. Improvement of road network and traffic safety facilities,
3. Roadside slope management,
4. Speeding,
5. Impaired driving,
6. Vehicle overloading,
7. Encouraging people to fasten seat belts and wear motorcycle helmets,
8. Safety of pedestrians,
9. Safety of elderly people,
10. Community approach to reduce road related injuries and fatalities,
11. Accident black-spot approach to reduce accidents, and
12. Raising the societal attention to road safety problems.



FLOWCHART ILLUSTRATING PROGRESS & METHODOLOGY





MAJOR ISSUE 1 COLLECTING AND SHARING ACCIDENT DATA

Our review of the relevant information, discussions and conclusions included in the report titled “*Final Report for Phase I Questionnaire of Road Safety Experts Group, Chinese Taipei – November 2002*” and additional literature review resulted in the following discussion paper submitted for the APEC review and approval. Note that our conclusions and recommendations differ somewhat from those of the authors of the APEC report.

1. ACCIDENT DATA USE

Accident data, combined with additional complimentary information, can be used for two main purposes in the APEC context, as follows:

a. Monitor the safety performance of the road network in member economy countries. For this purpose, global indicators may be used, such as:

- Accidents (by severity) per million vehicle kilometres
- Accidents per million population
- Accident (by severity) frequencies
- Etc.

b. Identify 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:

- Accident location;
- Accident type;
- Location description (road type, number of lanes, rural or urban, intersection,...etc.)
- Accident cause;
- Time of accident;
- Weather;
- Light/dark;
- Direction of travel;
- Vehicle type
- Number of vehicles involved/number of injuries
- Etc.

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, amongst other things, for:

- before-and-after comparisons;
- setting improvement priorities;
- monitoring performance over time.

However, uniformity of the data between APEC economies is not considered to be necessary. Given the current discrepancies between member economies, a drive for uniformity is not recommended, and in fact it is considered detrimental, as any changes in the definitions or classifications will result in the loss of the value of the historical data for continuity (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, such as those relating to licensing, estate management, insurance, culture and religion, etc.



2. RESULTS OF THE APEC SURVEY

From APEC survey, it is evident that the majority of the member economies collect and use similar data sets. However, the experts concluded that data could not be “integrated” throughout APEC for sharing, primarily due to differences in:

- The reporting and collection mechanisms;
- The definitions used in the reporting;

As noted, these discrepancies will not impede the implementation of countermeasures in the APEC economies.

3. RECOMMENDATIONS

- Should APEC be interested in monitoring road safety progress in various member economies, it is suggested that:
 - APEC establishes the key monitoring parameters of interest such as accident frequencies, accident severity, population, kilometres of road...etc.;
 - ensures that each member economy has up-to-date information on these parameters or that these parameters can be collected within a set time-frame;
 - establishes the monitoring criteria;
 - establishes individual base values for each criteria, for the “start date” (for example, the values in 2003) and for each member economy that will be monitored;
 - the monitoring should be made for each economy, relative to the base values.
- Specific accident information should be maintained by member economies for target countermeasures such as those recommended in this report. A final listing of the information necessary to implement the safety countermeasure will be made in conjunction with the recommendations for the preferred countermeasures.



MAJOR ISSUE 2 SAFER ROAD INFRASTRUCTURE (consolidation of issues: IMPROVEMENT OF THE ROAD NETWORK AND TRAFFIC SAFETY FACILITIES AND ACCIDENT BLACK-SPOT APPROACH)

1. DESCRIPTION

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

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

The two initiatives share common knowledge and empirical evidence and we propose to deal with these under one heading.

2. PLANNING AND DESIGN INITIATIVES (P&D)

2.1 RANGE OF COUNTERMEASURES (2-P&D)

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
1. Develop <u>Best Practice</u> guidelines and standards (planning, design, operations, construction, maintenance and Road Safety Audits) 2. Safety conscious planning initiatives		1. Training of practitioners in the application of safe planning and design principles	1. In support of best practice guidelines and standards

2.2 DETAILS OF COUNTERMEASURES (P&D)

2.2.1 Engineering (2-P&D-ENG)

2-P&D-ENG-1 Develop Best Practice Guidelines and Standards (with safety focus)

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. Thus, 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 the practitioners of 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:

- Guidelines on Transportation Planning (e.g. roadway classification, techniques to prioritize upgrades, land use planning, etc...)



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

Best practices guidelines should incorporate empirical evidence and heuristics derived from crash reduction potential of improvements such as those presented in *Appendix A*. For example, the “*Geometric Design Guide for Canadian Roads*”, Transportation Association of Canada, 1999 includes such empirical and heuristic evidence and incorporates it into a new design paradigm.

2-P&D-ENG-2 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. 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 “doing it right the first time”, rather than repeating the mistakes of the more mobilized countries. The safety conscious planning topics include:

- Network and Land Use Planning, combining the road planning with the land use decisions;
- Promoting Alternate Modes of Transportation (Walking, Cycling, Transit, etc...);
- Road Classification Planning;
- Development-led Planning (e.g. including explicit safety into traditional Traffic Safety Impact Assessments).

2.2.2 Education (2-P&D-EDU)

2-P&D-EDU Training of Practitioners

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

2.2.3 Policies (supporting initiatives) (2-P&D-PO)

2-P&D-PO Support Development of Best Practice

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.

3. REMEDIAL MEASURES FOR EXISTING INFRASTRUCTURE (EX)

3.1 DESCRIPTION

The treatment of accident prone locations through engineering countermeasures is covered in this sections. Specific treatments such as speeding and pedestrians are dealt with in separate sections.



3.2 Range of Countermeasures (2-EX)

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
1. Implement black-spot programs 2. Implement road safety countermeasures 3. Establish multi-year programs for black spots/road improvements	1. Review of legislation and targeted enforcement	1. Training of practitioners	1. Develop best practice guidelines and standards 2. Establish multi-year programs for black spots/road improvements

3.3 Details of Countermeasures (EX)

3.3.1 Engineering (2-EX-ENG)

2-EX-ENG-1 Black-Spot Programs

Accident black spot approach to reducing accidents is primarily an engineering and infrastructure oriented strategy.

Accident Black Spot Program has been proven to be one of the most effective ways to reduce traffic related accidents. Numerous programs around the world have demonstrated positive results, with significant achievements in reaching their goals of reducing the frequency and severity of accidents. It is recommended that the 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, and the compendium intends to provide introductory guidance on the following critical steps of a black spot program:

1. ***Data Collection / Management:*** Traditionally Black Spots were identified through historical accident data, typically collected by police agencies. In the compendium, the basic data collection requirements for black spot programs will be outlined. As well, various data management techniques will be pointed out. Those could be then tailored to various levels of sophistication, as appropriate for each member economy.
2. ***Identification of Black Spots:*** Various identification techniques will be briefly discussed in the compendium. These techniques are primarily quantitative methods. However, in light of the possible lack of quality data in some member economies, qualitative methods will also be mentioned.
3. ***Selecting the Appropriate Infrastructure Based Countermeasure:*** Methodologies to select the appropriate road safety countermeasures will be pointed out. Some of the key road safety countermeasures are described in detail in ***Appendix A***.
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. Methodologies to conduct benefit-cost analysis will be noted.



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.

2-EX-ENG-2 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 engineering based 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*. Those include some of the countermeasures submitted by the APEC economies and include other proven countermeasures from our literature review.

2-EX-ENG-3 Establish Multi-Year Programs

As noted, the Black Spot program is one of the most effective ways to reduce traffic accidents. 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.

3.3.2 Enforcement (2-EX-ENF)

2-EX-ENF-1 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 may be 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 would be implemented. Other infrastructure related enforcement campaigns might include jaywalking, vehicles yielding to pedestrians, STOP violations, etc...



MAJOR ISSUE 3 ROADSIDE SLOPE MANAGEMENT

1. 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, road closures, etc.
- 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 accident;
- The potential collapse of the road due to water seepage or geotechnical faults;
- The loss of friction of the road surface due to the presence of water and debris.

2. RANGE OF COUNTERMEASURES

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
<ol style="list-style-type: none"> 1. Databases of roadside conditions 2. Measures to remedy deterioration of cut and fill areas 3. Measures to advise public of significant conditions 4. Measures to accommodate occasional debris 5. Measures to protect the road and the roadside from water (drainage) 6. Measures to protect errant vehicles from roadside hazards 7. Measures to improve road surface in case of water/debris 8. Undertake routine maintenance of the roadside 		<ol style="list-style-type: none"> 1. Ensure that there is technical know-how on soil/geotechnical and environmental sciences. 2. Training of practitioners in the appropriate sciences. 	<ol style="list-style-type: none"> 1. Policies regarding regular maintenance of road prism and roadside 2. Provide opportunities for maintaining adequate skill levels 3. Dedicated technical team to address the roadside



3. Details of Countermeasures

3.1 Engineering (3-ENG)

3-ENG-1 Databases Of Roadside Conditions

Develop an inventory and databases of the roadside and road conditions. This will 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.

3-ENG-2 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 dependant on a number of variables such as geotechnical, environmental and climatic conditions and these will need to be selected on a location specific basis.

3-ENG-3 Measures To Advise Public Of Significant Conditions

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

3-ENG-4 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.

3-ENG-5 Measures To Protect The Road And The Roadside From Water (Drainage)

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.

3-ENG-6 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.



3-ENG-7 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.

3-ENG-8 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.

3.2 Education (3-EDU)

3-EDU-1 Technical Know-How On Soil/Geotechnical And Environmental Sciences

The main target of education initiatives is to ensure that member economies have sufficient technical knowledge to identify hazardous locations and the appropriate remedial measures.

3-EDU-2 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 issues.

3.3 Policies (3-PO)

3-PO-1 Policies Regarding Regular Maintenance Of Road Prism And Roadside

The responsible agencies should endeavour to adopt regular maintenance policies.

3-PO-2 Provide Opportunities For Maintaining Adequate Skill Levels

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

3-PO-3 Dedicated Technical Team To Address The Roadside

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



MAJOR ISSUE 4 SPEEDING

1. 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 laws of physics show that the faster a vehicle is travelling, the greater the distance it will need to stop, thus increasing the risk and severity of accidents.

From a legal point of view, 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 would need to focus on driver behavioural modifications through a co-ordinated effort of engineering, education and enforcement based efforts.

2. RANGE OF COUNTERMEASURES

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
1. Speed limiting geometric features 2. Appropriate speed limits 3. On road and roadside features that promote lower speeds (subliminal measures) 4. Planning initiatives 5. Speed governors or limiters	1. Focussed campaign targeted at high risk locations 2. Automatic or traditional speed enforcement measures 3. S.T.E.P. Campaigns 4. Graduated Fines	1. Driver Training Programs 2. Speedwatch – a community initiative 3. Police training in use of new technology 4. Media campaigns 5. Educate Teenagers	1. Redirect revenue from traffic fines to traffic safety initiatives

3. Details of Countermeasures

3.1 Engineering (4-ENG)

4-ENG-1 SPEED LIMITING GEOMETRIC FEATURES

Driver behaviours could be modified through changes in the physical environment they operate in. The changes are incorporated in the design and construction of roadway infrastructures. These include such features as:

- Chicanes,
- Road narrowing
- Traffic circles
- Roundabouts
- Gateway treatments at speed transition areas
- Other traffic calming devices, e.g. humps, cushions, tables, etc...

4-ENG-2 Appropriate Speed Limits

Setting appropriate speed limits to the road environment that meets driver's expectations and reduce the speed differentials. 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 companion of this measure that proved highly effective is the use of advisory speeds at locations such as curves, transition sections, structures, pedestrian areas, etc.

4-ENG-3 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.

4-ENG-4 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.

4-ENG-5 Speed Governors Or 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. 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. In Australia, a “three strike and you’re out” speeding policy is currently being discussed to introduce speed limiters for second time speeding offenders of heavy vehicle operators not fitted with a speed limiter. There has been very little evaluation conducted to date on the effectiveness. However, it appears that there is considerable opposition in introducing such systems. The issues include loss of freedom, government monitoring, effect on driving style, driver boredom, effect on vehicle emission, impact on motorcycles and other two-wheelers, the setting of speed limits, etc...

3.2 Enforcement (4-ENF)

4-ENF-1 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.

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 3kmh over) drivers will complain at the unfairness of this 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. Prohibit the sale and use of radar detectors should be considered.

4-ENF-2 Speed Enforcement Measures

For drivers the deterrence comes from the potential risk of being caught, and there are generally 2 different types of enforcement:



- Covert enforcement: 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 2 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.

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

4-ENF-3 S.T.E.P. Campaigns

Selected Traffic Enforcement Campaigns (STEP) have proven to be a very effective strategy in addressing several issues. This type of campaign begins with a 2-3 week period of information for road users about the particular issue. This can be accomplished through Mass Media Advertising and/or Community Initiatives. Then follows 2-3 weeks of intense police enforcement for the issue. The progress is monitored, the number of crashes, tickets and feedback are typically provided in a follow up campaign.

4-ENF-4 Graduated Fines

Severe and a graduated scale of traffic fines has proven to be a good deterrent to modify driver behaviour. Some of the keys to a graduated fining system include:

- Severe financial fines with graduated scale.
- May result in suspension or loss of driver’s license for repeat offenders.
- Repeat offenders to undergo mandatory testing or training.
- Introduce probationary periods for repeat offenders with severe consequences.

3.3 Education (4-EDU)

4-EDU-1 Driver Training Programs

Driver training programs (mandatory or volunteer) with component on consequences of excessive speeds were suggested as possible countermeasures.

4-EDU-2 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 school and playground zones. Drivers get instant feedback on their speed displayed on the reader-board as they pass.

Experience in Canada has shown that more than 70 per cent of drivers who are travelling 10km/h over the speed limit slow down when they see a speed-reader board. Speedwatch helps address traffic and speeding problems through:

- Creating public awareness about road safety;
- Community action to address speed-related problems;
- The collection of speed-related data;
- Assisting police to determine speed problem locations



- A community initiative with volunteers and “speed-reader” boards indicating speed of driver

4-EDU-3 Police Training In Use Of New Technology

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

4-EDU-4 Media Campaigns

Conduct media campaigns 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.

4-EDU-5 EDUCATE TEENAGERS

Intervention programs targeted at teenagers before they obtain their driver’s license with goals of:

- making speeding an unacceptable behaviour, and
- understanding the relationship between speeding, crashes and severity

3.4 Policies (4-PO)

4-PO-1 Redirect Revenue From Traffic Fines To Traffic Safety Initiatives

This initiative provides a dedicated revenue source for funding traffic safety initiatives, and helps in reducing the public’s perception that any speed enforcement campaigns as “cash grab” by the government. It also helps governments in showing their commitment to improve traffic safety.



MAJOR ISSUE 5 IMPAIRED DRIVING

1. DESCRIPTION

Impaired driving remains a significant cause of fatalities and serious injuries in many countries. However in the past ten to twenty years significant progress has been made in some countries that has seen drinking and driving 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. Yet enforcement is of limited value unless the appropriate legislation and sanctions are in place to deal with offenders. It was noted that 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.

2. RANGE OF COUNTERMEASURES

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
1. Alcohol ignition interlock device program	1. Focussed campaigns 2. S.T.E.P. Campaigns	1. Education in schools for teens on the consequences of impaired driving 2. Rehabilitation courses for repeat offenders 3. Training courses for servers of alcohol in detecting impaired drivers 4. Training of police in the use of alcohol testing equipment. 5. Media campaign advertising consequences of driving impaired 6. Designated driver programs	1. Establish low BAC level with severe consequences. 2. Zero tolerance for new/probationary drivers

3. DETAILS OF COUNTERMEASURES

3.1 Engineering (5-ENG)

5-ENG-1 Alcohol Ignition Interlock Device Program

Introduce the use of In-vehicle Alcohol ignition interlock devices (AIID). 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 and then prevent ignition if the driver's BAC goes over the pre-set limit. The device forms an integral part of an AIID program. DWI 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 DWI



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.

3.2 Enforcement (5-ENF)

5-ENF-1 Focussed Campaign

Enforcement campaigns must be focused and targeted. For drivers the deterrence comes from the potential risk of being caught, so the visibility of the Police 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.

5-ENF-2 STEP Campaigns

See notes at 4-ENF-3

3.3 Education (5-ENF)

5-EDU-1 Education In Schools For Teens On The Consequences Of Impaired Driving

Education in schools for teens on the consequences of impaired driving. Presenting information to schoolchildren as to 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.

5-EDU-2 Rehabilitation Courses For Repeat Offenders

Rehabilitation courses for repeat offenders. The effectiveness could be enhanced using the AIID program.

5-EDU-3 Training Courses For Servers Of Alcohol In Detecting Impaired Drivers

Training courses for servers of alcohol in detecting impaired drivers has been tried in some countries to some degrees of success. Other similar programs encourages “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.

5-EDU-4 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.

5-EDU-5 Media Campaign Advertising Consequences Of Driving Impaired

Media campaigns advertising the consequences of driving impaired remains one of the main tools to educate the driving population. Some campaigns focused on the possible loss of driving privileges as deterrence.



5-EDU-6 Designated Driver Programs

Designated driver programs aimed encouraging the public to designate drivers who do not consume alcohol. Some programs also encourage the public to use alternate transports such as taxis or public transit.

3.4 Policies(5-PO)

5-PO-1 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.

5-PO-2 Zero Tolerance For New/Probationary Drivers

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



MAJOR ISSUE 6 VEHICLE OVERLOADING

1. DESCRIPTION

Vehicle overloading refers to a number of conditions, namely:

- Excessive weigh loading of vehicles (e.g. over the manufacturer's 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 excessive number of passengers (e.g. over the capacity of the vehicle)
- Carrying passengers in vehicles unsuitable for transport of persons (e.g. in the back of lorries).

NOTE: Often, vehicles undergo structural modification to permit overloading.

2. RANGE OF COUNTERMEASURES

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
1. Dedicated truck/commercial routes 2. Parking and loading restrictions 3. Height/width checkpoints on routes 4. Warning signs at particularly prone locations for heavy vehicle overturning 5. Height/width signs on structures 6. In-vehicle weigh devices	1. Implement 'manual' or automated weigh-in-motion check points 2. Dedicated motor carrier enforcement units/police 3. Annual inspection of safety and structural features of vehicles	1. Initiatives to inform motor carriers of potential damage to roads and safety impacts (vehicle stability)	1. Ensure that there is adequate legislation in place against vehicle overloading 2. Legislation i.e. vehicle modifications 3. Legislation to remove financial incentives to overload 4. Legislation to assign liability to owners

3. DETAILS OF COUNTERMEASURES

3.1 Engineering (6-ENG)

6-ENG-1 Dedicated Truck/Commercial Routes

Assign truck/commercial routes that are safe for use by heavily loaded traffic, with appropriate geometrics and introduce signing to indicate this to all drivers. 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.



6-ENG-2 Parking And Loading Restrictions

Introduce parking and loading restrictions primarily for dangerous goods transport. This would help eliminate interference with other traffic (for example, avoid sight visibility restrictions for pedestrians)

6-ENG-3 Height/Width Checkpoints On Routes

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

6-ENG-4 Warning Signs At Particularly Prone Locations For Heavy Vehicle Overturning

Introduce static or dynamic warning signs at locations where heavy vehicles may overturn. The determination of appropriate locations requires analysis of accident 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.

6-ENG-5 Height/Width Signs On Structures

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

6-ENG-6 In-Vehicle Weigh Devices

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

3.2 Enforcement (6-ENF)

6-ENF-1 Implement ‘Manual’ Or Automated Weigh-In-Motion Check Points

Introduce weigh-scales at strategic points in the network to deter overloading. This initiative would require a detail review of the local network to prevent overloaded vehicles from “rat running”, and may require co-ordinated enforcement efforts.

6-ENF-2 Dedicated Motor Carrier Enforcement Units/Police

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

6-ENF-3 Annual Inspection Of Safety And Structural Features Of Vehicles

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

3.3 Education (6-EDU)

6-EDU-1 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.) to inform of the potential damage to infrastructure and the potential safety issues rising from vehicle overloading.

3.4 Policies (6-PO)

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

- 6-PO-1 Limit the weigh per axle permitted;
- 6-PO-2 Prohibit/limit the modifications allowed to be made to certain type of vehicles;
- 6-PO-3 Limit/remove financial incentives for vehicle overloading;
- 6-PO-4 Assign liability to owner/operators;
- 6-PO-5 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.).



MAJOR ISSUE 7

ENCOURAGING PEOPLE TO FASTEN SEATBELTS AND WEAR MOTORCYCLE HELMETS

1. 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. They 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 member 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 that an automobile has. The helmet absorbs 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.

2. RANGE OF COUNTERMEASURES

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
<ol style="list-style-type: none"> 1. Seatbelt systems 2. Establish minimum standards for the crashworthiness of helmets 	<ol style="list-style-type: none"> 1. Campaign aimed at seatbelt / Helmet enforcement 2. S.T.E.P. Campaigns 3. Graduated Fines 	<ol style="list-style-type: none"> 1. Media campaigns to promote the use of seatbelts and helmets 2. Educate police the importance of seatbelts and helmets 	<ol style="list-style-type: none"> 1. Mandatory use of seatbelts and motorcycle helmets

3. DETAILS OF COUNTERMEASURES

3.1 Engineering (7-ENG)

7-ENG-1 Seatbelt Systems

Introduce automatic seatbelt fastening systems. It should be noted that this has been tried in North America and Europe but was met with little success.

7-ENG-2 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.



3.2 Enforcement (7-ENF)

7-ENF-1 Campaign Aimed At Seatbelt / Helmet Enforcement

Enforcement campaigns aimed at Seatbelt and Helmet usage. Enforcement 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.

7-ENF-2 S.T.E.P. Campaigns

See notes at 4-ENF-3

3.3 Education (7-EDU)

7-EDU-1 Media Campaigns To Promote The Use Of Seatbelts And Helmets

Provide focused media campaigns to encourage the use of seatbelts and helmets. The campaign could be delivered through one of the following methods:

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

7-EDU-2 Educate Police 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 using accident statistics and the consequence of not wearing seatbelts or helmets could be helpful in overcoming this difficulty.

3.4 Policy (7-PO)

7-PO-1 Mandatory Use Of Seatbelts And Motorcycle Helmets

Most countries have some form of seatbelt and motorcycle helmet legislation. This is a priority, without such there can be no enforcement. Even those countries that have legislation there are often too many exemptions. Best practise should be that the country should have “Primary” seatbelt and helmet legislation that enables a police officer to stop and give a violation ticket to an unbuckled or un-helmeted driver/passengers.



MAJOR ISSUE 8

VULNERABLE ROAD USERS SAFETY (consolidation of issues: PEDESTRIAN SAFETY AND ELDERLY PEOPLE SAFETY)

1. 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 of 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 traffic growth in the future.

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 pedestrian collisions. Pedestrian collisions involving the elderly tend to occur more at intersections, since older pedestrians tend to cross at intersections. As well, elderly pedestrians tend to walk slower, or may have physical disabilities that compound the problems when crossing an intersection.

2 RANGE OF COUNTERMEASURES

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
<ol style="list-style-type: none"> 1. Implement Proven Countermeasures 2. Provide Basic Infrastructure & Pedestrian-Friendly Infrastructures 3. Pedestrian Facilities Addressing Special Needs 4. Implement Road Safety Audits for Roadway Design 5. Community Zones 6. Pedestrian Mall 7. Improve vehicle design 	<ol style="list-style-type: none"> 1. Enforcement campaign aimed at drivers and pedestrians 2. School Zones 	<ol style="list-style-type: none"> 1. School programs for children 2. Education reminders for elderly pedestrians 3. Safe Routes to School 4. Media campaign aimed at drivers and pedestrians 5. Training of Planners and Engineers 	<ol style="list-style-type: none"> 1. Setting the goal of improving vulnerable road user safety as a priority



3. DETAILS OF COUNTERMEASURES

3.1 Engineering (8-ENG)

8-ENG-1 “Proven” Countermeasures

A large number of pedestrian facilities may be used to improve pedestrian safety at specific locations. The following table provides a matrix of pedestrian safety countermeasures for various types of pedestrian collisions. The table is obtained from the Traffic Safety Toolbox, published by the Institute of Transportation Engineers.

Collision Type \ Countermeasures	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

Other proven countermeasures aimed at improving pedestrian safety related to the road infrastructure are also discussed in Problem 2. These include infrastructure based facilities that have a proven track record in improving road safety (i.e. reducing accidents)



8-ENG-2 Basic Infrastructure Improvements And Pedestrian-Friendly Infrastructures

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 the road authorities' planning and programming. These facilities are safety enhancements that could promote walking and providing the "basic" facilities for the road network and should be incorporated into the building of any new infrastructures. As well, individual programs could be set up with set funding to construct these facilities on an annual basis.

8-ENG-3 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 not limited to):

- Re-time 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

8-ENG-4 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. See Problem 2 for training.

8-ENG-5 Community Zones

Introduce the use of community zones 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.

8-ENG-6 Pedestrian Malls or Shared Facilities

At locations where there is 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 time of 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.

8-ENG-7 Improve Vehicle Design

Encourage and work with the automobile manufacturers to improve vehicle design in lowering the severity of crashes with pedestrians. For example, in the design of the front bumper.



3.2 Enforcement (8-ENF)

8-ENF-1 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.

8-ENF-2 School Zones

Establish a lower speed limit 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.

3.3 Education (8-EDU)

8-EDU-1 School Programs For Children

Establish pedestrian safety programs as part of the educational programs for children at young ages. This would involve developing a curriculum as part of the education.

8-EDU-2 Education Reminders For Elderly Pedestrians

For elderly drivers, introduce volunteered driving refresher course and road tests. Alternately, require the mandatory re-licensing of drivers once a certain age limit is reached.

8-EDU-3 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 be learning about pedestrian safety.

8-EDU-4 Media Campaign Aimed At Drivers And Pedestrians

Focussed media campaigns aimed at vulnerable road users safety. The campaign focus could be:

- Stressing the importance of "being seen" using reflective clothing
- Respect the rights of pedestrians
- Lookout for children
- Yielding right-of-way to pedestrians
- Dangers of jaywalking
- Walking on rural roads

8-EDU-5 Training Of Planners And Engineers

Transportation planners and engineers are traditionally trained to accommodate the automobile. The safe accommodation of vulnerable road users is often forgotten or ignored. Offer professional development seminars to planners and engineers to emphasize the importance of planning and engineering for the safety of pedestrians.



3.4 Policy (8-PO)

8-PO-1 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 as resources are typically diverted to more “worthwhile” projects to accommodate motor vehicles.



This item was consolidated with Issue 8



MAJOR ISSUE 10

COMMUNITY APPROACH TO REDUCE ROAD RELATED INJURIES

1. DESCRIPTION

One of the major challenges to promote and improve traffic safety at the community level is the lack of participation of the whole community. 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 the lack of participation.

There is also a general lack of coordination between various agencies to improve traffic safety. Sometimes, it resulted in the detriment of traffic safety conditions. The lack of partnership and consensus building mechanisms further exacerbated 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 encompasses all three E's of traffic safety and would require some consensus building in their successful implementation.

2. RANGE OF COUNTERMEASURES

ENGINEERING (ENG)	ENFORCEMENT (ENF)	EDUCATION (INCL. TRAINING AND PUBLICITY) (EDU)	POLICY (PO)
1. Area-wide Traffic Calming 2. Black Spot Programs with community input		1. Safe Route to School	1. Develop community road safety strategies

3. DETAILS OF COUNTERMEASURES

3.1 Engineering (10-ENG)

10-ENG-1 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 the local police, community groups, engineers and planners to work together in addressing and solving the issues. Furthermore, it also promotes the spirit of co-operation.

10-ENG-2 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 would be most familiar with the local traffic safety issues. Engineers working on the Black Spot programs should be encouraged to communicate with the residents in finding out the root causes of the problems and in developing countermeasures that are acceptable to the community.



3.2 Education (10-EDU)

10-EDU-1 Safe Route To School

Please refer to 8-EDU-3

3.3 Policy (10-PO)

10-PO-1 Develop Community Oriented Road Safety Strategy

A community would need to decide on the priorities to address various traffic safety problems. Use engineering, enforcement and educational resources to assist the community to develop a road safety strategy. In the United Kingdom, this effort was piloted in the “Safer City” program in Gloucester. The “safer city” approach made use of the three E’s of road safety in developing its strategy to reduce traffic accident related injuries and involved extensive consensus building.

A possible way to out reach to community is through the use of road safety officers or co-ordinators. These officers could serve as the liaison between the community and the government and could often provide the catalyst required to effectively address certain road safety issues.

Regardless, an effective community oriented road safety strategy would require strong leadership and commitment from the public sector for success.



MAJOR ISSUE 11 ACCIDENT BLACK SPOT APPROACH TO REDUCING ACCIDENTS

This item was consolidated with Issue 2



MAJOR ISSUE 12

RAISING THE ATTENTION OF ALL SOCIETY TO ROAD SAFETY PROBLEMS

1. DESCRIPTION

In order to raise the attention of all 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 traffic safety.

Public Sector

The public sector includes the following agencies that can help in the delivering a road safety plan:

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

Private Sector

The private sector includes the following agencies that can help in the delivering a road safety plan:

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

Non Governmental Organizations (NGOs):

The NGOs include the following agencies in the delivering a road safety plan:

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

Their roles and responsibilities are discussed in the organization section.

In raising the attention of society to the road safety problems, the initiatives involve high-level policy commitments from the various players. The key factors are highlighted below:

- 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 and 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



- Comprehensive public education campaign
- Include a road safety awareness element in every safety intervention



Section 2

Preliminary Evaluation Criteria

DEVELOPMENT OF THE EVALUATION CRITERIA:

1. Recognize the challenges

- Wide spectrum of road safety programs and initiatives that may or may not be appropriate for different member economies.
- Some of the highly mobilized economies already have advanced programs and state-of-the-art approach to road safety. These economies will also possess the knowledge and may not be interested in the APEC initiatives.
- Significant gap in the availability of road safety funding for the APEC economies.
- Significant difference in how road safety is planned and administered in various APEC economies.

2. Strategic Response to the Challenges

- Use APEC internal know-how to advance road safety in the region.
- Target member economies where road safety programs are not fully developed.
- Adopt a practical/cost-effective package of road safety initiatives that APEC will be prepared to promote/recommend and support.
- Tailor this package of initiatives to the needs of the Volunteering Economies prior to the Pilot Implementation (Phases II and III).

3. Proposed Strategy

Define “best practices” as those initiatives that encourage participation of member economies by fulfilling the following key success factors:

- Demonstrating effectiveness in relative short time;
- Attracting funding from non-governmental agencies;
- Providing high visibility/profile to the public at large;
- Can be replicated and sustainable;
- Can be supported (technically) by 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;
- Can be monitored and evaluated for the benefit of all member economies;



4. Proposed Evaluation Criteria

The proposed evaluation criteria are based on the strategic objectives set above. Note that each criteria has “degrees” of achievement, and these will be considered through the evaluation process.

- ***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.
- ***Replicability***
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).



Section 3

Discussion on the Roles and Responsibilities of the Public Sector, Private Sector and NGOs to Improve Road Safety

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.

Public Sector

The public sector includes the following agencies that may contribute to the delivery a road safety plan:

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

Private Sector

The private sector includes the following agencies that may contribute to the delivery a road safety plan:

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

NGOs:

The NGOs include the following agencies in the delivering a road safety plan:

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

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



PUBLIC SECTOR	PRIVATE SECTOR	NON-GOVERNMENTAL ORGANIZATIONS
<p>Government</p> <ol style="list-style-type: none"> 1. Provide leadership and a framework for the development and implementation of effective road safety policies. 2. Provide high standards of accountability in meeting road safety objectives and to ensure the effective use of resources. 3. Provide funds for road safety programs that maximize benefits. 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. 5. Ensure that planning of local facilities and residential areas effectively takes account of the road safety needs of the community. 6. Where possible, fund and implement road safety programs and initiatives. 7. Ensure effective policies for the control and enforcement of liquor laws. 	<p>Media</p> <ol style="list-style-type: none"> 1. Enhance community awareness and understanding of the causal factors and real costs of road crashes. 2. Support road safety initiatives through responsible and objective reporting. 3. Influence societal changes which lead to a reduction in unacceptable driver behaviour and poor attitudes. 4. Discourage advertising which glamorizes and/or promotes unsafe practices and products. 5. Actively encourage safer practices and products. 	<p>Communities and Local Organizations</p> <ol style="list-style-type: none"> 1. Provide support and leadership for road safety campaigns and initiatives. 2. Demonstrate a concern for the number of road deaths occurring and a commitment to foster improvements. 3. Persuade various communities to accept a greater participatory role in road safety improvements. 4. Work with other organizations in providing road safety education/publicity and other road safety programs.
<p>Education Providers</p> <ol style="list-style-type: none"> 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. 2. Develop links between schools and other agencies, such as the road authority, local road safety committee and police, in relation to road safety. 3. Assist in the life-long 	<p>Insurance Industry</p> <ol style="list-style-type: none"> 1. Assist in the development, sponsorship and funding of crash prevention programs. 2. Provide premium incentives as a means of encouraging and rewarding safer behaviour. 3. Provide feedback to government and regenerative crash trends and outcomes to assist in the further development of road safety policy. 	<p>Motoring Associations</p> <ol style="list-style-type: none"> 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. 2. Support, promote and sponsor effective road safety initiatives and campaigns. 3. Provide membership



PUBLIC SECTOR	PRIVATE SECTOR	NON-GOVERNMENTAL ORGANIZATIONS
education of road users.		feedback to government and industry on road safety policy and new initiatives.
<p>Police and Enforcement Agencies</p> <ol style="list-style-type: none"> 1. Improve road user behaviour and vehicle standards through a balance of education, 2. Encouragement and effective enforcement strategies. 3. Maximize enforcement effectiveness using proven enforcement systems and technology. 4. Maintain a high level of expertise in crash/casualty reporting. 5. Focus on high-risk behaviours and use casualty and crash data to identify locations and where police enforcement could minimize such unsafe behaviours. 	<p>Alcohol and Hospitality Entertainment Industry</p> <ol style="list-style-type: none"> 1. Adopt responsible standards of alcohol serving and host responsibility programs, especially for young adults. 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. 3. Promote the consumption of low-alcohol beverages in preference to higher proof drinks. 4. Advertise and promote alcohol responsibility. 	<p>Research Organizations/Universities</p> <ol style="list-style-type: none"> 1. Ensure that there is a balance between research on basic and applied topics. 2. Ensure that road safety research is of high quality, timely and that its implications are identified and promoted. 3. Ensure the development of high quality databases. 4. Evaluate effectiveness of measures implemented to ensure cost effective expenditure. 5. Provide reliable research results and knowledge against which policy decisions can be made.
<p>Health Agencies</p> <ol style="list-style-type: none"> 1. Ensure development of effective emergency medical/services. 2. Advise patients on their fitness to use the road, including the effects of prescribed drugs and medication on road user performance. 3. Provide feedback from injury assessment to improve vehicle occupant protection and road safety policy. 4. Provide health promotion road safety programs. 5. Liaise with other practitioners in the road safety field to avoid duplication of effort. 	<p>Vehicle Manufacturers and Importers</p> <ol style="list-style-type: none"> 1. Improve crashworthiness features of vehicles including enhanced occupant protection 2. Progressively introduce in-vehicle crash avoidance technology. 3. Adopt an advertising code which promotes the safety features and safety performance of vehicles and their responsible use. 4. Discontinue importation of crashed vehicles. Such crashed vehicles must be repaired/restored in the originating country before being imported. 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. 	



PUBLIC SECTOR	PRIVATE SECTOR	NON-GOVERNMENTAL ORGANIZATIONS
<p>Road Authorities and Highway Agencies</p> <ol style="list-style-type: none"> 1. Adopt effective and safe traffic management measures in planning transport and land-use developments. 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. 3. Improve the safety performance of the road network by ensuring that planning, design, construction and maintenance places a high priority on safety outcomes. 4. Apply crash reduction and crash prevention techniques to create safer road networks for the future. 5. Review and safety audit existing, rehabilitated and new roads to eliminate unnecessary hazardous locations and misleading/absent markings. 	<p>Transport Industry</p> <ol style="list-style-type: none"> 1. Adopt responsible freight forwarding and driving schedules which permit adequate rest breaks and promote driver safety. 2. Prevent the abuse of alcohol and drug stimulants and promote healthy lifestyle habits amongst drivers. 3. Ensure high standards of vehicle, mechanical safety, and load stability and security. 4. Enhance industry professionalism and safety through improved fleet management. 	
<p>Driver Training/Licensing Bodies</p> <ol style="list-style-type: none"> 1. Require all learner vehicles to display signs. 2. Equip learner and novice drivers with the necessary skills, attitudes and behaviour needed to drive safely on our roads. 3. Maintain and foster a high standard of driver training, instruction and professionalism. 4. Promote and foster the upgrading of driving skills amongst drivers, particularly drivers of heavy and public service vehicles. 5. Establish an Association and enhance industry professionalism by developing a Code of 		



PUBLIC SECTOR	PRIVATE SECTOR	NON-GOVERNMENTAL ORGANIZATIONS
Providers teaching materials, Driving Instructors training programs, etc., for their members.		
<p>1.1. All Organization</p> <ol style="list-style-type: none"> 1. Develop internal safety policies for their staff including host responsibility. 2. Promote safe practices in fleet operation. 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. <p>1.2.</p>		
<p>Individual Road Users</p> <ol style="list-style-type: none"> 1. Attain a greater understanding, awareness, and practice of safe behaviour and skills. 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. 		

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>.



Section 4

Discussion on Funding / Partnership Issues

CURRENT APEC ECONOMIES STATUS:

- Majority of road safety funding comes from government
- Consensus is that funding level is inadequate

Other sources:

- Donations: rare
- Funds from other organizations: rare
- Commerce activities: rare

POTENTIAL SOURCES OF ROAD SAFETY FUNDING:

- Licensing fee / surcharge: percentage dedicated for road safety funding;
- Gas Tax / Fuel Levy: percentage dedicated for road safety funding and/or coverage for uninsured;
- State/Province Insurer: dedicated intervention programs;
- Traffic Fines: percentage dedicated for road safety funding;
- Corporate Sponsors: “branding” of corporate products associated with the promotion of road safety.

POTENTIAL PARTNERSHIPS FOR ROAD SAFETY FUNDING:

Insurance Industries: *Important but often ignored player*

- **Road Safety Levy from Insurance Premium:** Nordic countries such as Finland and Switzerland impose a road safety levy in auto insurance to finance road safety organizations. Korea collects a levy of auto insurance premiums dedicated towards the operating costs of the Korea Road Traffic Safety Association (RTSA). Typical levy is less than 2% of the premium.
- **Donations from Insurance Sector:** Volunteer donations from the insurance industry appears to be much more popular. For example, Fiji’s National Road Safety Council (NRSC) and the Austrian Road Safety Council receives a percent of their income from insurance companies. The International Institute of Highway Safety (IIHS) in the United States is funded by the 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.
- **Sponsored Organizations from Insurance Industry:** A number of road safety organizations in European countries are sponsored by the auto insurance industry. Example: Belgian Road Safety Institute, Royal Society for the Prevention of Accidents in the U.K., Austrian Road Safety Board, Traffic Safety Committee of Insurance Companies (VALT) in Finland, Securite Routiere a.s.b.l. in Luxembourg.



SPONSORSHIP OF SPECIFIC INTERVENTIONS:

- Education/Publicity: Aggressive driving, Youth Initiatives, Seat Belts, Helmets, Drinking and Driving, Speeding, Children's Road Safety, etc...
- Road Safety Infrastructures: Investing in improving accident black spots, Training
- Traffic Law Enforcement: Sponsoring additional or enhanced enforcements targeted at drinking and driving, speed, safety cameras (red light and speed), etc...
- Driver Training: driving schools, advanced driver training, etc...
- Vehicle Safety: advocates safety devices such as head restraint, seat belt reminder systems, air bags, etc...

KEYS TO SUCCESS:

- 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.



Appendix A

Range of Countermeasures



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 accident 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 with limited visibility, High speed intersections	10% to 25% of all crashes
Remove Unwarranted Signals	Traffic control is inappropriate for location, driver frustration leading to non-compliance; rear-end	Signalized intersections, Review on a case by case basis	30% to 55% of all crashes



COUNTERMEASURE	SAFETY PROBLEM	TYPICAL APPLICATION	EFFECTIVENESS (PERCENT REDUCTION)
	and right angle crashes		
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