

A STRATEGIC APPROACH FOR SAFETY: PUTTING KNOWLEDGE INTO PRACTICE

27 September 2011 (pm)

STRATEGIC THEME C SAFETY OF THE ROAD SYSTEM

INTRODUCTORY REPORT

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EXECUTIVE SUMMARY

As the world's population continues to grow and increasing numbers of people desire new levels of mobility, the need for roadway safety has never been greater. Hundreds of thousands of people are killed in roadway accidents and millions more are injured each year. As a result, road agencies are motivated to re-examine their efforts in promoting road safety, working to increase drivers' awareness of road safety issues, as well as establishing policies and utilizing engineering and technological tools to promote road safety and ultimately reduce traffic-related injuries and fatalities. The renewed emphasis on reducing injuries and fatalities on the world's roadways presents an opportunity to evaluate and compare the means by which road agencies are setting and achieving their safety-related goals, and it provides a unique opportunity to share this information for implementation worldwide.

The UN Road Safety Collaboration has developed a Global Plan for the Decade of Action for Road Safety 2011-2020 with input from many partners through an extensive consultation process through meetings and the Internet. The Plan provides an overall framework for activities, which may take place in the context of the Decade. The categories or "pillars" of activities are: building road safety management capacity; improving the safety of road infrastructure and broader transport networks; further developing the safety of vehicles; enhancing the behavior of road users; and improving post-crash care. Indicators have been developed to measure progress in each of these areas. Governments, international agencies, civil society organizations, the private sector and other stakeholders have been invited to make use of the Plan as a guiding document for the events and activities they will support as part of the Decade of Action.

This paper summarizes the reports from 16 PIARC member nations describing their recent, ongoing, and future activities to improve safety on their respective roadway systems. The information is focused on the countries' strategic plans and approaches, and on the transfer of knowledge into practice. Reporting countries have instituted national safety programs that established ambitious goals for reducing crashes, fatalities, and injuries, and many of them have been quite successful in meeting their goals. While some of the goals may be similar from country to country, the methods they use to achieve those goals are many; each road safety program is comprised of a variety of strategies, ranging from traditional engineering treatments to innovative methods in technology, education, enforcement, and policy. These treatments are intended to provide a consistent high standard of roadway design, a population of well-trained drivers who are compliant with applicable laws, and a set of guidelines and regulations that promotes increased safety in the future.

Road agencies are also finding new ways to put new information into practice, collaborating with other government agencies, universities, private consultants, and agencies in other countries. These solutions allow agencies to expend resources more efficiently, focusing efforts on particular locations with specific issues that will produce added benefit from new safety treatments. They also allow agencies to communicate more effectively with their stakeholders and partners, to gain an appreciation for the safety needs that are most important to them. Finally, it provides new opportunities to share information with agencies in other nations that may be facing the same safety issues, facilitating the use of effective strategies and treatments on road systems worldwide.

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1. INTRODUCTION

Road safety continues to be a global concern. Deaths and injuries resulting from road crashes occur on streets and highways in nations around the world, motivating road agencies to reemphasize their efforts to increase drivers' awareness of road safety issues, as well as establish policies and utilize engineering and technological tools to promote road safety and ultimately reduce traffic-related injuries and fatalities.

1.1. Background

The renewed emphasis on reducing injuries and fatalities on the world's roadways presents an opportunity to evaluate and compare the means by which road agencies are setting and achieving their safety-related goals, and it provides a means by which information can be shared among road agencies worldwide. With that in mind, PIARC has chosen "A Strategic Approach for Safety: Putting Knowledge into Practice" as one of its Strategic Direction Sessions for the XXIVth World Road Congress. A Call for National Reports was issued in relation to this session, focusing on two key elements of safety programs: (i) strategic plans and approaches and (ii) the transfer of knowledge into practice. A total of 16 National Reports were received and reviewed in response to this call, from the following countries (with abbreviations used in this report shown in parentheses):

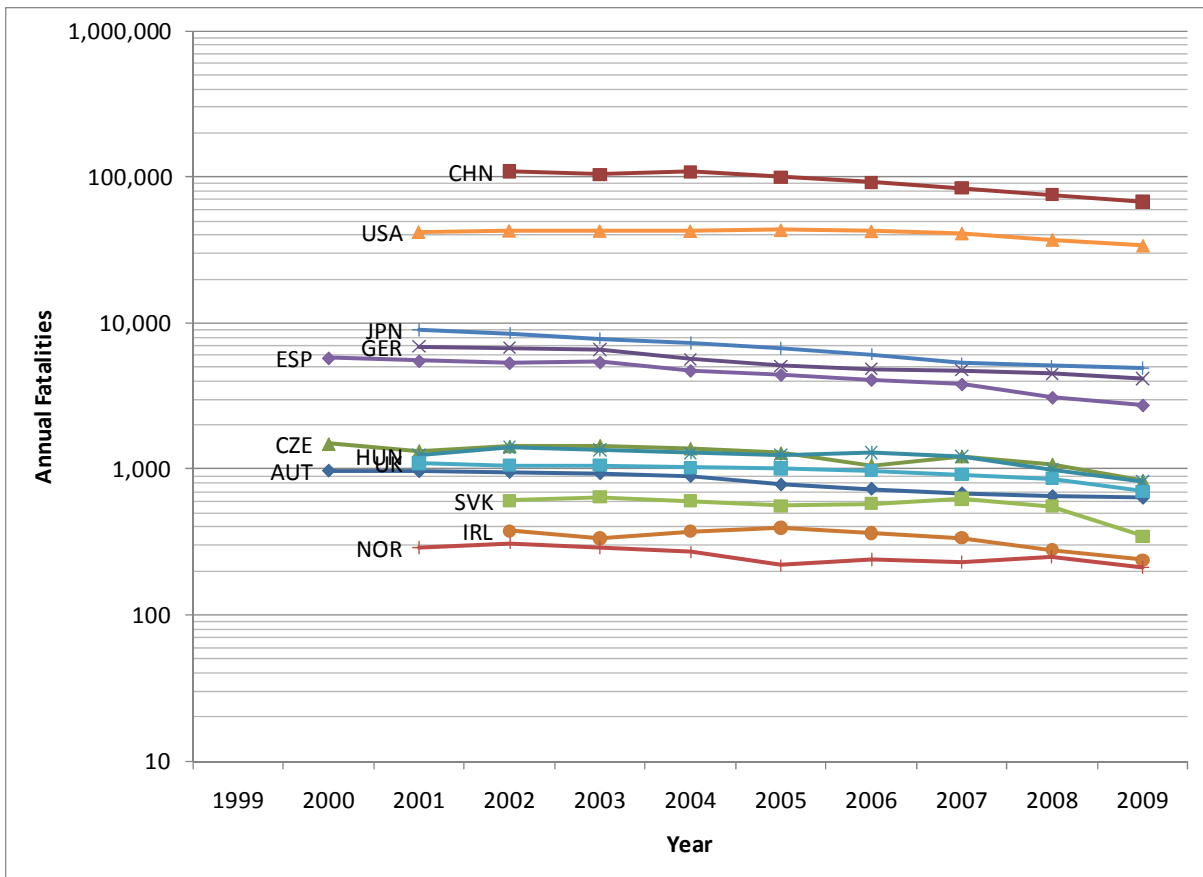
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- Germany (GER)
- Hungary (HUN)
- Ireland (IRL)
- Japan (JPN)
- Mexico (MEX)
- Norway (NOR)
- Romania (ROM)
- Slovak Republic (SVK)
- Spain (ESP)
- Switzerland (SUI)
- United Kingdom (UK)
- United States of America (USA)
- Vietnam (VIE)

This Introductory Report will summarize the information presented in those National Reports. It will serve as background for the Strategic Direction Session for the World Congress and offer conclusions based on the findings submitted by each country.

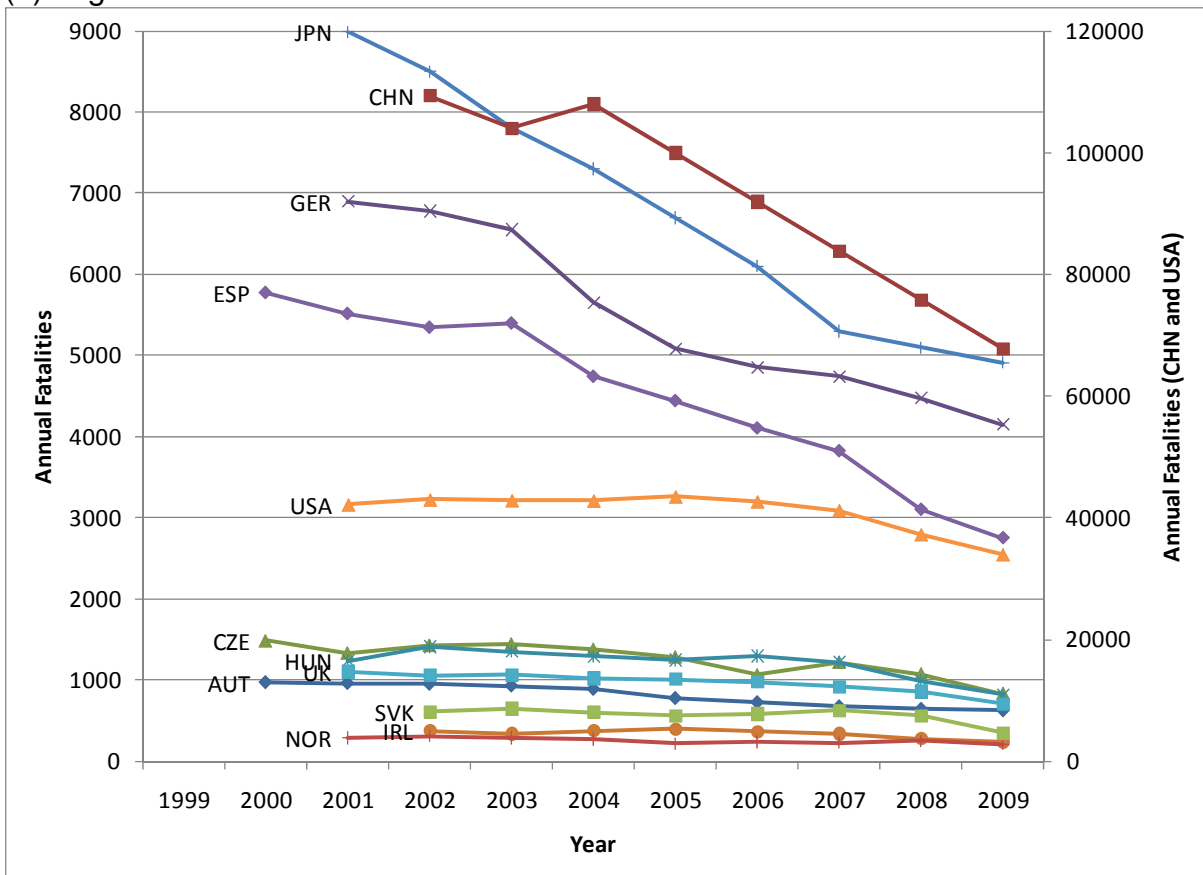
1.2. Current and Recent Trends

Most of the reporting countries included annual fatality, injury, and/or crash data in their reports. Each of those countries indicated that there have been declines in the number of fatalities and/or injuries on their respective roadway networks in recent years. Figure 1 provides examples of these trends in fatality data from the 12 countries from which annual data were available. These declines have come, in many cases, despite increases in distance traveled, number of registered vehicles, or overall population. China, in particular, has continued to add tremendous amounts of new roadways, new vehicles, and new drivers to their road network in the last 5 years.

Because the reporting countries have such a large difference in the magnitude of annual fatalities, displaying the data in a truly comparative format is important. Figure 1a displays the data on a logarithmic scale to display each country's data; this format is better for understanding the difference in magnitude of the crashes for China and the United States as compared to the other 10 countries shown on the figure. The logarithmic scale, however, makes it more difficult to appreciate each country's decline in fatalities over time.



(a) Logarithmic scale



(b) Linear scale with primary and secondary axes

Figure 1. Estimated Annual Road-Related Fatalities in Reporting Countries.

Figure 1b shows the data on a traditional linear scale, but it uses two vertical axes to scale the data and show actual annual changes in fatalities. This format better illustrates that each country showed noticeable declines in fatalities over the decade on a percentage basis, but the annual totals from China and the United States are read based on the secondary axis on the right side of the figure, while the remaining countries are read from the primary axis on the left side.

In European countries, the declines in fatalities, injuries, and crashes are at least partially attributed to new policies enacted in response to the passage of Directive 2008/96/EC of the European Parliament, which introduces a comprehensive system of road infrastructure safety management in its member countries.¹ Credit has also been given to Vision Zero-related policies that have been implemented in an increasing number of countries, such as Norway.²

Some areas of concern continue to exist in selected countries, drunk driving and low use of safety devices (e.g., seat belts, motorcycle helmets) being two of the most notable. These two items in particular have bases in societal influence and require approaches related to education and enforcement rather than engineering and technology.^{3,4} These and other trends, and various nations' approaches to address them, are discussed in the following sections of this report.

2. STRATEGIC PLANS AND APPROACHES

The information gained by a comparison of the strategic approaches taken by countries in advancing safety programs and their road safety policies will be beneficial for all countries. Some key components of the process for advancing these safety programs include:

- Examining the approaches that have been used to develop and execute road safety strategies, policies, and action plans.
- Establishing road safety goals and targets.
- Monitoring and measuring the progress made toward their accomplishment.

In their reports, the reporting countries have described a variety of methods and policies that they either have already enacted or will begin in the near future. These methods and policies have similarities in that they all seek to positively affect road safety, but they also have differences that are tailored to meet the specific needs of the countries in which they are applied. Each of the solutions highlighted in this section of the report fall into one or more of the component categories listed above.

2.1. Development and Execution of Comprehensive Safety Strategies

The strategies and solutions available to road agencies to improve road safety typically belong to one of four types: engineering, enforcement, education, or policy. A

¹ Transport: Safety Management of Roads. European Commission – Mobility & Transport. http://ec.europa.eu/transport/road_safety/infrastructure/safety_management_roads_en.htm. Accessed 10 March 2011.

² Amundsen, Finn Harald. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Norway – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

³ Mendoza-Díaz, Alberto, Emilio Mayoral-Grajeda, and Antonio García-Chávez. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Mexico – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁴ *Programa de Acción Específico 2007-2012 de Seguridad Vial* (Specific 2007-2012 Action Program on Road Safety) (PROSEV), Secretaría de Salud, México.

comprehensive safety plan will frequently involve strategies of multiple types, perhaps all four types, to accomplish its goals. Examples from each of the four types of solutions are presented here.

Engineering

The basic infrastructure of a roadway network is the foundation upon which all of the other components are built. Having an infrastructure that promotes safety is one of the most important engineering solutions a road agency can undertake, particularly in a nation where the infrastructure is aging or the road system is still being developed. A road system that lacks basic safety-related criteria for design, operations, or maintenance limits the effectiveness of other safety treatments. Upgrading existing facilities and building new facilities that meet modern criteria for safety establishes a starting point that facilitates the successful use of additional treatments.

China has instituted one such program as part of its Regulatory Project for Safety of Traffic Infrastructure.⁵ By the end of 2009, there were 621,900 highway bridges in China, most of which were built in the last two decades. Due to aging, structural damage, and relatively low design standards, some bridges were rated as dangerous and posed a potential threat to traffic safety. China's Ministry of Transport decided in 2007 to invest more in renovating potentially dangerous bridges, and renovations began in 2008. Ministry officials prioritized needs based on roadway class (e.g., national and provincial artery highways first, county and town highways second) and span length, and set out a plan to complete all renovations on national and provincial artery highways, as well as critical bridges on county and town highways, within three years.

The Czech Republic has also instituted a new initiative to improve maintenance and modernization, introducing a system of road safety audits, inspections, and treatment of accident black spots (i.e., locations with a history of particular safety or crash problems).⁶ There is a difference in the safety standard between newer expressways and older high-speed roads, though both have a posted speed limit of 130 km/h. New sections have a very high modern safety standard, but older roads have needs for updated infrastructure, mostly related to unprotected support structures for advertisements, very short or missing guardrails at overpass supports, short or non-existent acceleration and deceleration lanes, and sharp drop-offs at roadway edges, as shown in Figure 2. The new maintenance and modernization initiative will prioritize these needs, emphasizing common infrastructure improvements to improve safety along the nation's road network.

⁵ Zhang, Gao-qiang and Jian-jun Zhang. *A Strategic Approach for Safety: Putting Knowledge into Practice*, China – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁶ Landa, Jiri and Josef Mikulík. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Czech Republic – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.



Figure 2. Lack of Roadside Shoulder along High-Volume Road in Suburb of Prague.⁶

Ireland's National Roads Authority (NRA) published Guidelines on Traffic Calming.^{7,8} The Guide provides information on data collection and analysis, sets out the road safety criteria for intervention, and includes a series of standard layouts for traffic calming on the approaches to small towns and villages. The NRA found that the posting of speed limits alone, without any physical speed reducing measures, did not always encourage drivers to slow down sufficiently. The traffic calming schemes, funded by the NRA, aim to improve the safety of national roads where they pass through towns and villages. The extent of calming required is determined by geometric, traffic, and safety criteria.

Figure 3 shows gateway and plan layouts for a Type 3 design, which is intended for roads with hard shoulders and with a right of way width of between 15.7 m and 19.2 m and where public lighting exists or is proposed. Up to the end of 2009, traffic calming measures were installed in nearly 200 towns and villages. The NRA published a report⁹ on a 5-year before-and-after evaluation for the traffic calming schemes installed on national roads before the end of 2002. In that report, the village of Grange was discussed as a case study; in 2000, Grange received a gateway treatment similar to that shown in Figure 3. In the 4 years prior to the treatment, there were nine crashes in the village; four of the nine collisions were single-vehicle incidents and two were pedestrian collisions, both involving pedestrians attempting to cross the road. Skidding occurred in six of the nine collisions, which was an unusually large proportion and suggested that there was a high incidence of sudden braking from high speeds. In the four years after implementation of the scheme there were only two collisions, one in the village center where the rear of a

⁷ Cullen, Harry. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Ireland – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁸ NRA Guidelines on Traffic Calming for Towns and Villages on National Routes, National Roads Authority, 2005 <http://www.nra.ie/Publications/DownloadableDocumentation/RoadSafety/file,3651,en.pdf>. Accessed 10 March 2011.

⁹ Curtis, L. Evaluation of Traffic Calming Schemes Implemented from 1997 to 2002. National Roads Authority, Dublin, 2008. <http://www.nra.ie/Publications/DownloadableDocumentation/RoadSafety/file,15926,en.pdf>. Accessed 10 March 2011.

- In the medium term, the design standard for the highest priority national highways must be upgraded to motorways. This will provide a series of high-capacity roads designed to safely carry traffic at higher speeds on carriageways of two, three or four lanes in each direction.
- Install grade-separated interchanges that connect to the local road network on high-priority highways.
- Ban certain types of transport from these highways, such as pedestrians, bicycles, horses and agriculture vehicles, and underpowered vehicles.
- Close unauthorized businesses near the roadside to provide space for a hard shoulder or emergency lane.



Figure 4. Roadside Development in Vietnam.¹¹

The Welsh Assembly Government provides grants to local authorities each year to contribute towards solutions to road safety problems in their respective areas.¹² The grant program is in addition to local authorities' own highway and traffic engineering budgets. The most recent analysis showed that, aggregated together, 615 engineering schemes demonstrated an average annual reduction in personal injury collisions of around 46 percent. The consequent average annual reduction in the number of people killed or seriously injured was 52 percent.

The Welsh Government has also been actively promoting and supporting the increase in the number of 20 mph limits in Wales and local authorities have been encouraged to implement these where appropriate. There are currently in excess of 480 schemes in Wales, around 66 percent of which were funded by the Welsh Assembly Government, either from the annual Local Road Safety Grant or via the Safer Routes in Communities (previously Safe Routes to School) Programme. A recent evaluation of 414 of these schemes showed average annual reductions of around 38 percent and 42 percent in personal injury collisions and killed / seriously injured casualties, respectively. Before-and-after speed data for a smaller sample of locations showed an average speed reduction of 4.8 mph.

¹² Vowles, Graeme, Hugh Gillies, Alison Jones, Stuart Lovatt, and Greg McClelland. *A Strategic Approach for Safety: Putting Knowledge into Practice*, United Kingdom – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

While engineering solutions alone cannot solve all safety problems, they do promote the use of a single standard throughout a jurisdiction for specific roadway classes, which improves driver expectancy and removes potential obstacles to safe travel. These solutions are especially important in nations with a developing roadway network, but they are also useful in countries where portions of the infrastructure are aging and modernization would be beneficial.

Enforcement

On roadways where the design and the traffic control devices are of high quality, safety problems may still exist because of noncompliance with applicable traffic laws. Impaired/distracted driving, improperly loaded commercial vehicles, drivers lacking valid licenses, and improperly maintained vehicles are all potential causes of crashes, injuries, and fatalities. Some reporting nations highlighted particular enforcement countermeasures that they have implemented or have reason to believe will be successful if implemented.

A survey of driver opinions in Austria revealed that more than two-thirds of persons interviewed agreed that enforcement of legal provisions and punishment for traffic violations are useful and called for increased enforcement of traffic laws, and tougher penalties for traffic offences.¹³ This response was higher than for drivers in other European countries. The same study revealed that four out of five persons interviewed approved tougher fines for drivers under the influence of alcohol and advocated lowering the current alcohol limit by approximately one-third. The results from this survey could be used to facilitate the development of new legislation or new enforcement programs, but details of such developments were not provided in the report.

In 2005, the Spanish Traffic Management Centre instituted a triennial plan for the period 2005-2007 to install an automated speed control system, consisting of 518 speed control cabins equipped with 280 cinemometers.¹⁴ The main objectives of the Spanish plan were to reduce:

- The maximum driving speeds and to eliminate the highest speeds.
- The average speeds on the roads.
- The speed gradients.
- The number of surveillance officers specifically engaged in speed control, enabling a larger presence on the roadways for other services.

Analysis of 4 years of data on Spain's automated speed control network led to the following conclusions:

- The maximum speeds captured in the network monitored by the automated system were clearly lower than those registered at the beginning of the plan.
- As shown in Figure 5, average speeds were reduced substantially, not only at the speed control points, but in the network as a whole.
- The number of victims of fatal accidents decreased noticeably.

¹³ Eichinger-Vill E.-M. and B. Lautner. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Austria – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

¹⁴ Llamas Rubio, Roberto, Pablo Pérez de Villar, José M^a Pardillo Mayoral, Rafael Jurado Piña, Enrique Belda Esplugues, Ana Arranz, Beatriz Molina. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Spain – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

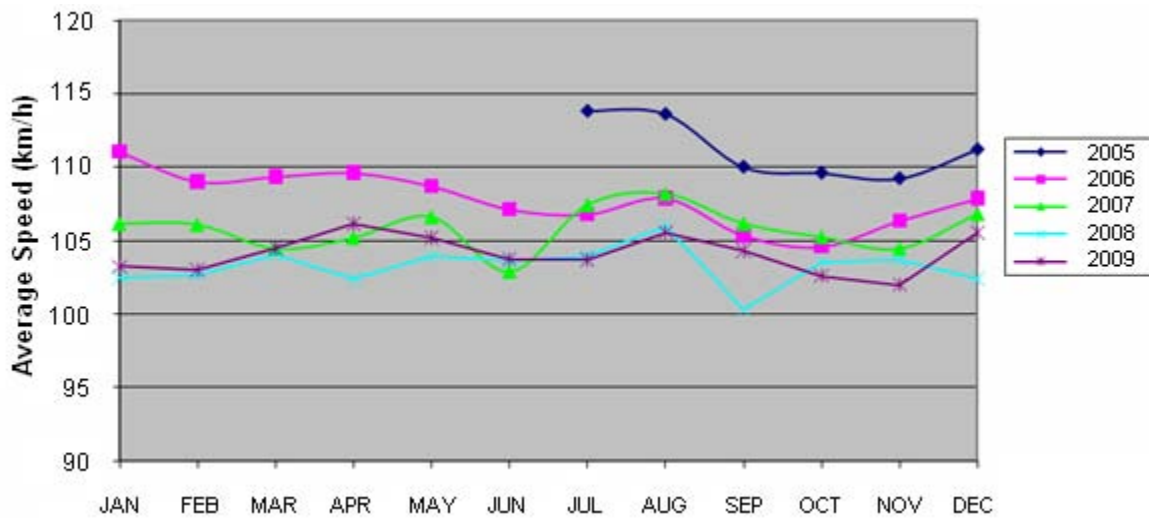


Figure 5. Average Monthly Driving Speeds at Radar Stations under Spain's Automated Speed Control System (Posted Speed Limit 120 km/h).¹⁵

When roads are built to comply with modern standards for geometry and traffic control devices, engineering countermeasures alone may not produce results needed to correct a problem at a particular location, especially if that location is experiencing a problem with poor compliance with roadway laws and regulations. Reporting countries have indicated that the implementation of enforcement measures can support the improved driving environment created on high-standard roadways, and increased compliance with laws appropriate for those roadways can be effective in improving safety.

Education

Closely related to enforcement of laws and regulations is education. Road users must be aware of the consequences of violating traffic laws and practicing unsafe driving habits, both in terms of legal liability and in terms of crashes, injuries, and fatalities.

Accident statistics from Mexico indicate that the largest percentages of accidents occurred on the road network patrolled by the Federal Police are due to speeding drivers (39 percent); invading a traffic lane (9.4 percent); for carelessness or inattention (5.9 percent) and for driving in a state of drunkenness (1.4 percent).¹⁶ Mexico's report makes a point to mention, however, that the percentage of crashes attributed to drunk driving is not representative of the actual proportion of crashes because it is commonly not listed in the accident report. The recently instituted Road Safety Program (RSP) of the Ministry of Communications and Transport (SCT) contains several strategies for educating road users. Among those strategies is the use of advertising campaigns among mass media (e.g., radio and television) to promote Road Safety Education and to create awareness among road users of:

- Compliance with alcohol consumption limits and with traffic signs.
- Presence of pedestrians and bicyclists.
- Compliance with speed limits, particularly on weekends and vacation terms.

¹⁵ Llamas Rubio, Roberto, Pablo Pérez de Villar, José M^a Pardillo Mayoral, Rafael Jurado Piña, Enrique Belda Esplugues, Ana Arranz, Beatriz Molina. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Spain – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

¹⁶ Mendoza-Díaz, Alberto, Emilio Mayoral-Grajeda, and Antonio García-Chávez. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Mexico – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

- The use of safety devices (e.g., safety belts, child restraining systems, and safety helmets) among users.

The Global Road Safety Partnership (GRSP) has joined with the government, businesses, and non-profit groups in Hungary to form an association known as the Partnership for Road Safety.¹⁷ One of their prominent activities is a safety belt campaign started in 2008 based on a previous campaign by the government's National Committee for Accident Prevention. Within this project, billboards were set up at motorway rest areas, at the exits of fuel stations, and in parking lots of supermarkets. According to report authors, these locations proved to be appropriate in raising the awareness of drivers and their passengers on usage of safety belts.

Strategic use of educational programs can be very effective, particularly for young people before they become drivers, at training the public on appropriate road user behaviors. A road user population that is properly trained and understands the legal and safety effects of appropriate and inappropriate actions will be much more likely to obey relevant laws and operate their vehicles in a safe manner, and the need for enforcement. It must be remembered, though, that unless there is some form of mass media communications effort associated with an educational program, or there is a plan for implementing these countermeasures widely across a jurisdiction or across the majority of communities within that area, educational measures are likely to have only a specific, short-lived effect. That is, their impact will be limited to those targets where such programs are implemented (e.g., in a specific school or community).¹⁸

Policy

Nearly every country report identified at least one new policy related to road safety. In many cases, it was a set of laws or regulations that would guide the road agency's future endeavors in building and maintaining the roadway system. In other cases, a new agency or commission was established to help focus and coordinate the agency's activities on safety-related initiatives. Each new program, however, represented an agency's effort to apply new strategies to achieve positive, measurable improvements in road safety.

The Austrian Road Safety Programme for 2002 to 2010 focused on four basic categories of factors that contribute to roadway safety: human behavior, infrastructure, vehicles, and transport policy/legal framework.¹⁹ A total of 31 priority areas were listed in these categories and over a hundred specific measures were defined to determine the success of the program.

- Human behavior activities focused on restraint systems, alcohol and other drugs, driving speed, basic driver education and advanced driver training, pedestrian safety, driver fatigue, motorized two-wheeled vehicles, following distances and traffic education.
- Infrastructure activities focused on high-risk site management, safety on rural roads, tunnel safety, wrong-way driving on motorways, safety management in urban areas, the implementation of Road Safety Audits (RSA) and Road Safety Inspections (RSI),

¹⁷ Hóz, E., Cs. Koren, and T. Mocsári. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Hungary – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

¹⁸ Preusser, D.F., A.F. Williams, J.L. Nichols, J. Tison, and N.K. Chaudhary. *Effectiveness of Behavioral Highway Safety Countermeasures*. NCHRP Report 622. Transportation Research Board, Washington, 2008.

¹⁹ Eichinger-Vill E.-M. and B. Lautner. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Austria – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

motorway roadwork zones, the properties of road surfaces, roadside telematics, and railway level crossings.

- Vehicle activities included the introduction of accident data recording, heavy goods vehicle safety as well as active and passive vehicle safety.
- Transport policy and legal framework covered the themes of the European Road Safety Charter, the Austrian Road Safety Council, independent accident investigation, heavy goods transport, legislation, land use planning, and influencing modal choice.

Hungary's National Road Safety Program for 2008 to 2010 is a comprehensive package of measures for improving road safety.²⁰ The Action Program itself contains the guidelines, objectives, actions and measures of road safety for the years 2008-2010, while the detailed tasks of the action areas outlined in the Action Program are described in other documents such as yearly action plans. The strategic objective of the Road Safety Action Program is to reduce the number road fatalities by 30 percent in 2010, as compared to 2001. Specific objectives, each related to a specific focus area for action items, are as follows:

- Reduce the number of road fatalities related to human errors by 25 percent.
- Reduce the number of road fatalities through improved infrastructure by 25 percent.
- Reduce the number of road fatalities through more intensive, more modern, more economical and more efficient control by 40 percent.
- Improve legal and technical regulations.
- Improve accident prevention activities, increasing their efficiency and creating a uniform national information system on road safety.

In 2005-2006, Ireland's Road Safety Authority was established to co-ordinate the efforts for road safety in that country.²¹ They worked with the Department of Transport to publish the next Road Safety Strategy for 2007-2012, with 126 actions required to be undertaken by the stakeholders involved. The primary goal of the strategy is to reduce road collision fatalities to no greater than 60 fatalities per million population by the end of 2012 and 50 or fewer in the following years with demonstrable downward reductions in the each year of this strategy.

Norway's National Transport Plan (NTP) for 2010-2019 has a goal to reduce the number of fatalities by one-third before 2020 should be established as an intermediate goal.²² To accomplish this goal, fatalities and severe injuries would be reduced from an expected level of 1,150 in 2010 to a maximum of 775 in 2020, as shown in Figure 6. A three-year short-term plan, the National Plan of Action for Road Traffic Safety 2010-2013, will establish the foundation upon which future safety plans will be built. The 2020 goal is considered to be an intermediate goal based on an ultimate goal of zero fatalities and severe injuries in road traffic ("Vision Zero").

²⁰ Hóz, E., Cs. Koren, and T. Mocsári. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Hungary – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011

²¹ Cullen, Harry. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Ireland – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

²² Amundsen, Finn Harald. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Norway – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

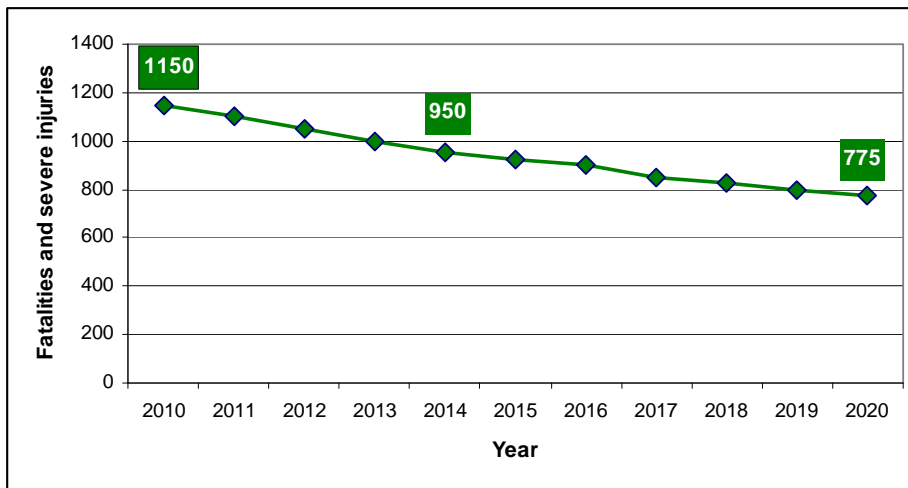


Figure 6. Reductions in Fatalities and Severe Injuries to Achieve Norway's NTP Goals 2010-2019. ²³

A new overarching initiative that is gaining momentum in the United States is called Toward Zero Deaths (TZD): A National Strategy on Highway Safety.²⁴ The TZD initiative (<http://safety.fhwa.dot.gov/tzd.cfm>) is an effort focusing on identifying and developing bold and innovative strategies for improving highway safety. A significant component of TZD is identifying and creating opportunities for changing American culture as it relates to highway safety. The primary purpose of the TZD program is for the broad safety community to work together to create the visionary framework for future safety programs. In order for it to be successful, the program must have a strong focus on changing the public's attitudes and culture regarding safety. Because of its broader scope and longer-term visionary view, the TZD should not conflict with the development of the internal U.S. Department of Transportation's planning efforts, such as the Roadway Safety Plan (RSP).

The intent of the TZD program is to engage all organizations that can contribute to reducing deaths and serious injuries on U.S. highways and have these organizations work together to develop a shared plan for the future. TZD is about involving government at the federal, state, and local levels, as well as engaging the private sector, associations, and academia. Because of the large number of participants, the TZD program needs to be executed on a more visionary and strategic level. The development of this approach is going to require the following actions:

- Establish broad, coordinated objectives.
- Develop an open process to look at the program's strengths, weaknesses, opportunities and risks.
- Conduct focus groups and outreach meetings to determine the attitudes, needs, and interests of the American public as they relate to highway safety.
- Establish a clear vision for highway safety.
- Identify barriers to progress from the participant's perspective.
- Establish an action plan for addressing barriers.
- Identify operational goals for the years addressed in the plan.

²³ Amundsen, Finn Harald. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Norway – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

²⁴ Griffith, Michael S., Patrick Hasson, and Ray Krammes. *A Strategic Approach for Safety: Putting Knowledge into Practice*, United States of America – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

The TZD coincides with the development of the RSP, and the two programs are expected to benefit from one another. Their exact connections will become more apparent as work proceeds.

Due to continuing European integration, the issue of road accidents crosses the borders of the individual countries. The gradual opening of economic cooperation within the European integration process establishes requirements for the elimination of bottlenecks in the cross-border connection of passenger and freight transport systems, with a focus on road safety. To this end, the Slovak Republic has begun the 2007-2013 Cross-Border Operational Programme, in cooperation with Austria.²⁵ The program is comprised of two projects:

- “Cross Border ROad SafEty MANagement,” known under the acronym ROSEMAN, is a 3-year project (2009-2011) developed as a cooperative venture between the Austrian Safety Board in Vienna, and the Slovak University of Technology in Bratislava.²⁶ The primary objective of the ROSEMAN project is to create conditions for road safety management in the road network within the cross-border territory of Austria and Slovakia that will allow the establishment of a compatible methodology of road safety management that is applicable to the selected road network in both countries.
- “Traffic Model AT-SK” is being developed over a 4-year (2009-2012) timeframe, with the cooperation of the Vienna University of Technology in Austria and the Slovak University of Technology in Bratislava.²⁷ This project is designed to establish a database of input data for modeling the traffic load of the transport network in the border area of East Austria and West Slovakia in both the short-term and long-term time periods. Because this model in this project covers the same territory of the ROSEMAN project, results of this cross-border project will be applicable not only to traffic load modeling, but also for and evaluation of road accidents within the affected model territory.

England’s “Transport 2010: The 10 Year Plan” provided the Highways Agency with a new direction and a role as a transport operator.²⁸ The Highways Agency developed the 2010 targets and defined measures to deliver the following reductions in fatal, serious, and slight casualties on the Trunk Road Network:

- A contribution to the national target of a 50 percent reduction in child casualties;
- A contribution to tackling the significantly higher incidence of road casualties in disadvantaged communities;
- A 33 percent reduction in the number of people being killed or seriously injured (KSI); and
- A 10 percent reduction in the rate of slight casualties.

²⁵ Bezák, B., V. Kapusta, M. Neumannová, and P. Rakšányi. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Slovak Republic – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

²⁶ ROSEMAN (2008). Cross Border ROad SafEty MANagement project, Cross-Border Cooperation Slovakia-Austria within the programme of CBC: "Creating the Future" 2007–2013. ATMOS – N 00022.

²⁷ Transport Model AT-SK (2008). Cross-border Cooperation Slovakia–Austria project within the programme of CBC: "Creating the Future" 2007–2013. ATMOS – N 00043.

²⁸ Vowles, Graeme, Hugh Gillies, Alison Jones, Stuart Lovatt, and Greg McClelland. *A Strategic Approach for Safety: Putting Knowledge into Practice*, United Kingdom – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

About a third of the Highway Agency's targets were achieved through engineering, e.g., new roads, road improvement schemes, signing, road marking, and effective traffic calming measures where necessary. The remaining targets were achieved through new technology supporting the driver, coupled with initiatives to change driver behavior to adopt safer driving practices.

In late 2009, the United States Department of Transportation was tasked with identifying a set of national priorities and specific goals to accompany their Fiscal Year 2011 budget.²⁹ When this process began, the U.S. Department of Transportation did not have a current plan that involved all of the agencies within the Department working together to advance highway safety programs. Although a goal was ultimately developed, the U.S. Department of Transportation needed a better process or plan for developing subsequent goals. Some key elements that have been identified include the following:

- Any future goals that are set should be tied to a national strategic plan that lays out the actions that would need to be achieved to reach those goals. The U.S. Department of Transportation wants to look more strategically at setting longer-term goals and plans that shape future investments and legislation for highway safety.
- The need for a U.S. Department of Transportation Roadway Safety Plan that brings together all roadway owners and users in working toward a common broad-based national safety strategy.
- The plan should provide substance to the U.S. Secretary of Transportation's charge to ensure that safety remains the U.S. Department of Transportation's first priority by building on the foundation of the Distracted Driving Initiative (<http://www.distracted.gov>), which educates the public about the dangers of using electronic and digital devices while driving. The plan should build broad-based support to implement an aggressive action plan.
- The plan should target the American public and include simple messages. While transportation officials may be able to gauge progress through such statistics as fatality rates, the public may not fully grasp such measurements.

Two major parallel efforts are contributing to the development of a new national strategy in the United States. The first effort is internal to the U.S. Department of Transportation and involves the development of the internal RSP. The second effort is external and involves the broader safety community made up of all key stakeholders, including State associations, industry, public health organizations, the public, and the U.S. Department of Transportation.

In China, the Inter-Ministerial Joint Conference on Nationwide Road Traffic Safety was established by the State Council in 2003.³⁰ The Joint Conference is a body with a very broad set of duties. It is responsible for:

- Tracking road traffic safety conditions in China;
- Analyzing road traffic safety status.
- Studying policy.
- Making medium and long-term strategic plans.
- Comprehensively coordinating and studying road traffic safety.

²⁹ Griffith, Michael S., Patrick Hasson, and Ray Krammes. *A Strategic Approach for Safety: Putting Knowledge into Practice*, United States of America – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

³⁰ Zhang, Gao-qiang and Jian-jun Zhang. *A Strategic Approach for Safety: Putting Knowledge into Practice*, China – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

- Making decisions on road traffic safety.
- Directing and supervising the work on road traffic safety by governments of directly administered cities, autonomous regions, and provinces and their respective functional agencies.

The duty of the Joint Conference also includes coordinating with multiple agencies to solve shared road traffic safety issues, promote cooperation and coordination between agencies to share information and build effective long-term mechanism, prevent and reduce road traffic crashes, and fully improve road traffic safety.

The Ministry of Transport in Romania focused on a different strategy than the other reporting countries. Based on the metric that in most European countries the cost of winter road maintenance is often about 50 percent of the total maintenance budget, the road agency decided to focus their attention on optimizing maintenance management and efficiency.³¹ The Romanian program emphasizes winter management systems for roads in the European context and also the maintenance technologies used in its specific operational traffic and climatic conditions. By maximizing the efficiency of their maintenance program, they can minimize risk and unnecessary costs, enabling them to apply more resources to countering road safety problems in non-winter conditions.

The wide variety of programs, strategies, and agencies involved in the preceding examples provide a glimpse into the myriad of issues that each individual country must address in establishing a comprehensive roadway safety policy. While the goal of reducing fatalities and injuries is common to all agencies, the means by which that goal is accomplished can vary widely.

2.2. Establishment of Safety Goals

A number of safety goals have been listed previously, in conjunction with the details of various national safety plans. Most goals in these multiyear plans are ambitious, and multiple countries, particularly those in Europe, have goals influenced by the Vision Zero program. Safety goals established for programs in other nations are similarly ambitious.

The overall goal of the Austrian Road Safety Programme for 2002 to 2010 was a 50 percent reduction in the number of fatalities and a 20 percent reduction of injury accidents resulting from road accidents. This ambitious target was in accordance with numerous national targets within the EU and also corresponded to the long-term reduction target of the European Commission.³²

The first National Strategy for Road Safety in the Czech Republic was approved by the government in 2004, and it was updated in 2008 for the period 2008 to 2012, with the goal of reducing the number of fatalities in 2010 by 50 percent, as compared to 2002. This goal coincides with European Directive 2008/96/ES on Trans-European Road Safety Management, which was implemented into Czech law until the end of 2010. The strategy is being updated for the period 2011 to 2020.³³

³¹ Andrei, Radu, Neculai Tautu, and Ioan Druta. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Romania – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

³² Eichinger-Vill E.-M. and B. Lautner. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Austria – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

³³ Landa, Jiri and Josef Mikulík. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Czech Republic – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

For its 2007-2012 Specific Program of Action on Road Safety, Mexico's Ministry of Health set a goal to reduce by 15 percent the number of deaths caused by traffic accidents involving motor vehicles in the population sector ranging from 15 to 29 years old.^{34,35} In addition, the Ministry of Communications and Transport set a goal for their Road Safety Program that by year 2020 there would be no more than 15,000 annual deaths and 300,000 injuries related to traffic accidents.³⁶ Because these are ongoing programs, final results are not yet available.

For the 10-year life of its new road safety strategy, Northern Ireland has set ambitious casualty reduction targets for the country that will cover the period up the end of 2020.³⁷ These are:

- 40 percent reduction in people killed in road collisions.
- 45 percent reduction in people seriously injured in road collisions.
- 55 percent reduction in children aged 0 to 15 killed or seriously injured.
- 55 percent reduction in young people aged 16 to 24 seriously injured in road collisions.

Ireland's primary goal for its "Road to Safety" strategy for 2007-2012 is to reduce road collision fatalities to no greater than 60 fatalities per million in population by the end of 2012 and 50 or fewer in the following years with demonstrable downward reductions in each year of the program.³⁸

2.3. Measurements of Success

Reporting countries typically measured the results of their safety programs by the number of crashes, fatalities, or injuries occurring during the duration of the program; some of these measures have been discussed in previous sections of this report. Commonly, the annual number for the final year of the program is compared to that of the year preceding the program and to each year within the program. Another comparison is the number of crashes that occurred in a given year versus a predetermined goal for that year. Other common measures include rates of crashes (or fatalities) per distance traveled, crashes per registered vehicle, or crashes per population.

Reduction in Crashes

Under Ireland's traffic calming campaign, traffic calming measures were installed in nearly 200 towns and villages by the end of 2009. The road agency conducted a five-year before and after evaluation for the traffic calming schemes installed in 91 locations on national roads before the end of 2002.³⁹ The evaluation, comparing the 4 years before each

³⁴ Mendoza-Díaz, Alberto, Emilio Mayoral-Grajeda, and Antonio García-Chávez. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Mexico – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

³⁵ *Programa de Acción Específico 2007-2012 de Seguridad Vial* (Specific 2007-2012 Action Program on Road Safety) (PROSEV), Secretaría de Salud, México.

³⁶ *Programa de Seguridad Vial de la SCT* (Program on Road Safety of the SCT). Secretaría de Comunicaciones y Transportes, México.

³⁷ Vowles, Graeme, Hugh Gillies, Alison Jones, Stuart Lovatt, and Greg McClelland. *A Strategic Approach for Safety: Putting Knowledge into Practice*, United Kingdom – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

³⁸ Road Safety Strategy (2007-2012). Road Safety Authority.

http://www.rsa.ie/Documents/Road%20Safety/RSA_Strategy_ENG_s.pdf. Accessed 10 March 2011.

³⁹ Cullen, Harry. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Ireland – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

scheme with the 4 years after, revealed that there was a reduction of 106 collisions at the 91 study sites, made up of 21 fatal collisions, 20 serious injury collisions, and 65 minor injury collisions.⁴⁰

Hungary's program goal was to have at least a 30 percent reduction in annual fatalities on its roadways between 2001 and 2010. In 2001, there were approximately 1,240 road-related deaths, resulting in a 2010 goal of no more than 868 fatalities. Crash data for 2002 to 2006 indicated a rise in fatalities, between 1300 and 1450 fatalities annually. In 2007, however, fatalities declined near 2001 levels. The downward trend continued for 2008 and 2009, such that, in 2009, Hungary saw 822 road fatalities, a reduction that exceeds the goals for both 2009 and 2010.⁴¹

Reduction in Fatalities

In 2002, prior to the beginning of their comprehensive road safety plan, China's national road system saw more than 800,000 crashes, resulting in 562,074 injuries and 109,381 deaths. The years 2003 and 2004 had similar numbers of fatalities, though injuries and crashes began a sharp decline. Beginning in 2005, the number of road fatalities also began a steady decline, so that by 2009, there were 238,351 crashes, leading to 275,125 injuries and 67,759 fatalities. This translates to a 69 percent reduction in crashes, a 51 percent reduction in injuries, and a 38 percent reduction in fatalities as compared to 2002.⁴²

Changes in Fatality and Crash Rates

China's crash rate per one hundred million vehicle-kilometers traveled on the national highway network declined each year from 17.6 in 2005 to 7.3 in 2008, while the fatality rate per one hundred million vehicle-kilometers fell from 5.7 to 3.1 over the same time period.

Spain's number of deaths in accidents per hundred million vehicle-kilometers traveled declined from 4.3 to 0.5 in the period 1991-2009; this decline includes a 52.4 percent reduction in the overall number of annual road fatalities from 2003 to 2009.⁴³

Other Measures

In addition to specific measures related to the number of crashes, fatalities, or injuries, some countries have defined other means of measuring their progress in accomplishing the goals of their road safety programs. Some measures are considered to be intermediate, in that they must be achieved in order to fulfill the ultimate goals of the program. Others are ultimate goals in themselves.

⁴⁰ Curtis, L. Evaluation of Traffic Calming Schemes Implemented from 1997 to 2002. National Roads Authority, Dublin, 2008.
<http://www.nra.ie/Publications/DownloadableDocumentation/RoadSafety/file,15926,en.pdf>. Accessed 10 March 2011.

⁴¹ Hóz, E., Cs. Koren, and T. Mocsári. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Hungary – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁴² Zhang, Gao-qiang and Jian-jun Zhang. *A Strategic Approach for Safety: Putting Knowledge into Practice*, China – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁴³ Llamas Rubio, Roberto, Pablo Pérez de Villar, José M^a Pardillo Mayoral, Rafael Jurado Piña, Enrique Belda Esplugues, Ana Arranz, Beatriz Molina. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Spain – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

Norway's series of measures are representative of the intermediate measures that many nations set for their road safety programs. Their intermediate measures are subdivided into four main targets: road users, road improvements, vehicles, and prevention of injury. Road user measures target groups of road users with a high rate of fatalities and severe injuries and implement preventive measures, especially with regard to children and young people, based on the idea that proper attitudes are formed at a young age. Road improvement measures are a major effort to improve the physical infrastructure in terms of investments, operation and maintenance. Vehicle measures are designed to focus on vehicle safety standards; monitoring activities will seek to ensure that an increasing proportion of all vehicles comply with statutory requirements, while parallel efforts will promote the use of new vehicle technologies that have a documented positive effect on traffic safety. Injury prevention focuses on providing high-quality and timely medical services both at the accident site and in hospitals.⁴⁴

3. TRANSFER OF KNOWLEDGE INTO PRACTICE

Reporting nations have used a variety of methods to apply the lessons learned in roadway safety to produce further benefits. The general forms of knowledge transfer can be seen in some of the methods and intermediate measures described previously in this document, particularly in the application of education and engineering treatments. This section of the document will highlight selected examples of transferring knowledge into practice.

3.1. Innovation

Treatment of Sun Glare

A recent development in Spain has created an automated procedure for the design of measures to prevent sun glare in critical sections, such as tunnel exits or entrances from minor roads onto major roads and junction turnoffs.⁴⁵ A computer tool has been developed at the Polytechnic University of Madrid that identifies and assesses sun glare problems. The computer tool facilitates designing the countermeasures to install in order to reduce or eliminate road glare problems at specific locations. The program is based on a methodology that calculates the days or hourly intervals of the year when the sun may affect drivers' vision on certain roadway sections, depending on the geographic location, its geometric design and the physical characteristics of the area.

In order to conduct the analysis of sun glare, the relevant variables are represented in cylinder charts, in which a cylinder surrounds the driver's perspective, creating a uniform scale for the axis of ordinates (y-axis), as shown in Figure 7. In addition to the solar paths throughout the year, other variables in the analysis include the direction of the driver's line of vision, glare cones, and visual obstructions. A glare cone is a cone whose axis corresponds to the driver's line of vision, and whose angle represents the limit at which a driver stops seeing objects in their field of vision when the sun is in it. The value of this angle depends on the driver's characteristics, particularly the driver's age. The position of the sun at a particular moment is represented by a point with its azimuth in the axis of abscissas (x-axis) and its elevation in the axis of ordinates. The solar paths are

⁴⁴ Amundsen, Finn Harald. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Norway – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁴⁵ Llamas Rubio, Roberto, Pablo Pérez de Villar, José M^a Pardillo Mayoral, Rafael Jurado Piña, Enrique Belda Esplugues, Ana Arranz, Beatriz Molina. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Spain – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

represented in the cylinder chart for different days of the year, so that seasonal changes can also be evaluated. A series of cylinder charts is used to analyze multiple locations on a driver's path through the tunnel.

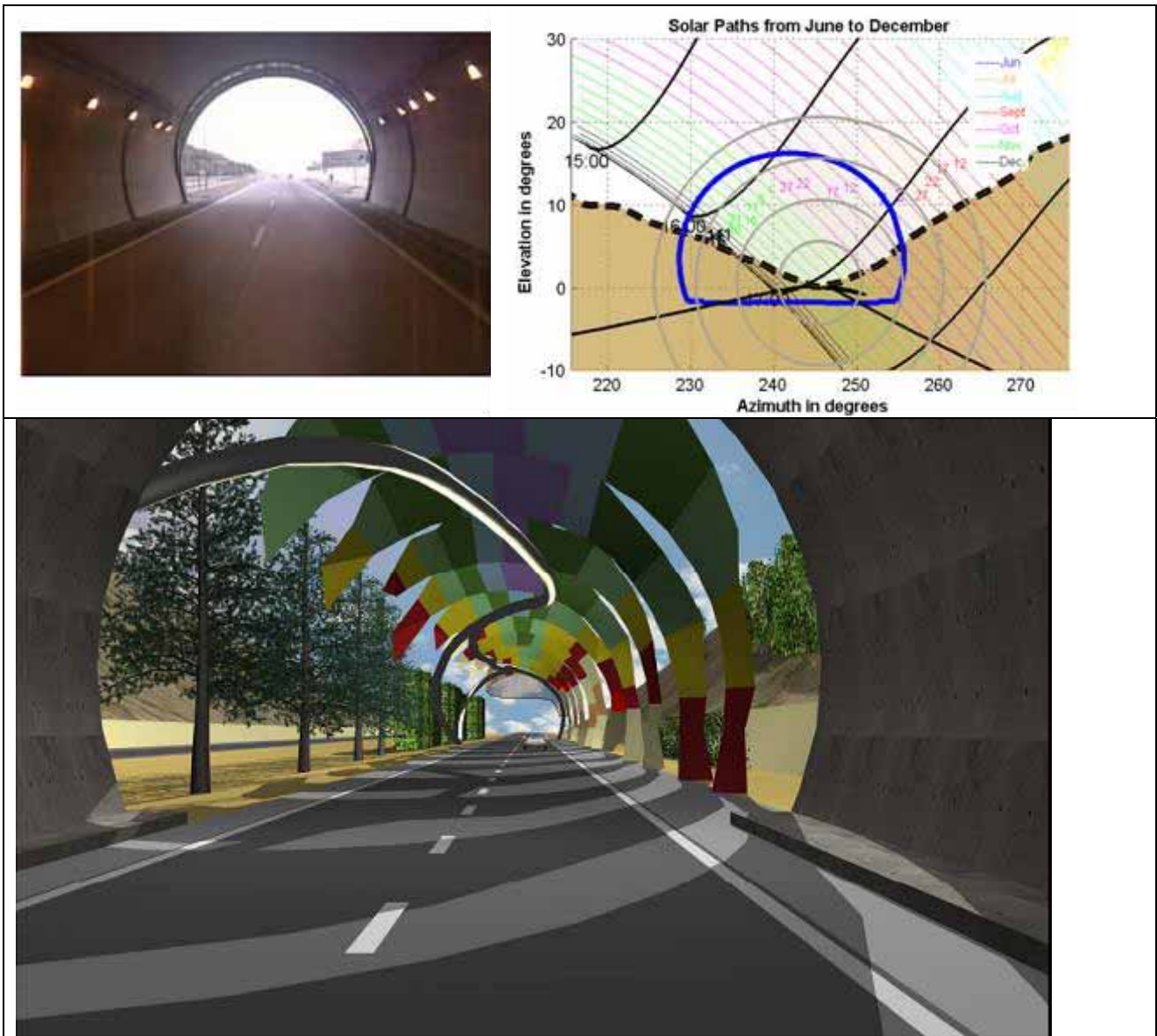


Figure 7. Evaluation of Sun Glare on a Roadway Tunnel in Spain.⁴⁶

The methodology allows the glare problems at the tunnel exits to be addressed, and a procedure is provided to study the design of countermeasures and evaluate their efficiency. This methodology was applied in the analysis of the problems of sun glare in the Miravete Tunnels on the A-5 motorway, as well the design of consistent countermeasures in plantations on the roadsides and on the roads. A graphical representation of the countermeasures is also shown in Figure 7.

⁴⁶ Llamas Rubio, Roberto, Pablo Pérez de Villar, José M^a Pardillo Mayoral, Rafael Jurado Piña, Enrique Belda Esplugues, Ana Arranz, Beatriz Molina. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Spain – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

Institutional Programs

The United States Department of Transportation sponsors or collaborates with several other programs to encourage innovation.⁴⁷ These programs include the following:

- Transportation Pooled Fund Program – The Federal Highway Administration (FHWA) sponsors this program⁴⁸ as a means for interested states, FHWA, and other organizations to partner when significant or widespread interest is shown in solving transportation-related problems.
- The National Cooperative Highway Research Program (NCHRP) – The NCHRP is a special shared-fund program administered by the Transportation Research Board (TRB).⁴⁹ The NCHRP is sponsored by member departments such as individual state departments of transportation of the American Association of State Highway and Transportation Officials (AASHTO), which is a national non-profit association that advocates for transportation-related policies and provides technical services to states and local transportation agencies. FHWA is a cooperating agency.
- Strategic Highway Research Program 2 – The U.S. Congress established a second strategic highway research program (SHRP 2) in 2006 to investigate the underlying causes of highway crashes and congestion in a short-term program of focused research. SHRP 2 has goals in four interrelated focus areas: safety, renewal, reliability, and capacity. The SHRP 2 safety goal is to significantly improve highway safety by understanding driving behavior in a study of unprecedented scale. Safety research in SHRP 2 aims to reduce crash risk, injuries, and fatalities by understanding driver behavior. The centerpiece of the research is a naturalistic driving study of 3,000 volunteer drivers, the largest of its kind ever undertaken.⁵⁰ The study investigates ordinary driving under real-world conditions to make the driving experience safer.
- The International Highway Technology Scanning Program – The scanning program serves as a means to access innovative technologies and practices in other countries that could significantly improve highways and highway transportation services in the United States. The program enables innovations to be adapted and put into practice much more efficiently without spending scarce research funds to recreate advances already developed by other countries. Personal domestic and international networking, team dynamics, and the creation of domestic champions for promising ideas from other countries are key functions of the scan process. Successful U.S. implementation of the world's best practices is the goal of the program. The program collaborates among FHWA, AASHTO and the NCHRP.

⁴⁷ Griffith, Michael S., Patrick Hasson, and Ray Krammes. *A Strategic Approach for Safety: Putting Knowledge into Practice*, United States of America – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁴⁸ Transportation Pooled Fund Program. Federal Highway Administration. <http://www.pooledfund.org>. Accessed 10 March 2011.

⁴⁹ National Cooperative Highway Research Program. Transportation Research Board. <http://www.trb.org/NCHRP/NCHRP.aspx>. Accessed 10 March 2011.

⁵⁰ Strategic Highway Research Program 2 (SHRP 2). Transportation Research Board. http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/Public/Pages/Safety_153.aspx. Accessed 10 March 2011.

3.2. Dissemination of Safety Products to Stakeholders

New Manuals

German guidelines for economic feasibility studies are currently being updated.⁵¹ Existing knowledge about the traffic safety assessment of planned roads will be considered therein. In addition, a German Highway Safety Manual is currently being developed as a support for the assessment of design variations. It includes expected values for accident cost rates for various road cross sections and intersection types as well as supplements to these expected values base on deviations from standard values. This manual will enable a comparison of different treatments for individual road sections and intersections. The goal is that the German Highway Safety Manual will be a counterpart to the German Highway Capacity Manual.

One of Mexico's action plans in its road infrastructure improvement strategy is to update all of its governing manuals, develop key new guidelines, and integrate them into the relevant rules and regulations.⁵² Specific actions in its current Road Safety Program include:

- Review and update the Manual of Geometric Design of Roads.
- Review and update the Manual of Devices for Signing and Traffic Control.
- Develop the Manual on Road Safety for the Ministry of Communications and Transport.
- Include the procedure for Road Safety Audits among the rules and regulations for the Ministry of Communications and Transport.

Development of Safety Action Plans

Switzerland has developed a comprehensive research program, "safety of the road traffic system and its civil engineering structures", to provide road agency administrators the information they need to make decisions on the best uses of financial resources to accomplish a consistent and mandatory safety standard across the entire road traffic system and to maintain that standard. The research package is structured into specific projects and by a synthesis report developing the following topics:

- Methodological basis for comparative risk assessment.
- Term of the network risk with particular regard towards civil engineering structures.
- Effectiveness and efficiency of intervention strategies.
- Scenarios of risk developments.
- Validation of the method through the use of a test case or an example.

To date, the procedures defined in the research program have permitted a great deal of cooperation among several different administration offices, resulting in common practices and facilitating the sharing of specific knowledge, thereby producing a considerable added value to the road agency. Results of the research program will facilitate the development of a safety action plan that is tailored to the needs of Switzerland's road system.

⁵¹ Roland Weber. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Germany – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁵² Mendoza-Díaz, Alberto, Emilio Mayoral-Grajeda, and Antonio García-Chávez. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Mexico – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

3.3. Examples of Effective Implementation of Best Practices and Technologies

GIS Database

The road safety inspections conducted in Spain consist of a process in which a team of road safety experts systematically revise the physical elements of the road infrastructure (its physical characteristics as well as geometric characteristics and control devices) and evaluate those changes for effects in reducing potential risks for road safety. The primary results of the data collected on site during the inspection and subsequently evaluated in the office include:

- General road inventories: sections, intersections, links, crossings, etc.
- Inventories of security elements: restraining devices, existing speed limits; overtaking prohibitions; beaconing on bends; danger warning signs, etc.
- Database of elements to be improved.

Due to its flexibility, a Geographic Information System (GIS) database has been created in order to manage all the information generated during this complex road safety process. The system simplifies the inspection process with three automated functions:

- Storing of information: the system allows the information that is collected during the inspection phase to be stored in a database organized in standardized tables (e.g., treatable elements, geometric characteristics, speeds, traffic, accidents) and referenced to the appropriate GPS coordinates.
- Work tool: the development of small applications allows information to be directly obtained in relation to the route, the visibility distances, and other key site characteristics, identifying treatable elements as well as directly assigning kilometer points to elements identified in the video.
- Results generator: the ability to edit reports filtered through the various fields of each table allows more efficient management of the analysis results, enabling the agency to edit the information by many factors such as zones, sections, or treatments.

Countermeasures for Black Spot Locations

Germany's Federal Highway Research Institute regularly calculates the safety potential for Germany's federal motorways. Actual accident costs for individual road sections are compared to the value of the expected accident costs for roadways that comply with the most recent design and traffic guidelines. The results of the comparison enable the agency to prioritize road sections according to potentially necessary infrastructure improvements.

The obligation to conduct a black spot management program is also specified in the German Road Traffic Code. For those parts of the road network where the accident frequency is above a specific threshold, an accident commission is required to conduct an investigation in order to develop countermeasures. These accident commissions are teams composed of experts from the police agency and the road and the traffic authorities. In order to support the work of these accident commissions, the effectiveness of different countermeasures was analyzed. Based on literature research and data from 65 nationwide accident investigation commissions, a collection of examples of measures taken to combat a total of 110 reported accident black spots was assembled between 2006 and 2008.⁵³ These measures were analyzed and evaluated with regards to crash reduction and

⁵³ Federal Motorway Sections With Safety Potential 2006-2008. German Federal Highway Research Institute, 2008. http://www.bast.de/cln_015/nn_82220/EN/e-Aufgaben/e-abteilung-u/e-referat-u2/e-analyse/pdf-Dateien/e-sicherheitspotenzial,templatelD=raw,property=publicationFile.pdf/e-sicherheitspotenzial.pdf. Accessed 22 March 2011.

cost/benefit efficiency. After the analysis was complete, researchers found a difference in the benefits of traffic engineering countermeasures as compared to infrastructure countermeasures. Specific values were not provided, but the report authors determined that infrastructure countermeasures were more effective in addressing the problems found at the black spot locations being evaluated.

Countermeasures for Common Crash Types

Research in the Slovak Republic ^{54,55} identified the most important factors that contributed to positive changes in road safety in that country:

- Setting of maximum speed limits in urban areas at 50 km/h.
- Requiring the use of daytime running lights throughout the year.
- Prohibiting the use of a telephone by drivers.
- Requiring the use of tires with a winter tread pattern when the road is covered by a continuous layer of snow or ice.
- Requiring bicyclists to protect their heads when driving outside urban areas (and children under 15 years of age in both rural and urban areas).
- Increased fines and more stringent sanctions for violating laws, particularly in cases involving detection of alcohol on the driver's breath.

These and other countermeasures were implemented during their national safety plan, with positive results.

⁵⁴ Bezák, B., V. Kapusta, M. Neumannová, and P. Rakšányi. *A Strategic Approach for Safety: Putting Knowledge into Practice*, Slovak Republic – National Report. Strategic Direction Session 3, XXIVth World Road Congress, Mexico City, 2011.

⁵⁵ Kapusta, V., Dohnal, I. (2010). Safety of the Highway Transportation in Slovakia. XIth Traffic Engineering Days. pp 82-89.

DRAFT CONCLUSIONS

Roadway safety continues to be a preeminent issue within the transportation community. Road owners, agencies, users, and the greater society have a shared responsibility for safety. As the world's population grows, along with the population of roadway travelers, safety will continue to grow in importance. A renewed emphasis on improving road safety will not only save lives and improve public health, but it will also greatly reduce societal costs in the forms of traffic congestion, inefficiency in the public work force, and inefficiency in agencies' methods and processes for administering and maintaining the road network in their jurisdictions.

Based on the information provided by the reporting countries, several concluding observations can be made:

- *Many countries are doing well, but all have ways in which they can improve.* Even in countries that have identified a "Vision Zero" approach, agencies recognize that intermediate goals must be set and achieved first. This does not imply that road-related injuries and fatalities are "acceptable", but agencies must continue to improve their safety strategies as their abilities and their knowledge allows them to provide better measures to positively affect safety. The continued emphasis on research, innovation, and sharing of knowledge will help agencies to find ways to improve safety in the years to come.
- *The need for minimum design and control standards should not be overlooked.* Particularly in countries with a developing roadway system, agencies must strive to establish a high level of minimum standards and then apply those standards consistently in new construction and in repairing, rebuilding, and maintaining existing infrastructure. This can be a daunting task in the face of limited budgets and legislative or cultural pressures, but it will be beneficial if applied.
- *Make safety a priority within the agency.* If the road agency develops a culture of promoting safety, it will be reflected in the policies, procedures, and regulations it uses to provide and maintain the nation's road system. As an example, multiple reporting countries deemed it appropriate to establish a special council or entity within their road agency, perhaps in conjunction with legislative or enforcement concerns, to emphasize and coordinate safety activities. This provides a tangible "leader" with which safety can be identified and promoted.
- *Do not underestimate the benefit of road safety education.* A number of countries reported detailed programs and initiatives for improving driver education on key issues such as drunk driving, safety restraints, and speeding. Extending this education to schoolchildren before they become drivers will be even more beneficial, because they can learn safe habits before unsafe habits are established. It must be remembered, though, that unless they are paired with other prevention or implementation strategies, educational measures rarely succeed by themselves or are likely to have only a limited effect.
- *Learn methods and strategies that are effective and apply them.* Cultural and other influences have an effect on not only the causes for certain safety issues, but also the effectiveness of strategies to address them. It is important for an agency to determine which methods are successful and why. Those methods can then be applied in greater emphasis to promote safety. In addition, it is valuable to learn best practices from agencies in other jurisdictions and countries, and then utilize the

practices that are appropriate; common problems can have common solutions regardless of geographic location.

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