Guidance for Implementation of the
AASHTO Strategic Highway Safety Plan

Volume 15: A Guide for Enhancing Rural Emergency Medical Services

NCHRP REPORT 500

Guidance for Implementation of the AASHTO Strategic Highway Safety Plan

Volume 15: A Guide for Enhancing Rural Emergency Medical Services

DARREN TORBIC
Midwest Research Institute
State College, PA

JOHN CHEW
MARK LIGHT
HOWARD KIRKWOOD
JD MILLER
DAVID MILLER
The EMSSTAR Group, LLC
Annapolis, MD

RONALD PFEFER
Zikhron Yaacov, Israel

TIMOTHY R. NEUMAN
KEVIN L. SLACK
KELLY K. HARDY
CH2M HILL
Herndon, VA

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2005
www.TRB.org

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Academies was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

Note: The Transportation Research Board of the National Academies, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. William A. Wulf are chair and vice chair, respectively, of the National Research Council.

The **Transportation Research Board** is a division of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's mission is to promote innovation and progress in transportation through research. In an objective and interdisciplinary setting, the Board facilitates the sharing of information on transportation practice and policy by researchers and practitioners; stimulates research and offers research management services that promote technical excellence; provides expert advice on transportation policy and programs; and disseminates research results broadly and encourages their implementation. The Board's varied activities annually engage more than 5,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. **www.TRB.org**

www.national-academies.org

FOREWORD

By Charles W. Niessner
Staff Officer
Transportation Research
Board

The goal of the AASHTO Strategic Highway Safety Plan is to reduce annual highway fatalities to 1.0 fatality per 100 million vehicle-miles of travel. This goal can be achieved through the widespread application of low-cost, proven countermeasures that reduce the number of crashes on the nation's highways. This fifteenth volume of *NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan* provides strategies that can be employed to enhance rural emergency medical services. The report will be of particular interest to safety practitioners with responsibility for implementing programs to reduce injuries and fatalities on the highway system.

In 1998, AASHTO approved its Strategic Highway Safety Plan, which was developed by the AASHTO Standing Committee for Highway Traffic Safety with the assistance of the Federal Highway Administration, the National Highway Traffic Safety Administration, and the Transportation Research Board Committee on Transportation Safety Management. The plan includes strategies in 22 key emphasis areas that affect highway safety. The plan's goal is to reduce the annual number of highway deaths by 9,000 by 2008. Each of the 22 emphasis areas includes strategies and an outline of what is needed to implement each strategy.

NCHRP Project 17-18(3) is developing a series of guides to assist state and local agencies in reducing injuries and fatalities in targeted areas. The guides correspond to the emphasis areas outlined in the AASHTO Strategic Highway Safety Plan. Each guide includes a brief introduction, a general description of the problem, the strategies/countermeasures to address the problem, and a model implementation process.

This is the fifteenth volume of *NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan*, a series in which relevant information is assembled into single concise volumes, each pertaining to specific types of highway crashes (e.g., run-off-the-road and head-on) or contributing factors (e.g., aggressive driving). An expanded version of each volume with additional reference material and links to other information sources is available on the AASHTO Web site at http://safety.transportation.org. Future volumes of the report will be published and linked to the Web site as they are completed.

While each volume includes countermeasures for dealing with particular crash emphasis areas, *NCHRP Report 501: Integrated Management Process to Reduce Highway Injuries and Fatalities Statewide* provides an overall framework for coordinating a safety program. The integrated management process comprises the necessary steps for advancing from crash data to integrated action plans. The process includes methodologies to aid the practitioner in problem identification, resource optimization, and performance measurements. Together, the management process and the guides provide a comprehensive set of tools for managing a coordinated highway safety program.

Contents

Acknowledgments

Summary

The AASHTO Strategic Highway Safety Plan (SHSP) identified 22 goals that need to be pursued to achieve a significant reduction in highway crash fatalities. Most of those goals focus on preventive actions to reduce the frequency and severity of crashes. However, no amount of preventive action will eliminate all highway crashes. Therefore, one of the goals within the AASHTO SHSP, the goal on which this guide focuses, concerns enhancing emergency medical capabilities to increase survivability of highway crashes. Specifically, this guide addresses methods to enhance emergency medical services (EMS) in rural areas, in part because approximately 8,000 more fatalities occur annually along rural highways than on urban highways.

The challenges facing rural EMS systems markedly differ from those facing urban EMS systems. Each setting faces a host of unique challenges in the delivery of adequate EMS. The wide disparity in the delivery of EMS in rural compared with urban areas is attributable to many factors, including but not limited to the following (Rawlinson and Crews, 2003; OTA, 1989):

- Geographical barriers;
- High reliance on increasingly hard-to-find volunteer staff;
- Inadequate financial resources;
- Aging or inadequate equipment;
- Difficulty in maintaining skills due to low call volumes;
- Lack of training opportunities close to home;
- Lack of proper medical direction;
- Gaps in telecommunications;
- Absence of regionalized systems of specialized EMS care, such as trauma systems; and
- Absence of local medical facilities to adequately support effective EMS delivery systems.

The purpose of this guide is to provide information to appropriate agencies to help improve EMS in rural areas. This guide targets the EMS and highway safety communities. EMS and highway safety agencies share a common mission to prevent injuries and save lives. Although they pursue this mission differently, their priorities mesh well.

This guide identifies four main objectives for enhancing EMS in rural areas:

1. Integrate services to enhance emergency medical capabilities,
2. Provide or improve management and decision-making tools,
3. Provide better education opportunities for rural EMS, and
4. Reduce time from injury to appropriate definitive care.

In developing these objectives and subsequent strategies, the intent was to identify objectives and strategies that cost relatively little and that can be implemented in a relatively short timeframe. Within the four objectives, there are 24 strategies. Due to varying levels of sophistication and development of EMS agencies in rural areas around the country, state EMS directors, local system managers, policy makers, and state and local

highway agencies are best suited to determine which objectives and strategies are most appropriate to pursue, based on their existing levels of service and resources.

By implementing the four objectives and their corresponding strategies detailed in this guide, EMS agencies in rural areas will be able to work more efficiently toward their goal of providing the best available care for injured patients involved in motor vehicle crashes. Specifically, agencies can gain the following benefits from the objectives:

1. Integrating services will enable EMS agencies to use capabilities of other organizations and to streamline processes and develop new and unique functionalities that previously did not exist.
2. Improving management and decision-making tools will enable system managers to make more informed decisions on ways to improve their services.
3. Providing better educational opportunities will improve the life-saving skills of EMS personnel and others who may not have previously been involved in EMS.
4. Reducing the time from injury to appropriate definitive care will increase the probability of survival for many patients.

Although specific data and research in EMS are sparse, principles of both good business and good medical practice indicate that meeting the above objectives will improve the care provided to injured patients involved in motor vehicle crashes and reduce the number of fatalities attributable to EMS deficiencies.

Introduction

Given that crashes will continue to occur, it is important to understand how best to care for the crash victims. The minutes directly following traumatic injury are often critical to saving the victim's life or minimizing the long-term effects of injury. Both the timeliness and level of expertise at which care is given are critical factors in increasing the survivability of a crash.

Emergency care scenarios are markedly different in urban, rural, and remote (i.e., frontier) settings and require strategies tailored to meet each of them. Rural areas face a host of challenges in providing adequate care and treatment to patients from first response through initial stabilization and subsequent emergency treatment.

Delivering adequate EMS to widely dispersed populations is very difficult. The time it takes to reach emergency patients is typically longer in rural areas because of the distances between services and rural residents. Likewise, the transport times are typically longer. In addition, in rural communities, there may be less than one emergency call per day. This low volume of calls often means that rural ambulance services cannot financially support themselves, and as a result many of the EMS tasks fall upon trained volunteers. In fact, an estimated 65–75 percent of EMS personnel in rural areas are volunteers. There are various definitions of volunteers as they exist in different configurations, often described as nonreimbursed volunteers, reimbursed volunteers, and paid volunteers. The longer transport times and low volumes of calls result in less frequent in-the-field use of potentially life-saving interventions. Thus, EMS providers have difficulty maintaining their specialized skills, and the frequent and effective use of such treatments can be instrumental in saving the lives of many patients.

This guide targets the EMS and highway safety communities. It identifies several objectives and strategies that state EMS directors and local-level system managers and policy makers may pursue on the basis of their existing levels of service and resources. The highway safety community (i.e., state and local highway agencies) should support EMS agencies in implementing these strategies and determine how best to develop partnerships to achieve their common goal of improving highway safety. Strong leadership within the EMS and highway safety communities is paramount to enhancing EMS for injured patients involved in motor vehicle crashes in rural areas.

Definition of EMS

EMS is widely regarded as including the full spectrum of emergency care, including recognition of the emergency, telephone access to the system, provision of prehospital care, and definitive care in the hospital and rehabilitation. EMS often also includes medical response to disasters, planning for and provision of medical coverage at mass gatherings, and interfacility transfers of patients. The more traditional, narrow definition of EMS is limited to prehospital health care for patients with real or perceived emergencies from the

time point of emergency telephone access until arrival and transfer of care to the hospital (NHTSA, 2001). Because, in rural areas, detection of the crash is particularly critical to the well-being of the victim, this guide will use the broader definition of EMS. That is, objectives and strategies to improve EMS begin with recognition of the emergency (i.e., detecting the crash) and continue through to definitive care in the hospital. Improving EMS to care for motor vehicle crash victims will, in turn, positively affect all patients who require EMS.

Objectives

There are four main objectives for enhancing EMS in rural areas:

1. Integrate services to enhance emergency medical capabilities,
2. Provide or improve management and decision-making tools,
3. Provide better education opportunities for rural EMS, and
4. Reduce time from injury to appropriate definitive care.

Within the four objectives are 24 strategies. These objectives and strategies have been chosen because they cost relatively little and because they can be implemented in a relatively short timeframe. Neither the objectives nor the strategies are prioritized. Because EMS systems around the country exist at various levels of sophistication and in various stages of development, and because system managers and policy makers make decisions based on available resources and a commitment to providing certain levels of service, the best people to determine which objectives and strategies to pursue are the state EMS directors, system managers, and local policy makers. State and local highway agencies should also work with their respective state EMS directors and local system managers to prioritize the objectives and strategies. It is important to point out, however, that the foundation of a sound EMS system is the ability to collect and interpret data. Without this ability, it is difficult to measure the success of implementing these or any objective or strategy.

It is recognized that many of the challenges of delivering adequate EMS in rural areas could be overcome by increases in financial resources and modifications to legislation and regulations. Similarly, recruitment and retention of EMS personnel are also a priority in rural areas. However, the finances, legislation, and personnel of EMS systems are seen as higher-level program issues that need to be addressed more at the national or federal level. Therefore, the objectives within this guide do not focus on financial, legislative, and personnel issues. The following sections briefly address these issues in only general terms. The reader is directed to the various EMS visionary documents (e.g., *Emergency Medical Services Agenda for the Future* [NHTSA, 1996] and *Rural and Frontier Emergency Medical Services Agenda for the Future* [NRHA, 2004]) that have been developed in recent years and address these issues in depth.

Finance

Financing EMS systems throughout the country has long been problematic. Although nearly 65–75 percent of all providers in rural America are volunteers, the service is not delivered without significant cost. In some areas of the country, the entire service is supported by volunteer efforts and community support that do not charge for services;

yet, in other areas, there is a combination of volunteer labor coupled with fee for service to support operational costs. In still other areas, an EMS/fire district tax is implemented. Many experts suggest that most rural EMS issues could be resolved with a significant infusion of money. Although this solution is effective, it may not be practical. It is quite clear that to reduce response times, additional EMS services, placed at locations considered strategic due to the history of calls for service, would reduce response times and improve outcomes. However, adequate funds and resources in rural areas have not been made available. System managers must, therefore, look at alternative solutions to accomplish improved outcomes. This guide focuses on those achievable alternatives.

Legislation

Most states have EMS legislation that provides for a lead EMS agency. Although much of this legislation is not comprehensive, it does for the most part provide for the delivery of EMS. Although there has been significant progress, many states still do not have comprehensive trauma system legislation that provides for a comprehensive system of trauma care as part of the EMS system. Effective trauma legislation is comprehensive, inclusive, and permissive and includes attributes for protection from discoverability, requirements for autopsies for those involved in motor vehicle crashes, and adequate and stable funding. It is well recognized that comprehensive EMS and trauma legislation is paramount to the success of effective EMS systems; however, legislative changes and improvements may take years to accomplish.

Personnel

A comprehensive EMS system consists of a team of providers, whose interaction is critical to delivering emergency care to patients (NHTSA, 1996):

- Public safety answering points,
- Bystanders,
- First responders,
- Emergency medical technicians (EMTs),
- Emergency nurses,
- Emergency physicians,
- Medical directors, and
- Trauma centers.

These EMS team members must work together in a systematic approach to deliver EMS, from recognition of the emergency to definitive care. Team members must understand and perform their own roles and responsibilities. In most cases, this requires a high level of discipline, education, and training on the part of each team member. Team members must also interact in a seamless fashion to provide high-quality care to patients and continue to strive to improve the quality of care provided to the patient. In addition to providing care for trauma patients, EMS systems provide other services such as prevention awareness, surveillance, education, rehabilitation, and specialty care (e.g., cardiac, stroke, poison, and pediatrics) to improve overall health care. Exhibit II-1 illustrates the system approach to delivering EMS and the multiple components. Appendix 1 provides more information on the roles and responsibilities of these EMS team members.

EXHIBIT II-1
EMS System Approach and Components
Source: NHTSA, 2004(b)
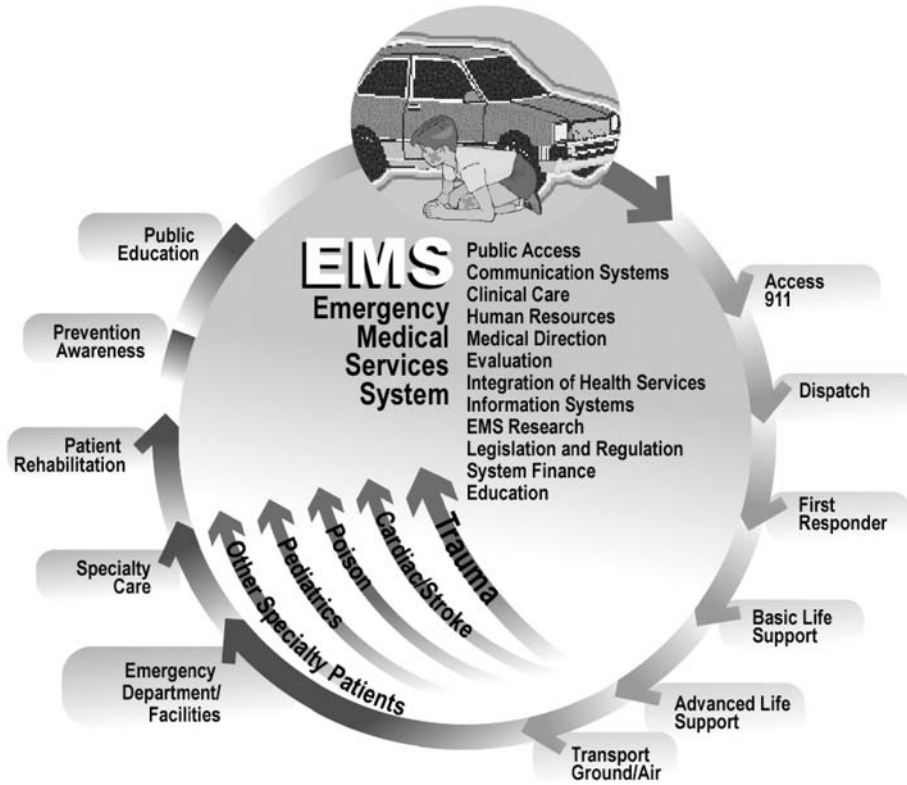
The degree of availability of adequate human resources is a central issue for rural EMS. Additionally, the geographic distribution of those resources is also problematic. EMS system managers and policy makers have long recognized this problem, and extensive efforts have been made to address these issues. Recruitment and retention programs, length of service awards programs, and various tax credits and other incentives have been used in an attempt to improve the human resources pool. Unfortunately, the decrease in the availability of active volunteers is not exclusive to EMS. Society has experienced a general decrease in volunteerism for all activities. Rural areas were at one time community-centric. Because of the increasing educational demands of EMS education, cultural changes, and the availability of competing activities for young and old alike, community members are often opting for other, more convenient activities to fill their time. Recruitment and retention of EMS providers remain one of the biggest challenges for EMS systems. Many manuals and specific recruitment and retention programs have been developed, but unfortunately have not ended the decrease in volunteerism (Rural Health EMS System Review at http://www. ruralhealthresources.com/EMSreview/toc.htm). Rather than focus on these issues, which are still receiving a great deal of emphasis by system managers, this guide focuses on potential solutions that will result in using available human resources more efficiently.

Brief Overview of EMS

Although civilian ambulance services have been operating in the United States since about the 1860s, a formal EMS program was not established in the U.S. Department of Transportation (USDOT) until the Highway Safety Act of 1966. Thus, EMS is still a relatively young field. Appendix 2 provides a chronology of the more important developments in EMS from its official establishment in 1966 until the mid 1990s. In 1996, the National Highway Traffic Safety Administration (NHTSA), which has been a leader in the field of EMS since its inception, developed the first of several visionary documents to guide the future of EMS into the new millennium (see Exhibit II-2). The *Emergency Medical Services Agenda for the Future* (NHTSA, 1996) serves as a visionary tool for EMS system planners across the nation. Other, spin-off EMS agendas in education, research, and trauma have furthered the spirit and concepts of the original 1996 *Agenda.* More recently, a draft *Rural and Frontier Emergency Medical Services Agenda for the Future* (NRHA, 2004) has been developed in a joint effort by the National Rural Health Association, the National Association of State EMS Directors, the National Organization of State Offices of Rural Health, and the federal Office of Rural Health Policy. These documents were reviewed while developing this guide.

EXHIBIT II-2
Recent EMS Visionary Documents

Date	Description
1996	NHTSA publishes the *Emergency Medical Services Agenda for the Future,* a document for developing EMS in the United States—a vision that builds on the strengths of America's diverse emergency resources and expands our country's emergency medical safety net.
2000	NHTSA publishes *EMS Education Agenda for the Future: A Systems Approach,* a vision for the future of EMS education, and a proposal for an improved structured system to educate the next generation of EMS professionals. The *Education Agenda* builds on broad concepts from the 1996 *Agenda* to create an education system that improves efficiency for the national EMS education process.
2001	The *National EMS Research Agenda* documents the need for EMS research and for elevating the science of EMS and prehospital care to a higher level. Barriers to conducting EMS research are discussed and innovative solutions offered in eight areas: (1) developing researchers, (2) facilitating collaboration, (3) establishing a reliable funding stream, (4) establishing alternative funding sources, (5) recognizing the need for EMS research, (6) viewing research as necessary for the improvement of patient care, (7) creating reliable information systems, and (8) enhancing ethical approaches to research.
2002	NHTSA publishes *Trauma System: Agenda for the Future.* This report documents the importance of fully implementing quality trauma systems across the United States to provide optimal care for injured patients and to enhance the country's readiness to respond to future acts of terrorism.
2004	The draft *Rural and Frontier Emergency Medical Services Agenda for the Future* defines and prioritizes needs for EMS systems not found in urban/suburban centers. This document does not recreate the 1996 *Agenda*, but it does elaborate and note variances from it made necessary by the realities of rural and frontier life.

Anticipated Results

By implementing the objectives and strategies detailed in this guide, EMS agencies in rural areas will be able to work more efficiently toward their goal of providing the best available care for injured patients involved in motor vehicle crashes. By integrating services, EMS agencies will be able to use the capabilities of other organizations, streamline processes, and develop new and unique functionalities that previously did not exist. Improved management and decision-making tools will enable system managers to make more informed decisions on ways to improve their services. Providing better educational opportunities will improve the life-saving skills of EMS personnel and others who may not have previously been involved in EMS. Finally, various strategies are identified for reducing the time from injury to appropriate definitive care. Thus, by integrating services, making better and more informed managerial-level decisions, becoming better educated, and reducing response times, it is anticipated that the care provided to injured patients involved in motor vehicle crashes will be improved, thereby reducing the number of fatalities attributable to EMS deficiencies.

Type of Problem Being Addressed

General Description of the Problem

When comparing highway safety information between rural and urban areas, it becomes evident that a disproportionate number of severe crashes occur in rural areas. First, according to some inventory and operational data for the U.S. highway system, in 2002 there were 4,943,396 km (3,071,768 miles) of public roads in rural areas and 1,439,883 km (894,726 miles) in urban areas (FHWA, 2002). In 2002, approximately 60 percent of the total vehicle-miles traveled (VMT) on state agency roads were in urban areas (1,727,596 VMT in millions), and 40 percent (1,128,160 VMT in millions) were in rural areas (FHWA, 2002). These percentages show that although there are significantly more rural road miles, most of the travel takes place in urban areas.

According to the crash data, more fatalities occur on rural roads. In 2002, 716 fatal crashes resulted in 25,849 fatalities in rural areas. Urban areas accounted for 15,440 fatal crashes resulting in 16,792 fatalities (NHTSA, undated [d]). Exhibit III-1 graphs the fatal crash and VMT data and displays the related crash rates.

EXHIBIT III-1
Rural and Urban Fatal Crashes Compared Using VMT
Sources: NHTSA, undated (b); NHTSA, undated (d); FHWA, undated
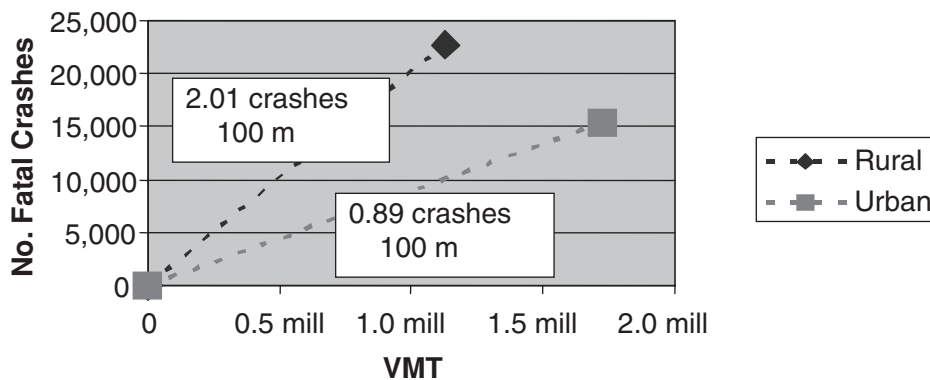
Exhibit III-2 and Exhibit III-3 illustrate some overall trends between rural and urban areas. Exhibit III-2 compares the number of fatalities by year and location from 1995 to 2002. From 1995 to 2002, approximately 8,000 more fatalities occurred annually in rural areas. Exhibit III-3 compares the fatality rates by year and location from 1995 to 2002. From a positive perspective, the fatality rates have been decreasing in both rural and urban areas; however, the fatality rate in rural areas has consistently been about 1.3 percentage points higher than the fatality rate in urban areas.

EXHIBIT III-2
Number of Traffic Fatalities by Year and Location, 1995–2002
Sources: FHWA, 2002; NHTSA, undated (b); NHTSA, undated (d)
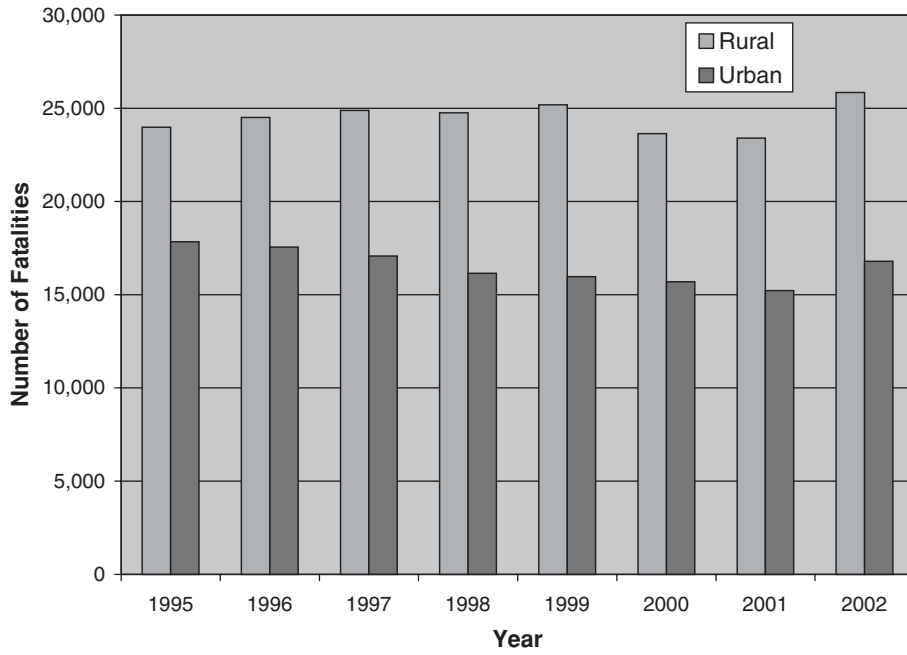
EXHIBIT III-3
Fatality Rates by Year and Location, 1995–2002
Sources: FHWA, 2002; NHTSA, undated (b); NHTSA, undated (d)
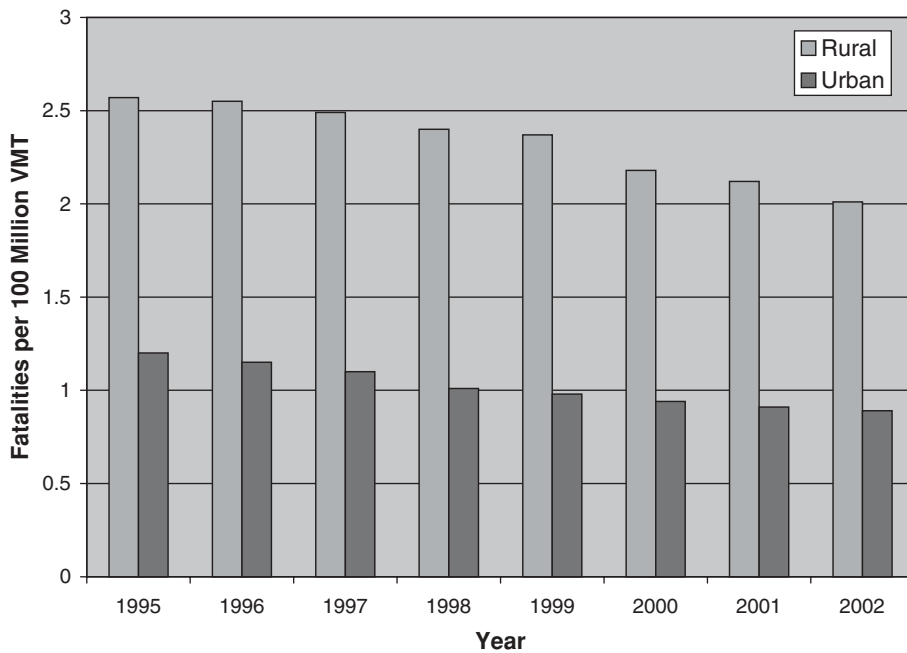
Exhibit III-4 illustrates geographical variations in death rates from motor vehicle crashes. Based upon data from 1979 to 1981, population-based death rates of occupants of motor vehicles were calculated and mapped according to county for the continental United States (Baker et al., 1987). The average death rate was 18.7 per 100,000 people for the entire United States, but the rate varied dramatically from one county to another. Mortality was highest in counties with low population density, and the highest death rates were seen predominantly in counties with fewer than five people per square mile. Thus, Exhibit III-4 implies that mortality rate is inversely correlated with the population density pattern.

EXHIBIT III-4
Death Rates of Occupants of Motor Vehicles per 100,000 People According to County, 1979–1981
Source: Baker et al., 1987

0.00—	
13.54—	
38.31—	
57.28—1465.20	
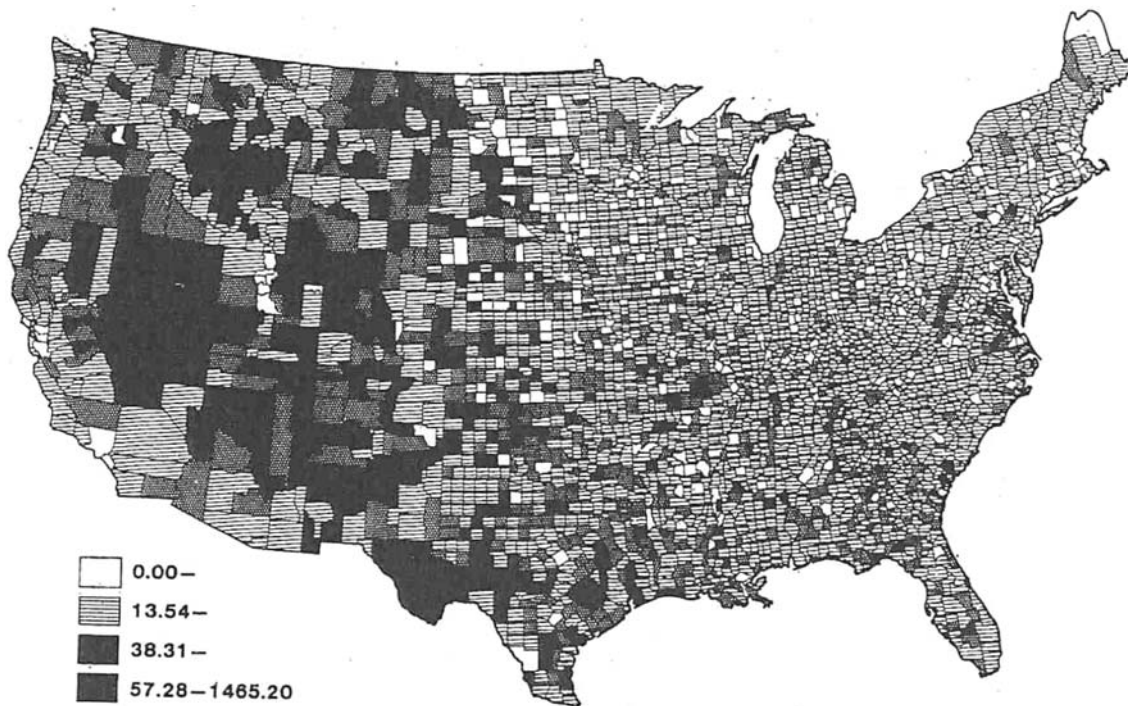
The highway safety community often focuses on mortality, and most of the data that are presented in this chapter are for fatal crashes. It should be recognized, however, that morbidity is also an important issue. Morbidity is often not a focus in part because the data are difficult to obtain. Data collection, interpretation, and evaluation are hampered by a variety of obstacles that require careful consideration and must be addressed in a systematic manner. The evolution and establishment of an EMS data collection system from which outcome measures can be derived have progressed slowly and sporadically. A compounding factor is the lack of standard nomenclature within EMS to describe patient conditions or to document patient care. In addition, EMS agencies and programs do not currently have either the appropriate number or type of personnel, or adequate funding, to support EMS evaluation efforts. The out-of-hospital setting is often considered to be a difficult environment in which to conduct outcome evaluations due to the lack of standardized care and the difficulty in identifying representative populations to study (NHTSA, 1994[a]). The following section discusses specific attributes of the safety problems in rural areas and identifies a host of the challenges that EMS providers face in rural settings.

Specific Attributes of the Problem

Victims of motor vehicle crashes suffer disproportionately higher fatality rates in rural areas than in urban areas. This fact can be attributed to several factors, including differences in travel speeds, seat belt use, types of vehicles, and availability of emergency care (Baker et al., 1987). Exhibit III-5 shows the percentage of fatal crashes by speed limit and location for 2002 (NHTSA, 2004[a]). The exhibit reveals that most of the fatal crashes in rural areas are occurring on roads with higher speed limits. Approximately 70 percent of all fatal crashes on roadways with lower speed limits (40 mph or less) are in urban areas. Fatal crashes occurring on roadways with moderately high speed limits (45 to 50 mph) are evenly split. Over 70 percent of the fatal crashes on roadways with high speed limits (55 mph or higher) occur in rural areas. Thus, EMS providers in rural areas must respond to a disproportionately high number of calls where the crash victims are likely to be severely or fatally injured as a result of high-speed travel.

EXHIBIT III-5
Percent of Fatal Crashes by Speed Limit and Location in 2002
Source: NHTSA, 2004(a)
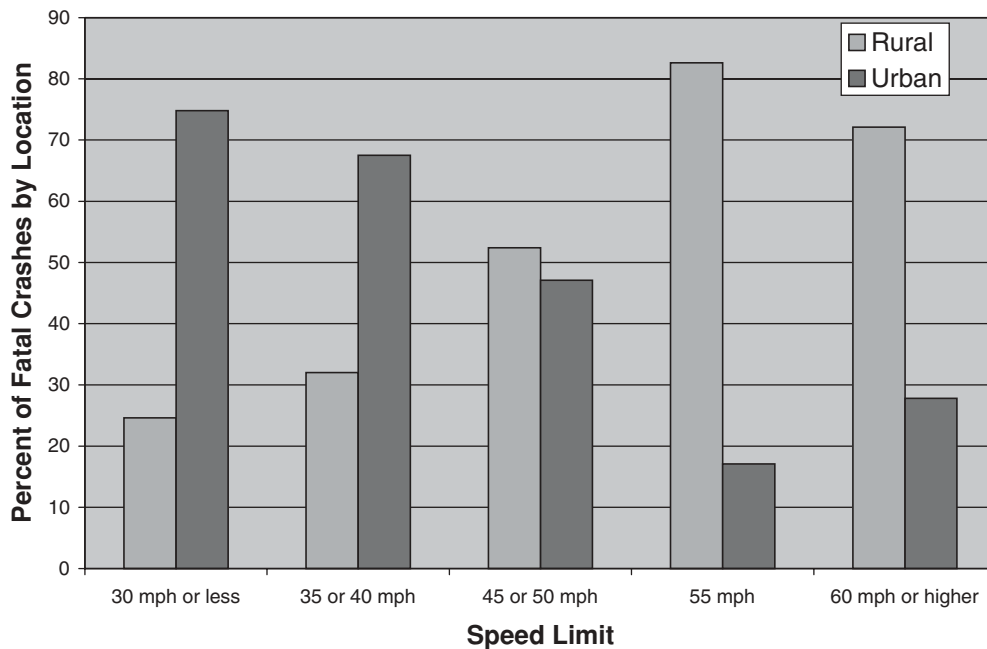
Seat belt use and vehicle type may also contribute to the higher fatality rate in rural areas. Vehicle occupants involved in rural fatal crashes are ejected 27 percent of the time, while vehicle occupants involved in urban fatal crashes are ejected 15 percent of the time (NHTSA, undated [d]). This suggests that vehicle occupants in rural areas are less likely to wear seat belts. Over recent years, the seat belt use in rural areas has increased. In 2002, seat belt use reached 73 percent in rural areas, which is very close to the 2002 national average of 75 percent (NHTSA, 2003[b]). However, the use of seat belts is very low (54 percent) among occupants of pickup trucks in rural areas, so the lower use of seat belts in these popular vehicles in rural areas may contribute to the high severities.

Two fundamental issues are apparent in assessing potential improvements to EMS care for victims of rural highway crashes: (1) minimizing response times for personnel and equipment to treat crash victims and (2) improving the quality of medical care afforded to victims.

Emergency medical care experience has shown that for many serious injuries, time is critical (Champion, 1999). The "golden hour" of trauma care is a concept that emphasizes this time dependency. For polytrauma patients (i.e., patients who suffer multiple injuries), the first hour of care is critical. If the time from the incident to hospital treatment is within this critical first hour, the patient's likelihood of survival is greatly increased (Rawlinson and Crews, 2003). In trauma care, the goal is to get seriously injured patients into the operating room of a trauma center with an experienced team of appropriately specialized trauma surgeons within this golden hour. Meeting this goal requires a highly efficient and effective EMS system.

In general, the time to deliver patients to definitive care consists of the six time intervals:

1. Time between crash occurrence and EMS notification,
2. Response time for EMS personnel to be notified and depart the station (i.e., chute time),
3. Travel time to the crash scene by EMS,
4. On-scene EMS rescue time,
5. Transport time to a hospital or trauma center, and
6. Emergency department resuscitation time.

The average elapsed time for several of these time intervals typically is longer in rural areas, as illustrated below.

Exhibit III-6 compares the national average response times for fatal crashes in rural and urban environments as reported by NHTSA. The exhibit divides response time into three time intervals. The exhibit reveals that average response times for each of the intervals is greater in rural areas than in urban areas. This trend has remained relatively consistent during recent years.

Exhibit III-7 compares the EMS response times nationally within designated minutes for fatal crashes in 2002 as reported by NHTSA. Approximately 30 percent of the rural fatal crashes exceeded the golden hour, while only about 8 percent of the urban fatal crashes exceeded it. The percentage of fatal crashes with a response time greater than 60 minutes has remained relatively constant since at least the early 1990s (Champion, 1999).

There are many reasons why EMS response times in rural areas are typically longer than in urban areas. For example, delays or greater response times in rural areas are related to increased travel distances in rural areas and personnel distribution across the response areas. Significant delays may also occur as volunteers travel to the EMS station and pick up the ambulance. Unfortunately, because greater distances are involved and because volunteers are distributed throughout the community, longer response times may be unavoidable in rural areas. In addition, in rural areas without well-designed trauma systems, delays may occur in moving patients from rural hospitals with limited surgical capabilities to tertiary care centers (i.e., trauma centers) specifically established to treat such patients. Regardless, a key concern of any program to meaningfully address the EMS role in fatal crashes should be the minimizing of EMS response times.

Note that caution is needed in analyzing response times for rural EMS systems. In some cases, the ability of rural EMS systems to effectively measure and understand response time

EXHIBIT III-6
National Average EMS Response Times for Fatal Crashes in 2002
Source, NHTSA, 2004(a)
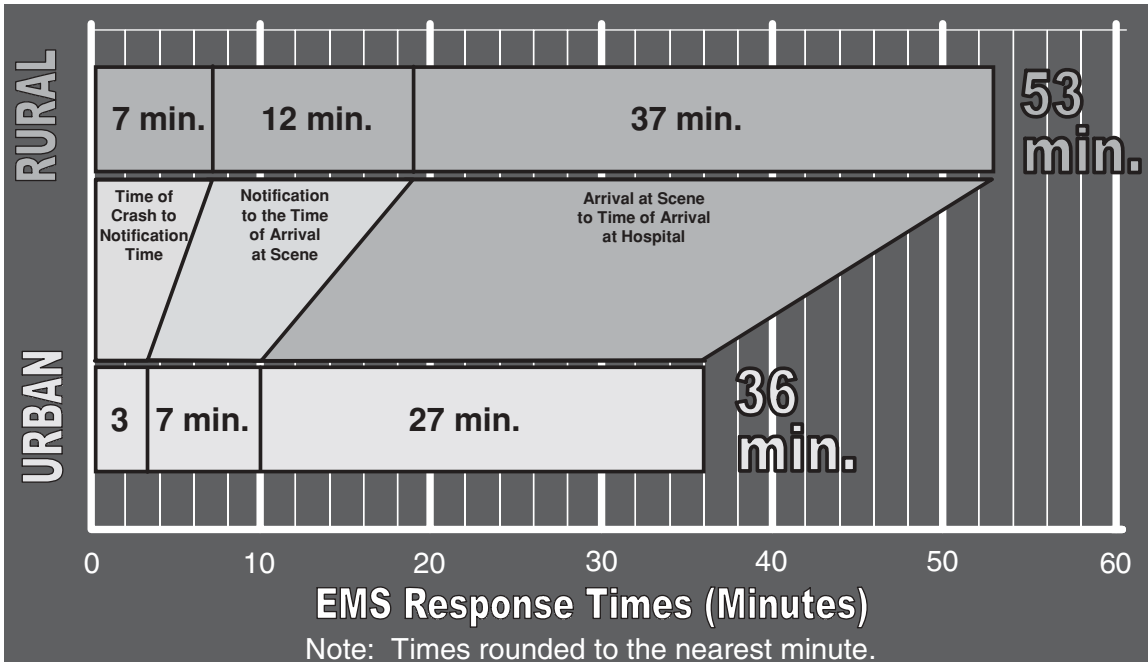
EXHIBIT III-7
Fatal Crashes by EMS Response Times within Designated Minutes in 2002
Source: NHTSA, 2004(a)
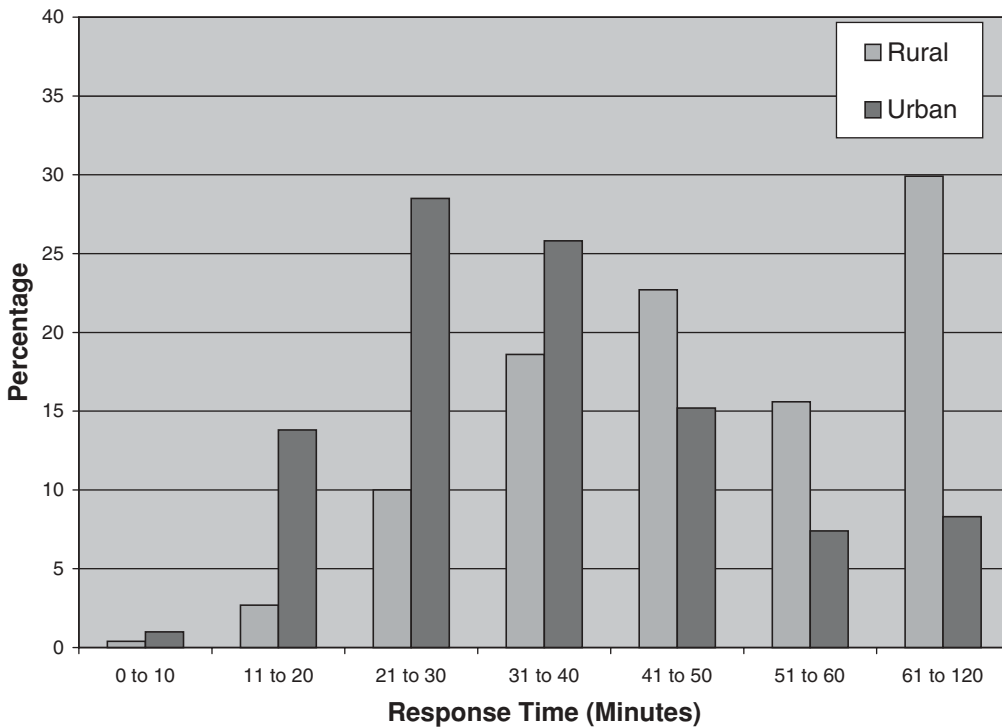
performance is limited. Many data points are self reported, and accurate response time intervals are often not collected. There also appear to be significant differences in the definitions used for certain response intervals. For example, in some parts of the country, "response time" means the time it took the provider to be notified and respond to the station and does not include time to the scene. These differences in definitions often result in distorted or inaccurate data or comparisons. Effective data collection systems to adequately evaluate performance are also limited. Most useable data are based on fatal crashes with little emphasis on morbidity, even though the majority of responses are for morbid crashes.

Improvements in the quality of medical care also appear possible. According to a study of preventable deaths and inappropriate care in a rural state, there is definite room for improvement in EMS systems (Esposito et al., 2003). A review of 347 trauma-related deaths revealed an overall preventable death rate of 8 percent after implementation of a voluntary trauma system. The overall rate of inappropriate care was 22 percent during prehospital care, 40 percent during the emergency department phase of care, and 29 percent during the post–emergency department phase.

This guide focuses on approaches to improve the quality of care and reduce the response time during the prehospital phase. However, it should be recognized that delays in secondary transfers and the quality of care following the prehospital phase significantly impact the overall outcome of the crash victim.

In summary, travel speed, seat belt use, type of vehicle, and availability of emergency care in rural areas are a few of the factors that contribute to the disproportionately high fatality rate for rural crash victims. There is also a need for better data on which to base management decisions, as well as to improve the quality of care. Several other implementation guides have been developed to address some of these issues (e.g., roadway characteristics and seat belt usage). This implementation guide focuses on the availability of emergency care in rural areas and ways to improve the response and quality of care provided by EMS in rural areas.

Index of Strategies by Implementation Timeframe and Relative Cost

Exhibit IV-1 classifies strategies according to the expected timeframe and relative cost for this emphasis area. In several cases, the implementation time will depend on such factors as an agency's willingness to accept a change in policy, legislative needs, or existing communication infrastructure and/or architecture. The range of costs may also vary for some of these strategies because of many of the same factors listed previously. Placement in the exhibit is meant to reflect the most common expected application of the strategy.

EXHIBIT IV-1
Classification of Strategies According to Expected Timeframe and Relative Cost

Timeframe for Implementation	Strategy	Relative Cost to Implement and Operate			
		Low	**Moderate**	**Moderate to High**	**High**
Short (<1 year)	20.1 A5—Integrate EMS systems into the Safe Communities effort	✔			
	20.1 A6—Use mobile data technologies that are interoperable with hospital systems			✔	
	20.1 B1—Develop resource and performance standards unique to the specific rural EMS		✔		
	20.1 B4—Provide evaluation results to elected and administrative officials at the county and local levels	✔			
	20.1 C1 Utilize technology-based instruction for rural EMS training		✔		
	20.1 C2—Establish an exchange program to allow rural EMS providers to spend a specified number of hours in urban/suburban systems	✔			
	20.1 C4—Require first care training for all public safety emergency response personnel, including law enforcement officers			✔	
	20.1 C5—Educate rural residents about the availability, capability, and limitations of existing systems	✔			
Medium (1–2 years)	20.1 A1—Establish programs with organizations to utilize nontraditional employees as EMS responders	✔			
	20.1 A2—Facilitate development of regional resources and/or cooperatives		✔		

EXHIBIT IV-1 (Continued)
Classification of Strategies According to Expected Timeframe and Relative Cost

Timeframe for Implementation	Strategy	Relative Cost to Implement and Operate			
		Low	Moderate	Moderate to High	High
	20.1 A3—Integrate support of EMS into rural hospital financing programs	✔			
	20.1 A4—Integrate information systems and highway safety activities			✔	
	20.1 B2—Identify, provide, and mandate efficient and effective methods for collection of necessary EMS data		✔		
	20.1 B3—Identify and evaluate model rural EMS operations	✔			
	20.1 C3—Include principles of traffic safety and injury prevention as part of EMS continuing education		✔		
	20.1 C6—Provide "bystander care" training programs targeting new drivers, rural residents, truck drivers, Interstate commercial bus drivers, and motorcyclists		✔		
	20.1 C7—Provide EMS training programs in high schools in rural areas		✔		
	20.1 D3—Utilize GPS technology to improve response time			✔	
	20.1 D4—Integrate automatic vehicle location (AVL) and computer-aided navigation (CAN) technologies into all computer-aided dispatch (CAD) systems			✔	
	20.1 D5—Equip EMS vehicles with multi-service and/or satellite-capable telephones			✔	
Long (>2 years)	20.1 A7—Require all communication systems to be interoperable with surrounding and state jurisdictions				✔
	20.1 D1—Improve cellular telephone coverage in rural areas			✔	
	20.1 D2—Improve compliance of rural 9-1-1 centers with FCC wireless "Phase II" automatic location capability			✔	

Description of Strategies

Objectives

As mentioned previously, the following objectives will meet the general goal of improving the responsiveness and quality of care for rural EMS:

1. Integrate services to enhance emergency medical capabilities,
2. Provide or improve management and decision-making tools,
3. Provide better education opportunities for rural EMS, and
4. Reduce time from injury to appropriate definitive care.

Exhibit V-1 presents strategies developed to meet each of these objectives for improving EMS in rural areas. Strategies for treatment of injured parties at highway crashes can significantly impact the ultimate level of severity experienced, and the length of time spent, in treatment. This is especially true when it comes to timely and appropriate treatment of severely injured persons. Thus, a basic part of a highway safety infrastructure is a well-based and comprehensive emergency care program. The types of strategies included here can be critical to the success of a comprehensive highway safety program. Therefore, an effort should be made to determine whether improvements can be made to this aspect of the system, especially for programs in rural areas.

EXHIBIT V-1
Objectives and Strategies for Improving EMS in Rural Areas

Objectives	Strategies
20.1 A—Integrate services to enhance emergency medical capabilities	20.1 A1—Establish programs with organizations to utilize nontraditional employees as EMS responders (T)
	20.1 A2—Facilitate development of regional resources and/or cooperatives (T)
	20.1 A3—Integrate support of EMS into rural hospital financing programs (T)
	20.1 A4—Integrate information systems and highway safety activities (T)
	20.1 A5—Integrate EMS systems into the Safe Communities effort (T)
	20.1 A6—Use mobile data technologies that are interoperable with hospital systems (T)
	20.1 A7—Require all communication systems to be interoperable with surrounding and state jurisdictions (T)

EXHIBIT V-1 (Continued)
Objectives and Strategies for Improving EMS in Rural Areas

Objectives	Strategies
20.1 B—Provide or improve management and decision-making tools	20.1 B1—Develop resource and performance standards unique to the specific rural EMS (T)
	20.1 B2—Identify, provide, and mandate efficient and effective methods for collection of necessary EMS data (T)
	20.1 B3—Identify and evaluate model rural EMS operations (T)
	20.1 B4—Provide evaluation results to elected and administrative officials at the county and local levels (T)
20.1 C—Provide better education opportunities for rural EMS	20.1—C1 Utilize technology-based instruction for rural EMS training (P)
	20.1 C2—Establish an exchange program to allow rural EMS providers to spend a specified number of hours in urban/suburban systems (E)
	20.1 C3—Include principles of traffic safety and injury prevention as part of EMS continuing education (E)
	20.1 C4—Require first care training for all public safety emergency response personnel, including law enforcement officers (T)
	20.1 C5—Educate rural residents about the availability, capability, and limitations of existing systems (T)
	20.1 C6—Provide "bystander care" training programs targeting new drivers, rural residents, truck drivers, Interstate commercial bus drivers, and motorcyclists (T)
	20.1 C7—Provide EMS training programs in high schools in rural areas (T)
20.1 D—Reduce time from injury to appropriate definitive care	20.1 D1—Improve cellular telephone coverage in rural areas (T)
	20.1 D2—Improve compliance of rural 9-1-1 centers with FCC wireless "Phase II" automatic location capability (T)
	20.1 D3—Utilize GPS technology to improve response time (T)
	20.1 D4—Integrate automatic vehicle location (AVL) and computer-aided navigation (CAN) technologies into all computer-aided dispatch (CAD) systems (T)
	20.1 D5—Equip EMS vehicles with multi-service and/or satellite-capable telephones (T)

Note: the following pages explain (T), (E), and (P) demarcations.

Types of Strategies

The strategies in this guide were identified from a number of sources, including the literature, contact with state and local agencies throughout the United States, and federal programs. Some of the strategies are widely used, while others are primarily an

experimental idea of a single individual or agency. Some strategies have been subjected to well-designed evaluations to prove their effectiveness. However, it was found that many strategies, including some that are widely used, have not been adequately evaluated.

The implication of the widely varying experience with these strategies, as well as of the range of knowledge about their effectiveness, is that the reader should be prepared to exercise caution in many cases before adopting a particular strategy for implementation. To help the reader, the strategies have been classified into three types, each identified by a letter:

- Tried (T) – Those strategies that have been implemented in a number of locations and that may even be accepted as standards or standard approaches, but for which there have not been found valid evaluations. These strategies—while in frequent, or even general, use—should be applied with caution, carefully considering the attributes cited in the guide, and relating them to the specific conditions for which they are being considered. Implementation can proceed with some degree of assurance that there is not likely to be a negative impact on safety and very likely to be a positive one. It is intended that as the experiences of implementation of these strategies continue under the AASHTO SHSP initiative, appropriate evaluations will be conducted so that effectiveness information can be accumulated to provide better estimating power for the user, and the strategy can be upgraded to a "proven" (P) one.

- Experimental (E) – Those strategies that have been suggested and that at least one agency has considered sufficiently promising to try on a small scale in at least one location. These strategies should only be considered after the others have proven not to be appropriate or feasible. Even when they are considered, their implementation should initially occur using a very controlled and limited pilot study that includes a properly designed evaluation component. Only after careful testing and evaluations show the strategy to be effective should broader implementation be considered. It is intended that as the experiences of such pilot tests are accumulated from various state and local agencies, the aggregate experience can be used to further detail the attributes of this type of strategy, so that it can be upgraded to a "proven" (P) one.

- Proven (P) – Those strategies that have been used in one or more locations, and for which properly designed evaluations have been conducted that show it to be effective. These strategies may be employed with a good degree of confidence, but any application can lead to results that vary significantly from those found in previous evaluations. The attributes of the strategies that are provided will help the user judge which strategy is the most appropriate for the particular situation.

Related Strategies for Creating a Truly Comprehensive Approach

The strategies listed above and described in detail below are those considered unique to this emphasis area. However, to create a truly comprehensive approach to the highway safety problems associated with this emphasis area, four types of related strategies should be included as candidates in any program planning process:

- Public Information and Education (PI&E) Programs – Many highway safety programs can be effectively enhanced with a properly designed PI&E campaign. For example,

"EMS Week" is observed annually during the third week of May and brings together local communities and medical personnel throughout the country to publicize safety and honor the dedication of those who provide the day-to-day lifesaving services of the medical "front line." EMS Week is sponsored by the American College of Emergency Physicians, NHTSA, and the Emergency Medical Services for Children program. The week of May 16-22, 2004, marked the 30th year for the event.

The traditional emphasis with PI&E campaigns in highway safety is to reach an audience across an entire jurisdiction or a significant part of it. However, there may be a reason to focus a PI&E campaign on a location-specific problem. While this approach is relatively untried compared with areawide campaigns, use of roadside signs and other experimental methods may be tried on a pilot basis.

Within this guide, where the application of PI&E campaigns is deemed appropriate, it is usually in support of some other strategy. In such a case, the description of that strategy will suggest this possibility (see the attribute area for each strategy entitled "Associated Needs"). In some cases, specialized PI&E campaigns are deemed unique for the emphasis area and are detailed in the guide. In the future, additional guides may exclusively address the details regarding PI&E strategy design and implementation.

- Enforcement of Traffic Laws – Well-designed and -operated law enforcement programs can have a significant effect on highway safety. It is well established, for instance, that an effective way to reduce crashes (and their severity) is to have jurisdictionwide programs that enforce an effective law against driving under the influence (DUI) or driving without seat belts. When that law is vigorously enforced with well-trained officers, the frequency and severity of highway crashes can be significantly reduced. This should be an important element in any comprehensive highway safety program.

  Enforcement programs, by nature, are conducted at specific locations. The effect (e.g., lower speeds, increased use of seat belts, and reduced impaired driving) may occur at or near the specific location where the enforcement is applied. This effect can often be enhanced by coordinating the effort with an appropriate PI&E program. However, in many cases (e.g., speeding and seat belt usage), the impact is areawide or jurisdictionwide. The effect can be either positive (i.e., the desired reductions occur over a greater part of the system) or negative (i.e., the problem moves to another location as road users move to new routes where enforcement is not applied). Where it is not clear how the enforcement effort may impact behavior, or where an innovative and untried method could be used, a pilot program is recommended. Within this guide, where the application of enforcement programs is deemed appropriate, it is often in support of some other strategy. Many of those strategies may be targeted at either a whole system or a specific location. In such cases, the description for that strategy will suggest this possibility (see the attribute area for each strategy entitled "Associated Needs"). In some cases, where an enforcement program is deemed unique for the emphasis area, the strategy will be detailed. As additional guides are completed, they may detail the design and implementation of enforcement strategies.

- Strategies Directed at Improving the Safety Management System – The management of the highway safety system is foundational to success. There should be a sound organizational structure, as well as in infrastructure of laws, policies, and so forth to monitor, control, direct, and administer a comprehensive approach to highway safety. A comprehensive program should not be limited to one jurisdiction, such as a state

department of transportation (DOT). Local agencies often must deal with most of the road system and its related safety problems and are more familiar with their problems. Additional guides may detail the design and implementation of strategies for improving safety management systems.

- Strategies That Are Detailed in Other Emphasis Area Guides – Any program targeted at the safety problem covered in this emphasis area should be created having given due consideration to the inclusion of other applicable strategies covered in the following guides:
  - A Guide for Addressing Collisions with Trees in Hazardous Locations,
  - A Guide for Addressing Head-On Collisions,
  - A Guide for Addressing Run-Off-Road Collisions,
  - A Guide for Reducing Collisions on Horizontal Curves,
  - A Guide for Reducing Collisions Involving Utility Poles,
  - A Guide for Increasing Seat Belt Use,
  - A Guide for Reducing Motorcycle Collisions, and
  - A Guide for Reducing Collisions Involving Drowsy and Distracted Drivers.

Objective 20.1 A—Integrate Services to Enhance Emergency Medical Capabilities

Strategy 20.1 A1—Establish Programs with Organizations to Utilize Nontraditional Employees as EMS Responders (T)

General Description

Since the late 1960s when civilian EMS was first conceptualized and implemented, it has become institutionalized throughout the United States at the intersection of the public safety and the medical care systems. EMS is particularly critical to rural and frontier residents because they experience disproportionate levels of serious injuries, and their distance from traditional health resources increases the morbidity and mortality associated with trauma and medical emergencies (see the National Rural Health Association website, http://www.nrharural.org/).

Throughout the country, certification criteria are established for first responders, EMTs, paramedics, and emergency medical dispatchers. EMTs and paramedics perform their duties under the direction of a medical director. First responder training varies greatly from program to program yet is often crucial when caring for victims of sudden illness or injury. Armed with basic skills, first responders often can prevent further injury or illness and provide life-saving treatments until EMTs or paramedics arrive. Expansion of first responder training is essential to improving rural EMS care.

According to a survey of state EMS directors, the top priority of rural EMS organizations, despite significant effort, continues to be recruitment and retention of emergency providers. Consequently, developing programs with other organizations to expand the number of available people able to respond to emergencies is of growing importance. Conversely, seeking a broader role for existing EMS providers in rural communities could spark interest for others to join the ranks, improve the health services of an area, and improve the financial condition of existing services by generating new revenue streams.

Recruitment and retention efforts will continue to be expanded and improved in the years ahead, with increasing consideration of targeting nontraditional and nonclinical people. Further, successful EMS providers will need to integrate more fully with public health and social service agencies, primary care providers, and other health care facilities to ensure that patients are referred or transported to the most appropriate and cost-effective facility. Care should not occur in isolation; rather, it should be part of a seamless system that provides patients with well-organized, high-quality care.

Integration refers to the horizontal and vertical linkage of health care providers to achieve a high degree of continuity of services. EMS integration can help ensure that out-of-hospital care is incorporated into the management of ill or injured patients. Historically, EMS has been effectively linked with the public safety sector (i.e., dispatch, law enforcement, and fire services), with nearby EMS providers for mutual aid, with the emergency departments of nearby hospitals and, in some areas, with designated trauma centers as part of regionally designed trauma systems.

Another part of EMS is surveillance. At a basic level, data from past incidents can help to forecast future situations (e.g., locations of highway intersections that may tend to experience frequent crashes and injuries). With the heightened awareness surrounding terrorism, surveillance includes watching for any pattern of injury or illness. On a more day-to-day mode, surveillance is watching over the people in a community and ensuring that their health care needs are being tended to so that local residents do not find themselves in an emergency situation requiring an ambulance. This is good for EMS because it has the potential to reduce the demand of the volunteer service.

In summary, the goal of this strategy is for EMS agencies to establish partnerships with organizations they have traditionally not worked with in the past. Drawing from the personnel of these partnering agencies, the plan is to increase the pool or number of EMS responders. Ideally, the employees of these partnering agencies would be trained to the level of first responder, but in the event that they do not achieve this level of training, at least they would have some formal training in EMS response such that if an employee from one of these partnering agencies encounters a crash, he or she can provide some level of first response until an EMT or paramedic arrives at the scene. As these systems and partnerships develop, opportunities also exist to address the needs of special populations that have sometimes been overlooked, including children, the elderly, minority groups, and persons with disabilities.

EXHIBIT V-2
Strategy Attributes for Establishing Programs with Organizations to Utilize Nontraditional Employees as EMS Responders (T)

Technical Attributes	
Target	Hospital and other health care staff (e.g., home care and nursing home staff); law enforcement; park rangers; state, county, and local highway crews; other fire and rescue staff; postal carriers; utility crews; and other service club (e.g., AARP, Lions Club, Jaycees) members.
Expected Effectiveness	No studies have been conducted to determine the effect on injury severity of increasing the number of first responders in an area through the establishment of such programs. A potential reason that no studies of this kind have been performed is the difficulty of isolating such an effect to evaluate its expected effectiveness. In the

EXHIBIT V-2 (Continued)
Strategy Attributes for Establishing Programs with Organizations to Utilize Nontraditional Employees as EMS Responders (T)

Technical Attributes	
	absence of data, anecdotal information regarding improved level of care or perceptions of the community may be useful for demonstrating potential effectiveness (see Appropriate Measures and Data).
Keys to Success	An effective program for recruiting and retaining people is the number one key for success. This requires networking and establishing good relations throughout the community and with outside agencies or groups. The program will also require communicating to the community, individuals, and management of outside agencies the importance of participating in such a program. This will stimulate interest among individuals, and managers of agencies will find it easier to permit their employees to miss work in order to attend to an injured person involved in an accident. A more long-term goal would be to sell the importance of such a program to outside agencies such that the agencies look to recruit new employees that already have EMS backgrounds or potentially include EMS responsibilities in job descriptions. Another key to success is excellent leadership. As EMS providers are confronted with tough challenges, good people with strong leadership skills are essential. With an increased number of EMS responders, the managers of EMS agencies must work to coordinate services in order to incorporate nontraditional employees into the overall EMS system in an effective manner. Sharing innovative programs and using effective communication will help to increase the success.
Potential Difficulties	Efforts to improve the value of volunteering one's time to the local ambulance service have been undermined by increased demands on an individual's time, more stringent training requirements, and the increased number of two-income families. Also, labor unions may resist increasing the responsibilities of their members unless the members are compensated in some manner.
Appropriate Measures and Data	The key measurements are the number, type, and level of training of people involved in EMS. Listing the number of nontraditional programs is another measure. In addition to quantitative information, anecdotal information regarding improved level of care or perceptions of the community may prove useful for demonstrating potential effectiveness and the conditions under which it is likely to occur.
Associated Needs	EMS must have a solid financial foundation to provide its critical safety net services in a high-quality fashion.

Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	Leadership of state and local agencies should support, through policy, that workers receive first responder training. The workers who receive the training should then be formally recognized for the valuable role they play in the delivery of EMS to their rural community. While the Good Samaritan Law would protect most people operating within their area of training, other legal concerns may need to be identified and solved.
Issues Affecting Implementation Time	Implementation requires that people be willing to be trained in first response. Traditional materials and resources are readily available for training purposes, but time may be required to develop nontraditional resources for nontraditional personnel. As people are trained, integration within the existing EMS system would need to be worked out. Also, a system of improvement would need to be put in place to ensure that quality services are being delivered.

EXHIBIT V-2 (Continued)
Strategy Attributes for Establishing Programs with Organizations to Utilize Nontraditional Employees as EMS Responders (T)

Organizational and Institutional Attributes

Costs Involved	The costs include that of initial training, ongoing continuing education, and medical equipment (as required). In some cases, costs for training courses given to nontraditional employees may be reduced as incentives for training. For example, a hospital in Oregon offered first responder training to maintenance workers at Oregon Department of Transportation at a reduced cost (ODOT, 2002). Costs for medical supplies and equipment such as first responder kits, oxygen bottles, and defibrillators may also be incurred.
	Furthermore, administrative costs will be involved in coordinating such a program and possibly evaluating the effectiveness of the program.
	Federal assistance to first responders, EMTs, primary care providers, allied health care providers, and nursing training programs could improve the general availability of EMS providers. Further, resource support would be very beneficial for meeting continuing education requirements.
Training and Other Personnel Needs	This strategy is primarily about the training of individuals. However, trainers themselves must be trained. Nontraditional forms of training may also be explored, such as self study or Internet-based training courses.
Legislative Needs	Federal and state regulation should allow for flexibility to pragmatically meet the local needs of rural providers, including regulation of EMS providers and services, scope of practice, system design, funding, training, and other such issues. Further, support of flexible processes for openly negotiating these realities at a cross-border, state-to-state level, is critical.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

In Spokane, Washington, postal workers are trained in surveillance (e.g., keeping a lookout for elderly and other citizens that may need health care assistance). If postal workers suspect impending problems, often signaled by mail piling up, they can summon assistance from law enforcement or others to check in. This is an example of a model community partnership that is using the existing postal services in a nontraditional way, which could lower the demand on emergency service response.

Another idea worth considering is to expand first responder training to all state and county highway crews, including road maintenance crews, snowplow drivers, and roadside assistance personnel. Currently, most law enforcement and fire service personnel are trained as first responders. Therefore, adding highway crews would increase the number of first responders on the roadways. For example, some maintenance crews for Oregon Department of Transportation (ODOT) (District 11) have received first responder training. These maintenance crews are equipped with medical supplies and equipment such as first responder kits, oxygen bottles, and defibrillators (ODOT, 2002).

In Pennsylvania, the Pennsylvania Turnpike Commission employs response workers known as Turnpike First Responders (Bodack, 1998). Reports of incidents along the Pennsylvania Turnpike are directed to one central location in Harrisburg—the Turnpike's communication center. Within seconds, a Turnpike First Responder unit close to the location of the incident is dispatched to the scene ready to help. First responders are prepared for almost any situation, and their job includes a wide range of duties. First responders could be called upon to clear debris from the roadway, transport customers whose vehicles may have broken down, plug and contain diesel fuel leaks, administer cardiopulmonary resuscitation (CPR), and even set up temporary traffic control at the scene of an accident. When a first responder arrives at the scene of an incident, the first priority is to assess the situation and then inform the communication center of the exact details so that the center can, in turn, dispatch the proper assistance, be it towing, fire, or ambulance service.

In another program in Pennsylvania, the Western Alliance EMS organization received a mini-grant through the Pennsylvania Office of Rural Health to support a recruitment program. Western Alliance EMS partnered with a local industry to train individuals for the plant's industrial brigade. Provisions of the grant included an agreement to permit brigade members to respond to emergencies in the vicinity of the plant.

For more information on the emergency response programs of ODOT and the first responder program of the Pennsylvania Turnpike Commission, see Appendices 17 and 18, respectively.

Strategy 20.1 A2—Facilitate Development of Regional Resources and/or Cooperatives (T)

General Description

Many rural counties do not have the population or the tax base to support individual county-based EMS systems. Furthermore, in some communities, neighboring EMS squads may work at cross-purposes, resulting in duplication of effort and higher total system costs. By sharing resources across geopolitical boundaries, it is possible to increase provider coordination and make better use of scarce resources (Schoenman et al., 1999).

In many cases, formal cooperatives may be developed. A cooperative is an organization that is owned and controlled by the people who use its products, supplies, or services. Although cooperatives vary in type and membership size, they are formed to meet the specific objectives of their members and are structured to adapt to member's changing needs. Self-reliance and self-help are the hallmarks of cooperatives. Although cooperation, that is, people working together for their mutual benefit, has been practiced throughout human history, the cooperative as a form of business organization began during the Industrial Revolution. Cooperatives were useful for promoting the interests of the less powerful members of society. Farmers, producers, workers, and consumers found that they could accomplish more collectively than they could individually. Rural health care providers may too benefit by forming a regional cooperative.

The role of the region in support of EMS activities varies widely from region to region and state to state. Rural providers are often not served by any type of coordinated regional activity. In addition, the role of the regional systems compared with the role of the state is confusing and, at times, conflicting.

The funding support for regional EMS systems has decreased dramatically over the past couple of decades. Healthy regional systems typically have excellent relationships with the lead state agency that regulates EMS. Many regional systems have been privatized as not-for-profit charitable organizations. They promote a variety of fund-raising activities, such as hosting educational conferences, to support the advancement of their local EMS providers.

While many regional EMS systems are struggling trying to understand what their role is, many other regional systems have built a strong foundation and are recognized as the driving force behind system improvements. It is the focus and characteristics of these strong systems that are highlighted below.

At a minimum, regional EMS systems often are the training, education, and certification arm of the state agency. The regional systems receive funds via the state and have the responsibility to properly administer and distribute the funds. They often provide the EMS educators that in turn teach and test EMS providers. In some cases, the education extends to first responder training.

Another common duty of regional EMS systems is data collection and analysis. Armed with this information, regional EMS systems are able to help EMS providers operate their services and plan for future needs. The scope of data collection can be very broad, including emergency run information, response times, medical quality data, and vehicle maintenance records.

Mass casualty preparedness is another common component that regional EMS systems provide. They help to create linkages between EMS providers, law enforcement, fire services, public works, government services, hospitals, and so forth. These linkages include planning and policy development, management education and training, telecommunication, training and drilling, procurement of supplies, and crisis counselors.

Regionalization can also result in better medical direction and, in some instances, consolidation of agencies.

EXHIBIT V-3
Strategy Attributes for Facilitating Development of Regional Resources and/or Cooperatives (T)

Technical Attributes	
Target	Emergency service organizations, hospitals, local and state government, and medical suppliers and vendors.
Expected Effectiveness	It is difficult to quantify the expected effectiveness, in terms of the number of lives saved, through the development of regional resources and/or cooperatives. Documented studies are not available. However, it might be through financial metrics or evidence of improved efficiency and effectiveness, or perhaps qualifications, that regionalization may be deemed effective. For example, agencies might be able to purchase at a discounted price equipment that they would not have been able to procure otherwise. Ultimately, this equipment could improve patient outcomes. As another example, regionalization might be instrumental in enabling agencies to provide advanced life support rather than basic life support so as to be able to improve patient care and outcomes. Regionalization might also enable EMTs to provide prehospital emergency medical care on the basis of protocols rather than calling a physician for orders on each emergency patient. These are just some of the ways that development of regional resources and/or cooperatives can help improve the quality of care and patient outcomes.

EXHIBIT V-3 (Continued)

Strategy Attributes for Facilitating Development of Regional Resources and/or Cooperatives (T)

Technical Attributes

Keys to Success | There are many keys to success in forming regional systems and/or cooperatives. For example, cooperatives should be created on a strong organizing business foundation in which members must abide by the rules of the cooperative. Excellent and visionary leadership is a must, and financial support is important. Members must effectively balance the collective good of the cooperative with their individual gains. Other key points on how to make a regional or cooperative agreement work include the following (NHTSA, 2000[b]):

- Keep communication open.

- Be forthright with the other agencies about what you need and want.

- Identify each need specifically.

- Understand each agency's needs. Keep talking until you do.

- Do not compete with other agencies and share credit.

- Investigate what other states and/or regions are doing and model your efforts after the best you find.

- Be prepared to both represent your own agency and respect the needs of other agencies.

- Be accessible as a resource and offer your input.

- Work out the details. Do not let things happen by chance.

- Make sure funds transfer and reimbursements are prompt.

- Do not overstate what can be accomplished.

- Give awards or certificates of appreciation for those who go "above and beyond."

Other keys to success may be learned from experiences in Michigan. Some of the features of the Michigan Upper Peninsula (http://www.rupri.org/rhfp-track/results/vol2num2.pdf) experience may have facilitated their regionalization efforts. Thus, it might make this type of initiative more difficult to replicate in other areas (Schoenman et al., 2001). However, following are several of the factors related to successes in the Upper Peninsula that have been noted:

- A strong history of regional cooperation in the UP,

- Key players who have worked together for years,

- A nonprofit EMS foundation that has operated in the region for several decades,

- Two large area hospitals that demonstrated an interest in strengthening the local health care system, and

- An enthusiastic core group of people who represent diverse interests and have been involved since the beginning.

Potential Difficulties | There are many potential challenges in developing a comprehensive regional EMS, including local providers learning how to deal with change and strong leadership that can lead the process. Many different groups must reach agreement on a multitude of issues, and appropriate funding support is required.

In addition, member agencies might have concern over losing autonomy and consequently might not abide by the rules of the agreement or cooperative.

EXHIBIT V-3 (Continued)
Strategy Attributes for Facilitating Development of Regional Resources and/or Cooperatives (T)

Technical Attributes

	Lack of real benefits for some members in regionalizing or forming a cooperative may also be a potential difficulty.
Appropriate Measures and Data	Measurements would depend on what services were provided by the region. It would be appropriate to measure the number of agencies involved and programs offered at the regional level as process measures.
	Financial metrics involved with those programs can be used for both process evaluation and impact evaluation. Savings generated through participating in a cooperative or at a regional level is an important measure. Also, anecdotal evidence of efficiency and effectiveness can be useful, although not quantitative, for measuring the degree of success (or lack thereof).
Associated Needs	Special training programs may be needed, which may require getting the help of specialists from this area.
	Vendors must provide attractive benefits (e.g., discounts for bulk purchases) for cooperatives or regionalization so that cooperatives or regional systems can achieve critical mass to make it of value for the members and vendors alike.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	The support of state and local government executives will be needed to provide the foundation on which to build a cooperative venture.
	It will be important to craft a policy about how the regional system will operate, how disputes will be settled, and how conformance will be managed. Agreements may need to be developed and signed.
Issues Affecting Implementation Time	Regionalization and cooperatives involve sharing and pooling each member's services and assets. The process of determining the value of each service and asset is complicated and can result in intense feelings that draw out negotiations. The inability to reach agreement will slow the process. Also, regionalization and/or a cooperative will likely require capital infusion. The members, and potentially a lending institution, will need to be comfortable with the business plan.
Costs Involved	Costs will vary depending upon what is included in the regional EMS system and/or the type of cooperative that is formed. In some cases, agencies may be required to pay annual dues to be a member of a cooperative.
Training and Other Personnel Needs	Leadership and the ability to advance complex issues through groups with varied interests will be two important training and personnel needs. Training may also be needed for compliance with new protocols and/or standards. There may also be a need to train trainers, i.e., to create a cadre of qualified people to do the training. Development of nontraditional training materials may also be necessary.
Legislative Needs	Legislation supporting the development of regional EMS systems would be helpful, but is not required. Ideally, legislation would provide adequate funding and other resources to improve the quality of emergency services.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

Many progressive regional systems have gone far beyond the basics. Several examples of very progressive regional systems and/or cooperatives include the following:

- Birmingham Regional Emergency Medical Services System (BREMSS),
- Michigan's Upper Peninsula,
- North Central EMS Cooperative (NCEMSC), and
- Texas Regional Advisory Councils (RACs).

These regional systems and/or cooperatives provide a comprehensive array of services. Highlights of these regional systems and/or cooperatives are provided below. More detailed information on these systems is provided in respective appendices.

Birmingham Regional Emergency Medical Services System

BREMSS is responsible for overall coordination and improvements in the prehospital emergency medical care system within a six-county region in Alabama and the subsequent city jurisdictions. BREMSS works with all components of the EMS system, which includes 180 EMS providers, 19 hospitals (with 10 trauma centers and 12 stroke center hospitals), more than 2,000 EMTs, more than 80 different municipalities, and 18 different 9-1-1 agencies. To achieve overall coordination, BREMSS has been effective in creating collaborative arrangements and agreements between differing components of the EMS system and local governments. Through BREMSS programs, system improvements have been made to increase the quality and quantity of services and improve patient outcomes of emergency medical patients within the region. For example:

- EMTs now provide prehospital emergency medical care on the basis of protocols rather than calling a physician for orders on each emergency patient.

- BREMSS was instrumental in the movement to add more than 40 new agencies to provide advanced life support rather than basic life support.

- BREMSS has developed and administered a regionwide, 12-lead electrocardiogram program, which allows for early recognition and transport of patients having acute myocardial infarctions (i.e., heart attacks).

- A state-of-the-art communication system that ties together all hospitals, as well as all major EMS transport agencies, was implemented at no initial cost to hospitals.

For more detailed information on BREMSS, see Appendix 3.

Michigan's Upper Peninsula

Michigan's Upper Peninsula relies on small, volunteer corps of medical first response and basic life support providers scattered throughout the area (Schoenman et al., 2001). The only advanced life support providers are located in the far eastern and western edges of the region. EMS oversight in Michigan is provided by county (or multi-county) entities called medical control authorities (MCAs). MCAs are organized by an area's hospital(s). The principal responsibility of MCAs is to develop protocols for prehospital care. MCAs are composed of volunteers and include a medical director, hospital representatives, and representatives from area EMS squads. Three MCAs serving four eastern counties of the Upper Peninsula have been

collaborating to create a more coordinated, regional EMS system. Rural Hospital Flexibility Program (Flex Program) funds have been combined with significant funds from other sources to support this initiative. The regional system has five main components:

- Standardization of EMS patient care protocols;
- Collection of prehospital data to support quality improvement initiatives;
- EMS training programs at local sites throughout the area;
- Strategic placement of ALS services throughout the region; and
- Ongoing planning, development, and funding for EMS resources and services.

For more detailed information on the regional system in Michigan's UP, see Appendix 4.

North Central EMS Cooperative

The NCEMSC, located in Minnesota, is in existence to reduce member costs, improve quality and efficiency, and establish standard specifications for organization supplies and equipment through a joint purchasing program. The cooperative began in 1997 with 3 members and has grown to 434 members located in 17 states as of 2004. Funding for the cooperative is through membership dues. Each member pays the same low dues, and members are guaranteed to save money, or they get their dues back. Vendors, however, are the primary funding source. A minimum percentage of their sales are returned to the cooperative. Several successes from this cooperative include the following:

- Basic life support service saved $20,000 on a new ambulance.
- Hospital saved nearly $11,000 on one software purchase.
- Basic life support service saved $500 on vital signs monitor.

For more detailed information on the NCEMSC, see www.ncemsc.org.

Texas Regional Advisory Councils

A RAC is a voluntary organization established by trauma care entities, including EMS providers and hospitals, within a trauma service area (TSA) for the purpose of improving care of critically injured patients within the TSA boundaries. The state of Texas is divided into 22 TSAs. Other entities, such as local and county government officials, injury prevention organizations, and consumer groups, may also participate.

The primary responsibility of the RACs is to develop, implement, and evaluate a regional EMS and trauma care system plan to decrease the number of fatalities and injures in Texas by ensuring that critically injured victims receive the most appropriate and expeditious care within the trauma care resources of the TSA. RACs also identify additional resources (such as grants) needed to upgrade the delivery of emergency health care within their regions. Other responsibilities include acting as a public forum for TSA issues, networking with other RACs to ensure appropriate care across TSA boundaries, state reporting, and distributing state monies. The RACs are also very active in injury prevention and public education programs in an effort to decrease the incidence of trauma.

For more detailed information on Texas RACs, see Appendix 5 or visit the Texas Department of State Health Services website at http://www.tdh.state.tx.us/hcqs/ems/links.htm and follow the "Regional Advisory Councils" link.

Strategy 20.1 A3—Integrate Support of EMS into Rural Hospital Financing Programs (T)

General Description

Traditionally, the goal of EMS is to provide immediate medical assistance and rapid transportation to a hospital. Typically, EMS providers offer routine interfacility transportation between health care facilities. In addition, EMS providers commonly deliver emergency medical dispatch care instructions by phone for emergency victims prior to arrival, as well as injury prevention and rehabilitative care.

In many rural areas, a rising aging population, increasing numbers of earlier discharges from hospitals, and the closure of many hospitals are influencing a growing demand for EMS. Often, these rural communities suffer from inadequate access to other medical resources, and EMS becomes a safety net for a broad array of nonurgent health services, including primary care. However, the strain of delivering EMS in several rural areas, where morbidity and mortality rates from serious injuries is higher than in urban areas, has reduced expectations that emergency care in such settings will always be fast and effective.

One of the unmet needs for rural EMS most often identified by state officials is appropriate financing of local EMS programs. Sparse populations in large geographic areas increase the cost of maintaining EMS, making it impossible for many rural local governments to fund EMS programs through taxes. In any locality, the most significant costs of delivering EMS are born by communication systems, vehicles and equipment, personnel training and continuing education, medical direction, and state and local regulations affecting staffing and licensing.

Nationally, most EMS programs are supported by a combination of public and private funds. Federal and state subsidies commonly derive from general tax revenues, service fees, special revenue (e.g., motor vehicle violations or vehicle/driver licensing), and other sources. Third-party payers, including Medicare, Medicaid, private insurance, private pay customers, and special service contracts may also be an important revenue source. Some EMS activities are funded through subscription agreements that allow consumers to prepurchase EMS, thereby ensuring that those subscribers have priority EMS service. Most rural communities do not have the profit potential and volume of business to sustain private-sector EMS, and, as a result, few private EMS services operate in rural environments. It should be noted that outside agency billing has increased revenue for many EMS agencies.

The relatively low volume of emergency calls in rural areas, in relation to the high overhead of keeping a prepared staff, leads to an abundance of EMS squads staffed by volunteers. In turn, this may lead to a less stable EMS organization. Many volunteer squads in rural areas do not even charge for their services because either they lack billing expertise or they simply view their function as one of public service.

The creation of critical access hospitals (CAHs) is one cornerstone of the Flex Program. Improvements to rural EMS systems constitute another critical component of the program. The Balanced Budget Act of 1997, which provided cost-based reimbursement for CAHs and established the associated federal grant program, provided explicitly for improvements to rural EMS systems. Integration of EMS into rural hospital financing programs via the Flex Program could provide necessary funding support for those organizations.

Integration is defined as the coordination and sharing of resources and personnel and/or the linkage with other community health resources to ensure that care does not occur in isolation and to enhance outcomes. Integration of EMS and hospital operations is very common in rural areas. Often it comes in the form of sharing of staff and training responsibilities. It is also common to see the use of EMS personnel in emergency departments. Some state EMS offices are reporting that rural hospitals are integrating for efficiency and continuity reasons, and integration appears to be increasing because of the nursing shortage.

In addition to grant-funded EMS initiatives, there are several reasons why CAH conversion, in and of itself, may affect the local EMS systems (Schoenman et al., 1999). First, CAHs must establish written agreements regarding patient transfers and communications between the CAH and at least one referral hospital. These arrangements could change the provision of EMS in the CAH community and surrounding areas. In more developed systems, CAHs may become part of a more extensive network, which could involve additional hospitals and other types of providers, including EMS providers. Recent legislation making it possible for some CAHs to qualify for reasonable cost reimbursement for ambulance services may provide an added incentive for CAHs and local EMS providers to change to hospital ownership of ambulance services and integrate services.

Second, even short of formal inclusion of EMS providers in the CAH network or CAH ownership of an ambulance service, changes in the day-to-day operations of the CAH may have spillover effects for its own emergency department or the local EMS system. For example, CAHs must provide access to emergency care around the clock, but on-site requirements and staffing provisions have been relaxed relative to acute care hospital standards. Likewise, postconversion changes in the CAHs' scope of services, changes in the community's support for the facility, improved ties to the network hospital and/or area trauma system, the 96-hour limit on average length of stay, and the number and type of patients transferred by ambulance between the CAH and other facilities may affect the volume and type of patients coming to the hospital emergency room.

Another method to increase integration is having EMS programs expand their mission and scope of services to address local health care needs. This could involve broadening the scope of prehospital emergency care provided (i.e., EMS staff would take on a more advanced medical function with patients before they reach the hospital; rather than just stabilizing and treating symptoms while in transit and deferring treatment until they reach the hospital). For example, EMS personnel may become more involved in staffing enhanced regional poison control centers. Other examples are as follows:

- Delivering triage for severe injuries or illnesses;
- Providing on-the-scene care for less severe injuries, including a follow-up visit to a clinic; and
- Serving a public health function that improves access to basic health care by performing
  - Immunizations,
  - Sports and preschool screenings,
  - Blood glucose testing,
  - Hypertension screening, and
  - Community education on self-care and prevention for such matters as managing children's illnesses, diabetes and epilepsy education, and injury prevention.

Another means for achieving EMS integration is to have all local health care providers, including EMS, build more cooperative communication systems and mutually acceptable clinical guidelines and care standards to ensure a continuum of patient care and the confidentiality of patient information. For example, clinical demonstration projects may be developed that expand the skills and scope of practice for certain rural EMS personnel and offer greater flexibility in the licensing requirements for EMS staff.

EXHIBIT V-4
Strategy Attributes for Integrating Support of EMS into Rural Hospital Financing Programs (T)

Technical Attributes	
Target	Rural ambulance services and rural hospitals.
Expected Effectiveness	It is difficult to quantify the expected effectiveness, in terms of the number of lives saved or injuries reduced, through integrating support of EMS into rural hospital financing programs. It is implied that through integration, an improved level of care and efficiency is achieved. However, information on these measures is anecdotal at best. Financial metrics may be the only information available to determine effectiveness.
	In West Virginia, Flex Program grant funds targeted for EMS were used to support feasibility studies of hospital integration with the local EMS system (Schoenman et al., 2001). Results of the studies concluded that integration could be achieved in varying degrees, from simply sharing resources (such as personnel, billing, or administrative capabilities) to outright ownership by the hospital. In West Virginia, the latter model was perceived as having the best potential for improving EMS operations. This perception was based largely on successes demonstrated by one of the state's hospitals that acquired the local EMS system during the Essential Access Community Hospital/Rural Primary Care Hospital program, which are recounted below.
	When the local West Virginia hospital acquired the local EMS system in 1997, the county-financed volunteer squad was transformed into a hospital-based operation with two stations operating with a paid staff and full-time paramedic capability. The following improvements resulted:
	• Response times were sharply reduced because of full-time paid staff and the operation of two stations, rather than one.
	• The quality of care improved because the staff had more consistent and better training.
	• Call volume increased because of increased trust in the community.
	• The level of sophistication of equipment and personnel improved to such an extent that the EMS system is considering becoming a critical care transport provider for the region.
	• Costs for medical and pharmaceutical supplies were reduced.
	• Costs for medical liability were reduced.
	• Hospital funds for capital acquisition became available.
	• Training programs for paramedic and emergency response teams were integrated.
	• There were more opportunities for EMS staff to use their skills when based at the hospital.
	• EMS staff had daily communication with the medical director.
	• Equipment and biomedical support were shared.
	• Experts were more available (e.g., marketing, human resources).

EXHIBIT V-4 (Continued)
Strategy Attributes for Integrating Support of EMS into Rural Hospital Financing Programs (T)

Technical Attributes

	• Full-time billing staff was available with an expertise in the nuances of Medicare and Medicaid regulations, which can enable a better collection rate for ambulance transport fees.
	In 1998, West Virginia became the first state to receive approval to implement the Medicare Rural Hospital Flexibility Program.
Keys to Success	A key to success is strong hospital and EMS leadership that guides the process of integration.
	It is important that the hospital employ managers with an expertise in EMS. It is unrealistic to manage an EMS system in the same manner as an emergency department (Schoenman et al., 1999).
Potential Difficulties	Some hospitals are not willing to link with EMS because of increasing liabilities associated with owning an ambulance service.
	Some of the successes identified above for the particular West Virginia hospital may be difficult to attain in today's environment (Schoenman et al., 1999). Most importantly, movement from a volunteer to a paid staff was facilitated by the fact that Medicare paid on a cost basis for hospital-owned ambulance services at the time, which sharply improved their revenue. Although the Benefits Improvement and Protection Act of 2000 will allow some CAHs that own an ambulance service to obtain cost-based reimbursement from Medicare, to qualify, there must not be any other ambulance providers operating within a 56-km (35-mile) radius of the hospital. All other EMS systems (whether hospital-owned or not) are to be paid under Medicare's new national fee schedule for ambulance services. Several CAHs in West Virginia that would currently qualify for cost-based reimbursement and are considering acquisition of the ambulance service have expressed concern that they would lose cost-based reimbursement if an independent EMS provider subsequently moves into the operational area.
	Hospital acquisition of the local EMS squad is not a solution for everyone. Other potential difficulties that have been noted in feasibility studies conducted in West Virginia include the following:
	• Resistance by local squads to losing their autonomy,
	• Local squad distrust of the management capability of the CAH or of its long-term viability,
	• Concern in the community that a hospital-owned system would make it more difficult to elect to bypass the CAH in the event of an emergency,
	• Concern by the hospital regarding its inability to break even with EMS, and
	• Continuing barriers to the cross-use of paramedic staff in emergency departments (this is seen as a great potential benefit of basing the EMS squad at the hospital, but one that cannot be realized without changes in state regulations).
Appropriate Measures and Data	Process measures include the number of CAHs that have integrated EMS in their funding source by state and metrics that compare financial aspects of integrating services.
	Financial and other data (e.g., of the type noted above for West Virginia) may be used for effectiveness evaluation. Anecdotal information on improved level of care and improved efficiency is another important measure.
Associated Needs	None identified.

EXHIBIT V-4 (Continued)
Strategy Attributes for Integrating Support of EMS into Rural Hospital Financing Programs (T)

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	The type and level of support will vary by institution. Some hospitals that already have an excellent working relationship with their EMS organizations will be able to more easily adjust to any changes that working together unveils. The organizational infrastructure may need modification to accommodate integration. Special governance committees may need to be formed.
Issues Affecting Implementation Time	Many issues can arise, including acceptance by the various governance committees, obtaining of proper legal advice, valuation of the business (in the case of a buyout or merger), and agreeing on terms of the arrangement.
Costs Involved	According to the West Virginia Office of Rural Health Policy, costs involved may include the following: • Costs for financial feasibility studies; • Legal fees; • Staff training costs (i.e., procedures and guidelines); • Equipment necessary for integration; and • In the case of a buyout or merger, the EMS agency would want to recover the valuation of the business.
Training and Other Personnel Needs	Hospital and EMS administrators need to perform proper due diligence to understand the benefits and drawbacks of an integrated model.
Legislative Needs	Legislation should be developed that provides incentives for local EMS programs to become more integrated into the larger health care system. Legislation offering greater flexibility in the licensing requirements for EMS staff may also be necessary.

Other Key Attributes

None

Strategy 20.1 A4—Integrate Information Systems and Highway Safety Activities (T)

General Description

EMS providers perform an important function relative to highway safety beyond the medical treatment and transportation. Specifically, EMS providers collect significant information about the patient, including personal, demographic, and medical information. They also collect information about what the patient and bystanders said were the causes or contributors of the incident (i.e., crashes or other events). In addition, some EMS agencies collect pertinent information about the scene, including road condition, environment, and contributing elements. This first account information is important for reconstructing the situation and learning about causation.

From a system level, many organizations are involved in making highways safer. When crashes occur, it is vitally important to learn as much about the event as possible so that corrective measures can be implemented to the site that will provide the best outcomes. This information can result in prevention programs and systems by focusing attention on improving education, engineering, and enforcement. All three of these activities together create the greatest change for lasting improvements.

Consequently, it is very important to integrate information systems of EMS with other organizations involved with highway safety activities. This integration will provide access to useful information that many can use to make highways safer. For example, databases maintained by highway agencies contain information on crash frequencies and locations. EMS agencies would find this information valuable in determining where to allocate resources (e.g., base stations) and in deploying personnel based upon concentrations of accidents. Identifying areas of high concentration of crashes can also be useful for establishing plans for air transport of patients where ground transport to a trauma center exceeds a certain time threshold (e.g., 1 or 2 hours). The overriding and universal theme for integrating information systems is that EMS and highway safety agencies share a common mission to prevent injuries and save lives. Although they go about it differently, their priorities mesh well.

The first step in integrating information systems and highway safety activities is establishing a data collection system. It is important that data collection be standardized among agencies so that data are collected in a uniform manner.

Data and a data registry are at the center of most improvement initiatives. Statewide highway safety data systems provide the basic information necessary for effective highway and traffic safety efforts at any level of government—local, state, or federal. State safety data are used to perform problem identification, establish goals and performance measures, allocate resources, determine the progress of specific programs, and support the development and evaluation of highway and vehicle safety countermeasures. Unfortunately, the use of state crash data is often hindered by the lack of uniformity between and within states.

The Model Minimum Uniform Crash Criteria (MMUCC) (NHTSA, 2003[a]) was developed in response to state requests for improved and standardized crash data at the local, state, and federal level. When implemented at the state level, the MMUCC provides a minimum set of data elements that are accurate, reliable, and credible within states, among states, and at the national level. Uniform state crash data are used to (1) perform problem identification, (2) establish goals and performance measures, (3) determine progress of specific programs, and (4) support the development and evaluation of highway and vehicle safety countermeasures.

Lead EMS organizations across the country, recognizing a large need, adopted NHTSA's Uniform Prehospital Data Elements in their state EMS data collection systems. The first step to creating a national EMS data set was to agree on a collection of defined data fields that will make up the database. The data set serves as the skeleton of the whole information system. It establishes uniform data elements with definitions of each stage of an EMS event. Data elements include such items as the patient care report number, the mechanism of injury, the number of defibrillation shocks administered, and the names of all hospitals served. Currently, the National Association of State EMS Directors is working with NHTSA and the Health Resources and Services Administration to develop a national EMS database. Such a database would be useful in developing nationwide EMS training curricula, evaluating patient and EMS system outcomes, facilitating research efforts, determining national fee schedules and reimbursement rates,

addressing resources for disaster and domestic preparedness, and providing valuable information on other issues and areas of need related to EMS care. This work on developing a national EMS database is being conducted under the National EMS Information System grant. It will be important to link key data from this EMS data set to the MMUCC data set.

Another important link is the state's traffic record system. Each state, in cooperation with its political subdivisions, should establish and implement a complete and comprehensive traffic records program. The statewide program should include, or provide for, data for the entire state. A complete and comprehensive traffic record program is essential for the development and operation of a viable safety management system and effective traffic-related injury control efforts. It is also essential for the performance of planning, problem identification, operational management and control, tracking of safety trends, and implementation and evaluation of highway safety countermeasures and activities. A complete and comprehensive traffic record program is the key ingredient to safety effectiveness and management.

In the face of a lack of integration of EMS, hospital, and other safety data, NHTSA developed a system for linking crash, vehicle, and behavior characteristics to their specific medical and financial outcomes. Through this linkage, prevention factors may be identified. This Crash Outcome Data Evaluation System (CODES) works as follows:

- Data that are collected by law enforcement agencies at the scene of a crash are linked to injury outcome data using probabilistic methods, rather than some unique identifier. As a result, the normal highway safety data set is enriched with medical system data that were collected at the scene, en route to the emergency department, and at the hospital or trauma center upon arrival and/or after discharge.

- The types of injuries, their severity, and the costs incurred by persons injured in motor vehicle crashes are described and computerized.

- The medical community is, as a result, able to access not only crash outcome data and law enforcement crash reports, but also data from sets such as vehicle registration, driver licensing, citation, and roadway inventory. It will be possible to combine these sources on a case-by-case basis with hospital discharge, trauma registries, EMS runs, and costs, thereby generating more comprehensive information to evaluate the effectiveness and role of medical trauma service in highway safety.

Appendix 6 contains further information on CODES.

EXHIBIT V-5
Strategy Attributes for Integrating Information Systems and Highway Safety Activities (T)

Technical Attributes	
Target	EMS organizations, government agencies, law enforcement, and highway departments.
Expected Effectiveness	No studies provide information on the expected effectiveness of this strategy. However, when agencies are working toward the same goal, they should work cooperatively together, and one of the simplest and most logical ways for agencies to work together is through the integration (i.e., sharing) of information. Integration involves more than the simple connection of two systems for the purpose of transferring data. Integration can more accurately be described as the connection and transfer of data between systems for the purpose of combining the functions of each, and the result is new and unique functionality that previously did not exist.

EXHIBIT V-5 (Continued)
Strategy Attributes for Integrating Information Systems and Highway Safety Activities (T)

Technical Attributes

Keys to Success	There are many keys to successfully integrating information systems and highway safety activities, including visionary leadership, adequate funding, cooperation between many different players, and information technology support.
	It is important that each agency/stakeholder involved see a benefit of the cooperative effort in terms of their own goals and objectives.
	It cannot be emphasized enough that data are only the first part of an information system. Data must be converted into information. The information should be readily accessible and directly applicable to the operations of the stakeholders. Thus, a major part of this effort may include significant revisions to data processing systems, with greater emphasis on end-user accessibility and ease of use. Another aspect of this will be the institution of comprehensive quality control mechanisms to assure the users that the data are valid.
	Other keys to success in integrating systems and activities include the following (NHTSA, 2000[a]):

- *Setting Priorities* – Finding common ground and setting priorities will probably be the least challenging part of the process.

- *Sharing Resources* – Typically, four types of resources will be shared: funding, information, technical expertise, and human resources. Equipment may also be shared.

- *Managing Expectations* – Common objectives are vital. It is acceptable to go into the process with your own specific objectives, but they must be clearly defined. Finally, a written plan with measurable goals is critical.

- *Doing Research and Networking* – Talk to others who have gone through similar processes. There is no point in making common mistakes.

- *Maintaining Open Communication* – Have formal channels of communication, such as planned meetings, written reports, and single points of contact, as well as encouraging informal communications.

- *Avoiding Turf Issues* – Lay everything out clearly from the beginning, and do not hide anything.

Many of the keys to success detailed in Strategy 20.1 A2 are also applicable to this strategy.

Potential Difficulties	Data privacy is an important issue to be understood. The Health Insurance Portability and Accountability Act of 1996 (http://www.cms.hhs.gov/hipaa/) requires that certain information be stripped out. One potential solution to the problem of maintaining patient confidentiality is to assign a longitudinal patient identifier. For example, in the state of Washington, trauma patients are given a bracelet with a unique identifying number that remains with the patient throughout the process of care. That number is kept with the medical record, but the patient's name and address are not maintained at the state level, thus preserving confidentiality because the unique number, not patient identifying data, moves from the hospital or EMS agency to the state. It should be noted, however, that if the unique identifier number is preserved in the state crash database, it can ultimately be linked back to private patient data. Therefore, once the linkage and merging of desired data are achieved, it is desirable to also strip out the unique identifier.

EXHIBIT V-5 (Continued)
Strategy Attributes for Integrating Information Systems and Highway Safety Activities (T)

Technical Attributes

| | The state of Washington has very specific confidentially provisions in its statutes that allow the collection of personal identifiers in addition to the trauma band number. For linking purposes, the experiences of the Office of Emergency Medical Services and Trauma System (Washington State Department of Health) suggest that trauma band numbers by themselves are somewhat inadequate. The reasons for this are that documentation of the trauma band number is sometimes lacking (e.g., missing on one record) and that data entry errors (e.g., keystroke errors) sometimes create problems with both false positives and false negatives. As a result, the trauma band number is useful, but it should not be relied upon solely for adequate linkage.

Another area that could create challenges is the information systems themselves. They need to be compatible with each other. In addition, managing large databases has its own set of challenges. |
| --- | --- |
| Appropriate Measures and Data | Achievement of this strategy could be measured by ratings, from system managers and users, on the degree to which systems have been integrated, the user friendliness of the system, and the usefulness of the data that are made available. |
| Associated Needs | None identified. |

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Organizations will need to support, by policy, the sharing of information and agree to participate in activities that will advance the mission of the local community relative to highway safety activities. This may require formal agreements or development of cooperatives between agencies.
Issues Affecting Implementation Time	Many issues will impact implementation time, including compatibility of information technology, funding, cooperation, and whether the cooperating agencies have a history of working together. Modification of forms and procedures may take more than a year, and this will normally have to be followed by intensive training of field and office staff. Software will have to be written and/or acquired and tested. Time must be allocated for acquiring new equipment and pilot testing new systems.
Costs Involved	Cost will vary depending on the scope of the effort. The primary costs will be related to information technology costs. For example, how will data sets be merged or linked? Will new software have to be developed to link systems? Will new hardware have to be purchased? Additionally, staff support will be required to manipulate the data. These costs could be significant, but at the same time, the financial burden can be shared among the agencies. Costs to train personnel on the new system will also be involved.
Training and Other Personnel Needs	Training and personnel needs are dependent on which system and approach are chosen. When Arkansas developed the prehospital data collection system, a dozen regional training workshops were held around the state during the first year of implementation to instruct users on correctly filling out the data collection form. To maintain the program, about six workshops are conducted on an annual basis (NHTSA, 2000[a]).
Legislative Needs	Legislation may be needed to modify currently legislated mandates for certain agencies to collect and maintain specific types of data.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

Below are two examples where EMS agencies and highway agencies collaborated to integrate their data collection and information systems (NHTSA, 2000[a]). The first example presents the collaborative effort between the Arkansas Department of Health/Division of EMS and Trauma Systems and the Arkansas State Highway and Transportation Department/Traffic Safety Section (TSS) to develop an EMS prehospital data collection system. The second example presents a joint effort by the Wisconsin Bureau of Emergency Medical Services (EMS) and Department of Transportation in creating the Wisconsin EMS Information System (WEMSIS).

Arkansas: Development of EMS Prehospital Data Collection System

A long-term goal of the Arkansas Department of Health was to develop a state trauma registry. The first step toward this goal was the establishment of a data collection system to collect and capture prehospital data for motor vehicle crashes from emergency providers. This information would help the state more accurately measure the quality of care and would also improve the accuracy of reporting to the NHTSA Fatality Analysis Reporting System (FARS).

A project to establish a prehospital data collection system was initiated in 1994. State officials felt that a new data collection system was a vital first step to the development of a state trauma registry. State officials from the two state agencies (EMS and TSS) agreed to a plan to use grant monies available to each to share the cost of implementing a computerized optical scan data collection system. The system would store and analyze prehospital care information collected from licensed EMS providers across the state. The information would be used for regulatory oversight and overall trauma system review and to supplement information in FARS. The partnership between the two state agencies was logical and cost-effective for the state. The two state agencies cooperated on all aspects of the project's implementation, with EMS taking the lead.

Hardware purchases included a flatbed infrared optical mark reader (OMR) scanner and a software package that generates user-defined standard and custom reports. The actual data collection system is housed and operated by the state EMS, which submits data extracts on a regular basis to TSS. The data are also shared with many injury prevention organizations and research groups through the state's university hospital system. Reports are sent back to the ambulance services and emergency providers for their use in quality management studies.

For more information on the Arkansas program, see *Cooperation and Partnership: Keys to Success: State Highway Safety and EMS Agencies Working Together to Improve Public Health* (NHTSA, 2000[a]).

Wisconsin: Comprehensive, Uniform Data Collection

About the time that NHTSA published its *Uniform Pre-Hospital Emergency Medical Services (EMS) Data Conference Summary Report* (NHTSA, 1994[b]), Wisconsin was one of several states struggling with the lack of uniformity in its data. Through state legislation, the state's EMS board and EMS bureau were charged with drafting a report to include

- Recommendations for a uniform data collection system,
- Recommendations for collection of post-transport data from hospitals, and
- Justification for the number of staff needed to analyze data and disseminate information gathered.

The result was a list of 65 essential data elements for Wisconsin's data collection project, essentially a modification of the NHTSA list.

Once the data needs were identified, data collection became the primary focus, and collaboration between the state EMS and DOT agencies focused on development of the WEMSIS software. The two agencies shared a cooperative agreement to meet the objective of the program, which was to link crash data using a common data set. Through its combined resources, the program had created a valid tool for EMS data collection. However, the program was dropped a few years after its conception for unspecified reasons.

Conceptually, WEMSIS had great potential, especially if widely adopted across the state. It would have allowed providers to collect a wide range of information, such as patient demographics, cause of injury, EMT procedures performed, and DOT safety and crash variables. This tool would have enabled the state of Wisconsin to better analyze the overall effectiveness of EMS.

For more information on this disbanded Wisconsin program, see *Cooperation and Partnership: Keys to Success: State Highway Safety and EMS Agencies Working Together to Improve Public Health* (NHTSA, 2000[a]).

Strategy 20.1 A5—Integrate EMS systems into the Safe Communities Effort (T)

General Description

The USDOT has made a clear commitment to the philosophy that communities are in the best position to effect improvements in motor vehicle and other transportation-related safety problems. When a community takes ownership of an issue, change happens.

The Safe Communities approach, developed under the sponsorship of NHTSA, represents a new way community programs are established and managed. All partners participate as equals in developing solutions, sharing successes, assuming risks, and building a community structure and process to continue improvement of community life through the reduction of injuries and costs.

A Safe Community expands resources and partnerships, increases program visibility, and establishes community ownership and support for transportation injury prevention programs. As the Safe Community concept addresses all injuries, transportation safety becomes positioned within the context of the entire injury problem.

In addition, the Safe Communities approach emphasizes the need to involve the medical, acute care, and rehabilitation communities. These groups need to be actively engaged as integral partners in preventing injuries.

Four main characteristics define Safe Communities: (1) injury data analysis and (where possible) data linkage; (2) expanded partnerships, especially with health care providers and businesses; (3) citizen involvement and input; and (4) an integrated and comprehensive injury control system.

The *EMS Agenda for the Future* (NHTSA, 1996) stated that, in the future, the success of EMS systems will be measured not only by the outcomes of their treatments, but also by their prevention efforts. Expertise, resources, and positions in communities and the health care system make EMS an ideal candidate to serve linchpin roles during multi-disciplinary

communitywide prevention initiatives. The NHTSA Safe Communities program provides a proven construct for EMS and other organizations to join forces toward injury prevention.

EXHIBIT V-6
Strategy Attributes for Integrating EMS Systems into the Safe Communities Effort (T)

Technical Attributes

Target	The principal target is the Safe Communities program, in which it is envisioned that EMS organizations will work cooperatively with schools, law enforcement, highway crews, local civic groups, local government, health maintenance organizations, and hospitals.
Expected Effectiveness	It is difficult to quantify the expected effectiveness, in terms of the number of lives saved, through integrating EMS into the Safe Communities effort. Many other safety initiatives have to be accounted for, so there is no real way to determine the actual effect on safety for this type of initiative. Thus, although crash experience needs to be monitored, the impact of this type of programmatic involvement on crashes cannot be inferred.
	Process measures would focus upon documenting the manner in which EMS organizations are involved in the program and measures of level of activity.
	Effectiveness analysis would focus upon achievement of program objectives and the costs involved. Surveys can be made of community awareness of, and attitudes toward, the programs and the role of EMS in it.
Keys to Success	Keys to success include local community leadership, adequate funding, willingness to collaborate, citizen involvement, deployment of a comprehensive injury control model, and celebration of accomplishments.
	In establishing Safe Communities in rural areas, consideration should be given to the following priorities: identification of the leadership, maximum use of interpersonal communication channels, reliance on local program control, and acceptance of the reality that successful change will only occur slowly (NHTSA, 1999).
	Some volunteer EMS programs may shy away from a Safe Communities effort because of its injury prevention nature. EMS systems with paid staff will more likely become involved in such programs. Thus, this strategy is geared more toward EMS systems with paid staff.
Potential Difficulties	It may be difficult to gain and maintain community awareness and interest in the program. Efforts are needed to use public information channels to communicate progress and achievements. Incentives should be sought for those most actively involved.
	It may take time to get stakeholders communicating freely with each other. It must be recognized and respected that the various community representatives involved will be coming from different backgrounds and organizational cultures and will have various agendas. Patience and strong leadership are needed.
	Individuals in stakeholder organizations may resist being involved in community safety in new ways. Training and incentives may be needed.
	Finally, as indicated above, it may be difficult to motivate volunteer EMS personnel to participate in injury prevention programs such as the Safe Communities effort.
Appropriate Measures and Data	The appropriate measure depends upon the program design. Some of the data often collected include crash and injury cost data. Other data such as community awareness and the number and type of programs and agencies involved are appropriate measures as well. Financial and personnel effort should be measured to analyze productivity measures.

EXHIBIT V-6 (Continued)
Strategy Attributes for Integrating EMS Systems into the Safe Communities Effort (T)

Technical Attributes

Associated Needs	This kind of community effort will usually involve some public relations efforts. It may be necessary to seek out some special expertise to put together and implement a plan for this strategy.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	As a method to reduce crashes and other incidents, organizations need to support prevention activities. Within EMS agencies, it may be difficult to expand into injury prevention because it may require a change in the philosophical direction of an agency for this strategy to be undertaken. Interorganizational agreements may be needed, and new organizational infrastructures will be created to implement this program.
Issues Affecting Implementation Time	Inadequate funding and data will impact implementation time by slowing the development of effective tactics for improvement. It takes time and patience to create new working relationships among organizations, many of which have not interacted previously and come from different organizational cultures. Creating new working relationships cannot be rushed.
Costs Involved	Costs vary depending on the program designed. Costs may involve staff, office space and equipment, public relations materials and activities, and training. Often grant money is available, and funding may come from local civic groups.
Training and Other Personnel Needs	Specific training is dependent upon the program. Potential training needs include grant writing to secure funding and facilitator training for the leaders. Training may be needed in association with injury prevention programs.
Legislative Needs	Legislation may be required to facilitate forming new organizational relationships, as well as to support activities that come out of the program. Legislative support for adequate funding is also desirable.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

There are many excellent examples of Safe Communities programs that have proven results throughout the country. One example of a program is the Wright County, Minnesota, Safe Communities Program, started in 1997 and still active today. The Wright County program was initiated with a grant from the American Association of Health Plans to the local EMS provider. This collaboration was the first ever between an EMS organization and a managed care organization in the development of a Safe Communities program. The results of the effort have been very positive. For more information on Safe Communities of Wright County, visit http://www.safecomm.org and see Appendix 7.

Santa Barbara County Safe Communities Injury Prevention Program is another example of an initiative with EMS involvement. This program began in 2001 with a grant from the California Department of Health Services. The Santa Barbara County Public Health

Department EMS Agency coordinated the program with an aim to engage representatives from all facets of public safety in a coalition to prioritize major causes of unintentional injury in the county and to strategize for the reduction of these injury types. Following an extensive effort to collect data on unintentional injury, the coalition prioritized areas of injury in accordance to incidence, cost, and perceived community interest. This research led to the development of a strategic plan that recommends strategies for intervention. For more information on the program, visit http://www.sbcphd.org/ems/safe_community.html.

Strategy 20.1 A6—Use Mobile Data Technologies That Are Interoperable with Hospital Systems (T)

General Description

More communities are requiring EMS mobile data communications as EMS providers struggle against time to save lives. The more information EMS crews have, the better prepared they are to handle any situation quickly and safely. Mobile data communications are cost-effective, reliable, and secure and can increase productivity, reduce costs, improve services, and increase personnel safety.

Mobile data systems using portable and vehicle mobile data terminals (i.e., mobile computers) and wireless communications can provide:

• Call information and street directions to get the ambulance crew to the scene quickly,
• Automatic vehicle location (AVL) data to send the ambulance along the quickest route,
• Critical medical information,
• Patient and address history for quicker appropriate action upon arrival, and
• The ability to complete run reports from the vehicle.

An effective and coordinated response requires radio interoperability, which is the ability to communicate by radio between emergency response agencies dynamically and on demand. Serious natural disasters (such as hurricanes and forest fires), major tragic events (such as the Oklahoma City bombing), and recent acts of domestic terrorism demonstrate the imperativeness of a coordinated response among public safety agencies from various levels of government. Local police, fire, and EMS agencies are the nation's first responders to these major incidents.

All emergency response personnel require safe, reliable, and secure communications with each other, as well as the ability to communicate quickly and directly with other local, state, and federal agencies and area hospitals. This improves the ability to effectively manage the scene of major incidents and to more effectively triage patients to specialized hospitals capable of caring for those patients. It also supports efficient triage of patients at times when the local hospital emergency departments are on divert mode.

Local emergency services agencies and hospitals require seamless, coordinated, integrated communications to effectively protect lives and property in their communities. There are many examples where police, fire, and EMS commanders at emergency scenes require reliable, secure, and clear wireless communications with each other at the incident command level and in coordination with local hospitals to carry out their job effectively, in the best interest of the public, and for the safety of the emergency response personnel. Exhibit V-7 provides a sampling of various mobile data technologies.

EXHIBIT V-7
Samples of Mobile Data Technologies

This strategy is closely related to Strategy A7 and all strategies associated with Objective D.

http://www.911dispatch.com/information/mobiledata.html

http://www.itronix.com/

http://www.med-media.com/pubsafety/remstat.htm

http://www.panasonic.com/computer/toughbook/home.asp

EXHIBIT V-8
Strategy Attributes for Using Mobile Data Technologies That Are Interoperable with Hospital Systems (T)

Technical Attributes	
Target	The target of this strategy is the communication systems of EMS organizations, hospitals, and government service providers.
Expected Effectiveness	The data managed using mobile data technologies can empower everyone involved in EMS. Medics can focus on patient care with a nonintrusive tool to rapidly collect, reference, and communicate data. A patient's assessment, their treatment, and the underlying care they receive can be enhanced. Administrators can manage resources and link information systems. Quality assurance and quality improvement are provided with unlimited data analysis capabilities to detect trends and modify education. Billing offices are given complete, precoded information, reimbursement-critical data capture capabilities, and automated system interfacing options. Medical direction is provided with accurate, complete information, including the data elements necessary to continually improve guidelines. Doctors, nurses, and hospitals receive legible, timely, wirelessly delivered reports. Dispatch can share run and patient information. Legal staff can decrease liability exposure. Area agencies and hospitals can receive properly formatted, paperless run data.
	Information is more effectively used when it can be easily and rapidly accessed and distributed. Interfacing with systems such as billing, dispatch, and hospital informatics can be accomplished through a wide variety of open data-sharing and connectivity standards.
	The wired and wireless real-time connectivity capabilities give agencies a powerful tool to perform many tasks, such as look up patient records, send current findings, communicate with medical devices, and deliver times and mission-critical patient information.
	Sanddal (2003) conducted a study for the Western Transportation Institute to evaluate the impact of PDAs on EMS response to traumatic injuries. The objective of the research was to compare the effectiveness of a scannable paper-based/desktop patient information system against a PDA-based/desktop system and a previous hard copy reporting system for issues of timeliness, accuracy, completeness and legibility of data, and inclusion or exclusion of prehospital records from the patient's hospital medical record. Sanddal found that both methods of electronic data collection, scannable bubble sheets and PDA data collection, performed better than the previous paper-based written patient contact forms in measures of completeness, legibility, patient information, care/treatment, and mechanism of injury descriptions. The scannable bubble sheets and PDA systems performed similarly in all measures except for legibility, where the PDA excelled. Sanddal concluded that the improvements in record keeping from both electronic technologies during the prehospital phase of trauma care could impact the eventual outcome of injured patients by allowing for greater continuity of care.
Keys to Success	An important key to implementing mobile data technologies is clearly identifying the needs of all agencies and hospitals that require communications both internally and with other agencies at emergency scenes during disasters and widespread emergencies. In addition, it is important to thoroughly assess all existing communication systems employed by all agencies and hospitals; to determine specific changes and additions that are required to meet their interoperability needs; and to establish clear, realistic budgetary estimates and priorities for implementing the required changes.
Potential Difficulties	Potential difficulties include lack of funding, lack of radio infrastructure to support communication needs, and security of the system.
	Some personnel may resist the use of new technologies. Careful introduction and training are needed to minimize this resistance, as well as to facilitate optimum use of the technology.

EXHIBIT V-8 (Continued)

Strategy Attributes for Using Mobile Data Technologies That Are Interoperable with Hospital Systems (T)

Technical Attributes

Appropriate Measures and Data	The number of agencies operating interoperable technologies is an appropriate process measure, along with documentation of the nature of technologies used, and the manner in which they are used. System downtime is another important process measure. In addition, one can acquire ratings by trauma operational staff and managers of the change in the value of the system, vis-à-vis the aspects listed in the section on effectiveness (above in this table). Where the system can have direct impact on operations, such measures as response time may be used.
Associated Needs	Competent IT capabilities are needed.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Because multiple organizations will be using these systems, the development of a regional consortium with joint powers to guide policy matters will be useful.
Issues Affecting Implementation Time	Many issues can affect implementation time, such as determining the type of technology that is most appropriate to meet the needs of all associated agencies, securing funding, and developing and testing the system. The time required to complete these tasks will be a function of the level of the existing information/communication infrastructure.
Costs Involved	Costs for these technologies can range significantly depending upon the complexity and sophistication of the system. For example, Perkins Township Fire Department noted that they purchased a system that included software, four hand-held computers, and three printers that use infrared signals to communicate with computers (Brown, 2003). In most cases, the primary costs involved will be hardware and software related. Developing a wireless secure network to transport data may also be of significant cost. Finally, training costs and maintenance costs will also be involved.
Training and Other Personnel Needs	Training needs include working knowledge of public safety technological and system standards, such as used by the Association of Public-Safety Communications Officials (APCO) Project 25, and experience working with the Telecommunications Industry Association/Electronics Industry Association (TIA/EIA) standards for wireless communication systems. Understanding The Health Insurance Portability and Accountability Act of 1996 (http://www.cms.hhs.gov/hipaa/) privacy regulations will also be important.
Legislative Needs	The area of mobile communication requires constant support by the state and federal legislature to fund new advancements. APCO provides a comprehensive list of key issues and strategies for improvements (http://www.apcointl.org/about/gov/).

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

Several agencies or organizations that (1) are using mobile data systems within their agency, (2) have participated in a demonstration project with such devices, or (3) plan on implementing the devices in the future include the following:

- The City of Akron, Ohio;
- Washington/Norwich Township Fire Departments (near Columbus, Ohio);

- Mecklenburg EMS Agency (MEDIC) in Charlotte, North Carolina;
- Agencies in Northern Shenandoah Valley; and
- Pennsylvania Department of Health Emergency Medical Services Office.

For more information on use of mobile data technologies within these agencies and organizations, see Appendix 8.

Strategy 20.1 A7—Require All Communication Systems to Be Interoperable with Surrounding and State Jurisdictions (T)

General Description

"Interoperability" refers to connecting two or more information systems for the purposes of enhancing and creating new functionality that did not exist prior to the integration of the systems. In the EMS field, the integration of communication systems is most often associated with connecting systems that reside at the public safety answering point (PSAP). Integration at the PSAP combines previously disparate systems into a single, consistent user interface. This integration has several benefits (http://www.911spec.com/samplewhy.htm). Most importantly, integration can provide new and unique ways of performing tasks that previously were not possible or were difficult to perform.

Integrating systems requires the ability of each system to communicate via a common language or protocol. Many 9-1-1 systems incorporate third-party, proprietary products, such as Private Branch Networks (PBXs). It is very difficult to integrate these products because they are proprietary and unable to communicate with other systems. Open systems employ and publish standard methods of communicating through application program interfaces (APIs), thus providing the ability for other systems to communicate and integrate the functionality of each.

With the advancement of communication technology, especially 800-MHz trunking, the ability to have a fully functional, interoperable communication system is not only desirable but also achievable. Communication is often sighted as a critical component to effectively managing emergency situations that involve multiple organizations.

This strategy is closely related to all of the strategies associated with Objective 4, "Reduce time from injury to appropriate definitive care."

EXHIBIT V-9
Strategy Attributes for Requiring All Communication Systems to Be Interoperable
with Surrounding and State Jurisdictions (T)

Technical Attributes	
Target	This strategy targets EMS organizations, law enforcement agencies, fire fighting services, local, regional, and state government, hospitals, highway departments, emergency management organizations, poison centers, regional response teams, other health care providers, and Hazmat response teams.
Expected Effectiveness	By requiring all communication systems to be interoperable, it is presumed that through integrating the functions of the various systems, new and unique functionality will enable agencies to work together more efficiently and seamlessly and improve the quality of care provided to trauma patients.

EXHIBIT V-9 (Continued)
Strategy Attributes for Requiring All Communication Systems to Be Interoperable
with Surrounding and State Jurisdictions (T)

Technical Attributes

Keys to Success	Keys to success include legislation mandating this requirement, information system technology, communication system infrastructure, adequate funding, and cooperation among all agencies.
	Moreover, for communication systems to be interoperable and to function properly, the following steps are recommended (Horan and Schooley):
	• *Access critical coverage gaps:* EMS is fundamentally dependent on mobile coverage.
	• *Integrate EMS planning into ITS planning and funding:* To receive local funding, such systems should be integrated into the transportation planning process because this is the means by which state and local funds are allocated.
	• *Develop a strategic plan and a management plan:* These two plans should remove artificial barriers to establishing interorganizational systems.
	• *Provide adequate training to specialists*: The new systems will require training at the local level.
	Data sharing and interoperability are key issues for public safety agencies (Schuman and Meyer). By partnering with transportation agencies, public safety agencies can design regional information and communication systems to serve the broadest public interest. In this manner, agencies will be able to share vital incident management information in real time, while preserving the privacy of nonpublic information on proprietary networks.
	Finally, visionary leadership is necessary to harness the full potential of new technology. Public safety and transportation agencies are challenged to work together in new ways, to learn to operate new systems, and to share both resources and responsibilities.
Potential Difficulties	Potential difficulties may arise if participation in such a system is optional. Other difficulties may include lack of funding and lack of technological and communication infrastructure.
Appropriate Measures and Data	The number of agencies in compliance with interoperability is an important process measure. Effectiveness can be measured in terms of new functionality that was not possible prior to interoperability, as well as anecdotal evidence that supports improved efficiency in operations or improved quality of patient care. Financial data will be needed in order to arrive at efficiency and productivity measures.
Associated Needs	Vendor support is important to ensure that all equipment has the ability to seamlessly integrate with other equipment. As an example, all participants' radio systems should be on 800 MHz, and one brand of radio (e.g., Motorola) should connect to another brand of radio (e.g., Standard).

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Many policy issues will be present, including (1) who owns the system, (2) who will manage the system, (3) how upgrades will be handled, and (4) who will operate the system.
	Everyone involved will be required to establish and comply with the operating rules governing the use of the system.
	Coordination with the Federal Communications Commission (FCC) over usage of the system will also be necessary.

EXHIBIT V-9 (Continued)
Strategy Attributes for Requiring All Communication Systems to Be Interoperable with Surrounding and State Jurisdictions (T)

Organizational and Institutional Attributes

Issues Affecting Implementation Time	Securing funding, availability of technology and infrastructure, developing cooperative agreements among the providers, and staff training will all affect implementation time.
Costs Involved	Costs highly depend on system requirements. In most cases, the primary costs involved will be hardware and software related. Current systems often require periodic upgrades and can be very costly as platform systems become obsolete and no longer supported by the providing vendor. However, training costs and maintenance costs will also be involved. Costs to upgrade systems will also be involved.
Training and Other Personnel Needs	Staff who use the system will need to learn the operation of the equipment and the rules of the system. If a centralized dispatch function is included in the system configuration, additional staff training will be needed.
Legislative Needs	Support will be required to designate certain radio channels exclusively for this system.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

A good example of a rural county advancing its communication systems to a level of full interoperability is Jeff Davis County, Georgia. Jeff Davis County, located in the middle of Southeast Georgia, boasts one of the most efficient 9-1-1 centers in that part of the country. The centralized center is equipped with a three-position communication system that provides four 9-1-1 trunks, 20 analog telephone lines, and eight radio channels with four trunking radios (Clifton, 2001). Additional system features include telecommunication device for the deaf (TDD), instant recall recording, and tone paging at each station. One year after implementation, the response times to calls have been reduced, and the efficiency of the responding units has improved. Appendix 9 provides additional details on the communication system in Jeff Davis County, Georgia.

Objective 20.1 B—Provide/Improve Management and Decision-Making Tools

Strategy 20.1 B1—Develop Resource and Performance Standards Unique to the Specific Rural EMS (T)

General Description

EMS is provided by a myriad of configurations across the United States. High-performance systems have appropriately trained and equipped personnel arrive at the scene of a medical or trauma emergency in a short period of time. This requires that EMS units be stationed

strategically throughout the service area 24 hours per day and have a means to rapidly respond to calls for assistance.

EMS agencies have typically established a response time standard of approximately 8 minutes for advanced life support. This standard has resulted from considerations other than trauma from crashes. The American Heart Association has conducted studies on the survival rate of out-of-hospital cardiac arrest. Because of that information, most EMS agencies strive to initiate early CPR, followed by early defibrillation, and then the initiation of advanced cardiac life support approximately 8 minutes after cardiac arrest occurs. According to studies, the amount of time to provide these critical steps impacts the survivability of cardiac arrest.

The Commission on Accreditation of Ambulance Services uses a time of 8 minutes, 59 seconds to have an advanced life support unit on scene. Based on Standard 1710, the National Fire Protection Association uses a response time of 480 seconds, or 8 minutes, to have an advanced life support unit on scene. Both of these measurements do not take into consideration the population density and the travel distance in providing on-scene coverage, but rather deal with the end result of the arrival of advanced life support in order to reduce deaths due to out-of-hospital cardiac arrest. The Commission on Fire Accreditation International does not have established timeframes for response but relies on local agencies to establish the response times that are appropriate to the level of risk in the community.

To further complicate the issue, there is no agreed upon performance measures other than that of response times. Even in urban areas, it is often difficult to maintain the response standards outlined above. Highway networks, traffic congestion, high-rise buildings, and 9-1-1 center incident processing methods all impact the ability to reach patients in need of emergency medical care within short time periods.

To date, two primary measures have been used to determine the success of an EMS system: the response to patients in cardiac arrest prior to biological death (discussed above) and the transport of trauma patients to the appropriate level of trauma center. Of these two measurements, only the first (i.e., response to patients in cardiac arrest) requires strict ambulance response times in order to improve the outcome. The response to trauma patients can be dependent upon rapid ambulance responses, but the overall time to a trauma center can be made up during other phases of the emergency, such as the use of air medical transport systems and well-functioning trauma systems that rapidly move patients into an operating room capable of handling the severity of the injury.

No widely known reliable studies have evaluated EMS systems based on the performance of the system other than the intervention of medical emergencies to prevent sudden cardiac arrest. Thus, the majority of EMS systems use the cardiac arrest survival potential in developing response times rather than measures based upon data derived from response to traumatic injury.

Particularly in rural areas, a better measure may be the response times required to positively intervene in other medical situations. In a rural area, it is unlikely that an emergency can be recognized, the 9-1-1 system can be accessed, an EMS unit can be dispatched, and an equipped and staffed unit can arrive on the scene within the time parameters outlined. This is primarily due to travel distance and dispersed population. Therefore, it is critical to

determine what response times are realistic in a given rural area, taking into consideration the standards set by the various national organizations. More importantly, it is critical to understand the threshold points of response times that have the most potential to positively or negatively impact patient outcomes. In addition, when considering establishment of threshold response times, consideration should be given to accepting slightly greater response times if a higher level of care can be provided to the patient upon arrival of the EMS unit at the site than if no significant medical intervention would be made until arrival at the trauma center. Although research by Liberman et al. (2003) indicates that there is no benefit of having on-site advanced life support for the prehospital management of trauma patients in urban centers, it also indicates that these conclusions may or may not apply to rural trauma patients. Because the tradeoffs between advanced treatment versus time have not been completely answered for rural areas, this consideration is valid when establishing threshold response times. This linkage between quality of care and response times can make direct comparisons between jurisdictions or plans difficult.

Finally, establishing optimum staffing resources is an additional dimension to the problem. Resources available to urban EMS systems typically include a medic unit staffed with two people and a first response unit, often a fire truck with four firefighters. This gives a total of six people to handle critical EMS incidents. In rural areas these levels of resources (both in numbers as well as skills) typically are not available. Therefore, it is important to determine an optimum staffing level for a given rural area and strive to attain (or maintain) this staffing level. A task analysis of response activities over a defined time period will allow systems to determine the appropriate number of personnel to have on duty at a given time as responders on EMS units.

Currently, there is an effort at the national level to create a guide to EMS performance measures. Ideally, this effort will develop national standards unique to rural EMS.

EXHIBIT V-10
Strategy Attributes for Developing Resource and Performance Standards Unique to the Specific Rural EMS (T)

Technical Attributes	
Target	The principal target for this strategy is the current status of resource and performance standards available for use by EMS providers, EMS administrators, physicians, hospitals, county and local administrators, fire chiefs, elected leaders, and emergency managers and medical directors.
Expected Effectiveness	No studies are available to provide a basis for estimating the safety effectiveness of this strategy. However, as resource requirements and performance standards are established for rural EMS systems, it will be feasible to measure the degree of success for similar systems and not to rely on comparisons with systems that service urban areas. This will help ensure that a level of service is available that is based on data rather than political pressure and lobbying efforts of stakeholders. The various political entities must be able to base staffing decisions on verifiable data that best serves the citizens in that locality.
Keys to Success	One key to success will be to establish resources and performance standards that balance the needs of victims with the reality of rural areas to provide acceptable levels of service. Establishing resource and performance standards will need to involve some level of data collection and analysis.

EXHIBIT V-10 (Continued)

Strategy Attributes for Developing Resource and Performance Standards Unique to the Specific Rural EMS (T)

Technical Attributes

	Successful initiation of this kind of action will be more likely to occur when pressure exists to respond to increasing urbanization in rural areas. Thus, it will become clear to those who manage the system that tools must be made available to assist the localities that do not have the staff or expertise to design an EMS system for their community.
Potential Difficulties	This may generate extensive discussion and disagreement, particularly from those in the EMS community who take the position that all victims should receive the same response time, regardless of location. Others believe that real world situations make it not cost-effective or practical to have EMS units strategically located to provide a response within 8 minutes in areas with a very sparse population and low incident volumes.
	If, or when, nationally accepted standards are established for rural EMS, some jurisdictions will be unable to meet any standard as set forth. This concern should not offset the need to have these standards. Therefore, mechanisms are needed to mitigate the impact on locations unable to meet the new standards.
	Added costs, experienced to meet new standards, will create stress on already tight budgets and result in resistance to the adoption of the standards. Basic levels of equipment to meet accepted standards will be necessary. Some agencies may realize that they need to hire full-time EMS workers to meet established standards.
Appropriate Measures and Data	Process measures include documentation of the existence, scope, and type of standards. Effectiveness measurements should be based upon differences in response times in relation to patient outcome. For example, measurements should look at patient outcomes upon the initiation of definitive advanced life support care (assumed to be present under improved standards) instead of outcomes for patients who do not receive definitive advanced life support care (assumed not to be present in the absence of improved standards).
Associated Needs	A community planning and integration process is necessary to help the community evaluate the place of EMS services in the community and to determine what resources and performance measures are acceptable. This type of planning will involve EMS agencies, hospitals and medical assistance facilities, governing bodies, schools, service clubs, the business community, and the public at large (Critical Illness and Trauma Foundation, 2003). Appendix 10 provides a model EMS community planning and integration guide to assist communities in building strong EMS systems.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	The major issues will be what the scope of the evaluation system will be and what performance measures and standards apply. The International Association of Firefighters has an EMS performance measurement system that is being instituted in various locations around the United States. This system will measure any participating systems, but, at this point, it does not provide benchmarks for rural systems.
	The convening authority will be faced with difficult value judgments when setting standards for rural EMS, since an entirely new measurement system may be adopted to replace the cardiac arrest scenario.
	For the rural EMS standards to be valid, the medical community in the area must be actively involved in establishing the local rural EMS standards, and, ultimately, the medical community at large must be involved in establishing national rural EMS standards.
	If, or when, nationally accepted standards are established, it is anticipated that separate standards will be established for rural and urban operations. It is imperative that rural standards be presented as appropriate only in rural areas.

EXHIBIT V-10 (Continued)
Strategy Attributes for Developing Resource and Performance Standards Unique to the Specific Rural EMS (T)

Organizational and Institutional Attributes

	Staff must work with stakeholders to ensure that standards are valid and reliable.
	Finally, by developing resource and performance standards based upon some level of data collection and analysis, agencies will be reducing their tort liability and other legal risks. Agencies will be demonstrating that they are taking a proactive approach in an effort to answer difficult questions instead of the current situation that most agencies find themselves in when they cannot adequately respond to questions concerning the difference in patient outcomes when treated with varying response times and differing levels of patient care administered at the scene and during transport.
Issues Affecting Implementation Time	It may prove difficult to convene a group that can easily decide on what data and measures need to be used to determine the effectiveness of EMS. Also, a data collection system must be in place that will adequately track emergency response units and then complete a follow-through with patient outcomes. This will require an integrated approach between the prehospital and in-hospital care systems that may take more than a year to operationalize.
Costs Involved	Costs involved will include the time and effort to determine the appropriate measures, the cost to collect and analyze the data, and the time involved to determine appropriate standards.
Training and Other Personnel Needs	All personnel involved in the affected operations will need to be informed, and some will need to be trained, regarding the impact of the revised evaluation system on their job and unit.
Legislative Needs	Legislation may be required to reduce liability of rural systems that decide to adopt standards that may be less stringent than urban systems.

Other Key Attributes

None

Strategy 20.1 B2—Identify, Provide, and Mandate Efficient and Effective Methods for Collection of Necessary EMS Data (T)

General Description

Two major considerations in the cost of data collection are (1) the amount and type of data to be collected and (2) the methods for data acquisition, data reduction, and data entry.

A complete assessment of any EMS system requires that an analysis be completed on the performance of the system. Typically, the performance of any EMS system is judged using the data that have been collected from previous incident reports. The data are collected by the EMS attendants and may be recorded in written or electronic form. In most EMS systems, the data are stored for legal and historical purposes. In many systems, data that are collected in written form are later entered into database systems to better manage the data and information. More progressive systems use mobile data computers or some form of hand-held computers to capture the information (see Strategy A6).

National standards have been developed in regards to collection of EMS data. In 1993, 80 EMS data elements were identified and agreed upon at the Uniform Pre-Hospital Emergency Medical Services Data Conference, sponsored by NHTSA. That information was disseminated to the EMS community for action at the state and local level. A great majority of states have followed suit and established data collection systems that use the adopted elements, while some agencies have added data elements that are specific to their state and local systems.

To update the work initiated in 1993, the National EMS Information System released an updated version of the NHTSA Prehospital Dataset in 2004 (Version 2.1). This information is now available to EMS agencies, and all states are being encouraged to implement this national standard.

According to NEMSIS, as of February 2005, 47 states and the District of Columbia have committed to implementing a standardized reporting system. Several states, such as Ohio, Minnesota, North Carolina, Delaware, and Mississippi, have developed model data systems. Every system depends on various agencies in the state to manage the data. In some cases, the data are archived at the local EMS agency, while in other cases, the data are sent to a central location in the state. Some states have the ability to analyze the data and to provide feedback to local agencies. Other agencies have collected data but are unable to provide usable information from the data.

A major issue with the data sets that have been developed is the ease of collection. Field providers routinely complain about the complexity of collecting the data and the time that it takes to document the elements, which field providers may not think are relevant to the care of that specific patient or to key system performance indicators. The minimum data set may not be completely suitable for rural EMS systems. It may be appropriate to eliminate or modify some data elements and add others to improve the quality, completeness, and unit costs associated with collection of EMS data in rural areas.

All personnel at EMS agencies need to understand that consistent, long-term collection of data is important and that each agency has the responsibility to collect the minimum set of data. A minimum data set must support analyses of response standards, patient care, treatments administered, and patient outcomes. In many cases, the data collection ends when a patient is delivered to an emergency department. To include the final discharge outcome of the patient, particularly in rural areas, consideration should be given to either extending reporting or linking to trauma center databases. These data can be linked to other data systems, so the information can then be used to gain a better understanding of the ultimate impact of treatments administered at the scene and en route, as well as the response and transport times.

A low-cost method of data handling is also needed. Collection of data using pencil and paper is often considered the lowest cost option; however, this option does not allow for efficient and less error-prone data entry. When data reduction is factored into the process, viable options to assist in data collection include the various mobile data technologies, as discussed in Strategy 20.1 A6. Optical scanning systems are also a possibility, but these systems, while significantly more efficient than traditional paper reports, still are less productive than automated data collection systems.

Mandating the use of some form of electronic collection systems would assist all agencies in establishing data systems that could be accessed universally in order to evaluate effectiveness and efficiency.

Information on Agencies or Organizations Currently Implementing this Strategy

The National EMSC (EMS for Children) Data Analysis Resource Center (NEDARC) is available to help state EMS offices develop their own capabilities to collect, analyze, and use EMS and other healthcare data to improve the quality of care in state EMS and trauma systems. Several states that have developed model EMS data systems include

- Ohio,
- Minnesota,
- North Carolina,
- Delaware, and
- Mississippi.

Additional information on the data systems in these states is provided on the NEDARC website (http://www.nedarc.org/).

Recently, the Rural EMS and Trauma Technical Assistance Center was established. This center will serve as a national focal point for the dissemination of information on rural EMS and trauma care. The center will provide services to a wide range of rural EMS providers. This center will ideally be the start of a central repository of rural EMS-related data. Making EMS information centers readily available will permit EMS systems to access information that can assist them in solving system problems. This will enhance current EMS systems by using proven programs or techniques that will enhance the overall delivery of EMS.

EXHIBIT V-11
Strategy Attributes for Identifying, Providing, and Mandating Efficient and Effective Methods
for Collection of Necessary EMS Data (T)

Technical Attributes

Target	EMS administrators, fire chiefs, state EMS directors, and EMS personnel.
Expected Effectiveness	The safety effectiveness of this strategy will not be easily or directly quantified. The strategy should provide analysts and decision makers with improved information for making decisions especially tailored to rural EMS conditions.
Keys to Success	It will be important to separate the essential data elements from others that may be desirable but not critical so that costs can be controlled.
	It will be critical to the success of this effort to have the involvement of all stakeholders from the beginning in such a way that their opinions, requirements, and concerns are recognized and addressed.
	A key to success for any information management system is to explicitly define the nature and format of the information that will be produced by the new system and to establish the purpose for each piece of information.
	The cooperation and enthusiasm of the stakeholders can be encouraged by clearly demonstrating to them the benefits to be derived from changing the system.
	It may be more appropriate to concentrate on making the current data collection system more user friendly than to attempt to implement a completely new process.
	Data privacy is an important issue to be understood, especially as related to the Health Insurance Portability and Accountability Act of 1996 (http://www.cms.hhs.gov/hipaa/).

EXHIBIT V-11 (Continued)
Strategy Attributes for Identifying, Providing, and Mandating Efficient and Effective Methods
for Collection of Necessary EMS Data (T)

Technical Attributes

	Finally, the timeliness of collecting the data and recording the information so that it can be analyzed during evaluations of the system is critical.
Potential Difficulties	It may prove difficult to get the various agencies to change their existing system if it has been in place for a long time.
	If EMS data are collected as part of a broader range of enterprise data, then changing that element may cause undesirable ripple effects in the remainder of the system.
	Additional issues may arise in asking rural EMS providers to change their current data collection methods and data elements. For instance, a scan data system may require the use of a broadband Internet connection, which may not be immediately available in some rural areas.
	A mandate (or legislative action) requiring the collection of EMS data is difficult to enforce unless the consequences of nonconformance are significant.
Appropriate Measures and Data	The number of agencies that adopt a new data collection and management system, along with documentation of the nature of those systems, is a good process measure. Effectiveness measures include changes in the accuracy, precision, completeness, timeliness, and reliability of the data. It will also be of interest to determine the average unit time and cost per fully executed report.
Associated Needs	None identified.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	States that have data collection systems in place are typically requiring licensed EMS agencies to complete the required minimum data set. Should a national standard be set for rural systems that is not in compliance with a state system, that agency may not be able to continue to be licensed in the state. This may require that each state agree to an alteration to their rules and regulations.
	Changing data elements or minimum data sets will require extensive discussion, debate, and approval at many levels in the stakeholder agencies. Changes to a data system involve many different stakeholders, all of whom need to be involved from the start.
Issues Affecting Implementation Time	It will require significant time to identify, assemble, and organize all the stakeholders and to proceed through a study process with them.
	Some states or localities will have a system of regulatory review that must take place prior to making changes to any component of the EMS system. This can result in very lengthy times to make changes or to gain approvals. At times, states may take 2 to 3 years to complete a review cycle for changes to their regulations.
Costs Involved	There will be a significant cost to develop new data elements to meet rural response needs. There will be an expense to have the elements identified, validated, and adopted by states and EMS agencies. Software development will be a major factor.
	If computer-based data collection systems (i.e., electronic data systems) are used, hardware and software may have to be purchased. Maintenance and service fees may also be involved with the hardware and software. Similar costs will be involved with optical scanning systems. Additionally, the cost of training must be accounted for.

EXHIBIT V-11 (Continued)
Strategy Attributes for Identifying, Providing, and Mandating Efficient and Effective Methods
for Collection of Necessary EMS Data (T)

Organizational and Institutional Attributes

Training and Other Personnel Needs	Training at all levels will be required for any agency that moves to a new data collection system.
Legislative Needs	Legislation may be needed to allow for new data collection systems in some states. Other states may require legislation to mandate data collection for all EMS agencies.

Other Key Attributes

	A future implementation guide will be developed on data needs, sources, and analysis. When it is available, it should be consulted as another source of information and ideas.

Strategy 20.1 B3—Identify and Evaluate Model Rural EMS Operations (T)

General Description

Rural EMS systems in the United States share one common trait – all are unique. In many rural areas across the country, the delivery of EMS has not been a planned or formally organized process. The service has traditionally been provided by volunteers that have functioned within the community, often without the benefit of strategic station placement, or using any formal deployment plan. Thus, service is delivered without a cohesive response or performance plan. Over time, EMS volunteers have been unable to keep up with the increased training requirements and with the time commitments that are required to stay proficient in EMS.

The decline of volunteer organizations has often mandated that paid personnel be added to meet the EMS demand. The progression of these systems has not been according to any set plan or standard and has not followed any set protocol or process. The decision to move from a volunteer system to a paid system is most often based on political considerations rather than on a critical analysis of the risk in the community.

To further complicate a full understanding of the delivery of EMS in rural areas, most accepted efficacy studies have looked at high-volume EMS systems that have shorter response times and a high emergency incident volume. Thus, no generally recognized and accepted studies have developed a model system based on actual practice in rural areas.

There is a need to evaluate the efficacy of existing rural systems to determine which model is best suited to the delivery of EMS in a given rural area. Particular attention will need to be given to the integration of volunteer organizations into the newer hybrid type of system that uses a combination of volunteer and career personnel.

Almost every suburban area in the United States has gone through a transition in the development of its EMS systems. Unfortunately, most EMS agencies that must make changes to meet service demands do not draw on similar experiences of other systems.

The ability to evaluate a number of different systems that are operational will be a very effective tool for EMS administrators and elected officials. An evaluation system can provide

government officials with information on peer systems (i.e., systems having similar demographics and service demands) to benefit from each other's experience. This should provide better access to information about strategies that have worked well (as well as those that have been less successful). Therefore, the new system can provide guidance for jurisdictions that are faced with enhancing their current system, or in some cases, developing a comprehensive EMS program.

Ultimately, these evaluations should be provided to the appropriate agencies, administrators, and officials (see Strategy 20.1 B4).

EXHIBIT V-12
Strategy Attributes for Identifying and Evaluating Model Rural EMS Operations (T)

Technical Attributes

Target	Rural EMS systems, rural EMS administrators, county and local administrators, elected officials, hospitals, rural EMS system operational medical directors, and state health officials.
Expected Effectiveness	It is not feasible to measure the direct impact of this strategy on crashes. However, what is learned from evaluating a range of rural EMS services will provide a better basis for establishing resource and performance standards (see Strategy B1), as well as guidelines for improving the operation of rural EMS systems. This is expected to lead to better quality of service.
	The ultimate effectiveness derived from the knowledge from a study would be the cost-effectiveness of the implemented system.
Keys to Success	One key will be to identify model systems in rural areas that are willing to be evaluated to determine how cost-effectively the system works vis-à-vis the norm. It will be critical to identify system configurations that are most compatible with existing contexts.
	The support of "champions" who have influence with the systems is also going to be key to achieving full cooperation.
	Ultimately, success will rest with the ability to convince existing EMS operators that the model system is worth emulating.
Potential Difficulties	It will be difficult, but crucial, that unique aspects of any existing system be identified and discussed during the evaluation of the system. Every EMS system has unique attributes that may not be reflected in the measures used and that may be difficult to replicate in other systems should those attributes be found important to system improvement.
	It will be difficult to provide a total evaluation of the system, particularly to identify the factors that were critical in reaching decisions on how the system was implemented.
	A major difficulty could be discovering political considerations and addressing them in a manner that will allow others to make an application to their contexts. Given the political climate in some jurisdictions, administrators may be reluctant to provide details that may not cast a favorable light on local processes.
Appropriate Measures and Data	A process measure is the number of systems evaluated. Effectiveness measures include documenting the resulting set of measures and standards, as well as the creation of a set of guidelines or recommendations resulting from analysis of the evaluations.

EXHIBIT V-12 (Continued)
Strategy Attributes for Identifying and Evaluating Model Rural EMS Operations (T)

Technical Attributes

	Appropriate measures to use in the evaluation of systems include cost of the system, response performance, patient outcomes, deployment plans, number of EMS units, longevity of the system, attrition of the previous system providers, and number and type of personnel staffed during various portions of the day.
Associated Needs	Specialists in system evaluation needed to provide oversight and direction for this effort.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	It will be important to establish a policy of nondisclosure for agencies that are unable to share some of their challenges. To understand the efficacy of existing systems, it will be imperative to evaluate the progression of the EMS system over time. To do so, agencies must be willing to fully discuss the issues that surrounded any significant changes that occurred in the system. This may create a dilemma for organizations reluctant to share information that (1) could be used in future litigation against the agency or (2) may reflect negatively on the jurisdiction. Failure to protect confidentiality could result in a product that is less than desirable because it may exclude critical information that would assist in understanding the dynamics of, and means for, meaningful change.
	Organizations may also be reluctant to discuss the human resource issues of their organization. However, systems depend on personnel for the delivery of the service, so it will be important for each organization to provide honest and candid answers to human resources questions as a part of the process.
Issues Affecting Implementation Time	A major consideration will be the time required to identify quality systems that will permit evaluations to be conducted. The length of time required for an evaluation will vary according to the data available, the structure and size of the system, and the cooperation received.
Costs Involved	Costs will include contractors needed to develop the evaluation system and to conduct the evaluations. There may also be some minor costs to agencies participating in the evaluation. Costs will be a function of the number of operations to be evaluated and the degree of complexity of the evaluation system adopted.
Training and Other Personnel Needs	Using a panel of subject matter experts will reduce the need for training of the system evaluators. The number of personnel requiring training will also be a function of the number of systems to be evaluated and the level of detail of the evaluations. At a minimum, teams of two evaluators will be needed for each system evaluation.
	Some information and education effort directed at the personnel in the system may be needed to help personnel understand what is being done, why it is being done, how it will benefit them, and what role they will be asked to play in the process.
Legislative Needs	No legislation is needed.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

Appendix 11 provides an assessment of the EMS system in Maine.

Strategy 20.1 B4—Provide Evaluation Results to Elected and Administrative Officials at the County and Local Levels (T)

General Description

Rural EMS programs often work without oversight, control, or responsibility to governing bodies. Volunteer organizations or private companies provide EMS to rural areas based on their historical presence in the jurisdiction. In other jurisdictions, paid personnel have been added by the jurisdiction or through private paid systems. In many cases the elected and administrative officials are not involved in the establishment of response or performance standards.

Given the lack of direct control of EMS systems in many rural areas of the country, the representatives of the citizens may not be aware of response issues until these issues become media events or until some tragic event triggers a reaction from the elected and appointed officials.

The ability to understand what levels of service are normally delivered in similar communities would assist elected leaders in making decisions prior to some threshold event. Providing elected and administrative officials with measures and standards that have been developed from evaluations would give the officials a better understanding of the levels of service offered in their community and the nature of any improvements needed. By understanding the myriad of issues, community leaders will be able to determine the actual level of service provided in the community, what level of service they desire for their community, and the issues related to meeting that level of response. This strategy is closely related to Strategy 20.1 B3.

EXHIBIT V-13
Strategy Attributes for Providing Evaluation Results to Elected and Administrative Officials at the County and Local Levels (T)

Technical Attributes	
Target	Elected officials, appointed administrators, EMS program managers, and fire chiefs.
Expected Effectiveness	Elected officials often make decisions without the benefit of an expert knowledge base in EMS. By educating key officials about the actual performance of exemplary EMS systems, they will learn what levels of service may actually be provided in their community. Further, having a set of measures and standards will allow elected officials to make decisions based on their desired outcomes and more effectively resist political considerations.
	This approach should be very effective in giving key officials an unbiased assessment of rural EMS systems and how they are designed, administered, and managed.
Keys to Success	It will be critical that the assessment be objective and founded in accepted practices of similarly situated jurisdictions. The assessment must not be edited or rewritten to meet the desires of the local EMS agency. The use of recognized evaluation expertise will help achieve the desired credibility.
	The elected body must be open to making changes and understand that the assessment will most likely be a public document available to the entire citizenry. Changes should be made based on the recommendations of the evaluation. Educating the targeted officials and including them from the very beginning of the process will be important activities to facilitate use of the results of the evaluation.

EXHIBIT V-13 (Continued)
Strategy Attributes for Providing Evaluation Results to Elected and Administrative Officials at the County and Local Levels (T)

Technical Attributes

	Elected and administrative officials are just a few of the stakeholders that should be involved in planning activities for EMS systems. Appendix 12 illustrates a way for elected and administrative officials to get involved in EMS planning activities, such as reviewing evaluation results.
Potential Difficulties	The potential cost to enhance the EMS system will be a major factor in the receptiveness of the evaluation. Particular difficulty will be encountered if there is no revenue stream to pay for system enhancements such as new ambulances or paid personnel. Therefore, it will not be enough to just evaluate operations. Successful funding methods also need to be documented.
	The use of volunteer systems historically creates a difficult situation in which political leaders can make enhancements. Volunteers put in many long hours of training and often raise funds for equipment, supplies, and vehicles. The long hours spent on delivering emergency response further endears the volunteers to the community. Elected leaders may be reluctant to upset the balance of volunteer organizations to make changes, particularly if additional costs are involved.
	It will be imperative that elected leaders have a strong understanding of the opposition they may experience. Elected officials should plan to address questions and issues that are brought forward as a result of any system evaluation.
Appropriate Measures and Data	A process measure will be the number and percent of desired political leaders to whom the evaluation results have been presented and the number of systems adopting change due to the involvement of elected and administrative officials at the county and local levels.
Associated Needs	Public information and education specialists may be needed to put together an effective presentation, or series of presentations, and to guide the process.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Given the technical nature of EMS, appointed leaders may not have the expertise to understand the local, state, and federal requirements that may be encountered by the EMS system. This is particularly noted when dealing with fee-for-service systems and when seeking federal reimbursement. Some degree of training of officials or access to technical experts may be needed to gain this expertise.
Issues Affecting Implementation Time	The main issue will be to go through the proper notification to get the evaluation on the agenda of the local governing body. Significant time may also be required to conduct background training for the officials. It may take some educating of the elected and administrative officials in order for this training to become a priority of theirs.
Costs Involved	Some cost could be incurred should the evaluators travel to the locality to present the evaluation findings to the elected and appointed officials. There may be some costs associated with developing and presenting a PI&E program designed to "train" the officials.
Training and Other Personnel Needs	Some PI&E effort may need to be developed and implemented to help educate local officials on aspects of EMS with which the officials may not be familiar.
Legislative Needs	In some states, localities are unable to regulate any programs that are not specifically approved by the state legislative body. In those states, it may be difficult for the local elected leaders to implement changes. It will be especially important in those cases that one or more members of the legislature be sought to champion the effort and to facilitate any legislative actions needed.

EXHIBIT V-13 (Continued)
Strategy Attributes for Providing Evaluation Results to Elected and Administrative Officials at the County and Local Levels (T)

Other Key Attributes

None

In 2004 the Emergency Medical Services Regulatory Board (EMSRB) in Minnesota conducted a pilot project to assess and assist stressed rural ambulance services. Assessments of four volunteer ambulance services in different regions of Minnesota were conducted. The final reports were presented to the ambulance service governing board and city officials. Approximately 1 year after each assessment, the EMSRB plans to follow up and describe the successes and challenges of implementing strategies recommended in each assessment report. For more detailed information on these rural ambulance assessments, visit the Minnesota EMSRB website: http://www.emsrb.state.mn.us/RuralAmbAssess.asp.

Objective 20.1 C—Provide Better Education Opportunities for Rural EMS

Strategy 20.1 C1—Utilize Technology-Based Instruction for Rural EMS Training (P)

General Description

Rural EMS systems face many challenges, especially finding ways to effectively train EMS providers. Initial education and continuing education present one of the biggest barriers to both recruiting new members and retaining existing members of an organization. Especially in rural areas, EMS personnel often spend more time in training than they do on runs responding to incidents.

EMS education is mandated by the regulating agencies and, like other aspects of medicine, is continuously improving and changing. Because of these changes, it is important to keep EMS providers trained so they are able to deliver the most effective care. Further, because of the low run volume, keeping current with skills is an ongoing challenge for rural providers.

The typical methods for education and training are to follow a cascade-type, classroom approach. As an example, a new technique for applying splints is approved. Instructors are trained, and they in turn train other providers in the new technique as well as other folks to be instructors. This approach requires each EMS organization to assign someone with the duty of being the service instructor. The service instructors by the nature of their work must be a competent provider and have the time available to train others. This is an especially difficult position to fill.

Colleges and universities have learned that to keep their enrollments up and meet the busy lifestyles of people today, they must bring the education to the people rather than requiring people to come to the education. Further, the education needs to be provided so that it meets the schedules of the students instead of being offered it at a fixed time and location. Technology today allows for this type of distance learning. The idea of distance learning has

sparked a debate about the quality of students trained in a typical classroom setting compared to others that are trained outside of a classroom. Increasingly, the results of technology-based instruction are proving favorable.

EXHIBIT V-14
Strategy Attributes for Utilizing Technology-Based Instruction for Rural EMS Training (P)

Technical Attributes

Target	EMS organizations and personnel; medical directors; universities; federal, state, and county regulating agencies; and individuals in rural communities.
Expected Effectiveness	Several studies have been conducted that illustrate the utility of technology-based instruction for rural EMS training. Sanddal et al. (2004) conducted a study to compare the results of prehospital pediatric continuing education using train-the-trainer and CD-ROM training methods. Pullum et al. (1999) assessed the strengths and weakness of five different training programs used in Montana:

- Train-the-trainer,
- Local cluster with videotape and guided practicals,
- Circuit rider training with interactive videodisc,
- Interactive video teleconference, and
- Distance education using interactive statewide computer network (i.e., TENKIDS statewide electronic infrastructure).

In Texas, Moshinskie et al. (1996) investigated the possibility of using distance education to train EMS caregivers for rural areas where serious shortages of ambulance crews had been reported. Each of the studies concluded that technology-based instruction for rural EMS training was a viable option, if not a better option than traditional classroom training. Appendix 13 provides additional details on the three studies identified above that assessed the utility of technology-based instruction for rural EMS training.

Keys to Success	Keys to successfully using technology-based instruction for rural EMS training include appropriate funding to provide adequate facilities and technology. Furthermore, strong organizational and medical leadership will be necessary to make the transition to this type of education.

Incentives and competition for those being asked, or required, to take the training will improve motivation.

The desired outcome of improved EMS operations and results for patients will ultimately also depend upon the quality of the material that is delivered through this vehicle.

It is also important that technology-based instruction be accepted as part of the national registry system.

Potential Difficulties	The lack of funding or information and communication technology could present difficult challenges.

There are several modes through which a person can learn. Some people learn best through one mode and others through another mode, or different combinations thereof. The use of computer-based systems may work well for some, but not others.

Local support will be needed to back up the instruction, especially for some of the students. It may be difficult to provide individualized assistance at each training station, beyond a call from the central instructional staff.

EXHIBIT V-14 (Continued)
Strategy Attributes for Utilizing Technology-Based Instruction for Rural EMS Training (P)

Technical Attributes

	Local technical support will be needed to maintain the operation of the system. The advanced nature of the technology may be beyond what is available within the agency, requiring either additional training or acquiring additional technical staff (through hiring or contracting).
Appropriate Measures and Data	Process measures include the number and type of courses offered, students enrolled, and lesson units completed; the number and proportion of students completing their assigned curriculum; and the proportion of time during which the technology is not available upon demand. Effectiveness measures include comparison of pre- and post-test results and observations of change in on-the-job performance.
Associated Needs	None identified.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Organizations will need to establish, by policy, the scope of technology-assisted education and how it will be used. They may also have to consider mandating an educational program. To enhance motivation, organizations may need to provide incentives for taking and completing the courses.
Issues Affecting Implementation Time	It may take significant time to help administrators, such as local medical directors, understand and accept the utility of technology-assisted training. In addition, if the communication/technology systems are not existing and readily available, the improvements needed may take significant time to achieve.
Costs Involved	Costs include communication equipment and linkage costs, classroom equipment and facilities, and student and instructor time. There may be an opportunity for organizations to share equipment and facilities, as well as communication systems and instructors.
Training and Other Personnel Needs	EMS organizations may need to train someone in the use of the technology to troubleshoot and to act as a "super user." Also, all personnel will require minimum training in the use of whatever technology is chosen. Furthermore, instructing with interactive technology is difficult, so the instructors should be trained to use this media effectively.
Legislative Needs	None identified.

Other Key Attributes

None

Strategy 20.1 C2—Establish an Exchange Program to Allow Rural EMS Providers to Spend a Specified Number of Hours in Urban/Suburban Systems (E)

General Description

EMS organizations across the United States can benefit from establishing a personnel exchange program. The initial focus of such a program would be to allow rural EMS providers a chance to work with a sister urban or suburban EMS organization.

The primary focus of the program would be to allow providers from a rural setting with a low case volume to increase their patient encounters and increase the types of medical and trauma incidents to which they are exposed. This focus would help providers build skills and transfer their learning to members of the rural organization who are unable to participate in this exchange.

A number of secondary benefits could be obtained through such an exchange. For instance, the rural provider would get a chance to build a network of contacts with other professionals for possible future assistance. The rural providers may also participate in buying programs, billing services, quality assurance programs, or other things that would be mutually beneficial. At a minimum, the urban providers would benefit from excellent public relations, which in turn would build creditability and good community relations.

Overall, these types of relationships could improve the quality of care in a given area and improve the safety for both residents and visitors. It should be noted that similar ride-along programs are used during the initial training of EMS personnel.

Before this type of exchange program is implemented on a large scale, a pilot program should be conducted, closely monitored, and carefully evaluated.

EXHIBIT V-15
Strategy Attributes for Establishing an Exchange Program to Allow Rural EMS Providers to Spend a Specified Number of Hours in Urban/Suburban Systems (E)

Technical Attributes

Target	The primary target of this strategy is the EMS technician who is involved in runs. The adoption of this strategy requires that providers, county and state EMS agencies, and medical directors be targeted with the information about the strategy's potential benefits.
Expected Effectiveness	This strategy should help improve performance by gaining significant experience in a relatively short period considering the rural setting.
	This strategy could reduce the amount of continuing education required to keep up skills. It should lead to wiser purchasing decisions because of the first-hand experience with different equipment that is more advanced than the equipment available in the rural service.
	The strategy offers the opportunity to build relationships between multiple services. These relationships would be beneficial in the event of a widespread disaster that requires cooperation between agencies. The strategy could also lead to standardizing medical protocols and sharing in purchasing programs.
Keys to Success	Significant cooperation between agencies and medical director approval and oversight of the program will be required.
	Regulatory agencies will need to support this effort and be sure their rules allow for this flexibility.
	Developing a business model with mutual benefits for all parties will help lead to improved success.
	Minimizing any medical liability for the providers and organizations will be required.

EXHIBIT V-15 (Continued)
Strategy Attributes for Establishing an Exchange Program to Allow Rural EMS Providers to Spend
a Specified Number of Hours in Urban/Suburban Systems (E)

Technical Attributes

Potential Difficulties	Insurance constraints and legal liability are two potential difficulties associated with this strategy.
	Finding hospitals that will accept or support this type of program may be difficult.
	Furthermore, lack of cooperation, and even competition between providers and organizations, could cause difficulties.
	Rural providers that cannot be a part of the exchange program because they find it difficult to find time to leave the community may have their advancement negatively affected. This effect may be a problem for volunteers.
	Union contract limitations may also create difficulties.
Appropriate Measures and Data	Appropriate process measures include the number of services involved, the number of personnel involved, the time on exchange assignment, and the volume of calls experienced by the participant while in the urban setting. Effectiveness measures include ratings of change of on-the-job performance and comparison of pre- and posttest scores through a test designed to measure change of knowledge.
Associated Needs	None identified.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Organizations will need to outline the scope of care that a provider can perform when involved with a different organization. Policies that outline all aspects of the exchange program need to be outlined in a formal agreement.
	Incentive programs may have to be created by the rural organizations.
Issues Affecting Implementation Time	Implementation time will be impacted by the effort required to (1) obtain cooperation between services and/or regulatory agencies or (2) ensure that liabilities are covered.
Costs Involved	Costs highly depend on the model chosen. The primary costs will likely be in the time and effort to develop policies that outline the aspects of the exchange program and limit liabilities. Travel expenses will also be involved. Flex grant monies may be available to offset costs.
Training and Other Personnel Needs	EMS personnel will need to be trained in the protocols of the "other service." First responders and local hospitals will also need to understand what the scope of the exchange program is so they are not surprised when they see different personnel on the ambulance service.
Legislative Needs	None specifically required.

Other Key Attributes

None

Strategy 20.1 C3—Include Principles of Traffic Safety and Injury Prevention as Part of EMS Continuing Education (E)

General Description

NHTSA has been the leading agency in developing EMS curricula, including basic, intermediate, and advanced courses. The EMT education programs are most commonly referred to as EMT (EMT-Basic, EMT-Intermediate) and paramedic programs. Several editions of each curriculum have been developed and published since the early 1970s. Each edition of the curriculum has been developed, reviewed, and approved by subject matter experts.

The vast majority of the emphasis in the curricula has concentrated on medical education and the treatment of emergency medical and trauma conditions. When a student completes the entire course of instruction, he or she has typically participated in more than 1,500 classroom sessions, clinical participation, and practical scenarios of emergency medical treatment.

Unfortunately, there is little preventative services education in any basic or advanced curriculum. The programs end up developing highly trained emergency responders, but there is no formal process to educate EMTs or paramedics about injury prevention or traffic safety. Thus, key local emergency responders do not typically participate in community accident and injury prevention education programs.

All emergency medical training programs should implement a module about traffic safety and injury and accident prevention. The module could be developed at the state, county, or local level. Alternatively, existing instructional materials that have been developed at the federal, state, and local levels could be used. For example, the National Highway Institute (NHI) already has courses, as do many T2 centers, and NHTSA published the first "Public Information Education and Relations for EMS – Injury Prevention" modules in 1986. Subsequent revisions served as a tool for state and local levels, focusing specifically on comprehensive primary injury prevention.

By including traffic safety and injury and accident prevention programs as part of EMS continuing education, emergency responders can use their experience and expertise to educate the community. This type of public education will serve to reduce the incidence of emergency medical incidents, thereby reducing the demand on the EMS system.

A module that includes information on traffic safety, injury and accident prevention, and standard instructional techniques will give emergency responders tools to use in working with their communities and will increase the nonemergency interaction with the citizens whom the EMS agency serves.

This program should prove to be very effective over a period of time. By giving EMTs and paramedics information about traffic safety and injury and accident prevention, EMS agencies will be able to expand their scope of work to prevent accidents rather than just respond to emergency incidents.

It will be imperative for medical directors and EMS administrators to make prevention activities a key part of an emergency responder's job. This approach must be supported by all levels of the response team, from the first responders through the hospital emergency department. A proactive prevention program should have long-term impacts on the

community. In addition, such a program will provide an opportunity for the emergency response personnel to interact with the citizens whom they serve. In turn, the citizens can learn how to prevent accidents, while learning about their emergency services system.

EXHIBIT V-16

Strategy Attributes for Including Principles of Traffic Safety and Injury Prevention
as Part of the EMS Continuing Education (E)

Technical Attributes

Target	EMS educators, NHTSA, and EMS personnel.
Expected Effectiveness	EMS personnel traditionally have not received training in the principles of traffic safety and injury prevention, so no data are available on expected effectiveness. However, by educating EMS personnel in the principles of traffic safety and injury prevention, it is expected that EMS personnel will communicate these principles to the general public, thereby raising the public's awareness of traffic safety and injury prevention and reducing the frequency of emergency medical incidents and the demand on EMS systems.
Keys to Success	It will be imperative to work toward a shift in attitudes of the emergency responders. Currently, emergency responders view their role as responders after the emergency occurs. Responders must be trained to see their role as health care providers, with an emphasis on prevention to reduce the incidence and severity of emergency incidents that occur in their community.
	For this strategy to work, it must go beyond simply informing EMTs and paramedics about prevention activities. The highest return on the investment will be to instruct EMTs and paramedics to teach others. This opens up multiple opportunities to provide public medical education to the community.
	Another key to successfully including the principles of traffic safety and injury prevention in the EMS educational core contents is, as implied, having these continuing education units (CEUs) recognized for national registration. EMS personnel are already required to take a significant number of CEUs to maintain their registration. If the CEUs for this course are not recognized for national registration, very few individuals will opt for this type of elective continuing education, primarily because of time constraints.
Potential Difficulties	EMTs and paramedics are attracted to the profession because of the nature of emergency responses. Some EMTs and paramedics will see an emphasis on prevention activities as an intrusion on their primary purpose.
	Time constraints will pose challenges in two ways. First, additional time will be required in the training programs. An adequate program could add up to 40 hours to the curriculum, particularly if the goal is to teach the EMS students how to be instructors. Adding hours for instructional purposes is often met with resistance. Second, many EMS systems have little down time for EMS providers to dedicate to instructing the public. EMS personnel are assigned to shifts and respond to emergency incidents while on duty. The incident volumes have increased. Thus, offering this type of program on a large scale may require alternative staffing schedules and possible overtime compensation.
Appropriate Measures and Data	Appropriate process measures are the number of EMS personnel who participate in traffic safety and accident prevention programs and the number of courses offered at a local agency. Effectiveness analysis can include measuring change of knowledge (i.e., administering tests before and after the course) and documenting the number and types of involvement by trained staff in accident prevention programs.
Associated Needs	Instructional materials may need to be developed if existing course materials are not used. Instructors familiar with the principles of traffic safety and injury prevention will be necessary.

EXHIBIT V-16 (Continued)
Strategy Attributes for Including Principles of Traffic Safety and Injury Prevention
as Part of the EMS Continuing Education (E)

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Adding this type of module to the established curricula will require additional contact hours to an already extensive program. EMS educators must buy into the program and integrate it into the classroom portion of the curriculum. EMS educators will be on the front line of this change process and must understand and champion the long-term benefits to the community.
	Another issue will be the individual EMS agencies that have not been involved in any community education programs. For these agencies, including principles of traffic safety and injury prevention as part of the EMS continuing education would require additional work because there may be resistance by current EMTs and paramedics.
	Given the desire of NHTSA to maximize the benefit of its EMS training, and given the limited time available to place trainees in a classroom, NHTSA may resist widening the focus of its training package to include peripheral topics. This plan must be weighed against other possible programs that may also be beneficial to the EMS agency or to the community.
Issues Affecting Implementation Time	Development of the course materials will take some time. Alternatively, the adoption of existing curricula will minimize implementation time. If NHTSA becomes involved with the program, its review and revision process will impact the timeframe for implementation.
Costs Involved	Establishing a proposed curriculum and working through the review process will require research and staff time. Additional costs will be required to develop a standard set of instructional materials that can be used in educating the community. NHTSA is funding a State and Territorial Injury Prevention Director's mini-grant program (http://207.15.200.54/template200.cfm?sub_cat=220) to involve EMS providers in injury prevention efforts.
Training and Other Personnel Needs	Instructors familiar with the principles of traffic safety and injury prevention will be needed.
Legislative Needs	There are no expected legislative needs.

Other Key Attributes

None

Strategy 20.1 C4—Require First Care Training for all Public Safety Emergency Response Personnel, Including Law Enforcement Officers (T)

General Description

NHTSA assumed responsibility for the development of training courses that respond to the standards established by the Highway Safety Act of 1966 (amended). As a result of this act, the "First Responder: National Standard Curriculum" was developed.

The curriculum was developed to train personnel who would arrive on an emergency scene prior to EMS personnel. The program is a 40-hour (minimum) course intended to provide a

basic understanding of human body systems and life-saving emergency care procedures. This program is designed for individuals who may be the first people to arrive at the scene of a medical emergency but who do not transport patients in the back of an ambulance (e.g., fire service, industrial, and law enforcement personnel).

The first responder program is not intended primarily for individuals whose main duty is the provision of ambulance services. It may, however, be used as a basic introduction to emergency medical care training.

Since the late 1970s, the first responder training program has been delivered to thousands of people across the country. During the early years of the program, firefighters and police officers were targeted to receive the training program. Over time, the increased EMS work load in fire departments led the majority of career firefighters to upgrade their training program to the EMT-Basic level. No national statistics show how many firefighters have remained at the first responder level of certification.

In rural areas, many public safety agencies have to take on unique roles. For example, law enforcement is one of the few 24-hour services that are strategically located throughout a jurisdiction. Further, police officers are in contact with 9-1-1 centers and can easily be alerted to any emergency in the jurisdiction. Therefore, law enforcement may be able to render patient care prior to the arrival of an EMS unit.

At the same time, police officers are faced with a lot of law enforcement training and continuing education. Anecdotal evidence suggests that the number of police officers trained as first responders is probably decreasing and that training centers across the country have concentrated their efforts at the higher-level EMS programs, such as EMT-Basic and paramedic. The result is that no one has emphasized training the true first responder community in EMS.

In rural areas, response times are typically longer than in urban areas. This increase in response time results in an increase in time for a medically trained person to arrive on the scene. Through law enforcement officers and firefighters, medical care can begin prior to the arrival of an EMS unit.

The American Heart Association has shown that a "chain of survival" is critical to reducing deaths from out–of-hospital cardiac arrest. The early initiation of CPR and automatic external defibrillation (AED) greatly increases a patient's chance of living. First responder training programs provide training in CPR and AED. Thus, this program enhances the chain of survival through the use of law enforcement and firefighters.

The intent of this strategy is not to require all public safety emergency response personnel to complete the first responder training at the level required of the national standard curriculum; rather, the intent is to require all public safety emergency response personnel to complete some level of first responder. Currently, several agencies require first responder training of law enforcement officers, including but not limited to the state of North Carolina and the county of San Mateo, California. In Iowa, the Coralville Police Department includes EMTs as first responder units when responding to medical calls. Coralville is one of three police departments in the state of Iowa that is certified to carry AED units.

EXHIBIT V-17

Strategy Attributes for Requiring First Care Training for All Public Safety Emergency Response Personnel, Including Law Enforcement Officers (T)

Technical Attributes

Target	Sheriffs, police chiefs, fire chiefs, state EMS directors, EMS educators, state police, and wildlife personnel.
Expected Effectiveness	No studies document the expected effectiveness of this strategy. However, law enforcement is one of the few 24-hour services that are strategically located throughout a jurisdiction. Further, police officers are in contact with 9-1-1 centers and can easily be alerted to any emergency in the jurisdiction. Therefore, properly trained law enforcement officers will likely be able to administer first care prior to the arrival of EMS personnel.
Keys to Success	Police chiefs, sheriffs, and fire chiefs must buy into the system approach for this program to be effective. An education program will need to be in place to teach police and fire personnel about the advantages to their citizens of this type of program.
	When programs are delivered to these audiences, it will be important to make the programs relevant to the jurisdiction.
	Because the level of training may be less than the national standard required for a first responder, guidance from the medical director on level of training and practice will be important.
Potential Difficulties	The time to train must be established. With law enforcement and fire responsibilities increasing because of terrorism preparation, many people will resist any new or expanded duties.
	Volunteer firefighters will be the most difficult group to address. This is due to the amount of time that the training takes. Volunteer firefighters in rural areas may not have the time to commit to additional training.
	The low incidence of accidents and medical emergencies in some rural areas will be a detriment in establishing a need for the amount of training that is required.
Appropriate Measures and Data	Appropriate performance measures include the number of potential first responders and the number of people who are medically trained or successfully trained as first responders in the locality. The number of person-hours of training may also be a useful measure.
	Impact measures can include before and after results of tests of knowledge and attitude. Additional measures more directly focused upon the effectiveness of the training in the field can include the proportion of EMS incidents in a locality where first responders were on the scene before an EMS unit, the proportion of EMS incidents in which the first responder gave initial medical assistance, and a rating (e.g., by the EMS unit responding) of the quality of the treatment given by the first responders.
Associated Needs	Training law enforcement and firefighters as first responders will address only part of the issue. The first responders must then be adequately supplied with medical equipment and AED units to effectively enhance the EMS system. This will require a means to replenish supplies used during an emergency, as well as to maintain the equipment. This can easily be addressed through an equipment exchange and maintenance program with the EMS agency. However, it is imperative that this arrangement be worked out early in the planning process.

EXHIBIT V-17 (Continued)
Strategy Attributes for Requiring First Care Training for All Public Safety Emergency Response Personnel, Including Law Enforcement Officers (T)

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	The biggest issue will be the process by which law enforcement and non-EMS fire departments implement this program. There may be significant resistance at the core levels to adding this role to already increasing demands of both disciplines.
	Police and sheriff training academies should integrate first care training into their standard curricula. State fire training programs will need to work with their state EMS agencies to provide the instruction to firefighters.
Issues Affecting Implementation Time	The ability to have police and fire training groups adopt this approach will be uncertain. In most cases, adoption of the approach will be over a period of years. A funding source will probably have to be established, and this could lengthen the time needed to fully implement this program.
Costs Involved	Costs will be incurred to develop the course materials. Alternatively, existing materials could be used from the national curriculum. Other costs include instructors, facilities, and equipment to conduct the courses, as well as the cost of time for the attendees.
Training and Other Personnel Needs	Instructors for each course will have to be available in adequate numbers to meet the demand. Police officers and firefighters may be more receptive to training that is delivered by someone from their respective disciplines. Consideration should be given to working with police and fire academies to develop instructors from their agencies who can deliver first responder programs.
Legislative Needs	Legislation should not be required in most states or jurisdictions.

Other Key Attributes

None

Strategy 20.1 C5—Educate Rural Residents about the Availability, Capability, and Limitations of Existing Systems (T)

General Description

In most communities, public awareness of specifics about an EMS system is low. Residents often are unaware of whether their local EMS agencies (first response or ambulance) are staffed by career or volunteer personnel, of the levels to which the agencies are trained (basic, intermediate, or advanced), and of the timeliness of service that the agencies provide.

Effective public information, education, and relations (PIER) have long been a key element of an EMS system. Since 1988, NHTSA's Technical Assistance Team assessments of state EMS systems have evaluated PIER as one of the elements of those systems. In the mid-1990s, a NHTSA initiative trained numerous EMS personnel to serve as spokespeople and PIER leaders. Many of these efforts focused on the delivery of injury prevention and mitigation messages.

EXHIBIT V-18
Strategy Attributes for Educating Rural Residents about the Availability, Capability,
and Limitations of Existing Systems (T)

Technical Attributes

Target	Rural citizens and elected officials.
Expected Effectiveness	No available studies document the effectiveness of this strategy. However, greater awareness by the general public of the capabilities and limitations of local EMS agencies will create informed public discussion and decision making about resource allocation by voters, elected officials, and appointed officials.
Keys to Success	For this strategy to succeed, standardized measures and terminology must be agreed upon. Frank discussion without fear of threat or embarrassment must occur between rural EMS providers, their communities, and their elected officials. Appendix 10 provides a guide for community planning of EMS agencies.
	Standardized agency and provider inventory data, standardized incident and patient data, standardized performance and outcome data, and standardized measures of resource input are all required to elevate the level of public policy discussion about rural EMS.
	Involvement and support of the local media and community leaders will be essential to attract attention to a matter that is generally of limited interest to the public.
Potential Difficulties	Candid discussion of system limitations may be embarrassing or demoralizing to resource-poor providers and agencies if the discussion is not carefully handled. Lack of accurate baseline data could prevent accurate comparison of needs, processes, and outcomes.
	Gaining public attention and interest will be a major challenge.
	Due to low density of population, it will be difficult to gather a sizable number of individuals for discussion sessions. Therefore, means will need to be employed to overcome the long travel distance or to plan on a large number of meetings. Electronic media can be used for holding discussions, including remote conferencing with multiple locations and web-based discussion groups.
Appropriate Measures and Data	Process measures include the number of citizen contacts, standard media coverage measures (i.e., column inches of articles), and counts of materials distributed. Impact measures would include surveys of publicly elected officials' attitudes and awareness before and after the implementation of the program.
Associated Needs	The information to be included will require that an evaluation be conducted of the EMS agency. The information generated from the evaluation will then need to be presented in an attractive and understandable manner to the general public.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	The primary issue is changing the existing environment into one in which this attempt to inform must be inserted. There has been, and continues to be, a general lack of informed policy discussion about EMS in rural areas. Rural EMS system culture has allowed the systems to evolve without significant policy input and public discussion. The result has been systems that are poorly funded, understaffed, and unable to approach the levels of service delivered in more urban areas.
Issues Affecting Implementation Time	Implementation time will be impacted by processes required to acquire and analyze necessary data, develop a consensus or "case statement," and disseminate the case statement information throughout rural areas.

EXHIBIT V-18 (Continued)
Strategy Attributes for Educating Rural Residents about the Availability, Capability,
and Limitations of Existing Systems (T)

Organizational and Institutional Attributes

Costs Involved	Costs involved with implementing this strategy include data collection and analysis, development of a consensus case statement, training of individuals from rural EMS communities to use the case statement for effective advocacy of EMS issues, and production and dissemination of educational materials (e.g., evaluation results) to the general public.
Training and Other Personnel Needs	EMS agency spokespeople and other EMS advocates may need training to serve as informed EMS advocates with the ability to address system deficiencies without alienating system participants and their supporters.
Legislative Needs	None identified.

Other Key Attributes

None

Strategy 20.1 C6—Provide "Bystander Care" Training Programs Targeting New Drivers, Rural Residents, Truck Drivers, Interstate Commercial Bus Drivers, and Motorcyclists (T)

General Description

The first person on the scene of an emergency often has a helpless feeling. After someone accesses the 9-1-1 system, there is time before a first responder or EMS unit arrives. When someone is not trained to deal with an emergency situation, minutes seem like hours. During that same time, a patient can be very uncomfortable and may even exacerbate the injury or condition if appropriate care is not rendered or inappropriate care is rendered.

In rural areas, it may take an extended time for emergency units to respond, often from very far distances. Bystanders who may be on the scene often do not know what to do. In most cases, bystanders provide emotional support or apply techniques they have read about or heard others talk about. In many cases, having someone there to offer comfort helps the victim during those first critical minutes; however, there are times where a patient could be adversely impacted by well-meaning bystanders.

In rural areas where ambulance response times are greater, it would be beneficial to have bystanders trained to an appropriate level. The 40-hour first responder level course is too extensive for bystanders. The number of hours required for the first responder program will prevent all but the most interested person from taking the course.

NHTSA is the distributor of the *National Standard Curriculum for Bystander Care* (Perez et al., 1992). This report describes a program to promote more effective bystander actions in rural highway crashes. This bystander care program explores how the lay public could learn to provide very basic life-saving care to respond to the most critical needs of seriously injured victims. The curriculum addresses how laypersons can call EMS, manage the airway, control

bleeding, and avoid getting hurt. Because bystanders (i.e., the public at large) are the first link in the out-of-hospital "chain of survival," instruction in CPR will greatly increase the probabilities that out-of-hospital cardiac arrest victims will survive.

By making a bystander care course available to new drivers, rural residents, truck drivers, Interstate commercial bus drivers, and motorcyclists, people who arrive at accident sites first will be able to provide a higher level of care than what is currently available. It is possible that this strategy could be developed in conjunction with NHTSA's "First There First Care Bystander Care for the Injured" program.

EXHIBIT V-19

Strategy Attributes for Providing "Bystander Care" Training Programs Targeting New Drivers, Rural Residents, Truck Drivers, Interstate Commercial Bus Drivers, and Motorcyclists (T)

Technical Attributes

Target	New drivers, truck drivers, Interstate commercial bus drivers, motorcyclists, local, county, and state agencies that have representatives who drive regularly during working hours, rural residents, and other citizens that spend a great deal of time driving their vehicles.
Expected Effectiveness	Only one study was found that evaluated the results of a bystander care program (Noland, 1996). In the mid 1990s, 120 EMS personnel were trained as bystander care instructors within the Central Iowa EMS Region. Subsequently, they trained more than 2,000 laypersons within the region. A preliminary analysis of the program indicated that participants, as a result of successfully completing the course, would be more likely to stop and provide assistance, would be better able to perform correct sequential interventions, and would be better able to provide complete and accurate information when calling 9-1-1. It was concluded that the program provided excellent preparation for layperson bystanders who arrive at the scene of traumatic injury, and this preparation benefits individuals traveling throughout the largely rural region.
	If this program could be incorporated in all new drivers' education programs, in 10 years, an entire generation will be trained as "bystander responders." This will be a very effective method to initiate immediate care, particularly in areas not served by a normal rapid EMS response.
Keys to Success	This type of a program will probably need a "champion" within a key governmental agency or a high-profile organization to gain the attention and support needed.
	For this method to be effective, a significant number of people must complete the training program. Therefore, it will be important that the program have the enthusiastic backing of community leaders and the cooperation of the media.
	In addition, incentives would need to be offered for people to attend (e.g., getting local shop owners and manufacturers to offer premiums, gifts, discounts, etc., to people who successfully complete the course).
Potential Difficulties	Gaining a widespread acceptance of this type of program may be difficult. A federal, state, or private agency should take the lead on informing the general public about the benefits of such a program. A means must then be in place to provide the training on an ongoing basis. It will then be important for rural areas to support this program for their residents and encourage others to participate in the training.
	Publicizing the need for bystander's assistance will require a well-thought-out program so that residents do not lose confidence in their EMS service.

EXHIBIT V-19 (Continued)
Strategy Attributes for Providing "Bystander Care" Training Programs Targeting New Drivers, Rural Residents, Truck Drivers, Interstate Commercial Bus Drivers, and Motorcyclists (T)

Technical Attributes

Appropriate Measures and Data	Process measures include the number of bystander courses offered and the number of persons successfully completing the training. Effectiveness measures include the number of times bystanders, trained under the program, were first on the scene and provided assistance prior to arrival of an EMS unit or first responder. Ratings of quality of bystander care given prior to first responder arrival on scene (e.g., by the responding EMS team) will also be important to obtain. Change in student knowledge and ability before and after the training can be tested and used to evaluate effectiveness, although in a less direct manner than other measures suggested here.
Associated Needs	None identified.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	This type of program has been in operation since 1992. A review should be conducted to evaluate locations where this program was instituted. A means to train and monitor instructors should be in place but should not be burdensome or create a bureaucracy.
Issues Affecting Implementation Time	Obtaining a primary sponsor and the review of a program will take 1 to 2 years. The information is currently available in different formats, so it should not be reinvented. This program will be one that will take years to realize the benefits. It is also one that must be ongoing, both for training new people and for maintaining skills of those who have previously been trained.
Costs Involved	Costs associated with this strategy will include the production of course materials for trainers and students, development of an instructional system, and cost to deliver the program (e.g., space and equipment, as well as instructor time). Given that this would be an additional level of EMS training, some states may see the need to regulate the instruction in the classes and to institute a formal testing process. Thus, the state will incur costs for this additional level of supervision and/or regulation of the program.
Training and Other Personnel Needs	Instructors will have to receive training in the new curriculum. It is recommended that personnel already trained in EMS serve as instructors.
Legislative Needs	All states will need to have "good Samaritan" laws in place to protect bystanders who render aid. Bystander responders are rarely held liable for helping in an emergency. Only in cases where an individual bystander responder's response was deliberately negligent or reckless or when the responder abandoned the victim after initiating care have the courts ruled that good Samaritan immunity did not apply. Appendix 14 provides several examples of existing good Samaritan laws.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy

Appendix 15 provides information related to "bystander responder" training programs developed specifically for motorcyclists.

Strategy 20.1 C7—Provide EMS Training Programs in High Schools in Rural Areas (T)

General Description

EMT programs have been in existence since the late 1960s. NHTSA assumed responsibility for the development of EMS training courses that respond to the standards established by the Highway Safety Act of 1966 (amended).

An EMT course is one of a series of courses making up a national EMS training program for prehospital care. The curriculum, "Emergency Medical Technician-Basic: National Standard Curriculum," is the cornerstone of EMS prehospital training.

The EMT-Basic curriculum is a core curriculum of minimum required information, to be presented within a minimum 110-hour training program. This curriculum is intended to prepare a medically competent EMT-Basic to operate in the field. It is recognized that the majority of prehospital emergency medical care will be provided by the EMT-Basic. This includes all skills necessary for the individual to provide emergency medical care at a basic life support level with an EMS agency, fire department, ambulance service, or other specialized service.

EMT is the basic level of care that is delivered by most EMS agencies. As such, personnel certified to this level are needed by every EMS agency in the United States. In rural areas, it may be difficult to find enough people who want to be certified EMTs. A significant time commitment is required just to complete the course. EMT classes typically take four to six months to complete, with many running 2 nights per week for 3 hours each class. Thus, there is always a desire to seek out a pool of potential EMTs so that they can begin their training process.

A potential pool of EMTs may be available in local high schools. Often students may be interested in helping the community or have a desire to establish a career in EMS. By teaching EMT courses as an elective in high school, students can earn high school credit toward graduation and work toward EMT certification. In turn, this will provide a qualified pool of EMTs to assist in their rural communities. A secondary benefit of this program is that some students may decide to pursue a medical or public safety career as a result of the course in high school. In the long term, EMTs may then be prepared to move to the advanced life support level of certification after they complete high school.

EXHIBIT V-20
Strategy Attributes for Providing EMS Training Programs in High Schools in Rural Areas (T)

Technical Attributes

Target	This strategy primarily targets high school students, but will also need to involve administrators from schools, hospitals, and EMS operations.
Expected Effectiveness	This program can be very effective in training personnel to an EMT-Basic level. Schools throughout the country have tried this approach, and even though the results are anecdotal, the results are consistently positive. Many rural EMS organizations end up with personnel that provide EMS care in their respective communities for several years.
Keys to Success	An instructor who understands educational methodology for young adults (i.e., how to teach high school students) will be important in the success of this program. Given the maturity level of many high school students, the instructor will have to require that the students meet all standards as set forth in the curriculum.
	The support of the local EMS agency will be important. Should a high school begin an EMS program, the local EMS agency must be willing to accept graduates of the program as volunteers or employees. Should the EMS agency desire not to work with students, there will be no means for the students to exercise their skills. The participation of representatives of the EMS agency in the instruction will also be important, so that students can have the opportunity to see first hand what an EMS operation involves, as well as to get questions answered by those directly involved.
	The school administration must buy into the process. It is very possible that the instructor will not be a teacher at the high school, so the process for class management, supervision, and control must be addressed in the planning process.
	In addition, it will be important in establishing the credibility of the program that a high percentage of the students who enroll in the program and apply for national registration pass the examination.
Potential Difficulties	There may be some reluctance in school systems to add a noncore program to their curriculum. Given the importance that is placed on testing and passing standards of learning programs, high schools may not approve putting new programs into the high school that do not specifically enhance standardized test scores.
	Maturity of the students can be a factor. Given the activities that will be required of a certified EMT, students must be mature and able to handle medical emergencies and trauma-related events.
	Child labor laws should also be considered in developing this type of program.
	Another potential difficulty is that jurisdictions frequently have statutory or regulatory minimum age requirements for becoming an EMT – 18 years of age in most states.
Appropriate Measures and Data	Process measures include the number of rural high schools offering EMS courses, the number of EMS instructors in rural areas, and the number of students that enroll in high school level courses. Impact measures include measures of learning achieved and the number and percentage of EMTs who have come from this source.
Associated Needs	School systems will need to have a cache of equipment to use for practical applications and for student practice.

EXHIBIT V-20 (Continued)
Strategy Attributes for Providing EMS Training Programs in High Schools in Rural Areas (T)

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	School systems will have to address how to integrate this type of training program into their course elective system. Should that not be possible, then EMT courses could be held at the high school immediately after school and/or on weekends.
	A policy will need to be in place that allows high school students to gain practical experience through observation at EMS units or in emergency departments.
	EMS educators will need to have the necessary support from elected school boards and top administrators to deliver EMS programs at local high schools.
Issues Affecting Implementation Time	Given that the curriculum already exists, primary time elements for implementation will include locating and training instructors and establishing a formal program at a high school (including provision for space, equipment, and materials). Establishing a list of best practices that have been in place and have been successful can reduce the implementation time.
Costs Involved	Primary costs will involve equipping classrooms for the program. Additional cost may be incurred to obtain a set of instructional materials.
	Students will incur the cost of books for the class.
Training and Other Personnel Needs	If sufficient numbers of EMT instructors are not available, then high schools may want to consider sponsoring a certified teacher to become an EMT instructor. There will be no other personnel needs.
Legislative Needs	States may have to pass legislation to allow for this type of program in high schools. State EMS agencies may have to alter rules to permit persons without high school diplomas to enroll in EMT courses, and exceptions may need to be noted in the child labor laws.

Other Key Attributes

	Given the nature of dealing with illness, serious injuries, and death, some students will not be able to handle the related stress. Consideration should be given to only permitting seniors to enroll in the program or to permit only those who are 17 or older enroll in the program. Psychological testing may also be required to screen student applicants.

Information on Agencies or Organizations Currently Implementing This Strategy

Several highs schools have implemented EMS training programs, including but not limited to the following:

- The Rising Star program gives high school seniors an opportunity to take college courses and prepare them to work or volunteer in EMS. The program is offered at SUNY Rockland Community College. Upon completion, students earn 8 college credits, as well as certification as a New York State EMT, Nationally Registered EMT, CPR for healthcare providers, and Pre-Hospital Trauma Life Support.

- At Winter Springs High School, the Community Emergency Response Team (CERT) program has become a permanent part of the curriculum (Perry, undated). In addition, school board employees, bus drivers, teachers, and other administrators have received CERT training.

- The Montgomery County, Maryland, High School Fire Science Program is a national award-winning, 1- or 2-year program for high school juniors and seniors to educate and train students to become EMS providers or firefighters in Montgomery County.

- The Neptune High School in Neptune, New Jersey, joined forces with Jersey Shore University Medical Center and Neptune Township administration to establish a school-based program that prepares high school students for certification as EMTs (Indhal, 2004).

Objective 20.1 D—Reduce Time from Injury to Appropriate Definitive Care

Strategy 20.1 D1—Improve Cellular Telephone Coverage in Rural Areas (T)

General Description

The ability to report emergencies via cellular telephone is taken for granted by most Americans. Yet in rural areas, cellular telephone coverage is often limited to areas immediately adjacent to Interstates and major state highways. Depending on the particular cellular carrier, even these major transportation routes may have long segments that are not covered. As a result, persons experiencing medical emergencies or traumatic injuries in rural areas are often unable to use cellular telephones to access emergency services.

A related issue is incompatibility of equipment and lack of interoperability between cellular telephone carriers. Common networking allows some cellular users to roam freely between networks, even when the discrete network of their originating or home carrier is not available. Others (e.g., Nextel) have built closed networks that do not permit this interoperability. Cellular networks are built and operated as purely private business ventures, under license from the FCC. Service areas and network development are driven solely by market forces, resulting in little attention to areas that are not densely populated.

In urban areas, 9-1-1 centers report that a significant and steadily increasing percentage of requests for emergency services arrive via cellular telephone. The FCC's recent "Phase II" automatic location initiative has required cellular carriers to provide accurate location information (i.e., latitude and longitude) of cellular telephone calls to 9-1-1 centers using a variety of technical means, including triangulation and global positioning system (GPS) information. Compliance with this Phase II requirement is not widespread. Current information on Phase II compliance can be found on the National Emergency Number Association website at http://nena.org/dot/.

For emergency response to be effective, reporting must be effective. Effective reporting is dependent on at least two factors. The reporting party must be able to access the communication system and be able to accurately report the location of the emergency.

This strategy is closely related to Strategy D2.

EXHIBIT V-21
Strategy Attributes for Improving Cellular Telephone Coverage in Rural Areas (T)

Technical Attributes

Target	Cellular telephone carriers and public utility regulatory agencies, including the FCC.
Expected Effectiveness	No studies document the expected effectiveness of this strategy. However, many people are using cellular telephones to access EMS. More than 100,000 people use cellular phones to call 9-1-1 every single day, and in some jurisdictions, more than 50 percent of all incoming calls are from cellular phones. Improving cellular telephone coverage in rural areas will enable more people to access EMS.
Keys to Success	For this strategy to succeed, affordable incentives must be found to induce private cellular carriers to extend service to areas that currently lack an adequate customer base to support profitable operation of that segment of the cellular telephone network. In addition, those same companies will also need incentives (or be required by regulation) to ensure interoperability between carriers, at least with respect to calls directed to the 9-1-1 system.
Potential Difficulties	The principal barrier to the expansion of cellular telephone networks in rural areas is economic. Because the cellular telephone networks are purely a private-sector proposition, network development and expansion are driven by demand for services from subscribers willing to pay for cellular services. In remote areas, there is no sufficient subscriber base to underwrite the cost of network development.
Appropriate Measures and Data	Process measures for this strategy would include the number of rural highway miles that are covered by at least one of the cellular telephone networks at the conclusion of the program that were not covered at the beginning. This should be accompanied by graphic displays of the sections of highways that were added, indicating when that change occurred. In addition, the accessibility of cell phone service needs to be measured in terms of the proportion of subscribers in the region who can use the available service, through either interoperability or redundancy of services available.
	Impact measures would include the change in the count of emergency calls before and after highway coverage is improved. A more direct measure would involve the change in the time from the occurrence of the event to the arrival of an EMS service on scene.
Associated Needs	None identified.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Public underwriting of the cost of cellular telephone infrastructure, or requiring carriers to incorporate costs of emergency system expansion into the rate base to be shared by all subscribers, is controversial as a policy matter.
Issues Affecting Implementation Time	The time required to implement cellular coverage in rural areas will directly correlate with the level of funding provided to the project. If no funding is provided, improved coverage will not occur or will occur only when areas become sufficiently populous to support the cost of the required infrastructure. If sufficient funding were available, the entire nation could conceivably be covered in a 5- to 10-year period. There will likely be several generations of change in cellular communication technology during that interval.
Costs Involved	Costs will vary depending upon a myriad of factors in a rapidly changing environment. The public costs of contribution to this effort could in significant part be mitigated by in-kind contributions (e.g., public land for location of tower sites and eased regulatory requirements for towers on public land).

EXHIBIT V-21 (Continued)
Strategy Attributes for Improving Cellular Telephone Coverage in Rural Areas (T)

Organizational and Institutional Attributes

Training and Other Personnel Needs	There appear to be no special personnel needs to implement this strategy. Once a mandate is in place and funding is available, infrastructure development will be performed by the respective cellular carriers.
Legislative Needs	High-level policy decisions will be required at the national level for this initiative to move forward. Alternatively, individual states or political subdivisions might elect to underwrite local infrastructure development through direct negotiations with cellular carriers.

Other Key Attributes

None

Strategy 20.1 D2—Improve Compliance of Rural 9-1-1 Centers with FCC Wireless "Phase II" Automatic Location Capability (T)

General Description

The benefits of complete implementation of Strategy D1 (Improve cellular telephone coverage in rural areas) could in large part be lost because vast areas of rural America are not discretely addressed. While the increased proliferation of cellular telephones over the last 20 years has greatly facilitated access to emergency services, it has also created certain difficulties. Particularly in rural areas, callers using cellular telephones are often not aware of their precise location and thus cannot describe the location of the emergency to 9-1-1 call-takers. This in turn leads to confusion and delay of emergency responders. In 2003, between 30 and 50 percent of calls to 9-1-1 centers arrived via cellular telephone. Thus, a significant portion of calls to 9-1-1 centers may not carry important location information.

In response to this problem, on June 12, 1996, the FCC adopted a Report and Order that created rules to govern the availability of basic 9-1-1 services and the implementation of Enhanced 9-1-1 (E9-1-1) for wireless services. This rule requires that wireless telephone carriers provide geographic location information as part of the data stream that accompanies each wireless call to 9-1-1, much as landline calls to 9-1-1 provide the exact street address of the hard-wired telephone from which the call is made. At the same time, the commission also adopted a Further Notice of Proposed Rulemaking to develop additional means of ensuring that mobile service providers implement the best possible E9-1-1 systems. Although much progress has been made, this effort has been stalled through effective resistance by the wireless telecommunications industry, the willingness of the FCC to grant waivers and extensions to the industry, and ongoing litigation of how the costs of meeting the "Phase II" standards will be distributed. In December 2004, Congress passed the "Enhance 9-1-1 Act of 2004," which authorized the creation of a national E9-1-1

Implementation Coordination Office. This legislation is designed to speed E9-1-1 implementation and improve coordination among all levels of government.

The USDOT has taken an active role to enhance E9-1-1 services. For example, a HYPERLINK "http://www.itspublicsafety.net/wireless_actionplan.htm" Wireless E9-1-1 Priority Action Plan (Wireless E9-1-1 Steering Council, 2003) was developed that outlines the six most urgent priorities:

- Establish support for statewide coordination of implementation of wireless location technology and identify points of contact within each state for each of the stakeholders.

- Help to convene stakeholders in appropriate 9-1-1 regions in order to facilitate more comprehensive, coordinated implementation of wireless location technologies.

- Examine cost recovery/funding issues at the state level.

- Initiate a knowledge transfer and outreach program to educate public safety answering points (PSAPs), wireless carriers, and the public about wireless location issues.

- Develop a coordinated deployment strategy encompassing both rural and urban areas.

- Implement a model location program.

The USDOT also funded the New York State Wireless Enhanced 9-1-1 Project to facilitate the development of wireless E9-1-1 in New York State (Bailey and Scott, undated [a, b]). The goal in supporting this project was to document how things were accomplished and lessons learned, thereby making the process smoother for other state and local organizations in developing and implementing E9-1-1 systems. The USDOT is also obtaining input from the EMS community in the area of ITS technology development (ITS America Public Safety Advisory Group Medical Subcommittee, 2002).

The technical capability for providing location information is well established. Cellular companies can meet the FCC standards through incorporation of GPS technology in telephone instruments, or they can establish the location through triangulation between fixed cell towers. Either methodology provides acceptable results.

At the other end of the connection, the 9-1-1 center receiving the call must be capable of receiving, decoding, and displaying the location information provided by the cellular carrier. This requires complete and accurate map data, as well as telephone termination equipment capable of integrating the location and map data.

Much of rural America is served by small (i.e., one- and two-position) 9-1-1 centers whose staff double as receptionists, records clerks, jail staff, and a variety of other functions. These centers, which often operate on extremely limited budgets and which frequently have aging or limited-capability equipment, may not be equipped to receive and use wireless E9-1-1 data even if the data are made available.

This strategy is closely related to Strategy 20.1 D1.

EXHIBIT V-22

Strategy Attributes for Improving Compliance of Rural 9-1-1 Centers with FCC Wireless "Phase II" Automatic Location Capability (T)

Technical Attributes

Target	Rural 9-1-1 centers and municipal, state, county, and local governments.
Expected Effectiveness	There are many documented cases of callers dialing 9-1-1 to report an emergency when the callers do not know where they are located and cannot sufficiently describe the location, and by the time emergency services arrive at the scene, it is too late.
Keys to Success	For this strategy to be successful, funding must be provided to agencies to procure the necessary equipment and connectivity for Phase II implementation. In addition, full implementation of Strategy D1 is required to ensure the necessary coverage. Some consolidation or centralization of rural 9-1-1 centers could also facilitate more effective implementation. Accurate electronic maps and updated hardware that can capture automatic number information (ANI) and automatic location identification (ALI) information from cellular telephones are required for all areas to be serviced.
Potential Difficulties	Resolution of the cellular telephone coverage and Phase II ALI capabilities lies at an uncomfortable intersection of public-sector regulation and private-sector implementation. Because the cellular telephone industry is an entirely private-sector venture, regulatory pressure is likely to be met with continued resistance.
	Limited availability of public funds poses a challenge to the options for public sector funding of network and center development.
	Because of the "shared workload" nature of many 9-1-1 call center staff, there is likely to be local resistance to consolidation of 9-1-1 centers. This issue has been ongoing in the State of Oregon, where the most populous counties have a single 9-1-1 center and rural counties often have between three and seven 9-1-1 centers.
Appropriate Measures and Data	A key process measure is the number, or percentage, of 9-1-1 centers adding Phase II capabilities. It will also be important to document the reasons that noncompliant centers have not attained Phase II compliance. Finally, the estimated cost for achieving compliance should be documented. Impact measures will include the change in the percentage of calls for service that have ALI and change in response time to crash locations.
Associated Needs	Associated needs include information concerning interjurisdictional cooperation, availability of incentives for regional cooperation and consolidation, and access to advocacy and partnering groups.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	First, the magnitude of the problem must be established. Second, policy-making officials must be made aware of the issue and the potential consequences of noncompliance. Third, a focus (such as state 9-1-1 program offices) must be identified and encouraged to champion the cause.
Issues Affecting Implementation Time	The solutions to this problem are largely financial. If adequate funding were available, two large industries (cellular telephone and telecommunication equipment) stand available to provide the necessary solutions in a moderate timeframe (i.e., 1-2 years).
Costs Involved	Costs include those associated with achieving adequate cellular coverage (Strategy D1), establishing necessary data networks for transfer of ANI and ALI information, Phase II–compliant 9-1-1 telephone termination equipment, and developing and maintaining accurate base maps. Training will be a minor cost component compared with capital investments.

EXHIBIT V-22 (Continued)
Strategy Attributes for Improving Compliance of Rural 9-1-1 Centers with FCC Wireless "Phase II" Automatic Location Capability (T)

Organizational and Institutional Attributes

Training and Other Personnel Needs	Personnel may need to be trained on any new equipment that is purchased.
Legislative Needs	Organizations must comply with FCC regulations concerning wireless Phase II automatic location capabilities.

Other Key Attributes

None

Strategy 20.1 D3—Utilize GPS Technology to Improve Response Time (T)

General Description

Once system access has been achieved and emergency response personnel dispatched, the next controllable system variable is the travel of responders and response vehicles to the scene of the emergency. The availability of GPS and other computer-based navigation technology provides an opportunity to improve the ability of rural responders to travel efficiently to the scene of an emergency and to eliminate or minimize the dependence on printed maps.

Effective use of GPS requires the availability of accurate maps, including GPS coordinates. Response vehicles need to be equipped with GPS location and navigation technology, and the GPS coordinates of all homes and businesses need to be recorded and available for use (currently these data are kept in 9-1-1 system master street address guides that are not directly accessible by responders). In addition, the emergence of "telematics" capabilities of GPS-based automated crash notification systems such as OnStar and ATX Technologies could link all private, public, and commercial vehicles directly to the closest response agency.

This strategy is closely related to Strategy 20.1 D4.

EXHIBIT V-23
Strategy Attributes for Utilizing GPS Technology to Improve Response Time (T)

Technical Attributes

Target	9-1-1 centers, emergency response vehicles, and new vehicle purchasers.
Expected Effectiveness	GPS-based computer-aided navigation (CAN) systems have been shown to reduce response times for emergency responders by up to 15 percent (Wilcox, 2004; also see Appendix 8). Automated crash notification (ACN) systems such as OnStar have been found to reduce the notification interval in emergency situations and to allow effective location of vehicles involved in collisions where occupants may be unable to request assistance by other means.
	In Nebraska, several state, local, and private agencies evaluated three GPS, messaging, and communication technologies to determine their capacity for improving day-to-day law

EXHIBIT V-23 (Continued)
Strategy Attributes for Utilizing GPS Technology to Improve Response Time (T)

Technical Attributes

	enforcement, emergency response, and highway maintenance (Mid-America Transportation Center, 2000). The study was conducted in northeast and north central Nebraska where existing topographic features, structural obstructions, and atmospheric conditions make two-way, low-band radio and wireless telephone communication unreliable in so-called "dead" spots. Participating agencies acknowledged that the technologies would enhance their existing communication systems, but in many cases, they indicated that significant modifications or improvements to the technologies would be required before the agencies would consider complete replacement of current communication equipment and protocols. Appendix 16 provides more details on the Nebraska study.
Keys to Success	For this strategy to be successful, emergency vehicles need to be equipped with systems that can communicate location data to emergency dispatch centers. Accurate street network maps ("routing-capable") must also exist. Moreover, both emergency responder systems and telematic systems for private vehicles are dependent on the existence of effective wireless data communication networks.
Potential Difficulties	There are significant costs associated with providing public safety grade CAN equipment to agencies and vehicles. Even with a national mandate for the inclusion of ACN telematics systems in newly purchased vehicles, 5-10 years would be required before substantial proportions of the U.S. vehicle fleet included these systems.
Appropriate Measures and Data	Process measures include the number of systems installing GPS technology and the costs associated with this. Measures of effectiveness will be change in the percentage of responses in which GPS technology was used, change in average response time, comparison of response time between centers using GPS technology and centers operating without it, change in proportion of cases in which ACN was in operation, and change in response time between centers having ACN and other types of conditions and centers with similar areas and distances from EMS base to the site of the crash.
Associated Needs	Geographic information system (GIS) databases are necessary to support effective public safety CAN systems.

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Beyond cost, there is very little institutional resistance to implementing CAN in public safety agencies. Many agencies, particularly those in urban areas, have already implemented some form of CAN for police, fire, and EMS vehicles. Rural communities, having lesser resources, have been slower to adopt CAN technologies.
	A mandate for private vehicle ACN (such as the OnStar system) would represent a significant national public policy initiative. Today's ACN alternatives require both an ACN-equipped vehicle (~$500-600 per vehicle) and a monthly service fee. With an estimated 18 million new vehicles sold in the United States each year, the cost of mandatory ACN system installation could add $9 billion per year to the cost of motor vehicle purchases. This cost would likely decline as the benefits of mass production make ACN systems more of a commodity than a novelty or luxury item.
Issues Affecting Implementation Time	Implementation time will be subject to availability of funding, time required for education of emergency communication and response personnel, procurement cycles, installation of vehicle and dispatch center systems, and evaluation and upgrading of existing GIS map bases sufficiently to support CAN routing. Developing digital maps and upgrading hardware in 9-1-1 centers may take 1-3 years to implement once adequate funding has been procured.

EXHIBIT V-23 (Continued)
Strategy Attributes for Utilizing GPS Technology to Improve Response Time (T)

Organizational and Institutional Attributes

	Costs and policy debates over the possibility of mandating CAN for private vehicles could result in extensive time before a mandate is adopted, if it ever is.
Costs Involved	Costs will be significant, including procurement and installation of a dispatch center, vehicle computers, communication networking, and procurement of software and geographic information needed for system operation.
Training and Other Personnel Needs	Initially these projects will place a significant burden on public safety IT services. Once installed, minimal training in GIS administration will be required for end users.
Legislative Needs	Legislation may be needed for funding the development of necessary data communication networks; GIS databases; and the necessary hardware, software, and communication links. In addition, public policy issues associated with mandatory ACN system installation in private vehicles should be considered during legislative initiatives.

Other Key Attributes

	The Center for Injury Sciences at the University of Alabama at Birmingham is conducting a project to integrate ACN technology with an organized trauma system to expedite identification of vehicle crashes with injuries and the delivery of appropriate medical care (FHWA, 2003). The project is employing remote electronic data collection by emergency medicine personnel and using these data to route patients to the appropriate medical facility. In addition, real-time collision parameters will be used to predict the likelihood of injury in a given crash. This project is closely related to Strategy A6.

Strategy 20.1 D4—Integrate Automatic Vehicle Location (AVL) and Computer-Aided Navigation (CAN) technologies into All Computer-Aided Dispatch (CAD) Systems (T)

General Description

Prompt delivery of emergency assistance to sick and injured persons is, conceptually, a simple matter. The location of the emergency is identified, the location of the appropriate emergency response resource is identified, that resource is alerted, and the alerted resource travels by the fastest route to the scene of the emergency. Two discrete processes can be made more efficient through the use of AVL and CAN technologies.

- AVL technology permits rapid and accurate identification of the closest appropriate emergency response resource (known in emergency services terms as the "T4-T5" interval, or "dispatch time").

- CAN technology permits the responders to travel most efficiently to the scene of the emergency, thereby reducing the response interval (known in emergency services terms as the "T6-T7" interval, or "travel time").

Many public safety dispatch centers currently use some form of CAD system to track and record the movements of police, fire, and EMS vehicles. A 1999 survey by the U.S. Department of Justice's (DOJ's) Bureau of Justice Statistics reported that 56 percent of

local police departments use CAD, while 70 percent of sheriff communication centers use CAD. Yet most of these systems are not equipped with AVL systems. Thus, they must use surrogates (station locations or response districts) to determine the closest response vehicle to a particular incident. As long as vehicles remain in-station, this surrogate is acceptable. However, as vehicles move about the response zone, frequently the "home station" vehicle is not the closest vehicle to the scene of an emergency. AVL technology mitigates that problem by providing real-time location data to the CAD system.

While CAD systems are common in many jurisdictions, AVL and CAN systems are less frequently found. Unlike consumer-grade vehicle navigation systems, public safety AVL and CAN systems require wireless data connections between vehicles and their communication center. Acceptable publicly owned or commercial wireless data networks are less common in rural areas.

As one moves away from the largest cities, another variable enters the equation. In many areas, consolidated communication centers serve multiple law enforcement, fire rescue, and EMS agencies. Decisions to implement new and costly technologies require the agreement and participation of multiple governing and funding bodies, thereby further complicating the implementation process.

This strategy is closely related to Strategy 20.1 D3.

EXHIBIT V-24

Strategy Attributes for Integrating Automatic Vehicle Location (AVL) and Computer-Aided Navigation (CAN) Technologies into All Computer-Aided Dispatch (CAD) Systems (T)

Technical Attributes

Target	Public safety dispatch centers, emergency response vehicles, and CAD vendors.
Expected Effectiveness	CAD systems have been shown to provide more effective control of public safety response assets. GPS-based CAN systems have been shown to reduce response times for emergency responders by up to 15 percent (Wilcox, 2004; ESRI, 2003).
Keys to Success	For this strategy to be successful, emergency vehicles need to be equipped with systems that can communicate location data to emergency dispatch centers. Accurate street network maps ("routing-capable") must exist. Moreover, emergency responder CAN systems depend on the existence of effective wireless data communication networks linking the vehicle with a dispatch center.
Potential Difficulties	Significant costs are associated with providing public safety grade CAN equipment to agencies and vehicles. In 2003, these costs were as high as $100,000 per dispatch center and $10,000 per emergency vehicle, including computers, software, and wireless connectivity.
Appropriate Measures and Data	Identification/dispatch and response times will be key measures for comparing both (1) before and after implementation and (2) against centers operating without the technology. Process measures should include the number of units and centers properly equipped and operating.
Associated Needs	GIS databases are necessary to support effective public safety CAN systems.

EXHIBIT V-24 (Continued)
Strategy Attributes for Integrating Automatic Vehicle Location (AVL) and Computer-Aided Navigation (CAN) Technologies into All Computer-Aided Dispatch (CAD) Systems (T)

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	Beyond cost, there is very little institutional resistance to implementing CAN in public safety agencies. Many agencies, particularly those in urban areas, have already implemented some form of CAN for police, fire, and EMS vehicles. Rural communities, having lesser resources, have been slower to adopt CAN technologies. Establishment of agency policy at the highest executive level may be necessary to develop the data communication networks and GIS databases and to identify funding for necessary hardware, software, and communication links.
Issues Affecting Implementation Time	Time components include availability of funding, time required for education of emergency communication and response personnel, procurement cycles, installation of vehicle and dispatch center systems, evaluation and updating of existing GIS map bases to support CAN routing, and installation and testing of the final system.
Costs Involved	Costs include procurement and installation of dispatch center and vehicle computers and communication networking and procurement of software and geographic information needed for system operation.
Training and Other Personnel Needs	Initially these projects would place a significant burden on public safety IT services. Once installed, minimal training is required for end users.
Legislative Needs	None identified.

Other Key Attributes

None

Strategy 20.1 D5—Equip EMS Vehicles with Multi-Service and/or Satellite-Capable Telephones (T)

General Description

More than 48,000 credentialed EMS vehicles are in the United States today. Although the vast majority of these are found in urban and suburban areas, a significant number of these serve mixed small city, suburban, rural, and frontier areas.

It is generally required by state regulation, and almost always desirable, for EMS vehicles to have the capability of communicating with other medical and public safety resources. Routine operational communications are normally conducted via public safety two-way radio systems. From 1970 until today, there have been efforts to extend these systems to allow for communication between EMS vehicles and on-line medical resources. However, particularly in rural areas, the cost of constructing and maintaining dedicated private radio networks has often proved prohibitive. EMS systems often rely on older communication methodologies that permit communications only when in close proximity to the receiving hospital.

The continued improvement of cellular telephones and the availability of multi-mode and satellite-capable cellular telephones puts on-line medical consultation well within the reach of every rural EMS provider at a reasonable cost. It should be emphasized that the use of

multi-service and/or satellite-capable telephones is not intended to replace existing communication systems.

EXHIBIT V-25
Strategy Attributes for Equipping EMS Vehicles with Multi-Service and/or Satellite-Capable Telephones (T)

Technical Attributes

Target	The principal target is the communication between EMS vehicles and medical consultants. The EMS agencies will be the responsible agency targeted to accomplish this.
Expected Effectiveness	This will permit any EMS vehicle away from the terrestrial cellular telephone system to access on-line medical consultation via satellite communications while at the scene or en route to the emergency department. It is presumed that the availability of this communication will allow earlier application of quality treatment than would otherwise be available should the patient have to wait until arrival at the trauma center to receive the same treatment.
Keys to Success	For this strategy to succeed, rural EMS providers must be persuaded that maintenance of on-line medical communications is to their benefit. In addition, funding to allow procurement of multi-service, satellite-capable telephone instruments ($1,000 each in 2004) and per-minute charges should be provided.

Immediate availability of medical consultants, upon calling, is fundamental to the success of this approach. |
| Potential Difficulties | Many remote EMS agencies have worked for so long without on-line medical communication that there is a misperception that it is neither necessary nor beneficial. |
| Appropriate Measures and Data | Process measures to employ include the number and percentage of units having the desired communication equipment, the number of runs on which the equipment is used, the number and percentage of cases in which use of the equipment has a significant bearing on the outcome of the run, and the number and percentage of cases in which the desired medical consultation is not available or is delayed in becoming available. An estimate of time spent in satellite communication by EMS operators on runs is another measure of system output. Terrestrial satellite coverage is a measure of secondary interest.

Effectiveness may be evaluated using measures such as the percentage and type of runs where the satellite communication had a significant impact on the outcome and related anecdotes of representative cases. In addition, the change in the distribution of time, from arrival on the scene until administration of the appropriate treatment, due to use of the technology may be of interest as a secondary measure of effectiveness. |
| Associated Needs | None identified. |

Organizational and Institutional Attributes

Organizational, Institutional and Policy Issues	The magnitude of the need must be established. Consensus of the EMS medical community and EMS medical directors must determine whether this level of on-line medical control is required or desired.
Issues Affecting Implementation Time	Once priority is established and funding made available, telephone instruments and service are immediately available from commercial sources.
Costs Involved	In 2004, the costs were approximately $1,000 per EMS unit needing the capacity, plus approximately $1.00 per minute of satellite communication time.

EXHIBIT V-25 (Continued)
Strategy Attributes for Equipping EMS Vehicles with Multi-Service and/or Satellite-Capable Telephones (T)

Organizational and Institutional Attributes

Training and Other Personnel Needs	No significant training needs.
Legislative Needs	Funding for enhanced rural EMS communications is desirable.

Other Key Attributes

None

Information on Agencies or Organizations Currently Implementing this Strategy
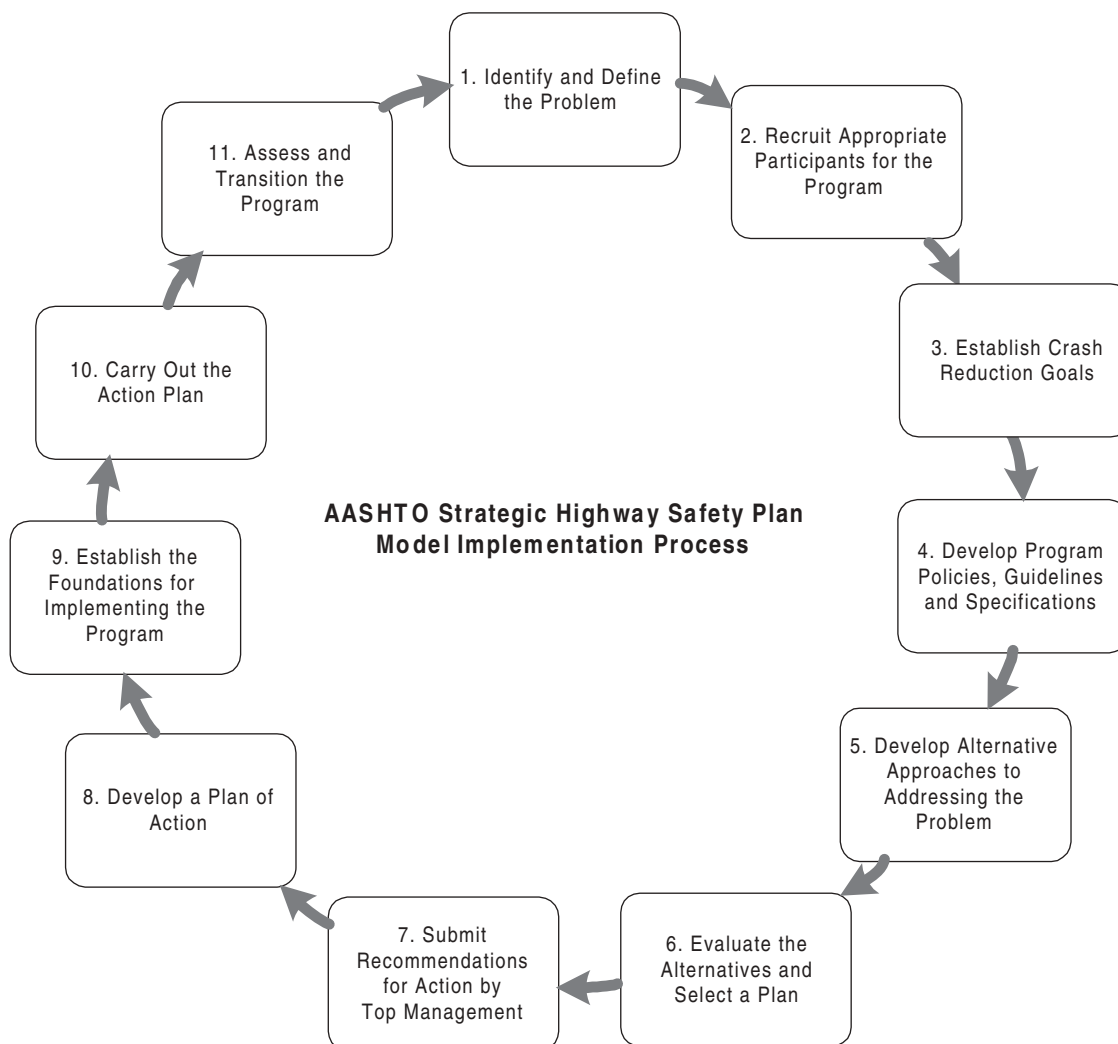
The EMS program in Alaska is beginning to purchase mobile satellite telephones to help provide coverage in "dead spot" areas. In Mississippi, EMS agencies are also pursuing the benefits of satellite technology.

Guidance for Implementation of the AASHTO Strategic Highway Safety Plan

Outline for a Model Implementation Process

Exhibit VI-1 gives an overview of an 11-step model process for implementing a program of strategies for any given emphasis area of the AASHTO Strategic Highway Safety Plan. After a short introduction, each of the steps is outlined in further detail.

EXHIBIT VI-1

AASHTO Strategic Highway Safety Plan
Model Implementation Process

1. Identify and Define the Problem
2. Recruit Appropriate Participants for the Program
3. Establish Crash Reduction Goals
4. Develop Program Policies, Guidelines and Specifications
5. Develop Alternative Approaches to Addressing the Problem
6. Evaluate the Alternatives and Select a Plan
7. Submit Recommendations for Action by Top Management
8. Develop a Plan of Action
9. Establish the Foundations for Implementing the Program
10. Carry Out the Action Plan
11. Assess and Transition the Program

Purpose of the Model Process

The process described in this section is provided as a model rather than a standard. Many users of this guide will already be working within a process established by their agency or working group. It is not suggested that their process be modified to conform to this one. However, the model process may provide a useful checklist. For those not having a standard process to follow, it is recommended that the model process be used to help establish an appropriate one for their initiative. Not all steps in the model process need to be performed at the level of detail indicated in the outlines below. The degree of detail and the amount of work required to complete some of these steps will vary widely, depending upon the situation.

It is important to understand that the process being presented here is assumed to be conducted only as a part of a broader, strategic-level safety management process. The details of that process, and its relation to this one, may be found in a companion guide. (The companion guide is a work in progress at this writing. When it is available, it will be posted online at http://transportation1.org/safetyplan.)

Overview of the Model Process

The process (see Exhibit VI-1, above) must be started at top levels in the lead agency's organization. This would, for example, include the CEO, DOT secretary, or chief engineer, as appropriate. Here, decisions will have been made to focus the agency's attention and resources on specific safety problems based upon the particular conditions and characteristics of the organization's roadway system. This is usually, but not always, documented as a result of the strategic-level process mentioned above. It often is publicized in the form of a "highway safety plan." Examples of what states produce include Wisconsin DOT's Strategic Highway Safety Plan (see Appendix A) and Iowa's Safety Plan (available at http://www. iowasms.org/toolbox.htm).

Once a "high-level" decision has been made to proceed with a particular emphasis area, the first step is to describe, in as much detail as possible, the problem that has been identified in the high-level analysis. The additional detail helps confirm to management that the problem identified in the strategic-level analysis is real and significant and that it is possible to do something about it. The added detail that this step provides to the understanding of the problem will also play an important part in identifying alternative approaches for dealing with it.

Step 1 should produce endorsement and commitments from management to proceed, at least through a planning process. With such an endorsement, it is then necessary to identify the stakeholders and define their role in the effort (Step 2). It is important at this step to identify a range of participants in the process who will be able to help formulate a comprehensive approach to the problem. The group will want to consider how it can draw upon potential actions directed at

- Driver behavior (legislation, enforcement, education, and licensing),
- Engineering,

- Emergency medical systems, and
- System management.

With the establishment of a working group, it is then possible to finalize an understanding of the nature and limitations of what needs to be done in the form of a set of program policies, guidelines, and specifications (Steps 3 and 4). An important aspect of this is establishing targets for crash reduction in the particular emphasis area (Step 3). Identifying stakeholders, defining their roles, and forming guidelines and policies are all elements of what is often referred to as "chartering the team." In many cases, and in particular where only one or two agencies are to be involved and the issues are not complex, it may be possible to complete Steps 1 through 4 concurrently.

Having received management endorsement and chartered a project team—the foundation for the work—it is now possible to proceed with project planning. The first step in this phase (Step 5 in the overall process) is to identify alternative strategies for addressing the safety problems that have been identified while remaining faithful to the conditions established in Steps 2 through 4.

With the alternative strategies sufficiently defined, they must be evaluated against one another (Step 6) and as groups of compatible strategies (i.e., a total program). The results of the evaluation will form the recommended plan. The plan is normally submitted to the appropriate levels of management for review and input, resulting ultimately in a decision on whether and how to proceed (Step 7). Once the working group has been given approval to proceed, along with any further guidelines that may have come from management, the group can develop a detailed plan of action (Step 8). This is sometimes referred to as an "implementation" or "business" plan.

Plan implementation is covered in Steps 9 and 10. There often are underlying activities that must take place prior to implementing the action plan to form a foundation for what needs to be done (Step 9). This usually involves creating the organizational, operational, and physical infrastructure needed to succeed. The major step (Step 10) in this process involves doing what was planned. This step will in most cases require the greatest resource commitment of the agency. An important aspect of implementation involves maintaining appropriate records of costs and effectiveness to allow the plan to be evaluated after-the-fact.

Evaluating the program, after it is underway, is an important activity that is often overlooked. Management has the right to require information about costs, resources, and effectiveness. It is also likely that management will request that the development team provide recommendations about whether the program should be continued and, if so, what revisions should be made. Note that management will be deciding on the future for any single emphasis area in the context of the entire range of possible uses of the agency's resources. Step 11 involves activities that will give the desired information to management for each emphasis area.

To summarize, the implementation of a program of strategies for an emphasis area can be characterized as an 11-step process. The steps in the process correspond closely to a 4-phase approach commonly followed by many transportation agencies:

- Endorsement and chartering of the team and project (Steps 1 through 4),
- Project planning (Steps 5 through 8),
- Plan implementation (Steps 9 and 10), and
- Plan evaluation (Step 11).

Details about each step follow. The Web-based version of this description is accompanied by a set of supplementary material to enhance and illustrate the points.

The model process is intended to provide a framework for those who need it. It is not intended to be a how-to manual. There are other documents that provide extensive detail regarding how to conduct this type of process. Some general ones are covered in Appendix B and Appendix C. Others, which relate to specific aspects of the process, are referenced within the specific sections to which they apply.

Implementation Step 1: Identify and Define the Problem

General Description

Program development begins with gathering data and creating and analyzing information. The implementation process being described in this guide is one that will be done in the context of a larger strategic process. It is expected that this guide will be used when the strategic process, or a project-level analysis, has identified a potentially significant problem in this emphasis area.

Data analyses done at the strategic level normally are done with a limited amount of detail. They are usually the top layer in a "drill-down" process. Therefore, while those previous analyses should be reviewed and used as appropriate, it will often be the case that further studies are needed to completely define the issues.

It is also often the case that a core technical working group will have been formed by the lead agency to direct and carry out the process. This group can conduct the analyses required in this step, but should seek, as soon as possible, to involve any other stakeholders who may desire to provide input to this process. Step 2 deals further with the organization of the working group.

The objectives of this first step are as follows:

1. Confirm that a problem exists in this emphasis area.

2. Detail the characteristics of the problem to allow identification of likely approaches for eliminating or reducing it.

3. Confirm with management, given the new information, that the planning and implementation process should proceed.

The objectives will entail locating the best available data and analyzing them to highlight either geographic concentrations of the problem or over-representation of the problem within the population being studied.

Identification of existing problems is *a responsive approach*. This can be complemented by a *proactive approach* that seeks to identify potentially hazardous conditions or populations.

For the responsive type of analyses, one generally begins with basic crash records that are maintained by agencies within the jurisdiction. This is usually combined, where feasible, with other safety data maintained by one or more agencies. The other data could include

- Roadway inventory,

- Driver records (enforcement, licensing, courts), or

- Emergency medical service and trauma center data.

To have the desired level of impact on highway safety, it is important to consider the highway system as a whole. Where multiple jurisdictions are responsible for various parts of the system, they should all be included in the analysis, wherever possible. The best example of this is a state plan for highway safety that includes consideration of the extensive

mileage administered by local agencies. To accomplish problem identification in this manner will require a cooperative, coordinated process. For further discussion on the problem identification process, see Appendix D and the further references contained therein.

In some cases, very limited data are available for a portion of the roads in the jurisdiction. This can occur for a local road maintained by a state or with a local agency that has very limited resources for maintaining major databases. Lack of data is a serious limitation to this process, but must be dealt with. It may be that for a specific study, special data collection efforts can be included as part of the project funding. While crash records may be maintained for most of the roads in the system, the level of detail, such as good location information, may be quite limited. It is useful to draw upon local knowledge to supplement data, including

- Local law enforcement,

- State district and maintenance engineers,

- Local engineering staff, and

- Local residents and road users.

These sources of information may provide useful insights for identifying hazardous locations. In addition, local transportation agencies may be able to provide supplementary data from their archives. Finally, some of the proactive approaches mentioned below may be used where good records are not available.

Maximum effectiveness often calls for going beyond data in the files to include special supplemental data collected on crashes, behavioral data, site inventories, and citizen input. Analyses should reflect the use of statistical methods that are currently recognized as valid within the profession.

Proactive elements could include

- Changes to policies, design guides, design criteria, and specifications based upon research and experience;

- Retrofitting existing sites or highway elements to conform to updated criteria (perhaps with an appropriate priority scheme);

- Taking advantage of lessons learned from previous projects;

- Road safety audits, including on-site visits;

- Safety management based on roadway inventories;

- Input from police officers and road users; and

- Input from experts through such programs as the NHTSA traffic records assessment team.

The result of this step is normally a report that includes tables and graphs that clearly demonstrate the types of problems and detail some of their key characteristics. Such reports

should be presented in a manner to allow top management to quickly grasp the key findings and help them decide which of the emphasis areas should be pursued further, and at what level of funding. However, the report must also document the detailed work that has been done, so that those who do the later stages of work will have the necessary background.

Specific Elements

1. Define the scope of the analysis
    1.1. All crashes in the entire jurisdiction
    1.2. A subset of crash types (whose characteristics suggest they are treatable, using strategies from the emphasis area)
    1.3. A portion of the jurisdiction
    1.4. A portion of the population (whose attributes suggest they are treatable using strategies from the emphasis area)
2. Define safety measures to be used for responsive analyses
    2.1. Crash measures
        2.1.1. Frequency (all crashes or by crash type)
        2.1.2. Measures of exposure
        2.1.3. Decide on role of frequency versus rates
    2.2. Behavioral measures
        2.2.1. Conflicts
        2.2.2. Erratic maneuvers
        2.2.3. Illegal maneuvers
        2.2.4. Aggressive actions
        2.2.5. Speed
    2.3. Other measures
        2.3.1. Citizen complaints
        2.3.2. Marks or damage on roadway and appurtenances, as well as crash debris
3. Define measures for proactive analyses
    3.1. Comparison with updated and changed policies, design guides, design criteria, and specifications
    3.2. Conditions related to lessons learned from previous projects
    3.3. Hazard indices or risk analyses calculated using data from roadway inventories to input to risk-based models
    3.4. Input from police officers and road users
4. Collect data
    4.1. Data on record (e.g., crash records, roadway inventory, medical data, driver-licensing data, citations, other)
    4.2. Field data (e.g., supplementary crash and inventory data, behavioral observations, operational data)
    4.3. Use of road safety audits, or adaptations
5. Analyze data
    5.1. Data plots (charts, tables, and maps) to identify possible patterns, and concentrations (See Appendixes Y, Z and AA for examples of what some states are doing)

    5.2.   Statistical analysis (high-hazard locations, over-representation of contributing circumstances, crash types, conditions, and populations)

    5.3.   Use expertise, through road safety audits or program assessment teams

    5.4.   Focus upon key attributes for which action is feasible:

        5.4.1.   Factors potentially contributing to the problems

        5.4.2.   Specific populations contributing to, and affected by, the problems

        5.4.3.   Those parts of the system contributing to a large portion of the problem

6. Report results and receive approval to pursue solutions to identified problems (*approvals being sought here are primarily a confirmation of the need to proceed and likely levels of resources required*)

    6.1.   Sort problems by type

        6.1.1.   Portion of the total problem

        6.1.2.   Vehicle, highway/environment, enforcement, education, other driver actions, emergency medical system, legislation, and system management

        6.1.3.   According to applicable funding programs

        6.1.4.   According to political jurisdictions

    6.2.   Preliminary listing of the types of strategies that might be applicable

    6.3.   Order-of-magnitude estimates of time and cost to prepare implementation plan

    6.4.   Listing of agencies that should be involved, and their potential roles (including an outline of the organizational framework intended for the working group). Go to Step 2 for more on this.

Implementation Step 2: Recruit Appropriate Participants for the Program

General Description

A critical early step in the implementation process is to engage all the stakeholders that may be encompassed within the scope of the planned program. The stakeholders may be from outside agencies (e.g., state patrol, county governments, or citizen groups). One criterion for participation is if the agency or individual will help ensure a comprehensive view of the problem and potential strategies for its resolution. If there is an existing structure (e.g., a State Safety Management System Committee) of stakeholders for conducting strategic planning, it is important to relate to this, and build on it, for addressing the detailed considerations of the particular emphasis area.

There may be some situations within the emphasis area for which no other stakeholders may be involved other than the lead agency and the road users. However, in most cases, careful consideration of the issues will reveal a number of potential stakeholders to possibly be involved. Furthermore, it is usually the case that a potential program will proceed better in the organizational and institutional setting if a high-level "champion" is found in the lead agency to support the effort and act as a key liaison with other stakeholders.

Stakeholders should already have been identified in the previous step, at least at a level to allow decision makers to know whose cooperation is needed, and what their potential level of involvement might be. During this step, the lead agency should contact the key individuals in each of the external agencies to elicit their participation and cooperation. This will require identifying the right office or organizational unit, and the appropriate people in each case. It will include providing them with a brief overview document and outlining for them the type of involvement envisioned. This may typically involve developing interagency agreements. The participation and cooperation of each agency should be secured to ensure program success.

Lists of appropriate candidates for the stakeholder groups are recorded in Appendix K. In addition, reference may be made to the NHTSA document at http://www.nhtsa.dot.gov/safecommunities/SAFE%20COMM%20Html/index.html, which provides guidance on building coalitions.

Specific Elements

1. Identify internal "champions" for the program
2. Identify the suitable contact in each of the agencies or private organizations who is appropriate to participate in the program
3. Develop a brief document that helps sell the program and the contact's role in it by
    3.1. Defining the problem
    3.2. Outlining possible solutions
    3.3. Aligning the agency or group mission by resolving the problem
    3.4. Emphasizing the importance the agency has to the success of the effort

    3.5.   Outlining the organizational framework for the working group and other stakeholders cooperating on this effort

    3.6.   Outlining the rest of the process in which agency staff or group members are being asked to participate

    3.7.   Outlining the nature of commitments desired from the agency or group for the program

    3.8.   Establishing program management responsibilities, including communication protocols, agency roles, and responsibilities

    3.9.   Listing the purpose for an initial meeting

4. Meet with the appropriate representative

    4.1.   Identify the key individual(s) in the agency or group whose approval is needed to get the desired cooperation

    4.2.   Clarify any questions or concepts

    4.3.   Outline the next steps to get the agency or group onboard and participating

5. Establish an organizational framework for the group

    5.1.   Roles

    5.2.   Responsibilities

Implementation Step 3: Establish Crash Reduction Goals

General Description

The AASHTO Strategic Highway Safety Plan established a national goal of saving 5,000 to 7,000 lives annually by the year 2005. Some states have established statewide goals for the reduction of fatalities or crashes of a certain degree of severity. Establishing an explicit goal for crash reduction can place an agency "on the spot," but it usually provides an impetus to action and builds a support for funding programs for its achievement. Therefore, it is desirable to establish, within each emphasis area, one or more crash reduction targets.

These may be dictated by strategic-level planning for the agency, or it may be left to the stakeholders to determine. (The summary of the Wisconsin DOT Highway Safety Plan in Appendix A has more information.) For example, Pennsylvania adopted a goal of 10 percent reduction in fatalities by 2002,[1] while California established a goal of 40 percent reduction in fatalities and 15 percent reduction in injury crashes, as well as a 10 percent reduction in work zone crashes, in 1 year.[2] At the municipal level, Toledo, Ohio, is cited by the U.S. Conference of Mayors as having an exemplary program. This included establishing specific crash reduction goals (http://www.usmayors.org/chhs/traffic/best_traffic_initiative_toledo.htm). When working within an emphasis area, it may be desirable to specify certain types of crashes, as well as the severity level, being targeted.

There are a few key considerations for establishing a quantitative goal. The stakeholders should achieve consensus on this issue. The goal should be challenging, but achievable. Its feasibility depends in part on available funding, the timeframe in which the goal is to be achieved, the degree of complexity of the program, and the degree of controversy the program may experience. To a certain extent, the quantification of the goal will be an iterative process. If the effort is directed at a particular location, then this becomes a relatively straightforward action.

Specific Elements

1. Identify the type of crashes to be targeted
    - 1.1.   Subset of all crash types
    - 1.2.   Level of severity
2. Identify existing statewide or other potentially related crash reduction goals
3. Conduct a process with stakeholders to arrive at a consensus on a crash reduction goal
    - 3.1.   Identify key considerations
    - 3.2.   Identify past goals used in the jurisdiction
    - 3.3.   Identify what other jurisdictions are using as crash reduction goals
    - 3.4.   Use consensus-seeking methods, as needed

---

[1] Draft State Highway Safety Plan, State of Pennsylvania, July 22, 1999
[2] Operations Program Business Plan, FY 1999/2000, State of California, Caltrans, July 1999

Implementation Step 4: Develop Program Policies, Guidelines, and Specifications

General Description

A foundation and framework are needed for solving the identified safety problems. The implementation process will need to be guided and evaluated according to a set of goals, objectives, and related performance measures. These will formalize what the intended result is and how success will be measured. The overlying crash reduction goal, established in Step 3, will provide the context for the more specific goals established in this step. The goals, objectives, and performance measures will be used much later to evaluate what is implemented. Therefore, they should be jointly outlined at this point and agreed to by all program stakeholders. It is important to recognize that evaluating any actions is an important part of the process. Even though evaluation is not finished until some time after the strategies have been implemented, it begins at this step.

The elements of this step may be simpler for a specific project or location than for a comprehensive program. However, even in the simpler case, policies, guidelines, and specifications are usually needed. Furthermore, some programs or projects may require that some guidelines or specifications be in the form of limits on directions taken and types of strategies considered acceptable.

Specific Elements

1. Identify high-level policy actions required and implement them (legislative and administrative)
2. Develop goals, objectives, and performance measures to guide the program and use for assessing its effect
    2.1. Hold joint meetings of stakeholders
    2.2. Use consensus-seeking methods
    2.3. Carefully define terms and measures
    2.4. Develop report documenting results and validate them
3. Identify specifications or constraints to be used throughout the project
    3.1. Budget constraints
    3.2. Time constraints
    3.3. Personnel training
    3.4. Capacity to install or construct
    3.5. Types of strategies not to be considered or that must be included
    3.6. Other

Implementation Step 5: Develop Alternative Approaches to Addressing the Problem

General Description

Having defined the problem and established a foundation, the next step is to find ways to address the identified problems. If the problem identification stage has been done effectively (see Appendix D for further details on identifying road safety problems), the characteristics of the problems should suggest one or more alternative ways for dealing with the problem. It is important that a full range of options be considered, drawing from areas dealing with enforcement, engineering, education, emergency medical services, and system management actions.

Alternative strategies should be sought for both location-specific and systemic problems that have been identified. Location-specific strategies should pertain equally well to addressing high-hazard locations and to solving safety problems identified within projects that are being studied for reasons other than safety.

Where site-specific strategies are being considered, visits to selected sites may be in order if detailed data and pictures are not available. In some cases, the emphasis area guides will provide tables that help connect the attributes of the problem with one or more appropriate strategies to use as countermeasures.

Strategies should also be considered for application on a systemic basis. Examples include

1. Low-cost improvements targeted at problems that have been identified as significant in the overall highway safety picture, but not concentrated in a given location.

2. Action focused upon a specific driver population, but carried out throughout the jurisdiction.

3. Response to a change in policy, including modified design standards.

4. Response to a change in law, such as adoption of a new definition for DUI.

In some cases, a strategy may be considered that is relatively untried or is an innovative variation from past approaches to treatment of a similar problem. Special care is needed to ensure that such strategies are found to be sound enough to implement on a wide-scale basis. Rather than ignoring this type of candidate strategy in favor of the more "tried-and-proven" approaches, consideration should be given to including a pilot-test component to the strategy.

The primary purpose of this guide is to provide a set of strategies to consider for eliminating or lessening the particular road safety problem upon which the user is focusing. As pointed out in the first step of this process, the identification of the problem, and the selection of strategies, is a complex step that will be different for each case. Therefore, it is not feasible to provide a "formula" to follow. However, guidelines are available. There are a number of texts to which the reader can refer. Some of these are listed in Appendix B and Appendix D.

In addition, the tables referenced in <u>Appendix G</u> provide examples for linking identified problems with candidate strategies.

The second part of this step is to assemble sets of strategies into alternative "program packages." Some strategies are complementary to others, while some are more effective when combined with others. In addition, some strategies are mutually exclusive. Finally, strategies may be needed to address roads across multiple jurisdictions. For instance, a package of strategies may need to address both the state and local highway system to have the desired level of impact. The result of this part of the activity will be a set of alternative "program packages" for the emphasis area.

It may be desirable to prepare a technical memorandum at the end of this step. It would document the results, both for input into the next step and for internal reviews. The latter is likely to occur, since this is the point at which specific actions are being seriously considered.

Specific Elements

1. Review problem characteristics and compare them with individual strategies, considering both their objectives and their attributes
    1.1. Road-user behavior (law enforcement, licensing, adjudication)
    1.2. Engineering
    1.3. Emergency medical services
    1.4. System management elements
2. Select individual strategies that do the following:
    2.1. Address the problem
    2.2. Are within the policies and constraints established
    2.3. Are likely to help achieve the goals and objectives established for the program
3. Assemble individual strategies into alternative program packages expected to optimize achievement of goals and objectives
    3.1. Cumulative effect to achieve crash reduction goal
    3.2. Eliminate strategies that can be identified as inappropriate, or likely to be ineffective, even at this early stage of planning
4. Summarize the plan in a technical memorandum, describing attributes of individual strategies, how they will be combined, and why they are likely to meet the established goals and objectives

Implementation Step 6: Evaluate Alternatives and Select a Plan

General Description

This step is needed to arrive at a logical basis for prioritizing and selecting among the alternative strategies or program packages that have been developed. There are several activities that need to be performed. One proposed list is shown in Appendix P.

The process involves making estimates for each of the established performance measures for the program and comparing them, both individually and in total. To do this in a quantitative manner requires some basis for estimating the effectiveness of each strategy. Where solid evidence has been found on effectiveness, it has been presented for each strategy in the guide. In some cases, agencies have a set of crash reduction factors that are used to arrive at effectiveness estimates. Where a high degree of uncertainty exists, it is wise to use sensitivity analyses to test the validity of any conclusions that may be made regarding which is the best strategy or set of strategies to use. Further discussion of this may be found in Appendix O.

Cost-benefit and cost-effectiveness analyses are usually used to help identify inefficient or inappropriate strategies, as well as to establish priorities. For further definition of the two terms, see Appendix Q. For a comparison of the two techniques, see Appendix S. Aspects of feasibility, other than economic, must also be considered at this point. An excellent set of references is provided within online benefit-cost guides:

- One is under development at the following site, maintained by the American Society of Civil Engineers: http://ceenve.calpoly.edu/sullivan/cutep/cutep_bc_outline_main.htm

- The other is *Guide to Benefit-Cost Analysis in Transport Canada*, September 1994, http://www.tc.gc.ca/finance/bca/en/TOC_e.htm. An overall summary of this document is given in Appendix V.

In some cases, a strategy or program may look promising, but no evidence may be available as to its likely effectiveness. This would be especially true for innovative methods or use of emerging technologies. In such cases, it may be advisable to plan a pilot study to arrive at a minimum level of confidence in its effectiveness, before large-scale investment is made or a large segment of the public is involved in something untested.

It is at this stage of detailed analysis that the crash reduction goals, set in Step 3, may be revisited, with the possibility of modification.

It is important that this step be conducted with the full participation of the stakeholders. If the previous steps were followed, the working group will have the appropriate representation. Technical assistance from more than one discipline may be necessary to go through more complex issues. Group consensus will be important on areas such as estimates of effectiveness, as well as the rating and ranking of alternatives. Techniques are available to assist in arriving at consensus. For example, see the following Web site for an overview: http://www.tc.gc.ca/finance/bca/en/Printable_e.htm.

Specific Elements

1. Assess feasibility
   1.1. Human resources
   1.2. Special constraints
   1.3. Legislative requirements
   1.4. Other
   1.5. This is often done in a qualitative way, to narrow the list of choices to be studied in more detail (see, for example, Appendix BB)
2. Estimate values for each of the performance measures for each strategy and plan
   2.1. Estimate costs and impacts
       2.1.1. Consider guidelines provided in the detailed description of strategies in this material
       2.1.2. Adjust as necessary to reflect local knowledge or practice
       2.1.3. Where a plan or program is being considered that includes more than one strategy, combine individual estimates
   2.2. Prepare results for cost-benefit and/or cost-effectiveness analyses
   2.3. Summarize the estimates in both disaggregate (by individual strategy) and aggregate (total for the program) form
3. Conduct a cost-benefit and/or cost-effectiveness analysis to identify inefficient, as well as dominant, strategies and programs and to establish a priority for the alternatives
   3.1. Test for dominance (both lower cost and higher effectiveness than others)
   3.2. Estimate relative cost-benefit and/or cost-effectiveness
   3.3. Test productivity
4. Develop a report that documents the effort, summarizing the alternatives considered and presenting a preferred program, as devised by the working group (for suggestions on a report of a benefit-cost analysis, see Appendix U).
   4.1. Designed for high-level decision makers, as well as technical personnel who would be involved in the implementation
   4.2. Extensive use of graphics and layout techniques to facilitate understanding and capture interest
   4.3. Recommendations regarding meeting or altering the crash reduction goals established in Step 3.

Implementation Step 7: Submit Recommendations for Action by Top Management

General Description

The working group has completed the important planning tasks and must now submit the results and conclusions to those who will make the decision on whether to proceed further. Top management, at this step, will primarily be determining if an investment will be made in this area. As a result, the plan will not only be considered on the basis of its merits for solving the particular problems identified in this emphasis area (say, vis-à-vis other approaches that could be taken to deal with the specific problems identified), but also its relative value in relation to investments in other aspects of the road safety program.

This aspect of the process involves using the best available communication skills to adequately inform top management. The degree of effort and extent of use of media should be proportionate to the size and complexity of the problem being addressed, as well as the degree to which there is competition for funds.

The material that is submitted should receive careful review by those with knowledge in report design and layout. In addition, today's technology allows for the development of automated presentations, using animation and multimedia in a cost-effective manner. Therefore, programs involving significant investments that are competing strongly for implementation resources should be backed by such supplementary means for communicating efficiently and effectively with top management.

Specific Elements

1. Submit recommendations for action by management
    1.1. "Go/no-go" decision
    1.2. Reconsideration of policies, guidelines, and specifications (see Step 3)
    1.3. Modification of the plan to accommodate any revisions to the program framework made by the decision makers
2. Working group to make presentations to decision makers and other groups, as needed and requested
3. Working group to provide technical assistance with the review of the plan, as requested
    3.1. Availability to answer questions and provide further detail
    3.2. Assistance in conducting formal assessments

Implementation Step 8: Develop a Plan of Action

General Description

At this stage, the working group will usually detail the program that has been selected for implementation. This step translates the program into an action plan, with all the details needed by both decision makers, who will have to commit to the investment of resources, and those charged with carrying it out. The effort involves defining resource requirements, organizational and institutional arrangements needed, schedules, etc. This is usually done in the form of a business plan, or plan of action. An example of a plan developed by a local community is shown in Appendix X.

An evaluation plan should be designed at this point. It is an important part of the plan. This is something that should be in place before Step 9 is finished. It is not acceptable to wait until after the program is completed to begin designing an evaluation of it. This is because data are needed about conditions before the program starts, to allow comparison with conditions during its operation and after its completion. It also should be designed at this point, to achieve consensus among the stakeholders on what constitutes "success." The evaluation is used to determine just how well things were carried out and what effect the program had. Knowing this helps maintain the validity of what is being done, encourages future support from management, and provides good intelligence on how to proceed after the program is completed. For further details on performing evaluations, see Appendix L, Appendix M, and Appendix W.

The plan of action should be developed jointly with the involvement of all desired participants in the program. It should be completed to the detail necessary to receive formal approval of each agency during the next step. The degree of detail and complexity required for this step will be a function of the size and scope of the program, as well as the number of independent agencies involved.

Specific Elements

1. Translation of the selected program into key resource requirements
    1.1. Agencies from which cooperation and coordination is required
    1.2. Funding
    1.3. Personnel
    1.4. Data and information
    1.5. Time
    1.6. Equipment
    1.7. Materials
    1.8. Training
    1.9. Legislation
2. Define organizational and institutional framework for implementing the program
    2.1. Include high-level oversight group
    2.2. Provide for involvement in planning at working levels
    2.3. Provide mechanisms for resolution of issues that may arise and disagreements that may occur
    2.4. Secure human and financial resources required

3. Detail a program evaluation plan
    3.1. Goals and objectives
    3.2. Process measures
    3.3. Performance measures
        3.3.1. Short-term, including surrogates, to allow early reporting of results
        3.3.2. Long-term
    3.4. Type of evaluation
    3.5. Data needed
    3.6. Personnel needed
    3.7. Budget and time estimates
4. Definition of tasks to conduct the work
    4.1. Develop diagram of tasks (e.g., PERT chart)
    4.2. Develop schedule (e.g., Gantt chart)
    4.3. For each task, define
        4.3.1. Inputs
        4.3.2. Outputs
        4.3.3. Resource requirements
        4.3.4. Agency roles
        4.3.5. Sequence and dependency of tasks
5. Develop detailed budget
    5.1. By task
    5.2. Separate by source and agency/office (i.e., cost center)
6. Produce program action plan, or business plan document

Implementation Step 9: Establish Foundations for Implementing the Program

General Description

Once approved, some "groundwork" is often necessary to establish a foundation for carrying out the selected program. This is somewhat similar to what was done in Step 4. It must now be done in greater detail and scope for the specific program being implemented. As in Step 4, specific policies and guidelines must be developed, organizational and institutional arrangements must be initiated, and an infrastructure must be created for the program. The business plan or action plan provides the basis (Step 7) for this. Once again, the degree of complexity required will vary with the scope and size of the program, as well as the number of agencies involved.

Specific Elements

1. Refine policies and guidelines (from Step 4)
2. Effect required legislation or regulations
3. Allocate budget
4. Reorganize implementation working group
5. Develop program infrastructure
    5.1. Facilities and equipment for program staff
    5.2. Information systems
    5.3. Communications
    5.4. Assignment of personnel
    5.5. Administrative systems (monitoring and reporting)
6. Set up program assessment system
    6.1. Define/refine/revise performance and process measures
    6.2. Establish data collection and reporting protocols
    6.3. Develop data collection and reporting instruments
    6.4. Measure baseline conditions

Implementation Step 10: Carry Out the Action Plan

General Description

Conditions have been established to allow the program to be started. The activities of implementation may be divided into activities associated with field preparation for whatever actions are planned and the actual field implementation of the plan. The activities can involve design and development of program actions, actual construction or installation of program elements, training, and the actual operation of the program. This step also includes monitoring for the purpose of maintaining control and carrying out mid- and post-program evaluation of the effort.

Specific Elements

1. Conduct detailed design of program elements
   1.1. Physical design elements
   1.2. PI&E materials
   1.3. Enforcement protocols
   1.4. Etc.
2. Conduct program training
3. Develop and acquire program materials
4. Develop and acquire program equipment
5. Conduct pilot tests of untested strategies, as needed
6. Program operation
   6.1. Conduct program "kickoff"
   6.2. Carry out monitoring and management of ongoing operation
      6.2.1 Periodic measurement (process and performance measures)
      6.2.2 Adjustments as required
   6.3. Perform interim and final reporting

Implementation Step 11: Assess and Transition the Program

General Description

The AASHTO Strategic Highway Safety Plan includes improvement in highway safety management. A key element of that is the conduct of properly designed program evaluations. The program evaluation will have been first designed in Step 8, which occurs prior to any field implementation. For details on designing an evaluation, please refer to Step 8. For an example of how the New Zealand Transport Authority takes this step as an important part of the process, see Appendix N.

The program will usually have a specified operational period. An evaluation of both the process and performance will have begun prior to the start of implementation. It may also continue during the course of the implementation, and it will be completed after the operational period of the program.

The overall effectiveness of the effort should be measured to determine if the investment was worthwhile and to guide top management on how to proceed into the post-program period. This often means that there is a need to quickly measure program effectiveness in order to provide a preliminary idea of the success or need for immediate modification. This will be particularly important early in development of the AASHTO Strategic Highway Safety Plan, as agencies learn what works best. Therefore, surrogates for safety impact may have to be used to arrive at early/interim conclusions. These usually include behavioral measures. This particular need for interim surrogate measures should be dealt with when the evaluation is designed, back in Step 8. However, a certain period, usually a minimum of a couple of years, will be required to properly measure the effectiveness and draw valid conclusions about programs designed to reduce highway fatalities when using direct safety performance measures.

The results of the work is usually reported back to those who authorized it and the stakeholders, as well as any others in management who will be involved in determining the future of the program. Decisions must be made on how to continue or expand the effort, if at all. If a program is to be continued or expanded (as in the case of a pilot study), the results of its assessment may suggest modifications. In some cases, a decision may be needed to remove what has been placed in the highway environment as part of the program because of a negative impact being measured. Even a "permanent" installation (e.g., rumble strips) requires a decision regarding investment for future maintenance if it is to continue to be effective.

Finally, the results of the evaluation using performance measures should be fed back into a knowledge base to improve future estimates of effectiveness.

Specific Elements

1. Analysis
    1.1. Summarize assessment data reported during the course of the program
    1.2. Analyze both process and performance measures (both quantitative and qualitative)

      1.3.   Evaluate the degree to which goals and objectives were achieved (using performance measures)

      1.4.   Estimate costs (especially vis-à-vis pre-implementation estimates)

      1.5.   Document anecdotal material that may provide insight for improving future programs and implementation efforts

      1.6.   Conduct and document debriefing sessions with persons involved in the program (including anecdotal evidence of effectiveness and recommended revisions)

2. Report results
3. Decide how to transition the program

      3.1.   Stop

      3.2.   Continue as is

      3.3.   Continue with revisions

      3.4.   Expand as is

      3.5.   Expand with revisions

      3.6.   Reverse some actions

4. Document data for creating or updating database of effectiveness estimates

Key References

Accident Scene Management, Inc. http://www.accidentscene.net

AAA Foundation for Traffic Safety. www.aaafts.org

American Heart Association, Emergency Cardiovascular Care. http://www.ems-c.org/cfusion/ResourceDetailNew.cfm?id=936981764

American National Standard, ANSI D16.1-1996, Manual on Classification of Motor Vehicle Traffic Accidents, Sixth Edition, National Safety Council.

American National Standard, ANSI D20-2003, Data Element Dictionary for Traffic Records Systems, American Association of Motor Vehicle Administrators, April 2003.

America's Health Insurance Plans. http://www.ahip.org/

Arrowhead Emergency Medical Services Association. "Emergency Medical Services Radio Communications Needs Assessment Report for the Rural Aspects of the State of Minnesota." A State of Minnesota–funded project, October 1, 2001. http://www.emsrb.state.mn.us/docs/communications-21.pdf

Association of Public-Safety Communications Officials (APCO International). http://www.apcointl.com/

Bailey, A. "DONORCYCLES?! Changing a Stereotype: How the Two Wheel Trauma Program Is Educating Riders, EMSs, and the Public." The Motorcycle Riders Foundation, September 1995. http://www.mrf.org/pdf/WhitePapers/Volume3-1995/Donorcycles.pdf

Bailey, B., and J.M. Scott. "The New York State Wireless Enhanced 911 Project: Implementation Guide." Department of Emergency Medicine, SUNY Upstate Medical University, Syracuse, New York. http://www.itspublicsafety.net/docs/ImplementationGuide.pdf. Undated (a), but accessed July 11, 2005.

Bailey, B., and J.M. Scott. "The New York State Wireless Enhanced 911 Project: Lessons Learned." Department of Emergency Medicine, SUNY Upstate Medical University, Syracuse, New York. http://www.itspublicsafety.net/docs/Lessons.pdf. Undated (b), but accessed July 11, 2005.

Baker Integrated Technologies. http://www.911spec.com/whywhy.htm

Baker, S.P., R.A. Whitfield, and B. O'Neill. "Geographic Variations in Mortality from Motor Vehicle Crashes." The New England Journal of Medicine, Vol. 316, No. 22, May 1987.

Birmingham Regional Emergency Medical Services System (BREMSS). http://www.bremss.org/

Bodack, T. "Help … When You Need It Most: First Responders Come to the Aid of Turnpike Travelers." The Pennsylvania Turnpike Commission, Winter 1998. http://www.paturnpike.com/tools/newsletters/winter98/page03.htm

Brown, L. "New System Helps Perkins Paramedics Transmit to Hospital." *Sandusky Register*, November 21, 2003. http://www.claytonids.com/articles/perkins.pdf

Bureau of Justice Statistics, U.S. Department of Justice. http://www.ojp.usdoj.gov/bjs/

Bureau of Transportation Statistics (BTS). "Geographic Information Systems (GIS)." U.S. Department of Transportation. http://www.bts.gov/programs/ geographic_information_services/

Cape Fear Community College, "Basic Law Enforcement Training." Wilmington, North Carolina, 2005. http://cfcc.net/cat/blet_cat.htm

Cellular Telecommunications and Internet Association (CTIA). http://www.ctia.org/

Center for Rural EMS Education (CREMSE.ORG). http://www.cremse.org/default.asp

Champion, H.R. "Reducing Highway Deaths and Disabilities with Automatic Wireless Transmission of Serious Injury Probability Ratings from Crash Recorders to Emergency Medical Services Providers." *International Symposium on Transportation Recorders.* May 3-5, 1999, Arlington, Virginia. http://www.nhtsa.dot.gov/cars/problems/studies/ acns/champion.htm

City of Coralville Police Department. http://www.coralville.org/mod.php?mod =department&did=26&PHPSESSID=4033f570fcaf0addf3f663f6764e67e3

Clifton, D. "DISPATCH*Works* Proves Affordable for Small, Rural Counties." Baker Integrated Technologies, LLC. 2001. http://www.dispatchworks.com/News_JeffDavis.htm

Commission on Accreditation of Ambulance Services (CAAS). http://www.caas.org

Commission on Fire Accreditation International (CFAI). http://www.cfainet.org

Commonwealth of Pennsylvania, Department of Health. Emergency Medical Services. http://www.dsf.health.state.pa.us/health/cwp/view.asp?a=170&Q=203353

Communications for Coordinated Assistance and Response to Emergencies (ComCARE). http://www.comcare.org/index.html

County of San Mateo California. http://www.co.sanmateo.ca.us/vgn/images/portal/ cit_609/6753846Personnel6.pdf

Critical Illness and Trauma Foundation. *EMS Community Planning and Integration Guide: Assisting Communities in Building a Stronger EMS System.* 2nd edition, 2003. http://www.citmt.org/download/03CommPlan.pdf.

Dawson, D., N. Sanddal, J. Pullum, K. Threet, J. DeTienne, and K.K. Obbink. "TENKIDS: A Virtual EMS Montana Links its EMS Organizations." *Journal of Emergency Medical Services,* Vol. 24, No. 12, December 1999.

Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. "World Health Day is April 7, 2004: Family Road Safety: Protect the Ones You Love." http://www.cdc.gov/ncipc/whd2004/

EMS Data Systems. http://www.emsdata.com/index.html

EMS Performance Measures Project. http://www.measureems.org/index.html

Environmental Systems Research Institute (ESRI), "GIS Mobile Data System from Bradshaw Consulting Services Helping EMS to Beat the Clock, Reach Patients Faster: System Proves to Be EMS Professional's Most Effective, Real-Time Navigational Tool." Business Partner press release, May 2, 2003, http://www.esri.com/partners/partner_news/03_qtr2/ bradshaw050203.html

Esposito, T.J., T.L. Sanddal, S.A. Reynolds, and N.D. Sanddal. "Effect of a Voluntary Trauma System on Preventable Death and Inappropriate Care in a Rural State." *The Journal of Trauma Injury, Infection, and Critical Care,* Vol. 54, No. 4, April 2003.

Federal Emergency Management Agency (FEMA). http://www.fema.gov/

Federal Highway Administration (FHWA). "Automated Crash Notification System, UAB." *ITS Projects Book,* U.S. Department of Transportation, January 2003.

Federal Highway Administration (FHWA). Highway Statistics. U.S. Department of Transportation, undated, but accessed July 2005. http://www.fhwa.dot.gov/policy/ ohpi/hss/hsspubs.htm

Federal Highway Administration (FHWA). Highway Statistics 2002. U.S. Department of Transportation, 2002. http://www.fhwa.dot.gov/policy/ohim/hs02/index.htm

Frank Thatcher Associates, Inc. "Statewide Emergency Medical Services Communication Plan." State of Alaska, September 1997. http://www.hss.state.ak.us/dph/targets/ha2010/ volume3/summaries/EMS_comm.htm

Goodwin, K. "Keeping Rural Emergency Medical Services Afloat." *NCSL State Legislative Report: Analysis of State Actions on Important Issues.* Vol. 27, No. 15, September 2002.

Governors Highway Safety Association (GHSA). www.ghsa.org

Horan, T.A., and B.L. Schooley. "Interorganizational Emergency Medical Services: Case Study of Rural Wireless Deployment and Management" (Draft). http://www.hhh.umn.edu/ centers/slp/projects/transroundtable/ISFrontiers-horan-Schooley.PDF

iAnywhere. "Clayton I.D.S. and Washington/Norwich Township Fire Departments." http://www.ianywhere.com/success_stories/clayton_ids.html#top

Idaho Department of Health & Welfare. "Emergency Medical Services." http://www.idahoems.org/

Illinois Fire Chiefs Association. "Emergency Medical Services Data Project." http://www. illemsdata.org/

Indahl, K. "Greater Neptune Community to Gain New EMS Volunteers through New High School Program." Meridian Health. May 2004. http://www.meridianhealth.com/index.cfm/ mediarelations/PressReleases/20040520-2.cfm

Indiana State Emergency Management Agency (SEMA). "Emergency Medical Services (EMS)." http://www.in.gov/sema/ems/

ITS America Public Safety Advisory Group Medical Subcommittee. "Recommendations for ITS Technology in Emergency Medical Services." 2002. http://www.itspublicsafety.net/ EMS_recommendations_ITS.htm

Larkin, K. "OPTIMUS Participates in Interoperable Emergency Communications Drill in Northern Shenandoah Valley." *Journal of Emergency Medical Services.* http://www.jems. com/aboutus/press/2003/121703a.html

Liberman, M., D. Mulder, A. Lavoie, R. Denis, and J.S. Sampalis. "Multicenter Canadian Study of Prehospital Trauma Care," *Annals of Surgery.* Vol. 237, No. 2, February 2003.

Mid-America Transportation Center. "Nebraska GPS (Global Positioning System) Messaging and Voice Communications Demonstration." U.S. Department of Transportation, Federal Highway Administration (FHWA), June 2000.

Minnesota 800MHz Digital Radio System. http://www.scanfan.com/article.php?sid=7

Minnesota Emergency Medical Services Regulatory Board. http://www.emsrb.state.mn.us/

Mobile Data for Public Safety. *Dispatch Monthly.* http://www.911dispatch.com/ information/mobiledata.html

Montgomery County, Maryland High School Fire Science Program. http://www.montgomerycountymd.gov/mcgtmpl.asp?url=/content/firerescue/psta/fire-science/index.asp

Moshinskie, J.F., J.L. Jarvis, G.A. Hobbs, and S.K. Roden. "The Effects of Using Distance Learning Technologies in Training Rural EMS Providers When Learner-Centered Designs Are Used." Texas A&M College of Medicine, April 1996. http://business.baylor.edu/ James_Moshinskie//research.htm

National Association of EMS Educators. "Pre-EMS Education and Instructor Development." Position Paper. September 2003. http://www.naemse.org/positionpapers/Pre-EMS.pdf

National Association of State EMS Directors (NASEMSD). http://www.nasemsd.org/

National Conference of State Legislatures: Forum on Rural EMS. http://www.ncsl.org/ programs/health/Forum/ruralems.htm

National Emergency Number Association (NENA). http://www.nena.org/

National EMS Information System (NEMSIS). www.nemsis.org

National Fire Protection Association (NFPA). http://www.nfpa.org

National Highway Traffic Safety Administration (NHTSA). *Cooperation and Partnership: Keys to Success: State Highway Safety and EMS Agencies Working Together to Improve Public Health.* Report No. DOT HS 809 111. U.S. Department of Transportation, August 2000(a). http://www.nhtsa.dot.gov/people/injury/ems/pub3/table_of_contents.htm

National Highway Traffic Safety Administration (NHTSA). "Crash Outcome Data Evaluation System (CODES)." U.S. Department of Transportation, undated (a), but accessed July 2005. http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/codes.html

National Highway Traffic Safety Administration (NHTSA). "Emergency Medical Services Agenda for the Future." U.S. Department of Transportation, 1996. http://www.nhtsa. dot.gov/people/injury/ems/agenda/emsman.html

National Highway Traffic Safety Administration (NHTSA). "Emergency Medical Services Outcomes Evaluation: An Examination of Key Issues and Future Directions." Report DOT HS 808 163, U.S. Department of Transportation, September 1994(a).

National Highway Traffic Safety Administration (NHTSA). "Emergency Medical Technician Paramedic: National Standard Curriculum (EMT-P)." U.S. Department of Transportation, 1998. http://www.nhtsa.dot.gov/people/injury/ems/EMT-P/disk_1%5B1%5D/index.htm

National Highway Traffic Safety Administration (NHTSA). "EMS Education Agenda for the Future: A Systems Approach." U.S. Department of Transportation, 2000(b). http://www.nhtsa.dot.gov/people/injury/ems/EdAgenda/final/

National Highway Traffic Safety Administration (NHTSA). Fatality Analysis Reporting System (FARS) Web-Based Encyclopedia. U.S. Department of Transportation, undated (b), but accessed July 2005. http://www-fars.nhtsa.dot.gov/

National Highway Traffic Safety Administration (NHTSA). *Model Minimum Uniform Crash Criteria (MMUCC) Guideline. Second Edition.* Report No. HS-809 577. U.S. Department of Transportation, April 2003(a). http://www.mmucc.us/

National Highway Traffic Safety Administration (NHTSA). *National EMS Research Agenda.* U.S. Department of Transportation, 2001. http://www.nhtsa.dot.gov/people/injury/ems/EMS03-ResearchAgenda/home.htm

National Highway Traffic Safety Administration (NHTSA). Safe Communities. Report No. HS-808 578. U.S. Department of Transportation, June 1999.

National Highway Traffic Safety Administration (NHTSA). "*Safe Communities.*" U.S. Department of Transportation, undated (c), but accessed July 2005. www.nhtsa.dot.gov/safecommunities/

National Highway Traffic Safety Administration (NHTSA). *Safety Belt Use in 2002 – Demographic Characteristics.* Report DOT HS 809 557, U.S. Department of Transportation, March 2003(b). http://www.nhtsa.dot.gov/people/injury/airbags/demographic03-03/demographic.htm

National Highway Traffic Safety Administration (NHTSA). *Traffic Safety Facts 2002: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System.* Report DOT HS 809 620, U.S. Department of Transportation, January 2004(a). http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2002Final.pdf

National Highway Traffic Safety Administration (NHTSA). *Traffic Safety Facts 2002: Rural/Urban Comparison.* Report DOT-HS-809-739. U.S. Department of Transportation, undated (d), but accessed July 2005. http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2002/2002RuralUrban.pdf

National Highway Traffic Safety Administration (NHTSA). *Trauma System: Agenda for the Future.* U.S. Department of Transportation, 2002. http://www.nhtsa.dot.gov/people/injury/ems/emstraumasystem03/index.htm

National Highway Traffic Safety Administration (NHTSA). "Uniform EMS Data Element Dictionary Format." U.S. Department of Transportation, undated (e), but accessed July 2005. http://www.nhtsa.dot.gov/people/injury/ems/DATASET.pdf

National Highway Traffic Safety Administration (NHTSA). "Uniform Pre-Hospital Emergency Medical Services (EMS) Data Conference." Report No. HS-808 107. U.S. Department of Transportation, January 1994(b). http://isddc.dot.gov/OLPFiles/NHTSA/007443.pdf

National Highway Traffic Safety Administration (NHTSA). "2004 EMS Week Campaign Book." American College of Emergency Physicians, 2004(b).

National Rural Health Association (NRHA). "Rural and Frontier Emergency Medical Services Agenda for the Future" (Draft 4.0). July 26, 2004. http://www.hospitalconnect.com/aha/key_issues/disaster_readiness/content/ruralemergencyservices.pdf

National Rural Health Association (NHRA). "Rural and Frontier Emergency Medical Services Toward the Year 2000." May 1997. http://www.nrharural.org/advocacy/sub/issuepapers/ipaper9.html

National Telecommunications and Information Administration (NTIA). *US National Spectrum Requirements: Projects and Trends, Chapter 1 - Mobile and Mobile-Satellite Services.* NTIA Special Publication 94-31, U.S. Department of Transportation, March 1995. http://www.ntia.doc.gov/openness/sp_rqmnts/mobile1.html

National Volunteer Fire Council (NVFC). http://www.nvfc.org/

Noland, S. "Bystander Trauma Care Program." 1996. http://www.nhtsa.dot.gov/people/outreach/safedige/Spring96/EMS/Iowa.html

North Central EMS Cooperative (NCEMSC). "Cooperatives: An EMS Case Study." http://tasc.ruralhealth.hrsa.gov/documents/2003_All_Programs_Cooperatives.ppt

Office of Emergency Medical Services. *Prehospital Patient Care Reporting (PPCR) Manual.* Virginia Department of Health, February 2000. http://www.vdh.state.va.us/oems/Files_page/ppcr/ppcrmanual.PDF

Office of Rural Health Policy, U.S. Department of Health and Human Services. http://ruralhealth.hrsa.gov/overview/

Office of Technology Assessment (OTA). "Rural Emergency Medical Services—Special Report." OTA Publication No. OTA-H-445, 1989.

Oregon Department of Transportation (ODOT). "District 11 East Maintenance Ready for Emergency Response." 2002. http://www.odot.state.or.us/region4/redesign/news_archives/emergency_response.htm

Palidor Radio Communications Consultants Ltd. "Fire/EMS Mobile Data Communications." http://www.palidor.com/fire.htm

Perez, C.E., A. Braslow, and H.C. Bock. *National Standard Curriculum for Bystander Care.* U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA). Report No. HS-807 872, October 1992. See http://www.nhtsa.dot.gov/people/injury/ems/new_item.htm for order form.

Perkins Township Fire Department. Sandusky, Ohio. http://www.perkinsfire.com/MobilEMS.htm

Perry, J. "Community Emergency Response Team Overview: Seminole County C.E.R.T. Training at Winter Springs High School." Department of Homeland Security, Federal Emergency Management Agency, and U.S. Fire Administration, undated, but accessed July 2005. http://training.fema.gov/EMIWeb/CERT/wintercer.asp#top

Pullum, J. D., N.D. Sanddal, and K. Obbink. "Training for Rural Prehospital Providers: A Retrospective Analysis from Montana." *Prehospital Emergency Care,* Vol. 3, No. 3, 1999.

Rawlinson, C., and P. Crews. "Access to Quality Health Services in Rural Area—Emergency Medical Services: A Literature Review." *Rural Healthy People 2010—Volume 1.* Texas A&M University System Health Science Center, 2003. http://www.srph.tamhsc.edu/centers/rhp2010/03Volume2accessems.pdf

Rural Health EMS System Review—Livingston and Steuben Counties. http://www.ruralhealthresources.com/EMSreview/toc.htm

Rural Health Resource Center, School of Public Health, University of Minnesota. http://www.hsr.umn.edu/rhrc/

Rural Health Resources. "Analyzing Outside Forces." http://www.ruralhealthresources.com/EMSreview/Analyzing_Outside_Forces.htm

Rural Policy Research Institute. Rural Hospital Flexibility Program (RHFP) Tracking Project. 1999. http://www.rupri.org/rhfp-track/

Safe Communities of Wright County, Minnesota. http://www.safecomm.org/

Sanddal, T.L. "The Impact of Personal Digital Assistants in Emergency Medical Services Providers' Response to Traumatic Injuries." Western Transportation Institute, 2003. http://www.coe.montana.edu/wti/wti/pdf/426390_Final_Report.pdf

Sanddal, N.D., T.L. Sanddal, J.D. Pullum, K.B. Altenhofen, S.M. Werner, J. Mayberry, D.B. Rushton, and D.W. Dawson. "A Randomized, Prospective, Multisite Comparison of Pediatric Prehospital Training Methods." *Journal of Pediatric Emergency Care,* Vo. 20, No. 2, February 2004.

Santa Barbara County SAFE Communities, California. http://www.sbcphd.org/ems/safe_community.html

ScanHealth, Inc. http://www.scanhealth.com

Schoenman, J., J. Barnas, B. Struck, and D. Wakeman. "Regionalization of Emergency Medical Services: The Experience of Michigan's Upper Peninsula." *CAH/FLEX National Tracking Project: Findings from the Field.* Vol. 2, No. 2, November 12, 2001. Rural Policy Research Institute. http://www.rupri.org/rhfp-track/results/vol2num2.pdf

Schoenman, J.A., P.E. Mohr, and C.D. Muller. *Rural Hospital Flexibility Program: Tracking Project Year Two Report.* "Chapter 4: EMS Activities Under the Rural Hospital Flexibility Program." Rural Policy Research Institute, 1999. http://www.rupri.org/rhfp-track/year2/chapter4.html

Schuman, R., and M.D. Meyer. "Advanced Transportation Technology: How It Helps Police, Fire, and EMS Operations." ITS Public Safety Program. http://www.itspublicsafety.net/ShumanMeyer.htm

Smith, S.C., and R.S. Hamburg. "Automated External Defibrillators: Time for Federal and State Advocacy and Broader Utilization." *Circulation.* Vol. 97, April 1998. http://circ.ahajournals.org/cgi/content/full/97/13/1321

State of Oregon 9-1-1 Program. http://egov.oregon.gov/OOHS/OEM/911_prog.shtml

Stoy, W.A., D.J. Samuels, H.C. Bock, and K.I. Maull. "EMT-Basic: National Standard Curriculum. Instructor's Course Guide." U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA). http://www.nhtsa.dot.gov/people/injury/ems/pub/emtbnsc.pdf

SUNY Rockland Community College. "High School Seniors Become EMT's Thanks to Free Program at SUNY Rockland Community College." Press release. http://www.sunyrockland.edu/pressrel/RisingStar.htm

University of California at Davis, Department of Agricultural and Resource Economics, Rural Cooperatives Center. http://cooperatives.ucdavis.edu/

University of North Dakota, School of Medicine & Health Sciences. "Personnel and Care Provision Needs Among Rural North Dakota EMS Squad Leaders." *Rural EMS Initiative.* Fact Sheet No. 4, June 2000. http://www.med.und.nodak.edu/depts/rural/pdf/remsifs4.pdf

University of Wisconsin, Center for Cooperatives. http://www.wisc.edu/uwcc/

U.S. Fire Administration (USFA). http://www.usfa.fema.gov/

Wilcox, R. "GIS Mobile Data System from Bradshaw Consulting Services Helping EMS to Beat the Clock, Reach Patients Faster: System Proves to Be EMS Professional's Most Effective, Real-Time Navigational Tool." 2004. http://www.bcs-gis.com/download/medicpr.pdf.

Wireless E9-1-1 Steering Council. "Wireless E9-1-1 Priority Action Plan." ITS Public Safety Program, U.S. Department of Transportation, May 2003. http://www.itspublicsafety.net/wireless_actionplan.htm

Appendixes

The following appendixes are not published in this report. However, they are available online at http://safety.transportation.org.

1   EMS System Team Members
2   Important Developments in EMS
3   Birmingham Regional Emergency Medical Services System (BREMSS)
4   Michigan Upper Peninsula (UP) Experience
5   Texas EMS and Trauma Care Systems Regional Advisory Councils (RACs)
6   Crash Outcome Data Evaluation Systems (CODES)
7   Safe Communities of Wright County
8   Agencies Using Mobile Data Technologies
9   Advanced Communication Systems
10 EMS Community Planning and Integration Guide
11 An Assessment of the Maine EMS System
12 Iowa EMS Strategic Planning Guide
13 Utility of Technology-Based Instruction for Rural EMS Training
14 Good Samaritan Laws
15 Two-Wheel Trauma Programs
16 Nebraska GPS Demonstration Project
17 Oregon DOT Maintenance Crews Ready for Emergency Response
18 Pennsylvania Turnpike Crews Provide Emergency Response

A   Wisconsin Department of Transportation 2001 Strategic Highway Safety Plan
B   Resources for the Planning and Implementation of Highway Safety Programs
C   South African Road Safety Manual
D   Comments on Problem Definition
E   Issues Associated with Use of Safety Information in Highway Design: Role of Safety in Decision Making
F   Comprehensive Highway Safety Improvement Model
G   Table Relating Candidate Strategies to Safety Data Elements
H   What is a Road Safety Audit?
I   Illustration of Regression to the Mean
J   Fault Tree Analysis
K   Lists of Potential Stakeholders
L   Conducting an Evaluation
M   Designs for a Program Evaluation
N   Joint Crash Reduction Programme: Outcome Monitoring
O   Estimating the Effectiveness of a Program During the Planning Stages
P   Key Activities for Evaluating Alternative Program
Q   Definitions of Cost-Benefit and Cost-Effectiveness
R   FHWA Policy on Life Cycle Costing
S   Comparisons of Benefit-Cost and Cost-Effectiveness Analysis
T   Issues in Cost-Benefit and Cost-Effectiveness Analyses
U   Transport Canada Recommended Structure for a Benefit-Cost Analysis Report