

MANAGING AND ORGANIZING COMPREHENSIVE HIGHWAY SAFETY IN EUROPE



U.S. Department of Transportation
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16. Abstract Effective development and implementation of a roadway strategic safety plan typically require the coordination of a variety of safety elements, funding sources, and people. The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study of Sweden, Germany, the Netherlands, and the United Kingdom to investigate management and organization of comprehensive highway safety programs. The U.S. delegation observed that the countries view highway safety as a public health or quality of life issue and base safety decisions on a common philosophy. The countries take a proactive approach to highway safety that includes a fully integrated and nationally accepted plan with measurable fatality and injury reduction targets. The scanning team's recommendations for U.S. application include developing a national safety plan with achievable safety improvement targets, creating a safety performance incentive program, and implementing a demonstration project involving corridor or area-wide safety improvements.					
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Managing and Organizing Comprehensive Highway Safety in Europe

Prepared by the Scanning Team:

Dwight Bower
Idaho DOT

Michael Griffith
FHWA

George "Ed" Rice, Jr.
Florida DOT

John Baxter
FHWA

Michael Halladay
FHWA

Douglas Van Buren
Wisconsin DOT

Mike Crow
Kansas DOT

Douglas Harwood
Midwest Research Institute

Eugene Wilson
University of Wyoming

Troy Costales
Oregon DOT

Keith Knapp
University of Wisconsin-
Madison

and

American Trade Initiatives, Inc.
&
LGB & Associates, Inc.

for the

Federal Highway Administration (FHWA)
U.S. Department of Transportation

and

The American Association of State Highway and
Transportation Officials

and

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EXECUTIVE SUMMARY

INTRODUCTION

Both the U.S. Department of Transportation (USDOT) and the American Association of State Highway and Transportation Officials (AASHTO) have identified safety as a top-level emphasis. Each organization has strategic safety plans and priority programs. A reduction in highway fatalities and injuries is the goal.

The effective planning, development, and implementation of a roadway strategic safety plan typically require the cooperation and coordination of a large number of people, safety elements, and funding sources. Recognizing that innovations from other countries could greatly influence practice in the United States, the Federal Highway Administration (FHWA) and AASHTO sponsored an international technology scanning study that investigated the management and organization of comprehensive highway safety programs in Europe. The study, conducted in March 2002, included visits to Sweden, Germany, the Netherlands, and the United Kingdom.

The objective of the scanning study was to investigate and review the supporting mechanisms used in planning, developing, and implementing highway safety programs. The policies, strategies, analytical tools, outreach efforts, and public-private sector relationships that guide these activities were examined. Of particular interest to the study team were:

- The existence, content, and effectiveness of a national safety goal or plan.
- The decision-making processes and management policies and procedures used to prioritize elements of a highway safety program.
- The resources, analytical tools, and legislative policies that guide and support highway safety decisions and priorities.
- Examples or results of successful highway safety programs produced by the decision-making process, as well as agency integration and interaction.

Scanning team members were selected to represent the diversity of professionals involved in highway safety. The team included representatives from FHWA, universities, State departments of transportation, and a non-profit private research organization. The team included engineers, a State patrol superintendent, and a governor's highway safety bureau representative.

KEY SCAN FINDINGS

Each country the team visited during the scanning study provided information with potential to significantly influence highway safety management and organization in the United States. Key study findings from each country are described below. Examples of safety program elements and activities for each country are in the main body of the text.

Sweden

The overarching philosophy that guides Sweden's approach and decisions related to roadway safety is called "Vision Zero." This philosophy is based on the idea that highway fatalities are not acceptable and that a fatality is a shared failure of the interacting entities within that system. These interacting entities include policymakers and politicians, planners, drivers and road users, police agencies, highway agencies and road managers, driving educators, and vehicle manufacturers. Sweden's safety plan includes a clear goal for total fatality reductions: a 50 percent reduction in the 1996 fatality total by 2007. The debate continues, however, on how the philosophy of Vision Zero and the theory of shared responsibility can be implemented. Some consider roadway safety to be the sole responsibility of the system designers, while others believe effective safety improvements are a shared responsibility of the government and the roadway user. The impact of the Vision Zero philosophy, the principle of shared responsibility on highway safety programming, and the day-to-day implementation of highway safety improvements are points of discussion.

The focus on highway fatality reductions in Sweden has resulted in a multidimensional programming framework related to the tolerance of a human body to kinetic energy. Measures that manage the kinetic energy during a crash are a key aspect. The framework model for fatality reduction, therefore, focuses on vehicle crashworthiness, occupant restraints and their use, and vehicle speed. Since 1997, all fatalities that occur in Sweden have undergone in-depth investigation. Fatal crashes are defined as those that occurred because participants acted outside the system criteria, took excessive risks, or produced excessive force. The output of these investigations and the general kinetic energy management framework have resulted in multidisciplinary solutions for reducing highway fatalities.

Crash analysis in Sweden has extended beyond identification and improvement of "black spots," or specific locations with safety concerns. The objective of many crash analyses is to identify locations where fatalities and serious injuries can be reduced in a cost-effective manner. This focus on fatalities and serious injuries is one of the impacts of following the Vision Zero philosophy. The safety analysis focus in Sweden is on "black environments," which are roadway subclasses, or roadways with similar characteristics, that have a higher-than-expected number of crashes per mile. If a particular subclass of roadway is found to have more crashes than anticipated, improvements are made to the entire subclass of roadways.

Germany

Germany has published a federal road safety program. This advisory document includes more than 100 suggested highway safety initiatives in the areas of engineering, education, and enforcement. The approved program does not include any suggested fatality or serious injury targets. During the scanning study, however, safety experts mentioned a 50 percent target reduction in fatalities and serious injuries in the next 10 years, and at least one speaker expressed the hope that it would be included when the next program is approved in two years. Highway safety improvements are a priority in Germany, and the country has experienced a large reduction in highway fatalities since it was reunified in 1990.

It was clear in Germany that a significant amount of coordination and communication exists among the agencies involved with highway safety. The safety plans and agendas at the national, state, and local levels have similar objectives and measures. The study team also observed this similarity when the nongovernmental highway safety organization discussed its objectives.

The Germans have institutionalized multidisciplinary local accident commissions. These commissions, totaling more than 500, consist of police officers and representatives of roadway and traffic authorities. The commissions are required to investigate high-risk safety locations identified by crash records and determine solutions to the safety concerns at these locations. Some commissions are more effective than others, and an ongoing training program exists for commission members. In addition, German police officers undergo a significant amount of consistent and comprehensive training in the areas of traffic management and crash analysis. This training and the data they provide make them essential and knowledgeable members of accident commissions.

The Netherlands

The Netherlands has had long-term national safety goals for decades. Its “National Traffic and Transport Plan” safety target is equivalent to a 30 percent reduction in fatalities (with an annual maximum of 750) and a 25 percent reduction in serious injuries (with a maximum of 14,000) by 2010.

The Dutch government recognizes that its ability to meet this safety goal requires a decentralization of implementation responsibility where feasible. In other words, highway safety improvements are often accomplished most effectively at the regional and local levels. In addition, the content and goals of the “National Traffic and Transport Plan” were determined through a process called the “Polder” model. This approach requires thorough and close consultation and coordination among all appropriate safety-related groups to reach agreement on a plan. This process often takes longer than others, but is common in the Netherlands. In fact, the National Traffic and Transport Plan and targets are the basis for the regional and metropolitan area safety plans in the Netherlands.

“Sustainable safety” has been the overarching philosophy followed in the Netherlands since 1997. The basis of this approach is the proactive prevention of unsafe roadway conditions. Some of the measures this approach focuses on involve vulnerable road users – including pedestrians, bicyclists, motorcyclists, and moped users – and the concept of self-explaining roadways with markings that clearly show drivers their expected behavior. It also includes reclassifying the roadway network and redesigning some roadways to make them more consistent with the self-explaining concept. The Netherlands focuses safety improvements on routes and areas expected to have problems versus individual spots. Measures to improve safety have been identified for local roadway corridors within specifically defined 30 kilometers-per-hour (about 18 miles-per-hour) zones in urban areas and 60-kilometers-per-hour (about 36 miles-per-hour) zones in rural areas. In essence, the Netherlands’ approach is the proactive implementation of measures known to improve safety.

United Kingdom

The United Kingdom consists of Great Britain (Scotland, Wales, and England) and Northern Ireland. Great Britain has a national safety plan with defined fatality and injury reduction targets. The safety targets in the plan, “Tomorrow’s Roads - Safer for Everyone,” include a 40 percent reduction in total roadway fatalities and serious injuries, a 50 percent reduction in the number of children killed or seriously injured, and a 10 percent reduction in the slight casualty rate. The first two goals focus on reduction in total magnitude, but the goal for slight casualties, which is expected to be the most difficult to achieve, is a rate. This new goal follows a similar effort launched in 1987 when a goal of a one-third reduction in road casualties by 2000 was set. This goal was met and exceeded, and federal officials expressed the opinion that having a specific fatality reduction goal was the most important aspect of their approach. The goal focused the efforts of the safety organizations involved on choosing and prioritizing strategies that truly would reduce fatalities and serious injuries.

The plan’s content was developed through significant communication and coordination among all safety agencies. In fact, regional and local highway agencies involved in safety helped determine the targets, and these form the basis for the highway safety plans the agencies developed. This approach, combined with a requirement for local transport plans, has resulted in fully integrated safety plans from the national to the local levels of government, as well as active support for the national plan. It also has produced a situation in which jurisdictions are proud of their safety improvements and compete with neighboring jurisdictions on safety issues.

Two components of the plan appear to be key to its success. First, research results are used to show highway safety agencies how the fatality and serious injury reduction targets are achievable. Documentation indicates the expected reduction contribution of individual measures. Second, the safety policy provides for performance-based financial incentives. For example, additional funding is provided to local governments if they meet safety targets.

As in the other countries visited, highway safety agencies in the United Kingdom have begun to do safety analysis and improvements on corridor and area levels. The scan team visited several corridors in England that had been improved as a whole route. A number of safety improvement measures were consistently applied throughout the corridors, and locations with special safety concerns were mitigated as appropriate. Measures included high-performance marking and signing, intelligent roadway studs, new or more consistently applied speed limits, and several traffic-calming devices. The United Kingdom also has experimented with the application of area-wide safety improvements in Gloucester. One objective of the Gloucester Safety City program was to reduce roadway casualties in the city 33 percent by April 2002. The program used a multidisciplinary approach to safety improvement, including engineering schemes, education, and additional enforcement.

COMMON SAFETY PROGRAM THEMES

The highway safety programs in the countries the team visited shared several common themes. In many cases, the effectiveness of the programs explored resulted from the application of these themes.

Highway Safety as a Public Health or Quality of Life Issue

For the most part, highway safety is viewed as a public health or quality of life issue in the countries visited. In addition, safety decisions and targets are based on a common philosophy or slogan.

Comprehensive and Coordinated Safety Plan and Goals

The countries visited take a proactive approach to highway safety that includes a fully integrated and nationally accepted plan. Three of the four countries had measurable and deliverable fatality and injury reduction targets.

The plans were developed and implemented with strong national leadership and significant financial support, and included local participation and input when plan content and safety improvement targets were determined. The national plan also forms the basis for local safety plans and targets.

Highway Safety Program Elements

The highway safety programs in the countries visited have several similar elements, measures, and focus areas. These include:

- Required (primary) seat belt use for all passengers.
- Low acceptable levels for driver blood alcohol content (often 0.05 and lower).
- Use of extensive public education campaigns on such issues as aggressive driving, alcohol-involved driving, and speeding.
- Substantial enforcement efforts, including use of automated enforcement (i.e., cameras) for red light running and speed.
- Speed management measures, such as speed cameras, traffic-calming devices, interactive signing, and variable speed limits.
- Vehicle crash studies and crashworthiness considerations in crash analysis.
- Focus on vulnerable road user protection and separation measures.
- Application or consideration of novice and young driver training and licensing programs.
- Route-based or area-wide safety improvement programs.
- Road safety audits.

Many of these elements have been implemented to some degree in the United States.

Highway Safety Support Activities

One factor that has an impact on the success of the highway safety programs investigated is the existence of strong highway safety support activities. Each country does a significant amount of data collection and analysis to show the impacts of existing or planned safety improvements, monitor and evaluate the effectiveness of measures, and investigate the performance of operating agencies. Significant funding is provided to highway safety research agencies for their active technical support, expertise, and policy analysis capabilities. Substantial intellectual capacity is directed to the highway safety field. In several cases, the national government provides a significant portion of the funding for research organizations with highway safety analysis capabilities and nongovernmental organizations. Nongovernmental organizations, for the most part, are direct participants in the highway safety programming and plan development decision-making process. They challenge governmental approaches and operate as a watchdog or representative of the general public.

RECOMMENDATIONS

The scanning team gathered a significant amount of information related to the development and implementation of highway safety programs. This information and the findings previously described resulted in several potential recommendations and useful examples for the U.S. highway safety program. The team outlines four recommendations below. The findings, observations, and recommendations are those of the scanning team and not of FHWA.

First, the scanning team recommends that the approach used in the countries visited to develop and implement highway safety programs be used in the United States. All the countries have a fully integrated highway safety plan that includes significant financial and administrative support. Consistent and comprehensive communication, participation, and input from all safety organizations were essential to the development and effective application of these plans. Communication links occur throughout the country and within and between organizations from the federal to local levels. Fully integrating all players in the highway safety arena is essential for developing a nationally accepted plan that forms the basis for state, local, and nongovernmental highway safety plans.

Second, the scanning team recommends that all highway safety plans include specific safety improvement targets or goals that are keyed to a national plan and agreed to by all the agencies and organizations involved. The plan should show that the targets are achievable by including supporting documentation that identifies the expected contribution of particular safety improvements. The sum of individual contributions should be equal to or greater than the overall reduction target in the plan. The specific measures included in these plans should be tailored to the highway safety concerns and needs of the jurisdiction.

Third, the scanning team recommends implementation of safety-performance incentive programs at the Federal and/or State level. It is generally recognized that the safety improvement targets proposed in a national highway safety plan can only be achieved through the implementation of program measures at State and local

EXECUTIVE SUMMARY

levels of government. The implementation of these measures has economic and staffing requirements, and providing financial incentives related to safety performance measures appears to be an effective tool to achieve national, State, and local safety improvement targets. The safety-performance incentive funds provided can then be used for additional safety improvements. Safety performance for these incentives should be compared to the targets documented in an individual agency safety plan, and the measures used to achieve safety performance recorded.

The scanning team's final recommendation relates to implementation of a demonstration project and continued U.S. focus on three highway safety program elements common in Europe. The team recommends that a demonstration project be completed that involves considering, identifying, implementing, and evaluating corridor or area-wide safety improvements. The corridors or areas used in this demonstration project should be chosen based on their expected safety performance. The team also recommends that speed management measures, automated enforcement, and implementation of road safety audits continue to be promoted and pursued in the United States.

IMPLEMENTATION STRATEGY

The scanning team identified several efforts related to the discussion of policy guidance and comprehensive coordination in the area of highway safety programming. Given the expected resources available for implementing any suggestions and the timing of the upcoming Federal transportation funding reauthorization, the team recommends only one specific action in its implementation strategy.

In April 2002, the Netherlands held a highway safety "Sunflower" Conference. The "Sun" in "Sunflower" refers to the initial letters of Sweden, the United Kingdom, and the Netherlands. The conference objective was to use highway safety in these three countries as examples to help other European Union countries. More specifically, discussions were held to identify the highway safety programs needed to continue improving safety performance throughout Europe, and dialogue focused on safety policies and project selection. The countries sponsoring the conference are Europe's leading safety experts and are recognized for their ability to work with senior leadership.

The scanning team recommends that two or three conferences of this type be held in the United States. Each conference would include participation of European experts the scanning team visited, some team members, and leaders from the State in which the conference is held. The team also recommends organizing a national-level conference of this type with USDOT and AASHTO involvement. The three tasks needed to develop the conferences are described in the main body of this document.

chapter one

INTRODUCTION

Highway safety is a primary focus of transportation professionals. Both the U.S. Department of Transportation (USDOT) and the American Association of State Highway and Transportation Officials (AASHTO) have identified safety as a key emphasis, and both organizations have created strategic plans and priority programs in the safety area. A number of State departments of transportation (DOTs) have used AASHTO and USDOT as examples in creating their own safety plans and programs. A reduction in highway fatalities and injuries is the common goal of all these plans.

Highway safety improvements, or reductions in highway fatalities and injuries, require the effective coordination of a diverse set of activities implemented by a wide range of transportation professionals. Safety improvements traditionally have been segmented into those related to the “3 E’s” – engineering, education, and enforcement measures – but other activities, such as emergency medical services and maintenance, also are relevant. In the United States, individual administrative units, agencies, or organizations focusing on one of the 3 E’s often complete safety improvements independently. Fortunately, many experts now recognize that a “stovepipe” or non-systematic mentality toward implementing safety improvements is not always effective. Internationally, recognition of this fact has produced specific safety policies and significant crash reductions.

The how, why, where, and when of programming decisions related to the implementation of safety improvements can be complex. It often requires the cooperation and coordination of a large number of people and funding sources. Recognizing that innovations from other countries could greatly influence U.S. practice, the Federal Highway Administration (FHWA) and AASHTO sponsored an international technology scanning study to investigate management and organization of comprehensive highway safety programs.

STUDY OBJECTIVE AND FOCUS AREAS

The objective of the scanning study was to investigate and review the supporting mechanisms used in planning, developing, and implementing highway safety programs. The team examined policies, strategies, programs, analytical tools, outreach efforts, and public-private sector relationships and roles that guide these decisions. Of particular interest to the team were:

- The existence, content, and effectiveness of a national safety goal or plan.
- The decision-making processes and management policies and procedures used to prioritize elements of the highway safety program.
- The resources, analytical tools, and legislative policies that guide and support highway safety decisions and priorities.
- Examples or results of successful highway safety programs produced by the decision-making process, as well as agency integration and interaction.

Meetings with experts in each country were designed to address one or all of these four focus areas, and the scanning study's goal was to identify safety policies, programs, and practices from each country that helped reduce roadway fatalities and injuries. The scanning team evaluated the possibility of implementing the European approaches and measures observed. Significant findings and commonalities among the countries are documented in this report. During the study, team members met with a diverse set of representatives from national transportation administrations and ministries, state departments of transportation, university faculty, research organizations, and nongovernmental organizations.

Key findings of the scanning study of each country are described in Chapter Two and the common themes found in these highly effective safety programs are discussed in Chapter Three. Chapter Four summarizes the recommendations and implementation strategies the scanning team proposes.

STUDY ORGANIZATION

The scanning team conducted its study of managing and organizing comprehensive highway safety in Sweden, Germany, the Netherlands and the United Kingdom from March 1 to 17, 2002. Primary contacts in these countries are listed in Appendix A. The countries and dates they were visited are shown in Table 1.

Table 1. Safety scan countries and dates visited.

Country	Dates of Visit
Sweden	March 2-5, 2002
Germany	March 6-9, 2002
The Netherlands	March 10-12, 2002
The United Kingdom	March 13-17, 2002

The team chose these countries because of their recent highway fatality reductions, past highway safety records and experience, and international reputation for cooperation and coordination in highway safety programming. Table 2, adapted from a German summary of highway fatalities in Europe and the United States, shows crash statistics and population of each country visited and the United States.⁽¹⁾

The size of the countries visited during the study varied considerably. Sweden is a little larger than California in land area and had an estimated July 1998 population of 8.9 million (1/30 of the U.S. population). Similarly, Germany is slightly smaller than Montana and had an estimated July 2000 population of 82.8 million (1/3 of the U.S. population). The Netherlands is about twice the size of New Jersey and had a July 2000 population of about 15.9 million (1/20 of the U.S. population). Finally, the United Kingdom is slightly smaller in land area than Oregon and had a July 2000 population of about 59.5 million (1/5 of the U.S. population).

Table 2. Scanning study country 1999 safety statistics.

Measure	Germany	The Netherlands	Sweden	United Kingdom	United States
Population (millions)	82.8	15.9	8.9	59.5	272.7
Public Road Network (1,000 Miles)	388.2	72.2	130.2	244.4 ^a	3,908.6
Total Annual Fatalities	7,772	1,090	580	3,564	41,611
Fatalities per 100,000 People	9.5	6.9	6.6	6.0	15.3
Fatalities per Billion Vehicle-Miles	19.7	15.0 ^b	13.4	13.1 ^a	15.5

^aData from 1997.

^bData from 1998.

Table 2 also shows that highway fatality rates per 100,000 population in the four countries the scanning team visited were 40 to 60 percent of the rate found in the United States. Fatality rates per billion vehicle-miles traveled, however, were 84 to 97 percent of the U.S. rate in three of the countries visited. The German rate was higher than the U.S. rate.

The scanning team also held three internal organizational meetings during the study. The team met March 3, 2002, to organize the study, emphasize its purpose, assign note-recording requirements, and identify team members' primary interests. The team held a mid-study meeting March 10 to review primary findings and common themes for the first two countries visited, discuss the remainder of the study, and reiterate its purpose. The team met March 16 to review key findings from the final two countries, determine common policy and themes in each of the four countries, develop preliminary recommendations and a final report outline, and organize a strategy implementation team.

PANEL COMPOSITION

FHWA and AASHTO sponsored the scanning study, which was organized by American Trade Initiatives, Inc. The study was scheduled initially for September 2001, but was rescheduled for March 2002 after the September 11, 2001, attacks on New York and the Pentagon. The rescheduling required replacement of some team members.

Team members were selected to represent the diversity of professionals involved in highway safety. The 11-member team included representatives from FHWA, two universities, five State DOTs, and a non-profit private research organization. The team included engineers, a State patrol superintendent, and a governor's highway safety bureau representative. Team members' safety expertise included roadway design, enforcement measures, educational programs, research, and technology transfer. Team members and their representative organizations are shown in Table 3. Contact information and biographic sketches for each member are included in Appendix B.

Table 3. Team members and organizations.

Dwight Bower Idaho Department of Transportation	Douglas Harwood Midwest Research Institute
John Baxter FHWA Indiana Division	Keith Knapp University of Wisconsin-Madison
Mike Crow Kansas Department of Transportation	George "Ed" Rice, Jr. Florida Department of Transportation
Troy Costales Oregon Department of Transportation	Douglas Van Buren Wisconsin Department of Transportation
Michael Griffith FHWA Office of Safety Research and Development	Eugene Wilson University of Wyoming
Michael Halladay FHWA Office of Safety	

AMPLIFYING QUESTIONS

The scanning team developed a series of amplifying questions to help focus the discussion with European safety experts and show them what subjects, topics, and issues were of interest. They included investigation of national safety goals and plans; decision-making and management processes, policies and procedures; resources, analytical tools, and legislative policies; and examples and results of good and poor safety improvements. The questions provided to the European hosts before the scanning study are included in Appendix C.

chapter two

KEY FINDINGS

Each country visited during the scanning study provided information with potential to significantly advance the effectiveness of highway safety programs in the United States. This chapter summarizes safety programs, policies, and implementation activities observed in each country that the scanning team considers key to the effective management and organization of comprehensive highway safety. Examples of safety program elements and activities in each country are also listed. Some of the examples were the focus of previous scanning studies and may have been implemented in the United States already. In other cases, elements and activities are described to reinforce the idea that international agreement exists on many safety approaches.

FINDINGS IN SWEDEN

In Sweden, the scanning team met with representatives of the Swedish National Road Administration and Swedish National Road and Transport Research Institute. Team members discussed a number of safety policies, programs, and activities with Swedish experts. The discussions summarized in this report focus on the “Vision Zero” philosophy, corridor-level crash analysis, and a program to investigate all fatal crashes. Examples of safety program elements used in Sweden also are provided.

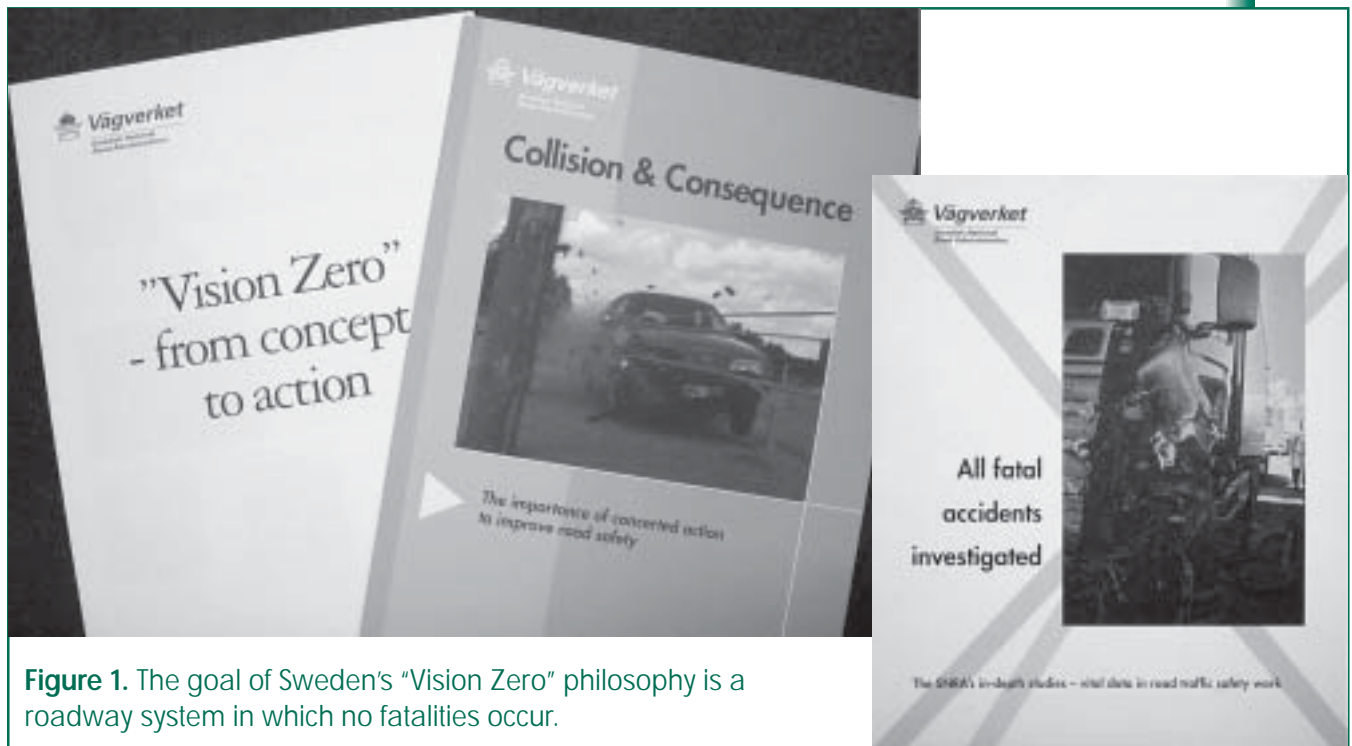


Figure 1. The goal of Sweden's “Vision Zero” philosophy is a roadway system in which no fatalities occur.

Vision Zero: National Philosophy and Continuing Discussion

A subject of international discussion for several years has been the concept of “Vision Zero.” This concept is the overarching safety philosophy that guides highway safety decisions in Sweden. The ultimate objective of Vision Zero is a roadway system in which no fatalities or serious injuries occur. It is recognized that roadway users will

always make errors, but Vision Zero is considered to be the basis for a social contract with roadway users that implies they will not be killed or seriously injured in a crash if they are responsible, wear seat belts, follow road rules (such as speed limits), and do not drive under the influence of alcohol. Sweden's safety goal is a total fatality reduction of 50 percent between 1996 and 2007.⁽²⁾ Note that this is a reduction in total fatalities and not a fatality rate reduction.

The philosophy of Vision Zero is that roadway fatalities and serious injuries are morally and ethically unacceptable, and that when they do occur it is a shared failure of the individuals and groups in the transportation system. These include, but are not limited to, transportation policymakers and politicians, planners, drivers and road users, police agencies, highway agencies and road managers, driving educators, transportation companies, and vehicle manufacturers. In the past, much of the responsibility for a safe trip was placed on roadway users. This has been a point of discussion, however, because roadway safety is one of the responsibilities of the Swedish National Road Administration, which now has a plan of measures for increased roadway safety.

Not surprisingly, the scanning team found a continuing dialogue in Sweden and elsewhere on the theory of shared responsibility for roadway fatalities and the impacts of Vision Zero on day-to-day safety program implementation. As mentioned previously, one component of Vision Zero is a shared responsibility approach, and many believe this will have to occur for it to be successful. At the same time, the Swedish National Road Administration and its roadway designers always have had ultimate responsibility for roadway safety throughout Sweden. Others believe that effective safety improvements require a shared responsibility between the government and the roadway user. The Vision Zero focus on fatalities and serious injuries has resulted in discussions about its impact on the need to implement day-to-day safety improvements to reduce the number of crashes. One argument is that about half of Sweden's fatalities occur on 15 percent of the roadway network, and focusing programs on these dangerous roads is the most cost-effective solution.⁽³⁾ The other side of the argument is that a focus on fatalities and serious injuries ignores the need and funding for general safety improvements that reduce total crashes.

The focus on highway fatality and serious injury reductions in Sweden has resulted in a programming framework that encourages safety improvements related to the tolerance of a human body to kinetic energy. The multidimensional model followed uses measures that manage kinetic energy during a crash as its key components. The model focuses on vehicle crashworthiness, occupant restraints and their use, and vehicle speed. This model is the framework followed for safety improvements and fatality investigations that occur in Sweden. The focus is on crash severity reduction, not total crash prevention.

Comprehensive Fatality Investigations

Since 1997, all crashes in Sweden that resulted in fatalities have been investigated individually.⁽⁴⁾ The objective of the investigations is to determine what factors caused the fatality (see the previous kinetic energy discussion) versus what caused the crash. Crashes are divided into three groups:

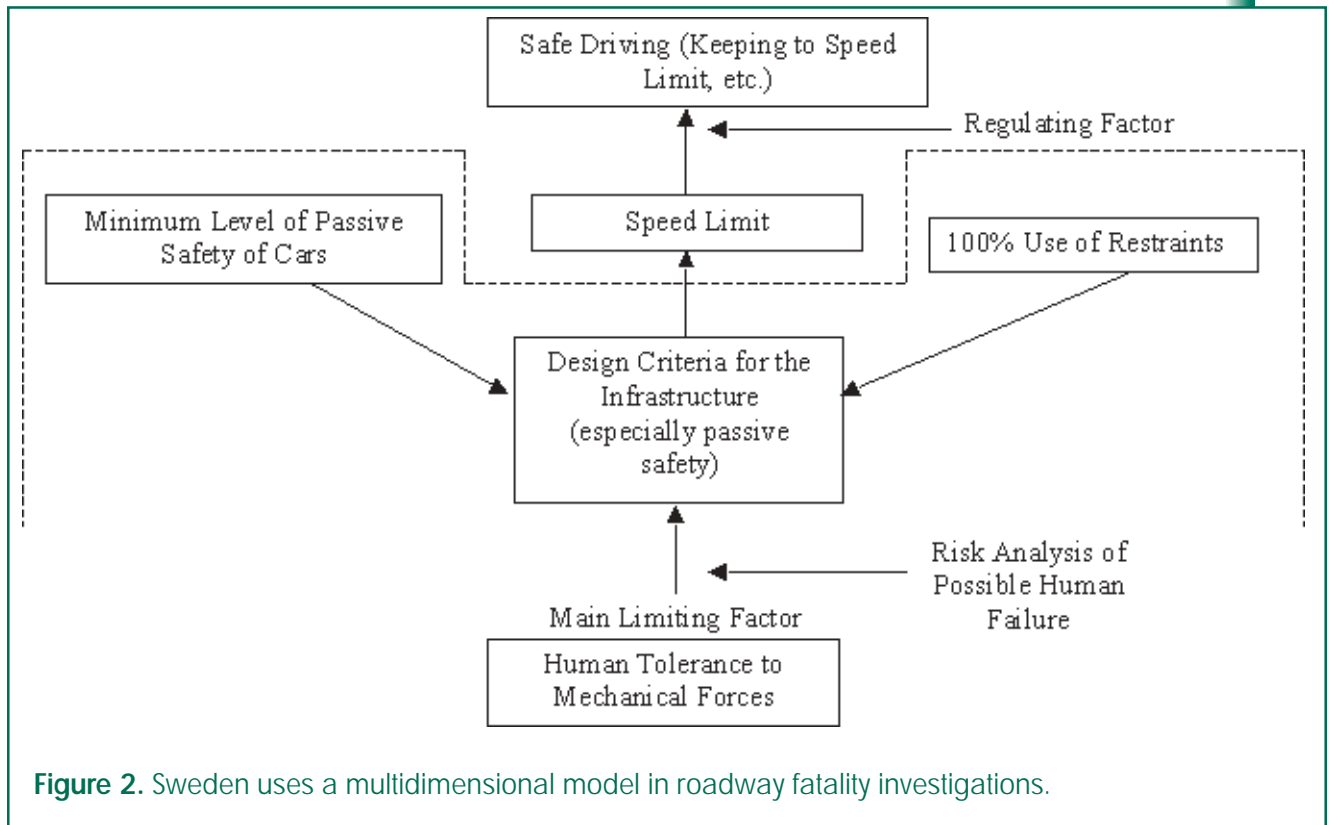


Figure 2. Sweden uses a multidimensional model in roadway fatality investigations.

- **Beyond System Criteria** – In this case, the roadway user violated road rules and it had an impact on the severity of the crash. Speeding is included in this category. Suggested countermeasures include limiting access to the system by these types of people (e.g., alcohol ignition locks) and automated or manual police enforcement.
- **Excessive Risk** – The roadway user in this case was killed because of a lack of personal protection, because it was either not available or not used. An example is a vehicle occupant who does not use a seatbelt or a motorcyclist who does not wear a helmet. Countermeasures include education on the use of seatbelts and improving the general crashworthiness of vehicles.
- **Excessive Force** – In this case, the fatality was caused by a combination of speed, roadway infrastructure, and the vehicle's safety capabilities. The roadway user followed all laws and regulations to the best of his ability, but made an error that resulted in a fatal crash. An example of this type of crash is someone leaving the roadway and hitting a tree. Countermeasures for these types of crashes usually focus on improving roadway infrastructure and vehicle crashworthiness and their interaction. Setting speed limits related to the crashworthiness of the elements also has been suggested. Between 1997 and 1999, two-thirds of the crashes that occurred in Sweden were in this category.

In general, the three groups of fatal crashes above are defined by which component of the roadway environment failed. For example, 62 percent of fatalities investigated were found to result from a mismatch between roadway speed and the passive safety designed into the roadway.⁽⁵⁾ The results of the investigation have been used to improve safety standards and implement safety improvements in Sweden. They

support the shared responsibility basis of Vision Zero because all interacting components of the crash environment were investigated (e.g., vehicle, design, and driver) and the ultimate cause of the fatality determined. In other words, the potential involvement in a crash of many different groups was considered. For example, if a crash involved a drunk driver who crossed the roadway centerline, hit a taxi, and caused the death of a baby, the responsibility of several different roadway safety groups might be represented by the following newspaper headlines:

- Drunk Driver Kills Baby (traditional)
- People Call for Median Barrier (roadway authority)
- Ambulance Arrives Two Hours After Baby Dies (emergency services)
- Taxi Companies Share Responsibility To Protect Children (commercial taxi driver industry)
- Cars Provide Insufficient Child Protection (vehicle industry)
- Law Loophole Allowed Baby to Ride Without Protection (enforcement or legal profession)
- Alcohol Interlocks Needed Now (driver safety groups)

Suggested solutions to avoid future fatalities also are often multidisciplinary, such as driver education on seatbelt use combined with roadside design improvements. These types of solutions, however, also require comprehensive coordination and communication within and between safety agencies.

Corridor Crash Analysis

The general approach to safety or crash analysis in Sweden is interesting. The approach corresponds to the requirements and focus of Vision Zero, and a basic understanding of the location and extent of the safety concerns in Sweden. For example, the objective of the analysis approach is to reduce fatalities and serious injuries in a cost-effective manner. In addition, safety improvement locations are chosen by a comparison of fatality rates per kilometer along similar roadway classes.

For the most part, identification of “black spot” or high-crash locations is done on a limited basis in Sweden. The focus instead is on “black environments,” those roadway subclasses, or roadways with similar characteristics, that have a higher-than-expected number of crashes per mile (kilometer). If an analysis of the data shows that an entire subclass – such as two-lane rural highways with no shoulders – has a higher-than-acceptable number of crashes, roadways within that subclass may become the focus of a safety improvement program. Improvements would be made to the entire subclass of roadways, and not be based on the crash experience at individual locations. The focus on the safety experience of a roadway environment or corridor also reduces the need for the accuracy necessary in crash location data for black spot analysis. Black spot investigations are still used to monitor safety concerns and suggest improvements at local and regional government levels, but the application of Vision Zero has had an impact on the ability to continue these activities.

Safety Program Elements and Activities

Examples of safety program elements and activities in Sweden are listed below. This list includes only a small portion of those occurring in Sweden and is not comprehensive. The list represents those safety program elements of particular interest to scanning team members.

- The Swedish government has tested or used roadside equipment that may be of interest in the United States. For example, it has tested crashworthy luminary poles and new guardrail end treatments that flatten and pass over or under a vehicle. For the most part, crash requirements and testing for roadside equipment are the same in Sweden as in the United States.
- Sweden has produced a crash cushion assembly that can be constructed off the roadway and dropped into location, reducing the exposure of construction workers installing such devices. It also is testing a truck-mounted attenuator for the front of a pavement-marking truck.
- Crash testing has been conducted to investigate vehicle roof strength, as well as the results when a vehicle collides with a moose. About 12 vehicle-moose crashes occur each day in Sweden, with 12 fatalities a year.
- Seatbelt use is required of all passengers, and front seatbelt usage is about 90 percent. Cell phone use is allowed in a hands-free mode only. Moped and motorcycle helmet use is mandatory. All vehicles must have their headlights on 24 hours a day.
- Sweden has a low tolerance for alcohol use, with an acceptable driver blood alcohol content limit of only 0.02.
- The minimum age for a learner's driving permit is 16, and driving with an approved supervisor is required until age 18. A full, non-restricted driver's license can be obtained at 18. Overall, the cost of obtaining a license is estimated at more than U.S. \$1,000.
- The Swedish National Road Administration has proposed a three-stage driver training system. This proposal involves checking the driving skills of those seeking licenses. On the premise that a skilled driver is not necessarily a safe driver, the proposal also recommends teaching new drivers to proactively assess risks rather than react with emergency skills.
- Research is being conducted into the safety of disabled children in vehicles and the use of alcohol ignition interlocks.
- In an example of the focus on black environments, investigators found that two-lane rural roadways with narrow shoulders had an unacceptable number of crashes and a 2+1 roadway cross section improvement was proposed. This cross section was discussed in a previous scan study on geometric design and includes the addition of alternating passing lanes every 0.6 to 1.5 miles. By the end of 2000, about 125 miles of this roadway configuration was complete with observed safety improvements. It was determined that volume levels on these roadways allowed opposing traffic flow to be effectively separated by a cable median barrier.

- Sweden has introduced lower winter speed limits on many roadways, which has had an effective impact on winter fatalities.

FINDINGS IN GERMANY

In Germany, the scanning team met with representatives of the following groups:

- Federal Highway Research Institute
- German Insurance Association
- German Road Safety Council



Figure 3. Sweden improved safety on many two-lane rural roadways by converting them to 2+1 facilities with alternating passing lanes.

- Cologne Institute for Road Traffic
- Federal Police Leadership Academy
- Road and Traffic Authority, Brandenburg
- Road and Traffic Authority, Rheinland-Pfalz
- Road and Traffic Authority, Hessen
- Technical University of Aachen
- Technical University of Darmstadt
- Technical University of Dresden
- Technical University of Erfurt
- Technical University of Potsdam

Team members discussed a significant number of safety policies, programs, and activities with German experts. The discussions summarized in this report focus on

the federal road safety program, local accident commissions, and the training and technology transfer of law enforcement and accident commission members. Examples of safety program elements and activities also are listed.

Federal Program for Improved Road Safety

In February 2001, the German federal government published the “Program for Improved Road Safety,” which includes more than 100 suggested highway safety initiatives in the areas of engineering, education, and enforcement.⁽⁶⁾ It is an advisory



Figure 4. Germany's local accident commissions include police officers, traffic authorities and road construction experts.

document for safety application in the German lander, or states. The initiatives recommend five safety program priorities:

- Improving the road or traffic climate, including promotion of less-aggressive road user behavior.
- Protecting vulnerable road users.
- Reducing the crash risks of novice and younger drivers.
- Reducing the dangers related to heavy vehicle transport.
- Improving safety on rural roadways.

Safety measures described in the program address:

- Road user behavior, through public relations efforts, traffic education and laws, and improvement incentives.
- Vehicle safety, through such measures as vehicle shape improvements and child restraint systems.



- Intelligent transportation systems, such as driver assistance systems and radio data systems.
- Infrastructure design and planning, including black spot treatments, bypasses, and road design.
- Rescue and emergency services, including improved first aid skills and crash location identification.

Similar, more detailed plans also have been prepared to guide specific safety activities in some German lander.

The "Program for Improved Road Safety" does not include fatality and serious injury crash reduction goals or targets. It appeared that a 50 percent reduction in fatalities and serious injuries within the next 10 years was proposed initially, but it was not included in the document approved by the government. One expert who met with the scanning team expressed hope that quantitative goals would be included when the next program was approved in two years. He believes quantitative safety goals would help inspire and motivate, indicate a stronger political commitment, allow more effective use of safety measures, and be a measure to evaluate completed safety improvements. Another proposal for the future is to use the government's annual "Road Accident Prevention Report" as a controlling document for the federal road

safety program. This document would be expanded to report the effectiveness of different safety measures and could be used to help monitor, measure, evaluate, and guide the safety program.

Highway safety analysis and improvements are high priorities in Germany, and many organizations are involved, including those the scanning team met with. The federal safety program guides the activities of these organizations. The similarity of subjects addressed by the groups the team visited, as well as their organizational plans and agendas, showed that a significant amount of coordination and cooperation exists among the national, state, and local governments, research organizations, and nongovernmental organizations. The German Road Safety Council, for example,



Figure 6. German safety initiatives include black spot treatments and improved road design in high-risk areas.

coordinates all public and nongovernmental activities of its members within Germany. It focuses on road-user education and is financially supported by the national and state ministries. Overall, the scanning team observed a sense of pride and competition among groups in improving Germany's highway safety.

Local Accident Commissions

The German government has required locally based accident commissions since 1971. More than 500 of these city and county commissions exist, and they are required to meet at least twice a year. The multidisciplinary commissions typically are composed of seven or eight members, including police officers and representatives from the road construction and traffic authorities. The legislative requirement to have these commissions has formalized and made commonplace the process of multidisciplinary local safety analysis in Germany. The commissions may be one reason a high level of safety coordination and communication occurs throughout the country.

The local accident commissions are required to identify, investigate, and suggest solutions for high-risk or black spot locations within their jurisdiction. They review pin maps, which are documents with colored pins to indicate locations of crashes of various types and severity levels. The police agency representative on the commission prepares pin maps for the previous year and the preceding three years. The one-year map includes all crashes that have occurred at each location, and the three-year map

includes only those with fatalities or serious injuries. About a third of the localities also review collision diagrams prepared by the highway agency.

The suggested criteria for identifying a safety black spot in a German locality is five similar crashes at a location in the past year, three fatalities or serious injuries in the past three years, or five personal injury crashes within the past three years. Commissions typically know where black spot locations are in their locality, and may consider all locations with five or more crashes in a year. They identify the 20 to 30 locations that cause the most concern, with a focus on locations with recent fatalities

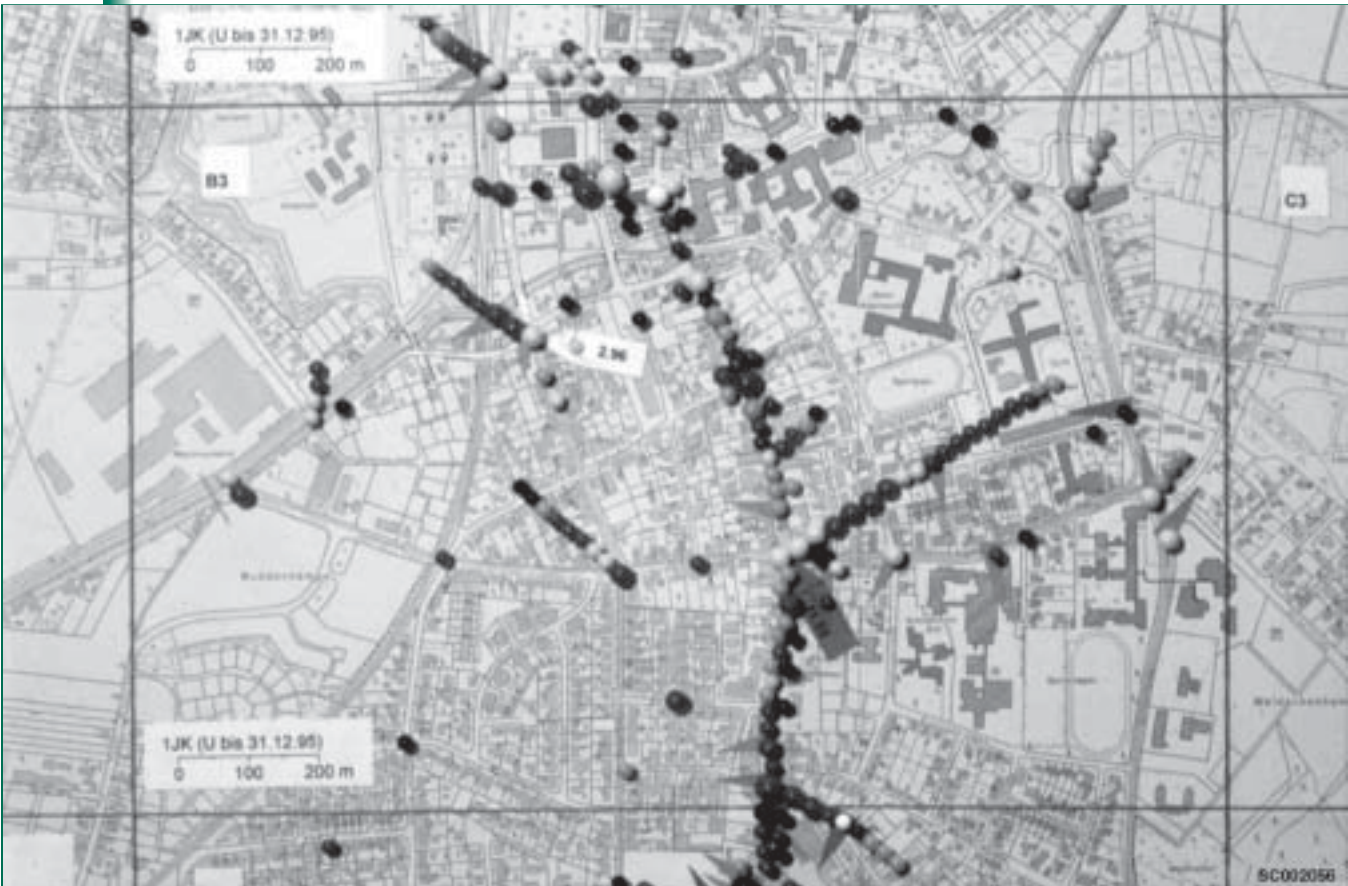


Figure 7. Germany's local accident commissions review crash location pin maps to determine high-risk areas.

and crashes involving children. At least two programs have been introduced in Germany to assist in the partial automation this process, but for the most part it is done manually.

Crash analysis in Germany is also done on a larger scale and at different stages of a roadway improvement. In addition to black spots, roadway segments and areas are also considered. For example, safety performance might be evaluated on roadways with specific characteristics, such as rural two-lane roadways with no shoulders. Also, there is a goal to incorporate safety into the process of designing and planning roadways through the introduction of an official road safety audit process, completion of cost-benefit safety analyses, and development of network safety analysis tools.

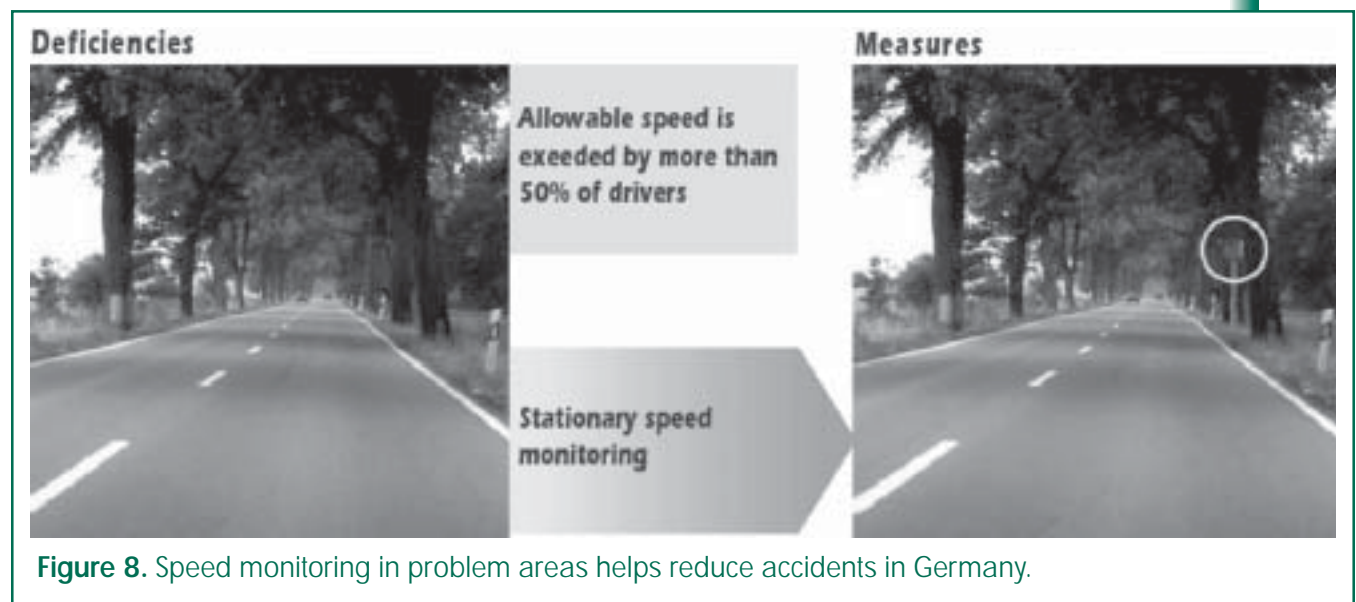
Training and Technology Transfer

A significant amount of safety training and technology transfer occurs or is planned in Germany. For example, police officers, including those on local accident commissions, receive consistent and comprehensive training in the areas of traffic management and crash analysis at the Federal Police Leadership Academy. They are trained in developing pin maps, as well as in analyzing and evaluating traffic safety situations. For this reason, they are key participants in accident commission discussions. Their training and the data they provide make them essential and knowledgeable commission members.

Some accident commissions, of course, are more effective than others. A training program for commissions recently has been developed, and instructors are being trained. Recently published documents available to the accident commission include “Measuring and Evaluating Accident-Type Maps” and “Measures Against Frequent Accident Sites.”^{(7) (8)} These documents help commissions with their use of pin maps and provide examples and photos of possible countermeasures for black spot locations.

Safety Program Elements and Activities

Examples of safety program elements and activities in Germany are listed below. This list includes only examples of particular interest to scanning team members and should not be considered comprehensive.



- Seatbelt use is required in Germany, and almost all drivers and passengers use seatbelts. Usage is about 98 percent along the autobahn, or freeway, and about 94 percent along rural roadways.
- German legislation limits the acceptable blood alcohol content of a driver to 0.05. It is also a traffic offense to drive under the influence of drugs or to use a cell phone while driving. Use of radar and laser detectors is also illegal.

- A license to drive can be acquired at age 18 in Germany, and the cost of obtaining a license is more than U.S. \$1,000. Several changes in the education and instruction of drivers have been suggested, including graduated licensing. A number of young driver education and awareness campaigns have been initiated.
- Speed management is an important part of highway safety programs in Germany. Speed limits have been instituted on some parts of the autobahn system. For example, the Rheinland-Pfalz highway authority has attained a 25 percent reduction in crashes on selected autobahn sections totaling about 90 miles by posting 80 miles-per-hour (130 kilometers-per-hour) speed limits and implementing no-passing restrictions on trucks.
- Variable message light-emitting-diode (LED) signs have been used along segments of roadway near construction and locations where congestion or crashes often occur. These LED signs indicate the status of the roadway lanes and regulate the speed in each lane. For example, speeds may be reduced gradually in lanes approaching a congested area. Signs in some areas indicate a more appropriate route for the driver.
- Traffic calming measures and speed cameras (photo radar) are also used in speed management. An example is use of gateways at interfaces from rural to urban areas. Use of this type of device was addressed by a previous scan study. In some German states, all speed enforcement is now accomplished with speed cameras.

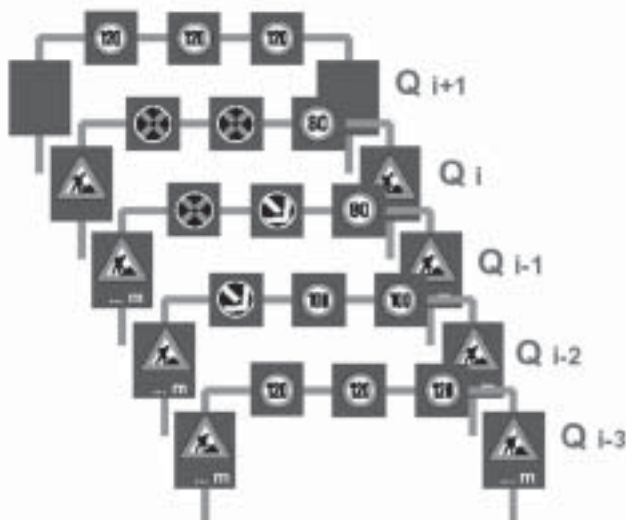


Figure 9. Germany uses variable speed limit and lane status signs in areas with construction or congestion.

- Collisions with trees result in 33 percent of the driving fatalities that occur in Germany. A significant amount of research has been done in this area and several recommendations have been generated to reduce vehicle-tree crashes. The arguments against removing trees along roadways in Germany, however, are the same as those in the United States.

- Trees and other visualization tactics are used to guide drivers to the existence and location of critical decision points, such as intersections, curves, and entry points to urban areas.
- The Germans have changed some rural two-lane roadways to the 2+1 cross section, which has a passing lane on alternating sides of the roadway. Unlike the Swedish, however, they do not use cable median barriers on these roadways.
- An experimental lighted in-pavement lane marking for a ramp diverge has been applied in at least one location in Germany. Authorities believe it has been effective in increasing the capacity and safety of this diverge area, and may have potential at other locations.
- Germany has initiated a proactive road safety audit program. Audits will be conducted by independent, well-trained investigators, and will be completed during a project's planning, initial design, detailed design, and pre-opening stages. The auditor will interact with the project's owning jurisdiction, which will make the decision to accept or reject any safety audit recommendations. Forty-eight audits have been completed in a pilot project, 34 of them in the state of Brandenburg. Road safety audits were the focus of a previous scanning study.

FINDINGS IN THE NETHERLANDS

The scanning team met with representatives of the following groups in the Netherlands:

- Transport Research Center
- Institute for Road Safety Research
- Information and Technology Center for Transport and Infrastructure
- Environment and Infrastructure Consultants
- Dutch Traffic Safety Association
- Ministry of Transport, Public Works, and Water Management

The scanning team discussed a significant number of safety policies, programs, and activities with experts in the Netherlands. The discussions summarized in this report focus on what team members believe are key components of the Dutch roadway safety improvement approach. Subjects discussed include the country's "National Traffic and Transport Plan," the concept of sustainable safety, the Dutch approach to decentralization and cooperation in highway safety, and the application of corridor and area-wide safety improvements. Examples of safety programs and activities also are listed.

National Traffic and Transport Plan

The Netherlands' "National Traffic and Transport Plan," distributed in October 2000, is a summary of the expected approach to traffic and transport issues between 2001 and 2020.⁽⁹⁾ The plan acknowledges the need for mobility, but adds that it must be balanced with accessibility, safety, and quality-of-life issues. A section of the plan



Figure 10. Germany is experimenting with in-pavement lane marking lights to make ramp diverge areas safer.

focuses on roadway safety. Key areas of consideration for roadway safety include creation of a sustainable safe roadway infrastructure, intensified traffic enforcement and new regulations, information campaigns and permanent traffic education, and introduction of in-vehicle technologies.

The Netherlands is believed to have been the first country to commit to quantitative roadway safety goals.⁽¹⁰⁾ The country has had long-term national safety goals since at least the late 1980s. The roadway safety improvement goal stated in the “National Traffic and Transport Plan” is a 25 percent reduction in fatalities and hospitalizations between 2001 and 2010. This goal is equivalent to a 30 percent reduction in fatalities (with a annual maximum of 750) and a 25 percent reduction in serious injuries (with a maximum of 14,000) by 2010, compared to the 1997-1999 average. The Institute for Road Safety Research has determined that achieving the target reduction for fatalities by 2010 is possible, but the reduction in serious injury and hospitalizations will require more work.

The goals in the “National Traffic and Transport Plan” form the basis of the safety plans, policies, and goals created at lower levels of government. For example, regional or provincial safety improvement reduction goals are the same as those stated in the national plan, but are adjusted for areas expecting large population increases. Details of regional plans are based on programming and implementation documents, as well as on capabilities and resources. Municipal safety plans are not required in the

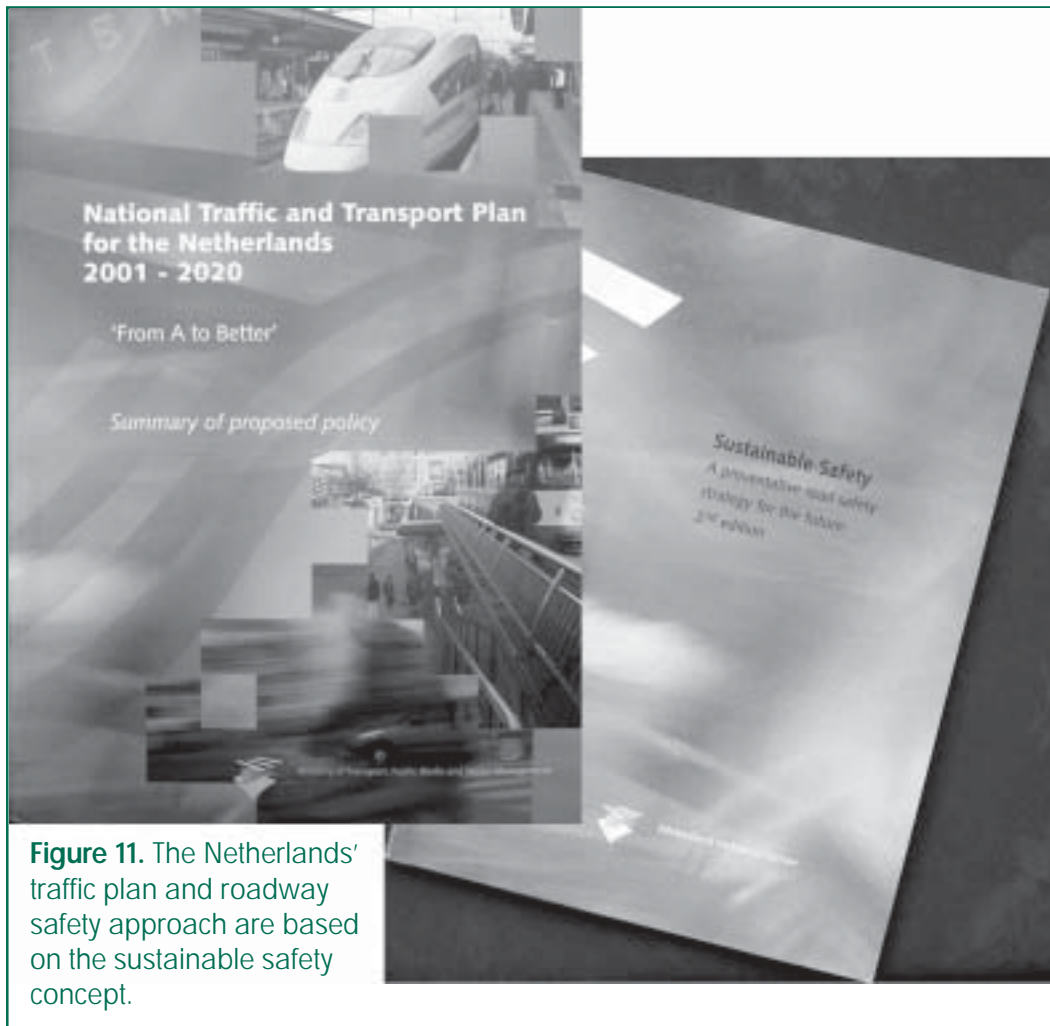


Figure 11. The Netherlands' traffic plan and roadway safety approach are based on the sustainable safety concept.

Netherlands, but these jurisdictions do indicate how they will help achieve national safety targets.

Sustainable Safety Concept

The Netherlands' current approach to roadway safety is the most recent stage in a series of advancements over several decades. During the 1980s and early 1990s, roadway safety was directed by a spearhead policy. The measures in this policy were generally reactive and mitigated the improvement of locations with known safety problems, such as black spots. It focused on activities related to the identification and improvement of black spots, speeding and speed management, drunk driving, cyclist and moped driver training, heavy vehicle safety, and promotion of such safety devices as seatbelts, helmets, and roadside barriers. The current strategy, "sustainable safety," was introduced in 1990. This approach to safety improvements is more proactive and preventive than past strategies.

The underlying philosophy of the sustainable safety approach is that roadway designs should be oriented to the human being, and that prevention and proactive safety improvements are better than a reactive approach of improving facilities after crashes have occurred. The sustainable safety approach encourages roadway

environments designed to address the limitations of roadway users, vehicles with technologies that simplify the driving task and protect other road users, and roadway users who are educated and well informed.

The roadway design principles of sustainable safety are:

- Functionality, or designing to prevent unintended use.
- Homogeneity, or designing to prevent major variations in speed, direction, and mass of vehicles at moderate and high driving speeds.
- Predictability, or designing to prevent uncertainty in roadway user actions.⁽¹¹⁾

Sustainable safety calls for roadways with similar functions to be designed in a similar manner to serve the appropriate roadway user and facilitate acceptable decisions, such as speed choice. These types of roadways are called “self-explaining.”

The Netherlands is implementing the sustainable safety approach in two phases. The first phase (1997 to 2001) focused on feasible and practical applications of safety improvement measures. The start-up program for the first phase included 24 actions. They included creating roadway classification plans, expanding urban 18 miles-per-hour and 36 miles-per-hour (30 and 60 kilometers-per-hour) zones, better assignment of priority on traffic arterials, standardized priority at roundabouts, roadway rules for mopeds, increased enforcement and education programs, and priority to cyclists from the right. In addition, the protocol for roadway safety audits was developed and tested in 1998, and audit training was conducted in 2001. Roadway safety audits, however, have not been formally adopted in the Netherlands as a requirement for transportation infrastructure projects.

Phase two of the sustainable safety implementation plan starts in 2002 and is planned to end in 2010. This phase will include education and enforcement measures, vehicles and vehicle technologies, spatial planning issues, and measures for the private transport sector. In addition, the 18 and 36 miles-per-hour (30 and 60 kilometers-per-hour) zones will be expanded, arterials will be re-engineered, and more communication and enforcement on alcohol and drug use will be added. In addition, safety activities will be targeted at schools, parents, and students, and a general increase in safety awareness will be promoted. More post-school education and safety training are envisioned.

Decentralization and Cooperation

Two key components of effective highway safety implementation in the Netherlands are appropriate decentralization of responsibility and a culture of coordination and cooperation. In the “National Traffic and Transport Plan,” the Dutch government recognized that its ability to meet national fatality reduction goals would require the decentralization of roadway safety improvement responsibilities. Many crashes occur on 30 and 48 miles-per-hour (50 and 80 kilometers-per-hour) roadways, and the goal was to assign responsibility to those levels of government where the improvement could be accomplished most effectively. An official roadway safety decentralization agreement was signed in 1994, and required establishment of Regional Road Safety Agencies to systematically coordinate safety organizations and their improvements.

In general, the Dutch government wants to “[d]ecentralize where feasible, centralize where imperative.”^{(9) (11)}

The decentralization agreement and the content of the “National Traffic and Transport Plan” were determined through a negotiation process called the “Polder” model. This model solves problems through close consultation and eventual agreement of all the groups interested in a particular subject. The Dutch understand that this process of cooperative and all-inclusive agreement may take longer than other approaches, but it is common in the Netherlands. The concept of sustainable safety was the result of consultation among national, regional, and local levels of government. In addition, a high level of cooperation and support exists between government entities and nongovernmental organizations.

Corridor and Area-Wide Improvements

The Netherlands traditionally has used an extensive reactive program of black spot identification for highway safety improvement programming. In fact, the Dutch developed a manual on black spot identification and correction and until 2001 subsidized local governments for these corrections. Over the years, however, roadway crashes in the Netherlands became more evenly distributed over the highway system, and as part of the sustainable safety concept the Dutch began to emphasize and implement corridor and area-wide safety improvements. For example, the Dutch have introduced 18 miles-per-hour (30 kilometers-per-hour) speed zones along local urban networks and streets with a relatively high level of pedestrian activity. They also have introduced 36 miles-per-hour (60 kilometers-per-hour) speed zones along local rural roadways, and begun to re-engineer urban and rural arterial roadways with 31 miles-per-hour (50 kilometers-per-hour) and 48 miles-per-hour (80 kilometers-per-hour) speed zones, respectively. The locations of these zones often are defined by the preferred function of the roadways in an area and the expected crash frequency along a specific corridor or within a specific area. Measures to improve roadway safety within these defined zones are then developed, and often include geometric designs and traffic-calming elements to create self-explaining and self-enforcing roadways that encourage drivers to travel at appropriate speeds. The overall objective is to proactively improve locations with high expected crash frequencies.

Safety Program Elements and Activities

Below are examples of safety program elements and activities in the Netherlands that team members learned about during the scanning study. The list is not comprehensive, but includes activities of particular interest to team members.

- The Netherlands has a blood alcohol content limit for drivers of 0.05, and would like to lower this level to 0.02 for drivers with less than three years’ experience. This approach is similar to that applied in the United States for drivers under 21, but would include new drivers of all ages. The introduction of a graduated or provisional licensing process is also being considered.
- The Dutch have a designated driver campaign called “BOB” that they consider a success. “BOB,” the designated driver, does not drink and ensures that his or her friends arrive home safely.



Figure 12. The Netherlands uses self-enforcing roadways and traffic-calming elements to encourage drivers to travel at appropriate speeds.

- Seatbelt and helmet use is required in the Netherlands, and photo enforcement of seatbelt use and speeding is common. Use of cell phones while driving is prohibited except in a hands-free mode. Truck speed limits have been introduced, along with some electronic surveillance of truck and driver activities.
- More than 50 percent of the trips in the Netherlands are non-motorized, and about 45 percent of roadway fatalities involve people outside a motor vehicle. This makes implementation of measures related to pedestrians, bicyclists, and moped drivers important. Many safety organizations in the Netherlands have human factors experts on staff. The Information and Technology Center for Transport and Infrastructure has produced both bicycle and pedestrian design guidelines. The general approach for vulnerable user safety in the Netherlands, however, is separating the different modes along roadways where the travel speed of vehicles and non-motorized traffic is high. The Information and Technology Center is also the organization responsible for drafting Dutch roadway design standards and guidelines.

- The Netherlands has many measures to improve the safety of pedestrians and bicyclists. For example, sidewalks are standard in urban areas, and most intersections have crossing facilities. Crossing facilities for special pedestrian groups exist, and wheelchair routes are widespread. Guidelines for addressing the needs of the visually handicapped are available, and certain areas in town centers are open only to pedestrians. In rural areas, pedestrians are accommodated when the need is recognized through such measures as recreational routes. For bicyclists, cycle paths or lanes exist along most arterial roads for day-to-day use, and a separate rural cycle path network is provided. Protected bicycle crossings with bicycle traffic signals are common, and cycle parking facilities are provided at focal meeting points. Traffic-calming devices are widespread, and considerable

attention is paid to bicycle rider comfort. Red asphalt has replaced tiles on bicycle facilities, for example, and the bicycle network is almost complete.

- The Dutch use a rural two-lane cross section – often with some type of pavement marking or physical barrier to separate opposing traffic – along some roadways where passing is not allowed. This approach is acceptable because towns are usually close enough that driver frustration rarely has a chance to occur. When prohibition of passing is not possible, the 2+1 cross section – construction of passing lanes on alternate sides of the roadway – is considered as an alternative.
- Computer visualization tools are used in the design and evaluation process to calculate sight distance on roadways.
- A standard approach to road safety audits was developed in 1998, and audit training began in 2001. The road safety audit process has resulted in design improvements and is considered a proactive approach to increasing roadway safety. The application of road safety audits, however, has not been adopted formally in the Netherlands as a requirement for transportation infrastructure projects.
- In the Netherlands, as in many countries, not all crashes are registered in the national crash record database. Typically, 97 percent of fatal crashes, 60 percent of serious injury crashes, and 16 percent of minor injury crashes are reported. The Dutch have devised a method to produce a more accurate estimate of actual fatalities and injuries by using medical, insurance, vehicle, road, and in-car information databases, along with data about mortality causes, hospitalized persons, persons aided at hospitals, and inquiry. The method, established in 1996, is the comprehensive system application of scientific extrapolation methods and independent sources. Other improvements for better crash data collection include consideration of more specific reporting standards, electronic recording for police enforcement, and a centralized reporting location.
- Dutch legislation has established a number of transportation-related education requirements. Mandatory traffic safety education occurs in primary school, for example, and traffic safety is addressed in lessons during the first three years of high school. A compulsory knowledge test is required to use a moped at age 16. A license for driving a vehicle requires a theoretical and practical test at 18. People learning to drive in the Netherlands must attend driving schools, which are monitored and controlled by the agency responsible for administering testing for a driver's license. Drivers ticketed for being under the influence of alcohol must attend rehabilitation courses.
- There is a general concern about the safety of moped and young passenger car drivers because they are the only groups for which the crash risk has not decreased during the past 15 years. The Dutch hope to introduce a practical driving test for moped licensing, a penalty point system for novice passenger car drivers, and a zero blood alcohol content requirement for novice drivers. Use of simulators and computer-aided instruction in driver training is being considered, along with regular proficiency tests for drivers, quality control for driving schools, and more traffic safety education in high school. Introduction of additional

rehabilitation courses for violations such as aggressiveness and speeding is of interest.

FINDINGS IN THE UNITED KINGDOM

The scanning team met with representatives of the following organizations while visiting the United Kingdom:

- Department for Transport, Local Government, and the Regions
- Highways Agency – Traffic Safety and Environment Division
- Highways Agency – Area Team 14
- Scott Wilson International Consultants
- University College – London
- Transport Research Laboratory

The scanning team discussed a significant number of safety policies, programs, and activities with experts in the United Kingdom. The discussions summarized in this report are key components of the roadway safety programming and policy approach in the United Kingdom. They include the national safety strategic plan, national safety targets, integration of safety plans throughout the country, financial incentives for safety, and corridor and area-wide safety improvements. Examples of safety program elements and activities also are listed.

National Safety Strategy

The United Kingdom consists of Great Britain (Scotland, Wales, and England) and Northern Ireland. In 1987, Great Britain's roadway safety goal for the year 2000 was to reduce casualties by a third, a goal that was met and exceeded.⁽¹²⁾ The three activities believed to account for most of the casualty reduction are increased use of occupant restraints, additional programs on driving while under the influence of alcohol or drugs, and implementation of roadway safety engineering design improvements. In addition, motorcycle riding, walking and bicycling declined. Government officials believe having a specific fatality reduction goal is one of the most important aspects of effective roadway safety programming.

In March 2000, the United Kingdom published a new national safety strategic plan entitled "Tomorrow's Roads – Safer for Everyone."⁽¹²⁾ This plan not only included new roadway safety improvement targets, but also described and prioritized more than 140 safety improvement strategies and actions related to the roadway environment and its users. Focus areas included:

- Children and other vulnerable road users
- Driver training and testing
- Drinking, drugs, and drowsiness
- Roadway infrastructure

- Speeds
- Vehicle design and maintenance
- Enforcement, education, and information

The plan defined primary safety concerns related to each of the focus areas and described actions and strategies. Measures and actions identified include safety engineering, education, and enforcement mitigation. The measures and actions identified were prioritized as those that should be implemented immediately, in the next two-to-three years, or over the long term, as well as those requiring new legislation. Both national and local officials have expressed strong support for the content of the roadway safety strategy and its targets. The document content was a result of communication and cooperation in the roadway safety community throughout the country.

Defensible Safety Targets

The national safety strategy recommends implementation of several measures to achieve the 2010 fatality and injury reduction targets. The safety improvement targets, compared to averages from 1994 to 1998, include:

- A 40 percent reduction in total roadway fatalities and serious injuries.
- A 50 percent reduction in the number of children killed or seriously injured.
- A 10 percent reduction in the slight casualty 100 million-vehicle-kilometer rate.

The first two goals are stated as a total magnitude reduction, but the goal for slight casualties, which is expected to be the most difficult to achieve, is a rate. It has been found that safety goals stated as magnitude reductions rather than rates are better understood by the public and allow easier monitoring and impact evaluation of the measures implemented. The government has required progress toward national goals to be reported in two three-year documents between 2000 and 2010.

Experts in the United Kingdom believe the government's three safety improvement targets are achievable. This conclusion is based on supporting research and analysis used in their creation.⁽¹³⁾ Researchers believe the reduction targets for those killed or seriously injured are conservative and may actually be exceeded. For example, the expected contribution of measures related to 12 policy areas have been studied and documented. These contributions are listed in Table 4. Achieving the reduction in the slight casualty rate is expected to be more difficult because safety improvements implemented to reduce fatalities may result in an increase of these types of injuries. Research supporting the idea that the safety targets are achievable was a key factor in the acceptance, development, and implementation of the national safety strategy and other highway safety plans in the United Kingdom.

Coordination and Communication

The content of the United Kingdom's national safety plan was developed through a significant amount of communication and coordination among safety professionals and agencies throughout the country. Coordination on highway safety planning

between national and local levels of government appears to be excellent. This approach has resulted in active support of the national strategic safety plan from the highest to lowest levels of government, and produced a situation in which localities take pride in achieving safety improvements. In fact, a sense of competition on roadway safety exists among neighboring jurisdictions. Having formal goals has focused safety organizations on the choices and priorities that truly can reduce fatalities and serious injuries.

The targets and measures in the national plan act as a focal point and form the basis for highway safety plans developed throughout the United Kingdom. The Highways Agency – an agency of the Department for Transport, Local Government, and the Regions – is responsible for operating, maintaining, and improving the motorways and trunk road network.⁽¹⁴⁾ This system represents about four percent of the roadway miles in the United Kingdom, but carries about 35 percent of the traffic and has only 12 percent of the crashes.^{(14) (15)} It is the safest system in England.

The Highways Agency’s strategic plan for safety includes measures and targets based on the national plan. The plan identifies and describes safety improvement measures and actions related to achieving the Highways Agency’s targets. These safety improvement goals are smaller than those in the national plan, but are considered more realistic because the agency has jurisdiction on a system that already is England’s safest and that is constructed to high design standards. The Highways Agency targets are to reduce the number of killed or seriously injured on the motorways and trunk roadways by a third, cut the rate of slight casualties by 10

Table 4. Expected killed and seriously injured reductions.

Area of Implemented Policy/Measure	Expected Killed and Seriously Injured Reductions (Percent)
General Road Safety Engineering	7.7
Improved Secondary Safety in Cars	8.6
Other Vehicle Safety Improvements	4.6
Cycle and Motorcycle Helmets	1.4
Safety on Rural Single Carriageways	3.4
Novice Drivers	1.9
Safer Conditions for Walking and Cycling	1.2
Reductions in Speed	5.0
Greater Safety for Children	1.7
Reduced Drunk Driving	1.2
Car Driving in Course of Work	1.9
Other Improved Driver Behavior	1.0
Combined Impact	35.0

percent, and contribute to the 50 percent reduction in child casualties.⁽¹⁵⁾ The actions and measures described in the Highways Agency safety plan are related to 10 road user groups and involve improvements to infrastructure, technology, education, enforcement, partnerships, and management and monitoring. To achieve these targets, the agency plans to coordinate with a number of safety organizations and local councils that have road and road safety responsibilities.

In England, local highway authorities are required to create and update a Local Transport Plan. The plan is intended to be a local vision for all transportation decisions, including a local safety strategy that includes:

- 2005 casualty reduction targets supported by annual milestones.
- An assessment of current safety problems.
- A description of how local citizens and groups will be involved in casualty reduction efforts.
- An explanation of how roadway safety is taken into account in other local policies.
- Annually updated performance indicators and a prioritized list of safety improvements with expected results.
- Education, training, and publicity measures that will be implemented.

In general, local governments in Great Britain are required to identify safety improvement targets that will help achieve those declared nationally. They can choose the measures they expect to implement to meet local targets, but they must monitor their progress toward these targets on an annual basis. They are also encouraged to participate in the Monitoring of Local Authority Safety Schemes program. This program is a database of information related to the effectiveness of local safety improvements. It can assist with the identification, expected impact estimates, and benefit-cost calculations of safety improvement measures. Local Transport Plans also include safety education, training, and publicity measures.

The United Kingdom government has produced “A Road Safety Good Practice Guide” to help local government and other transportation officials achieve local and national safety targets.⁽¹⁶⁾ This document describes some of the more effective measures used to improve roadway safety. It is based partially on measures used in existing Local Transportation Plans. It includes approaches to identify, prioritize, and improve locations with safety concerns. Safety improvements addressed include single-site actions, mass action to make improvements at all similar sites, area actions, and route treatments.

Financial Incentives

The United Kingdom’s national government funds most local safety improvements. For the most part, this funding is based on the content, implementation, and results of Local Transport Plans. How local safety funding is provided has changed recently in the United Kingdom. The new approach provides all funds in a block amount to the local government, and each locality prioritizes the spending of funds as it sees fit. The amount of money the national government provides a locality is based on its

measured performance. In fact, financial incentives for meeting a number of goals, including safety or transportation performance, are available. About 75 percent of local governments in the United Kingdom have chosen safety as their financial incentive performance measure.

Route and Area-Wide Safety Improvements

Similar to several other countries the scanning team visited, highway safety agencies in the United Kingdom have begun to focus many of their safety improvements at corridor and area-wide levels. Black spots, or locations with safety concerns, are still investigated and improved, but often are included in more widespread initiatives. Past improvement of black spots has resulted in data that show a larger number of widespread locations with similar safety levels.

A new approach has begun to be implemented that emphasizes comprehensive safety improvements along extended sections of highway or within specific areas rather than just at black spots. This new approach is data driven and emphasizes planning to implement cost-effective safety measures. A review of crash data helps determine and prioritize the routes or areas to be improved. For example, research has been conducted to establish safety improvement intervention crash levels for rural roadway sections. It is at these intervention levels that improvement of a roadway may be considered justified.

The scanning team viewed corridor improvement safety projects in Highways Agency Area 14, which is southeast of Manchester in England's Peak District. Management and maintenance of Highways Agency roadways in Area 14 have been contracted to a private contractor, which has completed several whole-route safety-related projects. A number of safety improvement measures are consistently applied throughout the corridors, but locations with special safety concerns are mitigated as appropriate. Corridor-level safety improvement measures implemented in Area 14 projects include high-performance marking and signing, intelligent roadway studs, new and more consistently applied speed limits (such as the same speed limits in consecutive villages), gateways, splitter islands, speed cameras, flashing fiber optic signs, higher-friction and colored pavements, guardrails, passing lanes, and improved cycle and pedestrian facilities. Preliminary data indicate that safety along the corridors has improved.

The United Kingdom also has experimented with the application of area-wide safety improvements. A project in Gloucester, a city with a population of 120,000, is known as the Gloucester Safer City program.⁽¹⁷⁾ Because of the scattered nature of crashes in the city, it did not lend itself to a traditional black-spot correction program. The program is a demonstration project for urban safety management, and was funded at about U.S. \$8 million. One objective was to reduce roadway casualties in the city by 33 percent by April 2002. This program used a multidisciplinary approach, not just engineering schemes, to improve safety. Key components include properly defining the roadway hierarchy, focusing through traffic on arterial roadways and residential traffic on residential roadways, and managing speed. The project recently ended, but in 2001 community-wide fatalities and serious injuries dropped 38 percent. Although slight casualties remained the same in Gloucester, they increased seven percent nationally from 1996 to 1999. An unexpected result of the focus on roadway safety

was a 13 percent increase in the number of crashes reported. A similar demonstration in an inner city area is being planned.

Safety Program Elements and Activities

Examples of safety program elements and activities in the United Kingdom include:

- Speed management measures often are used as safety improvement devices. Typical speed management techniques include the use of cameras for speed enforcement, interactive signs, and traffic-calming measures. For safety purposes, speed cameras in the United Kingdom are used only at locations with high speed-related crash numbers. Interactive signs have been used on approaches to horizontal curves, where a flashing beacon or “SLOW DOWN” message is activated when a speeding vehicle is detected. Variable speed limit signs help reduce vehicular conflicts and speed variability in congested areas. The concept of self-explaining roadways is also being implemented in the United Kingdom, and traffic-calming techniques are often used to indicate appropriate driving speeds. At the location where a through roadway enters a village, for example, a gateway may be added and pavement markings and signing changed.
- The United Kingdom has completed a general review of the speed policy.⁽¹⁸⁾ The review includes recommendations for future speed policies and identifies areas for research.
- Road safety audits have been implemented comprehensively in the United Kingdom. Independent audit teams consider the safety impacts of proposed improvements on all roadway users. Road safety audits, which are applied to all Highway Agency trunk roadway projects, are conducted during different stages of a project. These stages include the feasibility and initial design stage, preliminary design and draft plan stage, detailed design stage, and pre-opening or as-built stage. Use of road safety audits has been shown to be effective.
- Transportation safety professionals in the United Kingdom government have realized that public opinion is key to the success of a safety program. They approach the introduction of a safety initiative by determining and understanding its relevance to the public.
- Seatbelt use in the United Kingdom is high and considered a given in the area of roadway safety. Seatbelt use is required for all passengers in the front and back seats. For the most part, only small additional increases in seatbelt use are possible. Motorcyclist helmet use is also required.
- One objective for future educational promotions is convincing roadway users that they should have the same opinion of speeding as they have of not wearing seatbelts or drunk driving. The goal of a major advertising campaign will be to make speeding socially unacceptable.
- Research in the United Kingdom has found that marking a centerline on a two-lane roadway increases speeds, so the centerlines on some minor two-lane roadways have been removed to reduce speeds. Edgelines are sometimes used on roadways without the use of a centerline.



Figure 13. The United Kingdom uses high-performance marking and signing and consistently applied speed limits to improve safety along corridors.

- Another area of interest is the safety of workers who drive on the job, because research has found that workers in company cars have higher crash rates than the general population. Discussion has centered on making worker safety while driving as much a priority as worksite safety.
- Cameras to document speeding and red light running have been used in the United Kingdom for many years. As in the United States, it has been suggested that some jurisdictions used the cameras to produce revenue, but more people still approve of their use than disapprove. In addition, speed cameras for safety purposes are installed only at locations with speed-related crash concerns, and money collected is spent on additional cameras.
- As in the Netherlands, more 20 miles-per-hour zones are being implemented in the United Kingdom. Research has shown that the likelihood of a pedestrian fatality is much lower at this speed than at higher speeds. In most areas, however, reduction in speed limits is combined with physical measures to meet speed reduction goals.
- All police agencies in the United Kingdom use one crash report form. This information is deposited into a national database called STATS19. This information is used for research purposes and the creation of an annual national crash report.
- Overall, safety planning in the United Kingdom has led to funding improvements with a minimum benefit-cost ratio of 10.0. Some are concerned that this approach represents an under-investment in highway safety and that more projects with benefit-cost ratios between 1.0 and 10.0 should be funded. In the benefit-cost analyses that are done, crash costs are based on a “willingness to pay” approach. The cost of a fatality used in the analysis is estimated at 1 million pounds (about U.S. \$1.5 million) and the cost of an injury at 120,000 pounds (about U.S. \$180,000).
- All trucks in the European Union are required to have digital tachographs, devices that limit their maximum speed to 90 kilometers per hour (about 55 miles per hour). Buses or coaches are limited to 100 kilometers per hour (about 60 miles per hour).
- Provisional driving licenses are possible at 17 with a theory test and a practical test. The pass rate for 17-year-olds is about 56 percent. Once the tests are passed a full driver’s license is granted. Licenses for small mopeds – with maximum speeds of 30 miles per hour – are attainable at 16.
- The Transport Research Laboratory is involved in a large number of safety-related research activities. It has introduced the use of laser scanners, for example, to quickly collect data and three-dimensional models at crash scenes. The laboratory crash tests vehicles and roadside devices. It also is investigating skid resistance improvements, and the scanning team observed the vehicle simulator that it is using in a number of projects.
- A number of traffic-calming devices are used to reduce or control speeds in the United Kingdom. Examples include gateways, speed humps, and chicanes. Other

technologies used include variable message signs and variable speed limits. Similar to the other countries visited, the United Kingdom uses the alternating passing lane two-lane roadway cross section, or the 2+1.

chapter three

COMMON SAFETY PROGRAM THEMES

The scanning team noted that the highly successful highway safety programs in the four countries visited share a number of common themes. The effectiveness of the safety programs in Sweden, Germany, the Netherlands, and the United Kingdom appear to result at least partially from the application of these themes. Several commonalities among the highway safety programs explored are described below.

HIGHWAY SAFETY AS A PUBLIC HEALTH OR QUALITY OF LIFE ISSUE

For the most part, highway safety is viewed as a public health or quality of life issue in the countries visited. In all cases, this viewpoint started with the national government's clear support of safety programs. A number of approaches have brought the issue of highway safety to the forefront for local governments and the general public. These include major advertising campaigns, accident commissions, financial incentives, and the direct involvement of local representatives in creating national and local safety plans.

At least two countries the team visited have a roadway safety philosophy, concept, or slogan. This serves as a focal point for roadway safety discussions among transportation professionals, agencies, and the general public, and helps make safety a common point of discussion. Opinions differ, of course, on the choice of a national philosophy, concept, or slogan. Some transportation officials believe that if an overarching safety philosophy is not selected or communicated properly, it may do more harm than good to the relationship between transportation professionals and the general public.

COMPREHENSIVE AND COORDINATED SAFETY PLANS AND GOALS

All of the countries the team visited take a proactive approach to highway safety that includes a fully integrated and nationally accepted comprehensive safety plan. Normally, these plans are created through a coordinated effort of communication and input from all levels of government and other organizations involved in roadway safety. With this approach, individuals, agencies, and groups involved in actual application of safety improvements gain a vested interest in successful implementation of plan measures. In all the countries, local governments have most of the responsibility for safety improvement implementation, and their cooperative and effective involvement is necessary to achieve national safety goals and targets.

Three out of four countries have specific fatality and injury reduction targets in their national safety plans. These targets serve not only as a focal point for the safety improvement approach followed, but also for the safety measures recommended and implemented. Strong national leadership and significant financial support for safety improvements, combined with comprehensive involvement of the safety community, are keys to success.

The national safety plans typically form the basis for other safety plans and targets. In many of the countries visited, state departments of transportation and local governments develop and sometimes are required to create their own safety plans. Most of these lower-level plans consider the measures and targets expressed

nationally, and then describe how a particular agency intends to improve roadway safety. The plans take into account the agency's existing resources, identify safety-related measures it could implement, and set a specific safety target for the jurisdiction. Typically, these targets are the same as the national goals, but in some cases they are not. Normally, monitoring of progress toward local and national safety targets is required.

HIGHWAY SAFETY PROGRAM ELEMENTS

Several elements of highway safety programs in the countries the scanning team visited share similarities. These activities and approaches are key components to the effective application of the safety plan in these countries and past reductions in roadway fatalities and injuries. Some safety activities observed in more than one of the countries visited include:

- Required (primary) seat belt use for all passengers.
- Low acceptable levels and tolerance of driver blood alcohol content (often 0.05 and lower).
- Use of extensive public education campaigns on such issues as aggressive driving, alcohol-involved driving, and speeding.
- Substantial enforcement efforts, including use of automated enforcement and cameras for red light running and speeding.
- Speed management measures, such as speed cameras, traffic-calming devices, interactive signing, and variable speed limits.
- Vehicle crash studies and crashworthiness considerations in crash analysis.
- Focus on vulnerable road user protection and separation measures.
- Application or consideration of novice and young driver training and licensing programs.
- Route-based or area-wide safety improvement programs.
- Road safety audits.

Many items listed have been implemented in some form in the United States. Compliance with regulations related to these program elements in the countries visited appears to be significant, although no specific information was provided.

HIGHWAY SAFETY SUPPORT ACTIVITIES

One factor in each country that has a significant impact on the success of the highway safety program is the existence of strong, effective support activities. For example, each country does a significant amount of safety data collection and analysis. The results of these activities are used to determine appropriate national and local safety targets and to show how they can be achieved. In addition, results are used to indicate the impacts of existing or planned safety improvements, and allow evaluation of these impacts for effectiveness. These support activities also allow the performance of the

agencies implementing safety measures to be measured, and in at least one case the result of this analysis has financial incentive impacts. The data collected and analyzed help determine the general approach and specific measures used to influence roadway safety, such as black spot versus corridor or area-wide implementation.

Each country provides significant funding to highway safety research agencies for their active technical support, expertise, and policy analysis capabilities. In addition, substantial intellectual capacity and support are directed toward the highway safety field. In several cases, a significant portion of the funding to roadway safety research organizations and nongovernmental organizations is also from the national government. Nongovernmental organizations, for the most part, participate directly in the highway safety programming and plan development decision-making process. They often challenge governmental approaches or operate as a watchdog for the general public on roadway safety.

chapter four

RECOMMENDATIONS AND IMPLEMENTATION STRATEGY

SCANNING TEAM RECOMMENDATIONS

The scanning team gathered a significant amount of information on the management, organization, and implementation of highway safety programs. Key findings from each country and commonalities among the highway safety programs are described in this report. Examples of roadway safety programs and activities are also listed for each country. The findings of the scanning team led to four recommendations, outlined below. The findings, observations, and recommendations are those of the scanning team and not of FHWA.

Fully Integrated, Financially Supported Safety Plan

All the countries visited have a fully integrated highway safety plan that includes significant financial and administrative support. Consistent and comprehensive communication, participation, and input from all safety organizations are essential to the development and effective application of these plans. Communication links occur throughout the country, and within and between safety organizations from the federal to local levels. Full integration of all players in the highway safety arena is essential in developing nationally accepted plans and safety goals. The content of national plans forms the basis for state, local, and nongovernmental highway safety plans.

The scanning team recommends that this type of approach be used in the United States. One national safety plan with safety improvement goals is needed to serve as the focal point for guidance throughout the country. Individuals and organizations active in roadway safety at all levels should be included in the creation of this document. State and local governments could use the national safety plan to create their own strategic approaches and goals for improving roadway safety in their jurisdictions and ultimately contributing to national targets.

Achievable Safety Improvement Targets

The scanning team recommends that all highway safety plans in the United States include specific safety improvement targets or goals keyed to a national plan and agreed to by the agencies and organizations involved in the plan's creation. Safety targets included in these plans should be based on supporting roadway safety improvement research. In fact, plans should indicate how targets might be achieved by including as much supporting documentation as possible and identifying the expected contribution of particular safety measures. The sum of the expected individual contributions should be equal to or greater than the overall reduction target proposed in the plan. Specific targets and measures included in the safety plans should be tailored to the highway safety concerns, needs, and resources of individual jurisdictions.

In the United States, the ability to accomplish this recommendation would require completing additional research into the effectiveness of particular safety improvements and the safety impacts of specific roadway characteristics. It also

would require monitoring the effectiveness of the safety improvement measures implemented both individually and in combination. Ability to complete these tasks should be considered when the form – such as crash frequency or rate – of safety targets is identified.

Safety Performance Incentive Program

Safety performance incentive programs encourage governments to take active steps toward improving highway safety. The scanning team recommends implementation of this type of program in the United States at the Federal and/or State levels.

It is generally recognized that the safety improvement targets proposed in any national highway safety plan can be achieved only through implementation of program measures at State and local levels of government. Implementation of these measures involves economic and staffing requirements, and providing financial incentives related to safety performance measures could be an effective tool for achieving national, State, and local safety improvement targets. Safety performance incentive funds also could be used for additional safety improvements. The effective use of safety-related financial incentives would require measuring the performance of safety improvements implemented by individual jurisdictions and comparing them to the targets documented in their plans.

Demonstration Project and Safety Program Focus

The scanning team's final recommendation relates to implementation of a demonstration project and the continued focus in the United States on three highway safety program elements common in Europe. The team recommends a demonstration project on the consideration, identification, implementation, and evaluation of corridor or area-wide safety improvements. The corridors or areas used in this demonstration project should be chosen on the basis of expected safety performance. In addition, a safety plan and targets should be developed for the locations chosen, and the results of the project monitored and compared to the targets.

The team also recommends that speed management measures, automated enforcement, and road safety audits continue to be used and promoted in the United States. All three techniques, reviewed by earlier scanning studies, are part of the safety approach in all the countries visited. The effective use of these measures is directly related to the procedures used in their implementation, such as restriction to locations with a safety concern and evidence of their positive impacts once installed. These measures have been applied, often on a corridor or area-wide basis, with great success in the countries visited.

IMPLEMENTATION STRATEGY

The focus of this scanning study and its recommendations was on effective highway safety programs, policies, tools, and measures. Implementation of these types of elements is not typically short-term or physical in nature. In fact, the impact of this study may be measured by whether its recommendations and findings are incorporated into the national, State, and local highway safety plans and programs of the future. Implementation of the results from this study depends, therefore, on continuous, consistent, and comprehensive dissemination of its contents. Scanning

team members will advance this objective by presenting the study results at various meetings.

The scanning team identified several efforts related to the discussion of policy guidance and comprehensive coordination in the area of highway safety programming. Given the expected resources available for implementing any suggestions and the timing of the upcoming Federal transportation funding reauthorization, however, the team recommends only one specific action now.

In April 2002, the Netherlands held a highway safety “Sunflower” Conference. The “Sun” in “Sunflower” refers to the initial letters of Sweden, the United Kingdom, and the Netherlands. The conference objective was to use highway safety in these three countries as examples for other European Union countries. Discussions were held to identify the highway safety programs needed to continue improving safety performance throughout Europe, and dialogue focused on safety policies and project selection. The countries sponsoring the conference are Europe’s leading safety experts and are recognized for their ability to work with senior leadership.

The scanning team recommends that two or three conferences of this type be held in the United States. Each conference would include participation of European experts the scanning team met with, several team members, and leaders from the State in which the conference is held. A national-level conference of this type, with USDOT and AASHTO involvement, is also recommended. The three tasks identified to organize this type of conference are described below.

Task 1 – Form Steering Team and Select Host States

A subgroup of the scanning team, assisted by a private contractor, should identify two or three potential States where a “Sunflower” conference would be politically accepted and have a realistic chance of success. The contractor would make contacts with the selected States to test the feasibility of holding the workshop. In addition, the team would assess the possibility of a national-level “Sunflower” conference involving USDOT and AASHTO leaders.

Task 2 – Confirm Political and Senior Leadership Attendance

The States identified for a “Sunflower” conference would need to assure attendance by senior leaders, including the governor, State transportation secretary, police superintendent, and possibly legislators or judges. Host States would commit to a one-day workshop that includes a safety policy discussion among all disciplines in reaction to the European model for advancing highway safety. The pollination of these concepts with senior leaders is expected to lead to safety improvements that work toward the national safety goals. Similarly, a national-level “Sunflower” conference would focus on future approaches to involving State and local governments in national safety planning. It may be possible to organize a national conference as an extension of other regularly scheduled national highway safety meetings.

Task 3 – Host Multi-State Study by European Experts

Over a week-to-10-day period, a subgroup of the European experts visited during this scanning study would be involved in the State-level and national conferences. Members of the initial scanning team would host these meetings.

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appendix a

EUROPEAN CONTACTS

SWEDEN

Lennart Axelson
Director at International Secretariat
Swedish National Road Administration
S-781 87 Borlange, Sweden
Email: lennart.axelson@vv.se

Anders Lie
Traffic Safety Department
Swedish National Road Administration
SE-781 87 Borlange, Sweden
Email: anders.lie@vv.se

Birger Høeøk
Deputy Road Manager and Department
Manager
Swedish National Road Administration,
Stockholm Region
Hemvaernsgatan 15
SE-171 04 Solna, Sweden
Email: birger.hoeok@w.se

Roger Johansson
Deputy Director, Traffic Safety
Department
Swedish National Road Administration
S-781 87 Borlange, Sweden
Email: roger.johansson@vv.se

Peter Larsson
Traffic Safety Department
Swedish National Road Administration
S-781 87 Borlange, Sweden
Email: peter.larsson@vv.se

Torbjoern Falkmer
Swedish National Road and Transport
Research Institute
581 95 Linköping, Sweden
Email: torbjorn.falkmer@vti.se

Hans Erick Pettersson
Research Director
Swedish National Road and Transport
Research Institute
581 95 Linköping, Sweden
Email: hans.pettersson@vti.se

Staffan Nordmark
Senior Researcher
Swedish National Road and Transport
Research Institute
581 95 Linköping, Sweden
Email: staffan.nordmark@vti.se

Thomas Turbell
Research Director, Technology Division
Swedish National Road and Transport
Research Institute
581 95 Linköping, Sweden
Email: Thomas.turbell@vti.se

Goran Nilsson
Swedish National Road and Transport
Research Institute
581 95 Linköping, Sweden
Email: goran.nilsson@vti.se

Nils Petter Gregersen
Swedish National Road and Transport
Research Institute
581 95 Linköping, Sweden
Email: nils.gregersen@vti.se

GERMANY

Prof. Dr.-Ing. Klaus Habermehl
FH Darmstadt
FB Bauingenieurwesen
Haardtring 100
64295 Darmstadt, Germany
Email: habermehl@fbb.fh-darmstadt.de

Gunter Zimmermann
International Office
BAST
Bruederstrasse 53
51427 Bergisch Gladbach, Germany
Email: zimmermann@bast.de

Prof. Dr.-Ing. Christian Lippold
 TU Dresden
 Fakultaet Verkehrswissenschaften
 Friedrich List
 Institut fuer Verkehrsanlagen
 Lehrstuhl Gestaltung von
 Strassenverkehrsanlagen
 Mommsenstrasse 13
 01062 Dresden, Germany
 Email: Christian.lippold@mailbox.tu-dresden.de

Prof. Dr.-Ing. J. Stefan Bald
 TU Darmstadt
 Fachgebiet Strassenwesen
 Petersenstrasse 30
 64287 Darmstadt, Germany
 Email: jsbald@verkehr.tu-darmstadt.de

Prof. Dr.-Ing. habil. Bernhard Steinauer
 RWTH Aachen
 Institut fuer Strassenwesen
 Mies-van-der-Rohe-Strasse 2
 51056 Aachen, Germany
 Email: steinauer@isac.rwth-aachen.de

Prof. Dr.-Ing. Herbert Staadt
 FH Potsdam
 FB Bauingenieurwesen
 Pappelallee 8-9
 14469 Potsdam, Germany
 Email: staadt@fh-potsdam.de

Prof. Dr.-Ing. Hartmut Muench
 FH Erfurt
 FB Bauingenieurwesen
 Werner-Seelenbinder-Str. 14
 99096 Erfurt, Germany
 Email: muench.we@t-online.de

DI Dr. Peter Maurer
 Arsenal Research, Wien
 Faradaygasse 3
 A-1030 Wien, Austria
 Email: maurer.p@arsenal.ac.at

Prof. Dr.-Ing. Detlef Rothe
 FH Darmstadt
 FB Bauingenieurwesen
 Haardtring 100
 64195 Darmstadt, Germany

Polizeidirektor Martin Moennighoff
 Polizei-Fuehrungsakademie
 Fachbereich 2: Polizeiliches Management
 Zum Roten Berge 18-24
 48165 Muenster, Germany
 Email: moennighoff@pfa-ms.de

Dr. Rudolf Krupp
 BAST
 Leitender Regierungsdirektor
 Referatsleiter
 Sicherheitskonzeptionen
 Bruederstrasse 53
 51427 Bergisch Gladbach, Germany
 Email: krupp@bast.de

Dr.-Ing. Ekkehard Bruehning
 Head of Section
 Highway Planning, Highway Design
 Bruederstrasse 53
 51427 Bergisch Gladbach, Germany
 Email: Bruehning@bast.de

Prof. Dr. Guenter Kroj
 BAST
 Head of Division
 Behaviour and Safety
 Bruederstrasse 53
 51427 Bergisch Gladbach, Germany
 Email: kroj@bast.de

Dipl.-Ing. Axel Elsner
 Head of Section
 Accident Statistics, Accident Analysis
 Bruederstrasse 53
 51427 Bergisch Gladbach, Germany
 Email: elsner@bast.de

APPENDIX A: EUROPEAN CONTACTS

Dr.-Ing. Guido Schuster
Referatsleiter
Landesamt fuer Strassen- und
Verkehrswesen
Referat V/I
OEPNV, Eisen-Bergbahnen, Schifffahrt,
Gueterkraftverkehr
56068 Koblenz, Kastorhof 2, Germany
Email: Abt5.stvg@lasv.rlp.de

Dipl.-Ing. Werner Koeppel
Institut fuer Strassenverkehr Koeln ISK
Ebertplatz 2
50668 Koeln, Germany
Email: w.koeppel@isk-gdv.de

Hans-Joachim Vollpracht
Director Road Management, Road Traffic
Division
Ministry of Urban Development, Housing
and Transport
Henning-von-Tresckow-Str. 2-8
D-14467 Potsdam, Germany
Email: [Hans-
Joachim.Vollpracht@mswv.brandenburg.de](mailto:Hans-Joachim.Vollpracht@mswv.brandenburg.de)

Dipl.-Oekonom Welf Stankowitz
Leiter des Referates fuer
Strassenverkehrstechnik und
Kraftfahrzeugtechnik
Deutscher Verkehrssicherheitsrat e. V.
Beueler Bahnhofplatz 16
53222 Bonn, Germany
Email: WStankowitz@dvr.de

Dipl.-Geographin Jacqueline Lacroix
Leiterin des Referats Europa und
Sonderaufgaben
Deutscher Verkehrssicherheitsrat e. V.
Beueler Bahnhofplatz 16
53222 Bonn, Germany
Email: JLacroix@dvr.de

Dr.-Ing. PH.D.USA Juerg M. Sparmann
Praesident Hessisches Landesamt fuer
Strassen- und Verkehrswesen
Wilhelmstrasse 10
65185 Wiesbaden, Germany
Email: j.sparmann@hsvv.hessen.de

Dipl.-Ing. Gerd Riegelhuth
Leiter des Dezernates Telematik,
Verkehrsbeeinflussung
Hessisches Landesamt fuer Strassen-
und Verkehrswesen
Wilhelmstrasse 10
65185 Wiesbaden, Germany
Email: gerd.riegelhuth@hsvv.hessen.de

THE NETHERLANDS

Govert Schermers
Senior Consultant, Traffic Safety
Division for Transport and Society
Ministry of Transport, Public Works and
Water Management
AVV Transport Research Centre
Boompjes 200
P.O. Box 1031
3000 BA Rotterdam
The Netherlands
Email: g.schermers@avv.rws.minvenw.nl

Willem P. Vlakveld
Senior Consultant, Traffic Safety Section
Ministry of Transport, Public Works and
Water Management
AVV Transport Research Centre
Boompjes 200
P.O. Box 1031
3000 BA Rotterdam
The Netherlands
Email: w.p.vlakveld@avv.rws.minvenw.nl

Harry M. Derriks
Senior Consultant
Department for Transport and Society
Ministry of Transport, Public Works and
Water Management
AVV Transport Research Centre
Boompjes 200
P.O. Box 1031
3000 BA Rotterdam
The Netherlands
Email: h.m.derriks@avv.rws.minvenw.nl

Ing. Pieter van Vliet
 Programme Manager, Traffic Safety
 Division
 Department for Transport and Society
 Ministry of Transport, Public Works and
 Water Management
 AVV Transport Research Centre
 Boompjes 200
 P.O. Box 1031
 3000 BA Rotterdam
 The Netherlands
 Email: p.vvliet@avv.rws.minvernw.nl

Rob Methorst
 Senior Consultant
 Traffic Safety Section
 Ministry of Transport, Public Works and
 Water Management
 AVV Transport Research Centre
 Boompjes 200
 P.O. Box 1031
 3000 BA Rotterdam
 The Netherlands
 Email: r.methorst@avv.rws.minvenw.nl

John P. Boender
 Project Manager
 Information and Technology Center for
 Transport and Infrastructure
 P.O. Box 37
 NL-6710 BA Ede
 The Netherlands
 Email: boender@crow.nl

Ing. Domien P. Overkamp
 Senior Projectleider
 DHV Milieu en Infrastructuur BV
 Laan 1914, nr. 35
 3800 BB Amersfoort
 The Netherlands
 Email: domien.overkamp@mi.dhv.nl

C.D. Van den Braak
 Senior Bibliothecaris/Literatuur
 Informatie
 SWOV
 Postbus 1090
 2260 BB Leidschendam
 Duindoorn 32
 The Netherlands
 Email: c.d.van.den.braak@swov.nl

SWOV
 Fred Wegman
 Ms. Ingrid van Schagen
 Peter Levelt
 Charles Goldenbeld
 Jeroen Kempen
 Ms. C.D. van den Braak
 SWOV
 P.O. Box 1090
 2260 BB Leidschendam
 The Netherlands
 Duindoorn 32
 Tel: +31-70 317 33 33
 Fax: +31-70 320 12 61

UNITED KINGDOM

John Smart
 The Highways Agency
 SSR-SLVR
 Room B250
 Romney House
 43 Marsham Street
 London SW1 3HW
 United Kingdom
 Email: john.smart@highways.gov.uk

Judith Barker, BSc MSc MIHT
 Senior Road Safety Engineer
 TRL Limited
 Old Workingham Road
 Crowthorne
 Berkshire RG45 6AU
 United Kingdom
 Email: jbarker@trl.co.uk

APPENDIX A: EUROPEAN CONTACTS

Rod Kimber, PhD CPhys FInstP FSS
FIHT
Director Science and Engineering
TRL Limited
Old Workingham Road
Crowthorne
Berkshire RG45 6AU
United Kingdom
Email: rkimber@trl.co.uk

Adrian Runacres, BSc (Hons) MIHT
FRMetSoc
Investigations & Risk Management
Group
TRL Limited
Old Workingham Road
Crowthorne
Berkshire RG45 6AU
United Kingdom
Email: arunacres@trl.co.uk

Steve Forgham, MSc MICE
Area Manager – Area Team 14
Midlands Network & Customer Services
Highways Agency
Floor C3, Broadway
Broad Street, Birmingham B15 1BL
United Kingdom
Email: steve.forgham@highways.gsi.gov.uk

William R. Kemp, MA MSc MICE FIHT
Director
Scott Wilson
Bayheath House, Rose Hill West,
Chesterfield
Derbyshire, S40 1JF
United Kingdom
Email: William.kemp@scottwilson.com

Kevin F. Smith, BEng CEng MICE
Traffic Manager
Scott Wilson
Dimple Road Business Centre, Dimple
Road
Matlock, Derbyshire DE 4 3JX
United Kingdom
Email: Kevin.smith@swkeurope.com

Mark Humpage
Project Engineer
Scott Wilson
Dimple Road Business Centre, Dimple
Road
Matlock, Derbyshire DE 4 3JX
United Kingdom
Email: mark.humpage@swkeurope.com

Dennis Roberts
Director Roads & Traffic Directorate
Roads and Traffic Directorate
Department of the Environment,
Transport and the Regions
3/03A, Great Minster House
76 Marsham Street
London SW1P 4DR
United Kingdom
Email: dennis_roberts@detr.gsi.gov.uk

Ian Drummond
Road Safety
Department for Transport, Local
Government and the Regions
2/09, Great Minster House
76 Marsham Street
London SW1P 4DR
United Kingdom
Email: ian.drummond@dtir.gsl.gov.us

Sue Falker
Road Safety
Department for Transport, Local
Government and the Regions
2/09, Great Minster House
76 Marsham Street
London SW1P 4DR
United Kingdom
Email: sue.falker@dtir.gsl.gov.us

Prof. Richard Allsop
University College London
Chadwick Building, Room 212
Gower Street, London WC1E 6BT
United Kingdom
Email: rea@transport.ucl.ac.uk

appendix b

TEAM MEMBERS

CONTACT INFORMATION

John Baxter
Division Administrator
FHWA, Indiana
575 North Pennsylvania St., Room 254
Indianapolis, IN 46204
Phone: 317-226-7476
Fax: 317-226-7341
Email: john.baxter@fhwa.dot.gov

Dwight M. Bower
Director
Idaho DOT
3311 West State St.
Boise, ID 83707
Phone: 208-334-8807
Fax: 208-334-3858
Email: dbower@itd.state.id.us

Troy E. Costales
Governor's Highway Safety
Representative
Oregon DOT, Transportation Safety
Division
235 Union St. NE
Salem, OR 97301-1054
Phone: 503-986-4192
Fax: 503-986-4341
Email: troy.e.costales@odot.state.or.us

Mike Crow
Chief of Traffic Engineering
Kansas DOT
217 SE Fourth St.
Topeka, KS 66612
Phone: 785-296-3618
Fax: 785-296-3619
Email: mikec@ksdot.org

Mike Griffith
FHWA, TFHRC
6300 Georgetown Pike
McLean, VA 22101-2296
Phone: 202-493-3316
Fax: 202-493-3374
Email: mike.griffith@fhwa.dot.gov

Michael Halladay
Director
Office of Safety Program Integration &
Delivery
FHWA, HAS-30, Room 4136
400 Seventh St. SW
Washington, DC 20590
Phone: 202-366-9469
Fax: 202-366-3222
Email: michael.halladay@fhwa.dot.gov

Douglas W. Harwood
Principal Traffic Engineer
Midwest Research Institute
425 Volker Blvd.
Kansas City, MO 64110
Phone: 816-753-7600, extension 1571
Fax: 816-561-6557
Email: धारwood@mriresearch.org

Dr. Keith Knapp
University of Wisconsin, Madison
432 North Lake St., Room 713
Madison, WI 53706
Phone: 608-263-6314
Fax: 608-263-3160
Email: knapp@epd.engr.wisc.edu

George E. Rice, Jr.
State Safety Engineer
Florida DOT
605 Suwannee St., MS-53
Tallahassee, FL 32399-0450
Phone: 850-410-4904
Fax: 850-922-2935
Email: ed.rice@dot.state.fl.us

Douglas Van Buren
Former Superintendent
Wisconsin DOT, Division of State Patrol
4802 Sheboygan Ave., Room 551
Madison, WI 53702
Phone: 608-267-7102
Fax: 608-267-4495
Email: doug.vanburen@dot.state.wi.us

Dr. Eugene Wilson
Department of Civil Engineering
University of Wyoming
University Station, Box 3295
Laramie, WY 82071
Phone: 307-766-3202
Fax: 307-766-6784
Email: wilsonem@uwyo.edu

BIOGRAPHIC SKETCHES

Dwight M. Bower (team co-chair) is director of the Idaho Transportation Department in Boise, Idaho. He is responsible for the activities of more than 1,800 employees and an annual budget of \$431.9 million. Before joining the Idaho department, Bower was deputy director of the Colorado Department of Transportation, where he also served as a district engineer, assistant district engineer, and senior highway engineer. He began his career as an engineering technician in 1957, earning a bachelor's degree in civil engineering from the University of Colorado in 1967. He was co-chairman of the National Quality Initiative and a member of the Executive Committee of the Transportation Research Board. Bower was president of the Western Association of State Highway and Transportation Officials in 1997, and now serves on the American Association of State Highway and Transportation Officials' (AASHTO) Board of Directors. He was vice chairman of AASHTO's Strategic Forum Steering Committee and now chairs the Standing Committee on Research. He also serves on the Research and Technology Coordinating Committee and the Joint AASHTO-AGC-ARTBA Executive Committee.

Michael Halladay (team co-chair) is acting director of the Office of Program Integration and Delivery for the Safety Unit at the Federal Highway Administration (FHWA). This office leads safety strategic and performance planning for FHWA, along with developing safety research and technology programs and integrating safety programs and issues with other key initiatives. Before that, Halladay served as a senior official in the FHWA Office of Research, Development, and Technology and chief of the Technology Management Division, where he directed research and technology strategic planning and evaluation initiatives and facilitated development of broad-based strategic partnerships for national research and technology delivery programs. Halladay has a bachelor's degree in civil engineering from Duke University and is a registered professional engineer in Virginia. He is a member of the American Society of Civil Engineers and Institute of Transportation Engineers, and is active on several Transportation Research Board committees.

John Baxter is division administrator for the Federal Highway Administration's Indiana Division in Indianapolis, Indiana. He leads a 24-person staff that administers a \$700 million annual Federal-aid program in partnership with the Indiana Department of Transportation. As division administrator, Baxter has directed an increased focus on safety at leadership and technical program levels. Earlier in his career, Baxter was involved in infrastructure improvements for the 2002 Salt Lake City Winter Olympic Games, worked with Los Alamos and Sandia National

Laboratories to convert defense-related technologies to civilian applications, and administered elements of the Intelligent Transportation Systems program at the national level. He is a civil engineering graduate and has a master's degree in transportation engineering from Clemson University in South Carolina. He is a registered professional engineer in Utah.

Troy E. Costales is the governor's highway safety representative for the State of Oregon in Salem, Oregon, and directs the Transportation Safety Division of the Oregon Department of Transportation. He manages driver education, motorcycle driver education, highway safety, governor-appointed committees, and highway safety programs, including those on safety belts, alcohol and other drugged driving, work zones, pedestrians, and bicyclists. Before joining the Transportation Safety Division in 1997, Costales supervised the statewide crash data system, motor carrier crash data system, fatality data system, traffic-counting program, and Intermodal Surface Transportation Efficiency Act management systems for Oregon. He has been involved in creating and testifying on State legislation for highway safety for the past 12 years. Costales has a bachelor's degree in management from George Fox University in Oregon. He is a member of the National Association of Governor's Highway Safety Representatives' executive instructor core, the Oregon Real Estate Board, and the American Association of State Highway and Transportation Officials' Safety Management System Committee.

Mike Crow is bureau chief of traffic engineering for the Kansas Department of Transportation. His bureau is responsible for crash analysis, signing, lighting, and pavement markings statewide. Crow is chairman of the American Association of State Highway and Transportation Officials' national Transportation Safety Information Management System project. The project is developing a crash data system that will be able to integrate numerous databases, including emergency medical services, road inventory, crash, police report, and driver's license databases. Crow is a graduate of the University of Missouri at Rolla and has a master's degree in civil engineering from Kansas State University. He is a licensed professional engineer in Kansas. He is a member of the National Committee on Uniform Traffic Control Devices and the American Traffic Safety Services Association.

Michael S. Griffith is technical director for the Office of Safety Research and Development for the Federal Highway Administration at the Turner-Fairbank Highway Research Center in McLean, Virginia. Griffith manages the Safety Analyst Project. His research emphasis includes highway safety data, analytical tools for safety management, development of relationships between safety and highway geometric design elements, and before-and-after evaluation of the safety effects of highway improvements. Griffith has a master's degree in transportation engineering from the University of Maryland and a master's degree in statistics from State University of New York at Buffalo. He serves as chairman of the Transportation Research Board's Committee on Statistical Methodology and Statistical Computer Software in Transportation Research.

Douglas W. Harwood is principal traffic engineer for Midwest Research Institute, a not-for-profit research organization in Kansas City, Missouri. Harwood serves as principal investigator of a Federal Highway Administration project to develop a

comprehensive highway safety improvement model, an effort that will develop new software tools for safety management of the roadway system and identification of the need for site-specific safety improvements. Harwood has more than 28 years of experience at Federal, State, and local agencies. He is a civil engineering graduate of Clarkson College and has a master's degree in transportation engineering from Purdue University in Indiana. He is a licensed professional engineer in Missouri. Harwood chairs the Transportation Research Board's Committee on Operational Effects of Geometrics, and is a member of its Committee on Highway Capacity and Quality of Service and Joint Subcommittee on the Development of a Highway Safety Manual.

Dr. Keith Knapp (report facilitator) is assistant professor/program director for the Engineering Professional Development Department and the Civil and Environmental Engineering Department at the University of Wisconsin-Madison. Knapp directs and organizes programs for transportation professionals in the operations and safety fields. Before joining the University of Wisconsin-Madison, Knapp was assistant professor at Iowa State University and manager of Traffic and Safety Programs at the Center for Transportation Research and Education. Knapp is a graduate of the University of Wisconsin-Madison. He has a master's degree from Cornell University in New York and a doctorate from Texas A&M University. He is a licensed professional engineer in Illinois, Michigan, and Iowa. He serves on the Geometric Design and Operations Committee of the American Society of Civil Engineers, and the Joint Subcommittee for the Development of a Highway Safety Manual and the Operational Effects of Geometrics Committee of the Transportation Research Board.

George E. (Ed) Rice, Jr. is State safety engineer for the Florida Department of Transportation in Tallahassee, Florida. Rice directs the department's Safety Office, which has functional responsibilities related to the traffic crash database for State roads, Highway Safety Improvement Program, State and Community Highway Safety Grant Program, pedestrian and bicycle safety, Highway Safety Management System, Community Traffic Safety Teams, industrial safety, and emergency management. He participates on a department management steering committee for work zone safety. Rice also spent 23 years with the Federal Highway Administration, the last 16 of which included highway safety duties. He has a bachelor's degree in civil engineering from the University of Kentucky. He is a member of the American Association of State Highway and Transportation Officials' Standing Committee on Highway Traffic Safety, the Board of Directors for the Florida Operation Lifesaver initiative on rail-highway grade crossing safety, and several other committees related to his functional areas.

Douglas Van Buren is superintendent of the Wisconsin State Patrol in the Wisconsin Department of Transportation. Van Buren understands all aspects of traffic law enforcement, having held numerous positions in the Wisconsin State Patrol over his 30-year career. He oversees all patrol, commercial vehicle, communications, training, chemical testing, and support services activities of the Wisconsin State Patrol. Van Buren holds a business administration degree from Cardinal Stritch University in Milwaukee, Wisconsin. He also is a graduate of Northwestern University's Traffic Institute in Evanston, Illinois. He is a certified police officer and serves on the Wisconsin Law Enforcement Standards Board and the American

Association of State Highway and Transportation Officials' Standing Committee on Highway Traffic Safety. He serves on the Wisconsin Governor's Council on Highway Safety.

Dr. Eugene Wilson is a professor of civil engineering at the University of Wyoming and director of Wyoming's Local Technical Assistance Program. Wilson conducts research and training on proactive safety, focusing on issues associated with road safety audits. He also develops and provides training on other areas of transportation safety. His recent activities have focused on training workshops tailored to applying road safety audits for State departments of transportation and local governments. Before 1974, he served on the faculty at the University of Iowa and was also director of its Center for Urban and Regional Research. Wilson has bachelor's and master's degrees in civil engineering from the University of Wyoming and a doctorate from Arizona State University. He is a licensed professional engineer in Iowa, Colorado, and Wyoming and is certified as a professional traffic operations engineer. Wilson serves on several technical committees of the American Society of Civil Engineers, Institute of Transportation Engineers, and Transportation Research Board. He also is director of the Transportation Professional Certification Board, Inc.

appendix c

AMPLIFYING QUESTIONS

The U.S. scanning study team is interested in talking to members of your highway safety community who plan and determine how, where, and when resources are applied to the area of highway safety. A discussion of the tools used to make these decisions is also of interest. The panel members would like to visit projects that have resulted from your highway safety programs, including projects that represent both successful and not-so-successful approaches and procedures. The following questions are divided into four categories to help focus our discussion.

A. Existence, content, and effectiveness of national safety goals and plans.

1. What are your national highway safety goals and objectives? Do you have an implementation plan that indicates what strategies and funds are needed to achieve these goals and objectives? If so, how are they incorporated into the budgetary process? What performance measures do you use to evaluate the success of their implementation?
2. How do you incorporate safety into the transportation planning and/or project development process at national, state, regional, and local government levels?
3. How are national safety law changes established? Have you recently enacted or are you planning to enact any significant highway safety laws? Can local jurisdictions establish laws that are more stringent than the national version?

B. Decision-making processes and management policies and procedures used to prioritize engineering, education, and enforcement elements of highway safety.

1. How has your country and organization changed its focus from reactive to proactive highway safety initiatives to, for example, reduce the number and severity of highway crashes?
2. How do you determine the needed balance of engineering, enforcement, and education and public information highway safety elements? What factors are considered in your decision-making process? Do you believe your prioritization scheme works well? What improvements (such as analytical capability, data quality, etc.) do you see as necessary?
3. What are the relative funding types and levels for the engineering, enforcement, and education highway safety elements implemented in your country?
4. Do you use an integrated team approach (i.e., interaction of engineer, police officer, educator, public transit official, physician, etc.) to guide, determine, and implement specific safety strategies? Please indicate how this approach is structured and implemented, and provide some examples of successful project results.
5. How do you consider safety in highway projects that are selected for reasons other than safety? For example, if a project is selected to address capacity issues, how is safety explicitly considered?

C. Resources, analytical tools, and legislative policies that guide and/or support highway safety decisions and engineering, education, and enforcement priorities.

1. What methods are used in your country to identify sites and corridors in need of safety improvement, often known as high-crash locations or “black spots?” Specifically, what criteria are used to systematically review the roadway network and determine whether particular sites experience more traffic crashes than expected?
2. Has your country established formal procedures to diagnose safety problems and identify appropriate improvements using the crash history or other information at particular sites to decide whether a potentially correctable pattern of crashes exists? Do you have accepted guidelines that show a direct link between specific crash patterns and appropriate countermeasures?
3. Do you use formal economic analysis procedures, such as benefit-cost or cost-effectiveness analyses, to decide which safety improvements to make at specific sites?
4. Do you use a formal priority ranking system for candidate safety improvements to decide which sites should be improved first? What criteria are considered in such rankings?
5. Describe the role of data in your analysis approach. Are databases for driver, vehicle, and crash information linked? If so, what reports are routinely generated using the databases?
6. How do the political process and legal profession affect your ability to initiate highway safety programs? What type of legislative framework supports highway safety programs in your country?

D. Examples and results of successful highway safety programs that resulted from the decision-making process and/or agency integration and interaction.

1. What have been the most successful engineering, education, and enforcement programs, actions, and improvements you have used to reduce traffic crashes and injuries? If money were not a constraint, what programs would you expand?

Some areas of interest to the panel include:

- Driver behavior (i.e., older and younger drivers, aggressive driving, seat belt use, non-attentive driving, and driving while intoxicated)
- Fixed-object, run-off-the-road, and head-on crashes
- Signalized and non-signalized intersection crashes
- Non-motorist (pedestrian and bicyclist) and truck-related crashes
- Emergency response strategies
- Driver education and licensing requirements

APPENDIX C: AMPLIFYING QUESTIONS

2. What organizational structure exists to complete highway safety functions and implement highway safety programs? Does the organizational structure of your safety staff allow easy interaction with other units of government?
3. How do you achieve interagency and intra-agency cooperation in highway safety practices? How important is cooperation and coordination (and possible sharing of resources) among levels of government in your country? What methods have you used to coordinate and what type of coordination do you see as most important?
4. Please describe the role of nongovernmental entities in achieving highway safety improvements. What types of relationships have been most effective and rewarding? What are the key success factors in these relationships?
5. What structure do you have in place to work with other units of government and the private sector on the transfer and implementation of effective and innovative highway safety improvements (e.g., advanced safety technologies and devices)? Provide examples of these innovations.

Office of International Programs
FHWA/US DOT (HPIP)
400 Seventh Street, SW
Washington, DC 20590

Tel: 202-366-9636

Fax: 202-366-9626

international@fhwa.dot.gov

www.international.fhwa.dot.gov