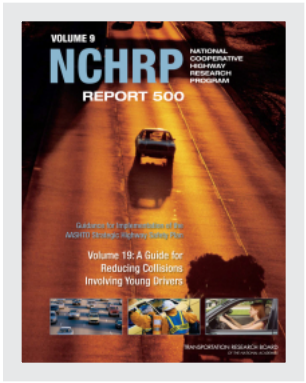

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 500

Guidance for Implementation of the AASHTO Strategic Highway Safety Plan

Volume 19: A Guide for Reducing Collisions Involving Young Drivers

Arthur Goodwin
Robert Foss
Jamie Sohn
University of North Carolina at Chapel Hill
Chapel Hill, NC

Daniel Mayhew
Traffic Injury Research Foundation
Ottawa, Ontario, Canada

Subject Areas
Safety and Human Performance

Research sponsored by the American Association of State Highway and Transportation Officials
in cooperation with the Federal Highway Administration

TRANSPORTATION RESEARCH BOARD

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2007
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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

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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.

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CRP STAFF FOR NCHRP REPORT 500, VOLUME 19

Christopher W. Jenks, *Director, Cooperative Research Programs*
Crawford F. Jencks, *Deputy Director, Cooperative Research Programs*
Charles W. Niessner, *Senior Program Officer*
Eileen P. Delaney, *Director of Publications*
Natassja Linzau, *Editor*

NCHRP PROJECT 17-18(3) PANEL
FIELD OF TRAFFIC—AREA OF SAFETY

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Leanna Depue, *Missouri DOT*
L. Keith Golden, *Georgia DOT*
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Bruce Ibarguen, *Maine DOT*
Marlene Markison, *National Highway Traffic Safety Administration*
Margaret "Meg" Moore, *Texas DOT*
Kathryn R. Swanson, *Minnesota Department of Public Safety, St. Paul, MN*
Rudy Umbs, *FHWA*
Thomas M. Welch, *Iowa DOT*
Ray Krammes, *FHWA Liaison*
Ken Kobetsky, *AASHTO Liaison*
Richard Pain, *TRB Liaison*

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 nineteenth volume of *NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan* provides strategies that can be employed to reduce collisions involving young drivers. 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 nineteenth 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

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This volume of *NCHRP Report 500* was developed under NCHRP Project 17-18(3), the product of which is a series of implementation guides addressing the emphasis areas of AASHTO's Strategic Highway Safety Plan. The project was managed by CH2M HILL, and the co-principal investigators were Kevin Slack of CH2M HILL and Ron Pfefer. Timothy Neuman of CH2M HILL served as the overall project director for the team. Kelly Hardy, also of CH2M HILL, served as a technical specialist on the development of the guides.

The project team was organized around the specialized technical content contained in each guide, and the overall team included nationally recognized experts from many organizations. The following team of experts, selected on the basis of their knowledge of young drivers, served as lead authors for the young drivers guide:

- Arthur Goodwin, Robert Foss, and Jamie Sohn
  University of North Carolina at Chapel Hill
- Daniel Mayhew
  Traffic Injury Research Foundation

Development of the volumes of *NCHRP Report 500* used the resources and expertise of many professionals from around the country and overseas. Through research, workshops, and actual demonstration of the guides by agencies, the resulting documents represent best practices in each emphasis area. The project team is grateful to the following list of people and their agencies for supporting the project by providing material, participating in workshops and meetings, and providing input and comments during the development of the young driver guide:

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Herb Simpson, PhD

Traffic Safety North
James Hedlund, PhD

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SECTION I

Summary

Introduction

In the United States, motor vehicle crashes are the leading cause of death for young persons, and young drivers are greatly overrepresented in motor vehicle crashes. It is widely recognized that most novice drivers do not have sufficient experience to handle the complex task of driving when they are first licensed. Moreover, the late teen years involve continuing developmental changes that characterize the transition from childhood to adulthood. These changes result in a variety of behaviors that are risky when they occur in a motor vehicle. Young drivers are more likely than older adult drivers to engage in risky driving behaviors such as speeding and allowing shorter headways. Although such behaviors are sometimes intentional, young driver crashes generally result from errors in attention, failing to recognize hazards, and driving too fast for conditions. Reducing young driver crashes will involve effectively addressing both the youthful propensity to engage in risky behaviors and lack of experience.

Statement of the Problem

Young drivers are more likely to be involved in a motor vehicle crash than any other age group. This is the case whether crash rates are measured per population, per licensed driver, or per mile traveled. This greater crash involvement also results in additional injury risks because the youngest drivers tend to carry the largest number of passengers, typically other teens. And this group—drivers and passengers alike—is least likely to wear safety belts, thereby foregoing the best protection against injury in the event of a crash. Young drivers are a hazard to other road users, as well. A recent analysis showed that the majority of fatalities in crashes involving 15- to 17-year-old drivers are to persons other than the teen driver, including occupants of other vehicles and nonmotorists.

In 2003, 6,424 teens between the ages of 15 and 20 years old were killed in motor vehicle crashes (CDC, 2006). Although 15- to 20-year-olds represented 8.4 percent of the United States population and 6.3 percent of licensed drivers, they accounted for 13.6 percent of drivers involved in fatal motor vehicle crashes and 18 percent of drivers in police-reported crashes (NHTSA, 2005). The economic cost of crashes involving young drivers amounts to nearly 41 billion dollars a year (NHTSA, 2004).

The greater involvement of younger drivers in crashes results from a variety of factors. Especially during the first few months of driving, inexperience plays a central role in elevated crash rates. Crash rates for newly licensed drivers are highest during the first 6 months of driving alone, during which time they rapidly decrease. This suggests that novices improve their driving relatively quickly. Lack of experience partly coincides with, and is partly responsible for, young drivers' tendency to make poor judgments about hazards in the driving environment and hazardous actions on their own part. Although "risk taking" is often cited as a problem among young drivers, "risky driving" is the more appropriate term.

Programs and Strategies

Based on an extensive review of tried and tested strategies, the following is a summary of strategies most likely to be effective in reducing injuries and fatalities involving young drivers or occupants of motor vehicles driven by young drivers.

Implement or Improve Graduated Driver Licensing Systems

Graduated driver licensing (GDL) systems provide the foundation for protecting young drivers, their passengers, and other road users. Most states have implemented GDL systems, but simply having a GDL system in place is not sufficient. It is important for GDL systems to include the most beneficial risk-reducing restrictions, including the following:

- **Enact a full GDL system.** GDL is designed to provide beginning drivers with substantial driving practice under the safest possible conditions, exposing them to more risky situations (e.g., nighttime driving) only as experience is gained over time.
- **Require at least 6 months of supervised driving for beginners, starting at age 16.** A substantial amount of practice is needed—at least 6 months—before a novice driver begins to develop the savvy required to be a proficient and safe driver. Driving with an adult supervisor enables novice drivers to gain needed "real world" driving experience in a reasonably safe fashion.
- **Implement a nighttime driving restriction that begins at 9 p.m.** A disproportionately high number of young driver fatal crashes occur between the hours of 9 p.m. and 6 a.m. Beginning drivers should not be exposed to the most risky driving conditions.
- **Implement a passenger restriction allowing no young passengers.** Carrying teen passengers greatly increases the risk of a serious crash for young drivers. Passenger restrictions for the first several months of unsupervised driving eliminate the distractions that teen passengers inevitably create.
- **Prohibit cell phone use by drivers with a GDL license.** Recent research suggests that using a cell phone is associated with a fourfold increase in the likelihood of a serious crash among drivers of all ages. Reducing this risk for inexperienced drivers is an appropriate goal for a GDL system.

Publicize, Enforce, and Adjudicate Laws Pertaining to Young Drivers

Some laws pertain specifically to young drivers. Other laws that govern all drivers are particularly important for young drivers. Enhanced publicity, enforcement, and adjudication of these laws, including the following measures, will benefit young drivers:

- **Publicize and enforce GDL restrictions.** To the extent that teens do not comply with protective restrictions under GDL systems, the safety benefits of GDL will be reduced.
- **Publicize and enforce laws pertaining to underage drinking and driving.** Both minimum drinking age laws and "zero tolerance" laws have proven effective in reducing alcohol-related crashes and fatalities involving young drivers.

- **Publicize and enforce safety belt laws.** Safety belt use is lower among young drivers than among adult drivers. Well-publicized enforcement programs and primary safety belt laws have increased belt usage for all drivers, including teen drivers.

Assist Parents in Managing Their Teens' Driving

Parents are inescapably involved in the licensing process of their children, even though they may not recognize the extent of their potential influence. Efforts to assist parents in this role, including the following, can benefit teen drivers:

- **Facilitate parental supervision of learners.** More effective supervision of teen drivers holds substantial promise for further reducing young driver crashes. Simply distributing educational/advisory materials to parents is insufficient. Persuasive techniques that encourage parents to make use of materials and guidance are needed.
- **Facilitate parental management of intermediate drivers.** Teen drivers experience a dramatic increase in crashes when they first begin driving alone. Parent-teen driving agreements and new technologies for monitoring teen drivers have the potential to reduce young driver crashes during this high-risk period.
- **Encourage selection of safer vehicles for young drivers.** Teens often drive vehicles that are less likely to have important safety features. A program that encourages the greatest possible use of safer vehicles by young drivers holds substantial promise for reducing deaths and injuries among teen drivers and their passengers.

Improve Young Driver Training

Although there is no evidence that formal driver education classes are effective in reducing subsequent crash rates among novice drivers, there are a number of promising improvements that can be made in the training of young drivers administered by states:

- **Improve content and delivery of driver education/training.** The model followed by current driver education programs in the United States was developed in the late 1940s. There is widespread belief that both what is taught and how it is taught can be improved significantly, with the promise that young driver crashes can be reduced as the result. Doing so will require a substantially more ambitious effort than simply adding content to the current curriculum.

Employ School-Based Strategies

Nearly all beginning drivers are in high school. This affords an opportunity to adopt strategies to reduce young driver crashes by implementing policies that take advantage of this natural grouping in both space and time to alter that environment:

- **Eliminate early high school start times.** Recent developments in understanding human sleep needs indicate that teenagers need to be asleep in the early morning hours. As a result, school systems in the United States have begun to move school start times back to 8:30 or later. This promises to reduce young driver crashes.
- **Review transportation plans for new/expanded high school sites.** When new schools are built, transportation plans should take into account that there will be a high concentration of inexperienced teens driving in the vicinity of the high school.

SECTION II

Introduction

In the United States, motor vehicle crashes are the leading cause of death for young persons, and young drivers are greatly overrepresented in motor vehicle crashes. Whereas drivers 15–20 years old constitute just over 6.3 percent of the licensed driving population, they represent 13.6 percent of all drivers in fatal crashes (NHTSA, 2005). It is widely recognized that most novice drivers do not have sufficient training or experience to handle the complex task of driving when they are first licensed. Moreover, the late teen years involve continuing developmental changes that characterize the transition from childhood to adulthood. These changes result in a variety of behaviors that are risky when they occur in a motor vehicle.

Despite dramatic engineering improvements in the safety of roadways and motor vehicles, as well as substantial behavioral improvement among drivers (e.g., increases in safety belt use and decreases in alcohol-impaired driving), fatal crash rates per licensed driver increased substantially among 16-year-olds from 1976 to 1996 (IIHS, 1998). During that same period, fatality rates among all other age groups declined. Although fatal crash rates declined for 17- to 19-year-olds, these decreases were less than those of the general driving population. The situation with young drivers can best be summed up as one where individuals begin driving with (1) insufficient savvy to recognize and avoid dangerous situations and behaviors and (2) inadequate driving experience to recover safely from the potentially crash-producing situations in which they are more likely to find themselves. Young drivers are more likely than adult drivers to engage in risky driving behaviors, such as speeding and allowing shorter headways (Simons-Morton, Lerner and Singer, 2005). Although such behaviors are sometimes intentional, young driver crashes generally result from errors in attention, failing to recognize hazards, and driving too fast for conditions (McKnight and McKnight, 2003). Reducing young driver crashes will involve effectively addressing both the youthful propensity to engage in risky behaviors and the lack of experience. The latter involves cognitive/judgmental development, not merely the simple physical skills involved in driving.

Addressing young driver crashes is a particularly complex issue because the factors that lead to crashes among 16- and 17-year-olds are quite different from those that contribute to crashes of 18- and 19-year-olds. Indeed, at every age, the relative contributions of inexperience, impulsiveness, distractibility, poor judgment, alcohol use, speeding, and lack of safety belt use change. Decreasing young driver crashes will require not only reducing the factors that contribute to crashes for all drivers, but also addressing the inexperience and the social, emotional, and biological development that characterize young drivers.

SECTION III

Type of Problem Being Addressed

Young Driver Crashes

General Description of the Problem

Young drivers are more likely to be involved in a motor vehicle crash than any other age group (Williams, 2003). This is the case whether crashes are measured per population, per licensed driver, or per mile traveled. This greater crash involvement also results in additional injury risks because the youngest drivers tend to carry the largest number of passengers, typically other teens. And this group—drivers and passengers alike—is least likely to wear safety belts, thereby foregoing the best protection against injury in the event of a crash (Fell et al., 2005). Young drivers are a hazard to other road users, as well. A recent analysis showed that the majority of fatalities in crashes involving 15- to 17-year-old drivers are to persons other than the teen driver, including occupants of other vehicles and nonmotorists (American Automobile Association, 2006).

As a consequence of these factors, along with the fact that young people are infrequently affected by fatal diseases, motor vehicle crashes are by far the leading cause of death among teens in the United States, as shown in Exhibit III-1.

In 2003, 6,424 teens between the ages of 15 and 20 were killed in motor vehicle crashes (CDC, 2006). Although 15- to 20-year-olds represented 8.4 percent of the U.S. population and 6.3 percent of licensed drivers, they accounted for 13.6 percent of drivers involved in fatal motor vehicle crashes and 18 percent of drivers in police-reported crashes (NHTSA, 2005). The economic cost of crashes involving young drivers amounts to nearly 41 billion dollars a year (NHTSA, 2004).

The greater involvement of younger drivers in crashes results from a variety of factors. Especially during the first few months of driving, inexperience plays a central role in elevated

EXHIBIT III-1
Cause of Death Among Persons Ages 16–20 in the United States
(U.S. Centers for Disease Control, 2006)

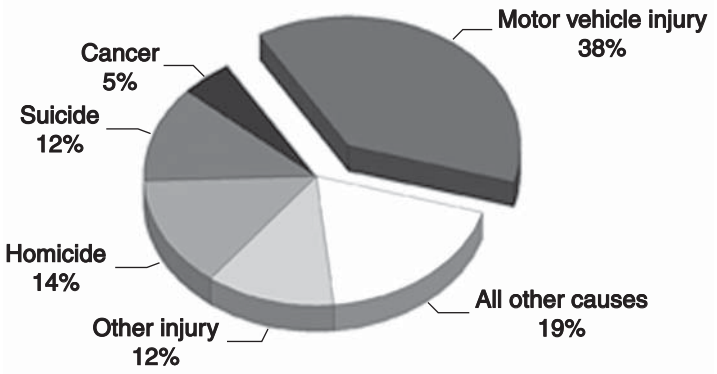
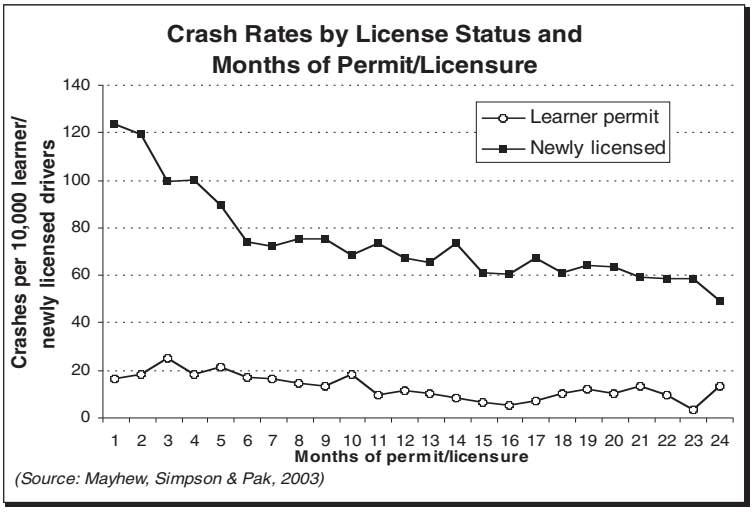


EXHIBIT III-2
Crash Rates by License Status and Months of Permit/Licensure
(Mayhew, Simpson and Pak, 2003)



crash rates. As shown in Exhibit III-2, crash rates for newly licensed drivers are highest during the first 6 months of driving, during which time they rapidly decrease. This suggests that individuals improve their driving relatively quickly. Crash rates for newly licensed drivers are substantially higher than for drivers holding a learner permit, who are only allowed to drive with an adult in the vehicle—very few learners crash while driving with a supervisor.

This lack of experience partly coincides with, and is partly responsible for, young drivers' tendency to make poor judgments about hazards in the driving environment and hazardous actions on their own part. Although "risk taking" is often cited as a problem among young drivers, "risky driving" is the more appropriate term. Evidence suggests that deliberate risky actions account for only a small proportion of crashes (McKnight and McKnight, 2003), although they play a somewhat larger role in fatal crashes. Most crashes among the youngest drivers result from lack of awareness about what is risky, and many of the unquestionably risky actions that young drivers engage in (e.g., speeding and following too closely) result from motivations other than an explicit desire to drive in a risky manner.

Recently, attention has focused on the possible role of brain development in young driver behavior. Research suggests that the part of the brain responsible for decision making and impulse control does not fully mature until the mid 20s (Giedd, 2004). Although it is currently unknown how brain development may affect the driving behavior of young drivers, researchers are using brain imaging techniques such as magnetic resonance imaging (MRI) to study teenagers' brains while they perform simulated driving tasks. These studies may reveal whether teenagers are cognitively able to perceive risks in the same manner as adult drivers.

Specific Attributes of the Problem

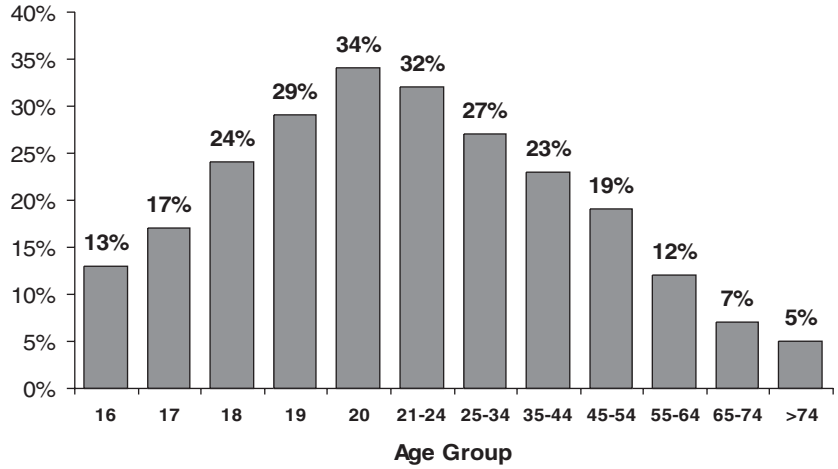
When considering strategies to reduce crashes, perhaps the most important feature of young driver crashes to consider is the substantial variation in the nature and extent of this problem within a small age range. The highest crash risk per trip, or per mile driven, is

found among the youngest drivers—16-year-olds (Williams, 2003). Crash risk per mile driven declines sharply among 17-year-old drivers and drops again for 18-year-olds, although crash rates remain substantially higher than among the general driving population. The substantial differences represent a combination of factors that change rapidly among young drivers. The youngest drivers are the least experienced and the most prone to errors resulting from poor judgment; they are also the least likely to drive at all and they drive less, yet they are also more likely to carry passengers. Sixteen- and 17-year-old drivers generally live with parents and other adults and have the protections that come with this living situation. By contrast, drivers 18 and older are more likely to live outside the family home. This results in them driving more and having fewer protective constraints on their time and driving. Their crash rates per mile continue downward due to increasing experience, but their crash numbers increase as a result of greater exposure and an increase in dangerous behaviors, of which driving after drinking is perhaps the most obvious example.

Alcohol

One clear example of how the changing developmental stage, social milieu, and living situation contribute to increased crash risks as a teen ages is the situation with alcohol use. Alcohol-involved crashes increase from relatively low rates among 16-year-old drivers to a peak among drivers ages 20 to 24, as shown in Exhibit III-3. Although alcohol-involved crashes remain high among drivers into their mid-30s, impaired driving declines each year as individuals take on more stable jobs, marry, and begin to have children—all of which entail responsibilities that conflict with a carefree lifestyle that is associated with excessive drinking.

EXHIBIT III-3
Percentage of Drivers Involved in Fatal Crashes Who Had a Blood Alcohol Content (BAC) of 0.08 Percent or Higher by Age, 2004 (NHTSA, 2005)



Young Passengers

Young drivers—especially 16- and 17-year-olds—are responsible for a larger number of passenger injuries and fatalities per crash than more experienced drivers. In crashes involving 16- and 17-year-old drivers, more than one-half of all fatalities occur when passengers younger than 20 are present and there is no adult in the vehicle (Williams, 2003). This results from both

their greater propensity to transport several passengers and the increased likelihood of a crash that multiple passengers create. Teen passengers can be distracting to a beginning driver and may encourage the driver to take risks. One observational study of approximately 500 teen drivers found that teens drove faster and allowed shorter headways than adult drivers, especially when male teen passengers were present (Simons-Morton et al., 2005). In addition to the risks created for themselves and their passengers, young drivers also constitute a threat to other road users. One-quarter (24.2 percent) of persons killed in crashes involving 15- to 17-year-old drivers are occupants of a vehicle other than the teen's, and another 7.5 percent are nonmotorists (e.g., a bicyclist or pedestrian) (American Automobile Association, 2006).

Nighttime Driving

Nighttime driving is also associated with increased risk of serious crashes for young drivers. Among 16-year-old drivers, the risk of a fatal crash is about three times higher after 9 p.m. than during the daytime (Williams, 2003). Not all nighttime trips are high risk. Driving to and from work, for example, probably entails little risk for young drivers. However, recreational driving, which typically involves young passengers, is a substantially different—and more risky—undertaking.

Although nighttime driving can be risky, most teen driver crashes (and fatal crashes) occur during the daytime, especially during high-exposure hours just before and after school (7–8 a.m. and 3–4 p.m.). Each year, approximately 450 teens are killed and 78,000 injured in crashes during normal school travel hours (Transportation Research Board, 2002).

Drowsy Driving

Fatigue can play a role in early morning crashes. Recent research on human sleep needs indicates that because of a biologically based sleep phase shift, teens begin to fall asleep later. Consequently, in order to obtain sufficient rest, they need to be asleep during the early morning (e.g., 6 a.m.) (Jenni et al., 2005; National Sleep Foundation, 2000). Later school start times are associated with fewer young driver crashes and improvements in academic performance and behavior (Danner, 2002; National Sleep Foundation, 2000)

Graduated Driver Licensing

Teenagers need driving experience in order to become proficient, "savvy" drivers, and therefore reasonably safe drivers. Yet the process of obtaining experience initially exposes them to great risk because of their lack of experience. Graduated driver licensing (GDL) systems address this seeming paradox in two ways. First, GDL systems have an extended learner stage, often 6 months or more, which allows beginning drivers to gain experience while driving under supervision. As shown in Exhibit III-2 above, crash rates are extremely low during the learner stage, when an adult supervisor is present. Second, GDL systems restrict newly licensed drivers from driving unsupervised in high-risk conditions, such as at nighttime or with teenage passengers.

The concept of graduated licensing has been around for several decades (Waller, 2003). Although Maryland implemented an early version of a GDL program in 1979, the "modern era" of graduated licensing in the United States began in 1997 with the introduction of full three-stage licensing systems in Georgia, Michigan and North Carolina. Since that time,

most states have implemented a three-tiered licensing system, although the requirements and restrictions vary greatly from state to state. GDL has been highly effective in reducing crashes and fatalities among young drivers. Fatal crashes among 16-year-old drivers in the United States have decreased from a high of 31 per 100,000 population in 1995 to 23 in 2003 (NHTSA, 2005). Although encouraging, it appears the main reason for this decline is that fewer teenagers are obtaining a license while they are 16 (McKnight et al., 2002). That is, it appears that reductions in crashes and fatalities among young drivers are primarily due to decreased exposure rather than improvements in young driver behavior. There is some evidence, however, that young drivers who have been through a GDL program with a lengthy learner period exhibit lower crash rates once they begin driving without an adult supervisor (Mayhew et al., 2003).

Although young driver crashes and fatalities have decreased in recent years, young driver crash rates continue to exceed those of adult drivers. Thus, there is still a great deal of work to be done in improving young driver safety. It would be unrealistic to expect that GDL can accomplish this alone (Mayhew et al., 2006). In general, the reasons for young driver crashes are more complex than those for experienced drivers, rendering their amelioration more difficult. In addition to the factors that contribute to crashes for all drivers, there are issues of inexperience as well as matters of social, emotional, and biological development that uniquely affect young drivers.

SECTION IV

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 this 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

		Relative Cost to Implement and Operate			
Timeframe for Implementation	**Strategy**	**Low**	**Moderate**	**Moderate to High**	**High**
Short (1 year)	1.1 B1—Publicize and enforce GDL restrictions (E)		✔		
	1.1 B2—Publicize and enforce laws pertaining to underage drinking and driving (P)			✔	
	1.1 B3—Publicize and enforce safety belt laws (P)		✔		
	1.1 E2—Review transportation plans for new/expanded high school sites (E)	✔			
Intermediate (1–2 years)	1.1 A1—Enact a GDL system (P)	✔			
	1.1 A2—Require at least 6 months of supervised driving for beginners starting at age 16 (P)	✔			
	1.1 A3—Implement a nighttime driving restriction that begins at 9 p.m. (P)	✔			
	1.1 A4—Implement a passenger restriction allowing no young passengers (T)	✔			
	1.1 A5—Prohibit cell phone use by drivers with a GDL license (T)	✔			
	1.1 C3—Encourage selection of safer vehicles for young drivers (T)	✔			
	1.1 E1—Eliminate early high school start times (i.e., before 8:30 a.m.) (T)		✔		

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

		Relative Cost to Implement and Operate			
Timeframe for Implementation	**Strategy**	**Low**	**Moderate**	**Moderate to High**	**High**
Long (>2 years)	1.1 C1—Facilitate parental supervision of learners (T)			✔	
	1.1 C2—Facilitate parental management of intermediate drivers (E)		✔		
	1.1 D1—Improve content and delivery of driver education/training (E)			✔	

Note: P = Proven, T = Tried, and E = Experimental. See further explanation in the “Types of Strategies” subsection of Section V.

SECTION V

Description of Strategies

Objectives

This section begins by focusing on the single most important approach for reducing young driver crashes: implementing or improving graduated driver licensing (GDL) systems. It provides recommendations for enforcing GDL and other key laws pertaining to young drivers. It then describes the need to help parents play a more effective role during the licensing process. Next, it suggests strategies for improving young driver training. Finally, it suggests two strategies using engineering and policy approaches that take advantage of the fact that young drivers are clustered in high school settings. The five general objectives of the strategies are to:

- Implement or improve GDL systems;
- Publicize, enforce, and adjudicate laws pertaining to young drivers;
- Assist parents/adults in managing their teens' driving;
- Improve young driver training; and
- Employ school-based strategies.

Strategies

Exhibit V-1 shows the objectives and strategies to reduce young driver crashes.

EXHIBIT V-1
Objectives and Strategies to Reduce Young Driver Crashes

Objectives	Strategies
1.1 A—Implement or improve GDL systems	1.1 A1—Enact a graduated licensing system (P)
	1.1 A2—Require at least 6 months of supervised driving for beginners starting at age 16 (P)
	1.1 A3—Implement a nighttime driving restriction that begins at 9 p.m. (P)
	1.1 A4—Implement a passenger restriction allowing no young passengers (T)
	1.1 A5—Prohibit cell phone use by drivers with a GDL license (T)
1.1 B—Publicize, enforce, and adjudicate laws pertaining to young drivers	1.1 B1—Publicize and enforce GDL restrictions (E)
	1.1 B2—Publicize and enforce laws pertaining to underage drinking and driving (P)
	1.1 B3—Publicize and enforce safety belt laws (P)

EXHIBIT V-1 (Continued)
Objectives and Strategies to Reduce Young Driver Crashes

Objectives	Strategies
1.1 C—Assist parents in managing their teens' driving	1.1 C1—Facilitate parental supervision of learners (T)
	1.1 C2—Facilitate parental management of intermediate drivers (E)
	1.1 C3—Encourage selection of safer vehicles for young drivers (E)
1.1 D—Improve young driver training	1.1 D1—Improve content and delivery of driver education/training (E)
1.1 E—Employ school-based strategies	1.1 E1—Eliminate early high school start times (i.e., before 8:30 a.m.) (T)
	1.1 E2—Review transportation plans for new/expanded high school sites (E)

Note: P = Proven, T = Tried, and E = Experimental. See further explanation below.

Types of Strategies

The strategies in this guide were identified from a number of sources, including the traffic safety literature, internationally recognized experts in young driver research, 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 have been subjected to well-designed evaluations to demonstrate their effectiveness; others have not yet been adequately evaluated.

Because of the widely varying experience with these strategies, as well as of the range of knowledge about their effectiveness, the reader should exercise caution before implementing a particular strategy. To help the reader, the strategies have been classified into three types, each identified by a letter:

- **Proven (P)**—Strategies that have been used in one or more locations, and for which properly designed evaluations demonstrate their effectiveness. 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 a particular situation.
- **Tried (T)**—Strategies that have been implemented in a number of locations and that may even be accepted as standards or standard approaches, but for which careful evaluations have not been found. These strategies—although in frequent 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 will not be a negative impact on safety and will likely be a safety benefit. It is intended that, as implementation of these strategies continues under the AASHTO Strategic Highway Safety Plan initiative, appropriate evaluations will be conducted. Resulting information on their effectiveness can then be used to provide better estimating power for the user, and the strategy can then be upgraded to a "proven" (P) one.
- **Experimental (E)**—Strategies that have been suggested and that have been 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 to be inappropriate or not feasible. When they are considered, their implementation should initially be in the form of a well-designed pilot study with a properly designed evaluation. Only after careful evaluation shows the strategy to be effective should broader implementation be considered. As the findings from such pilot tests are accumulated, the aggregate experience can be used to further detail the attributes of this type of strategy, with the hope that it can be upgraded to a "proven" (P) one.

Explanation of Objectives and Strategies

The strategies in this guide were identified using a two-step process. Potentially useful approaches were first identified through an extensive review of the research literature on programs and policies to reduce young driver crashes. The most promising approaches were then selected and clarified in consultation with a group of experts on young drivers. This group was composed of experienced researchers and state officials with responsibility for young driver programs. The strategies presented here are considered to be the most promising based on either the results from well-designed evaluation studies or the opinion of top experts in the field. Although these strategies often require state-level action, several can also be adapted and productively used in individual communities.

Implement or Improve GDL Systems

GDL systems provide the foundation for protecting young drivers, their passengers, and other road users. Most states have implemented GDL systems, although the specific provisions of GDL vary greatly from state to state, and many are insufficient to provide the needed protection for young drivers as they develop from complete novice to moderately experienced driver. A growing body of evidence suggests that GDL systems are highly effective in reducing young driver crashes and the resulting injuries and fatalities. Simply having a GDL system in place, however, is not sufficient. It is important for GDL systems to include the most beneficial risk-reducing restrictions. Several states implemented GDL systems before the importance of certain restrictions was fully understood (e.g., limits on transporting teen passengers). Most states currently have some, but not all, of the key GDL elements described in this guide. In addition, several states' existing restrictions can be improved with modest revisions to bring them in line with established principles for reducing young driver crashes.

- **Enact a GDL system.** GDL is designed to provide beginning drivers with substantial driving practice under the safest possible conditions, exposing them to more risky situations (e.g., nighttime driving) only as experience is gained over time. Reductions of 25–35 percent in crash rates of 16-year-old drivers and 15–20 percent in crash rates of 17-year-old drivers can be expected following implementation of a GDL system that has appropriate restrictions.
- **Require at least 6 months of supervised driving for beginners, starting at age 16.** Substantial amounts of practice are needed—at least 6 months or more—before a novice driver begins to develop the savvy required to be a proficient and safe driver. Driving with an adult supervisor enables novice drivers to gain needed "real world" driving experience in a reasonably safe fashion.
- **Implement a nighttime driving restriction that begins at 9 p.m.** A disproportionately high number of young driver fatal crashes occur between the hours of 9 p.m. and 6 a.m.

Many states, however, have nighttime restrictions beginning at midnight or later. This is too late to affect the majority of nighttime crashes. Nighttime driving restrictions that begin at 9 p.m. are needed.

- **Implement a passenger restriction allowing no young passengers.** Carrying teen passengers greatly increases the risk of a serious crash for young drivers. Passenger restrictions eliminate the distractions that teen passengers inevitably create. An additional benefit of a passenger restriction is that it reduces the number of occupants exposed to injury in the event of a crash.
- **Prohibit cell phone use by drivers with a GDL license.** Recent research suggests that using a cell phone is associated with a fourfold increase in the likelihood of a serious crash among drivers of all ages. Cell phones can be both physically and cognitively distracting, especially for young drivers. A growing number of states have prohibited cell phone use by drivers with a GDL license. This restriction should apply to both hands-free and handheld phones.

Publicize, Enforce, and Adjudicate Laws Pertaining to Young Drivers

Some laws pertain specifically to young drivers, such as "zero tolerance" for driving after drinking and laws governing novice driver licenses. To ensure their effectiveness, these laws must be adequately enforced. Other laws that govern all drivers are particularly important for young drivers because of their lower inclination to comply (e.g., safety belt and speed laws). Accordingly, enhanced enforcement of these laws will benefit young drivers more than older, more experienced drivers, though the latter will also likely benefit.

- **Publicize and enforce GDL restrictions.** To the extent that teens do not comply with protective restrictions under GDL systems, the safety benefits of GDL will be reduced. Compliance with restrictions can be encouraged through stepped-up enforcement efforts such as checkpoints and nighttime saturation patrols coupled with publicity to raise awareness for the enforcement.
- **Publicize and enforce laws pertaining to underage drinking and driving.** Although young drivers are less likely than persons older than 21 to drive after drinking, those who do are more likely to be involved in a serious crash. Both minimum drinking age laws and "zero tolerance" laws have proven effective in reducing alcohol-related crashes and fatalities involving young drivers.
- **Publicize and enforce safety belt laws.** Safety belt usage is lower among young drivers than among adult drivers. Because teenage drivers have a substantially higher crash risk than adult drivers, failure to wear safety belts makes them especially vulnerable to injury or death. Well-publicized enforcement programs and primary safety belt laws have increased belt usage for all drivers, including teen drivers. As part of their GDL systems, states can also include a belt use requirement for all occupants riding with a young driver.

Assist Parents/Adults in Managing Their Teens' Driving

Parents are inescapably involved in the licensing process of their children, even though they may not recognize the extent of their potential influence. They supervise their teens' early driving experience, they determine the timing of licensure, they govern access to (and choice of) vehicles, and they may impose restrictions on driving privileges. In addition, they

provide a highly salient model of driving behavior, whether consciously or not, that will affect their children's driving.

- **Facilitate parental supervision of learners.** Although more effective supervision of teen drivers holds substantial promise for further reducing young driver crashes, studies show that simply distributing educational/advisory materials to parents does not appear to influence their behavior as supervisors. More persuasive techniques are needed to encourage parents to use the materials and guidance that are available to them.
- **Facilitate parental management of intermediate drivers.** Teen drivers experience a dramatic increase in crashes when they first begin driving alone. There are many ways in which parents can manage their teen's driving in order to reduce this risk. Parent-teen driving agreements and new technologies for monitoring teen drivers have the potential to reduce young driver crashes during this high-risk period.
- **Encourage selection of safer vehicles for young drivers.** Teens often drive vehicles that are relatively old and small, which are less likely to have important safety features such as front and side airbags. Vehicles such as sport utility vehicles (SUVs), pickups, and motorcycles can also be dangerous for beginning drivers. A program that encourages the greatest possible use of safer vehicles by young drivers holds substantial promise for reducing deaths and injuries among teen drivers and their passengers.

The Insurance Institute for Highway Safety provides additional information to help parents and adults improve their teens' driving (http://www.iihs.org/research/topics/teenagers.html).

Improve Young Driver Training

Although there is no evidence indicating that formal driver education classes are effective in reducing subsequent crash rates among young drivers, a number of promising improvements can be made in the training of young drivers administered by states. These improvements take into account recent experimental research findings on the factors that contribute to young driver crashes and take advantage of the ability to expose young drivers to real-world conditions using computerized simulation. Following congressional requirements, in the next few years the National Highway Traffic Safety Administration (NHTSA) is expected to provide recommendations for a standard, more promising approach to driver training incorporating the latest information on young driver behaviors and crash risks as well as learning styles of teenagers. At that time, more detailed guidance should be available for states.

- **Improve content and delivery of driver education/training.** The model followed by current driver education programs in the United States was developed in the late 1940s. There is widespread belief that both what is taught and how it is taught can be improved significantly, with the promise that young driver crashes can be reduced as the result. Doing so will require a substantially more ambitious effort than simply adding content to the current curriculum.

Employ School-Based Strategies

Nearly all beginning drivers are in high school. This affords an opportunity to adopt strategies to reduce young driver crashes by implementing policies that take advantage of this natural grouping in both space and time to alter that environment.

- **Eliminate early high school start times (i.e., before 8:30 a.m.).** Recent developments in understanding human sleep needs indicate that teenagers need more sleep than either younger children or adults, and they need to be asleep in the early morning hours. As a result, school systems in the United States have begun to reverse the decades-long trend toward earlier high school start times. Preliminary studies suggest that moving start times back to 8:30 a.m. or later results in reductions in young driver crashes as well as improvements in academic performance and behavior.
- **Review transportation plans for new/expanded high school sites.** When new schools are built—or existing schools expanded—there is an opportunity for state and local transportation agencies to become involved as transportation plans are developed. Although the focus of such plans is to ensure that road users can get into and out of the school efficiently and safely, it is important to take into account that there will be a high concentration of inexperienced teens driving in the vicinity of the high school. Formal agreements need to be established between DOTs and public school systems to ensure DOT involvement in school transportation plans.

Related Strategies for Creating a Truly Comprehensive Approach

The strategies described above directly address driving by young and inexperienced drivers. Other, more general strategies also should be included in a comprehensive approach:

- **Public Information and Education (PI&E) Programs—**Many highway safety programs work hand in hand with a properly designed campaign to communicate effectively with the target audience. Communication campaigns implemented in conjunction with programs focusing on young drivers may add to the safety benefit. The communication needs for each strategy are identified in the strategy descriptions.
- **Strategies to Improve the Safety Management System—**Effective management of the highway safety system is fundamental to improving traffic safety. A sound organizational structure and an effective decision support system, as well as a set of appropriate laws and policies to monitor, control, direct, and administer a comprehensive approach to highway safety are all necessary. It is important that a comprehensive program not be limited to one jurisdiction, such as a state DOT. Other agencies often oversee an important part of the safety system, and they may know, better than others, about the most important problems. As additional guides are completed for the AASHTO Strategic Highway Safety Plan, they may address the details regarding the design and implementation of strategies for safety management systems.
- **Strategies to Improve Emergency Medical and Trauma System Services—**Treatment of injured persons at crash sites can have a significant effect on injury severity and the duration of needed treatment. Thus, a basic part of a highway safety infrastructure is a comprehensive emergency care program. Although emergency services are often thought of as simply support services, they can be critical to the success of a comprehensive highway safety program. Therefore, an effort should be made to determine if there are improvements that can be made to this aspect of the system, especially for programs that are focused upon location-specific (e.g., corridors)

or area-specific (e.g., rural areas) issues. *NCHRP Report 500, Volume 15: A Guide for Enhancing Rural Emergency Medical Services*, covers one specific aspect of this area.

- **Strategies That Are Detailed in Other Emphasis Area Guides—**Programs to improve young driver safety should also consider applicable strategies covered in the following volumes of *NCHRP Report 500*:

  – *Volume 4: A Guide for Addressing Head-On Collisions*
  – *Volume 7: A Guide for Reducing Collisions on Horizontal Curves*
  – *A Guide for Motorcyclists* (to be published)
  – *Volume 10: A Guide for Reducing Collisions Involving Pedestrians*
  – *Volume 6: A Guide for Addressing Run-Off-Road Collisions*
  – *Volume 15: A Guide for Enhancing Rural Emergency Medical Services*
  – *Volume 11: A Guide for Increasing Seatbelt Use*
  – *Volume 2: A Guide for Addressing Collisions Involving Unlicensed Drivers and Drivers with Suspended or Revoked Licenses*

All volumes in the *NCHRP Report 500* series can be viewed or purchased online at http://trb.org/news/blurb_detail.asp?id=1645. Agencies dealing with safety issues related to younger drivers at the state and local levels should integrate information from this volume, as appropriate, into their existing plans and programs, including in particular statewide strategic highway safety plans.

Objective 1.1 A—Implement or Improve Graduated Driver Licensing (GDL) Systems

Strategy 1.1 A1—Enact a Graduated Licensing System (P)

General Description

Graduated Driver Licensing (GDL) systems provide the foundation for protecting the safety of young drivers, their passengers and other road users. Although the concept of GDL dates back to the 1970s, GDL was not generally adopted in the United States until the late 1990s. Since that time, most states have implemented GDL systems, although the specific provisions of GDL vary greatly from state to state. No state currently has all of the GDL provisions that are described in this guide.

GDL is designed to provide beginning drivers with substantial amounts of practical driving experience under the safest possible conditions, exposing them to more risky situations (e.g., nighttime driving) only as experience is gained over time. Graduated licensing systems typically involve three stages:

1) *Supervised permit stage.* GDL systems begin with a learner stage of adult-supervised driving lasting 6 months or longer. Novice drivers need substantial driving experience in a wide variety of situations to develop the "savvy" that is needed for safe driving. A considerable amount of time spent driving is required to accomplish this.

2) *Intermediate (provisional) stage*. This stage allows the novice to drive without an adult in the vehicle while restricting driving to less risky conditions. It is important that young drivers avoid situations that can be dangerous for novices, such as driving late at nighttime or with

multiple teenage passengers. In addition, potential distractions to the driver, such as passengers and cell phones, should be minimized.

3) *Full provisional stage.* Restrictions are usually lifted for novice drivers in this stage, although special safety belt requirements or other provisions may apply. This stage typically lasts until age 18, at which point the young driver becomes eligible for an adult license.

Another key feature of comprehensive GDL systems is that novices are only allowed to earn unrestricted driving privileges if they demonstrate that they can and will drive responsibly. For example, Iowa's GDL system requires teens to avoid traffic violations and at-fault crashes for 6 months before moving to the intermediate stage of licensure; those with an intermediate license must drive for 12 months with no violations or at-fault crashes (or turn age 18) in order to obtain a full license. Requiring novices to maintain a safe driving record rewards individuals for safe driving. It also incorporates the fact that a person's driving record is a far better predictor of future safe driving behavior than any test.

A substantial and growing body of evidence suggests that graduated licensing is highly effective in reducing young driver crashes and the resulting injuries and fatalities. Evaluations from two of the earliest states to implement GDL, Michigan and North Carolina, found decreases of 25 percent and 23 percent, respectively, in crash rates for 16-year-old drivers (Foss et al., 2001; Shope et al., 2001). A number of more recent studies in several other states document similar reductions (Shope, 2007). This decrease was attributed, in large part, to the growth of graduated licensing systems during that period and the resulting decrease in the number of 16-year-olds licensed to drive without protective restrictions.

Surveys show that parental approval of GDL is high (Waller et al., 2000; Williams et al., 1998; Williams et al., 2002). For example, 79 percent of parents in California said they strongly favored GDL, while only 4 percent were neutral or opposed (Williams et al., 2002). Most parents also support extended learner periods, as well as nighttime and passenger driving restrictions. Contrary to common belief, teenagers are also in favor of GDL. A survey of teenagers in North Carolina, for example, found that 80 percent supported GDL (Foss et al., 2002).

EXHIBIT V-2
Strategy Attributes for Enacting a Graduated Licensing System (P)

Technical Attributes	
Target	Novice drivers under the age of 18
Expected Effectiveness	Research indicates that reductions of 25–35% can be expected in crash rates of 16-year-old drivers following implementation of GDL. Reductions of 15–20% in crashes of 17-year-old drivers can also be attained. However, the magnitude of these benefits will depend largely on the particular provisions of a state's GDL system. Those programs that effectively delay the age of full licensure, and which have strong protective restrictions, will achieve greater crash reductions. A national evaluation of GDL can be found here: http://www.nhtsa.dot.gov/people/injury/NewDriver/GDLReport/index.html.
Keys to Success	Even as noted above, several states delay progression through the stages of their GDL system if young drivers are convicted of moving violations, GDL violations or safety belt infractions. In an evaluation of Maryland's initial GDL system, researchers judged that the requirement for 6 months of violation-free driving was primarily responsible for the declines in crashes and violations that resulted from the provisional licensing program (McKnight, Hyle and Albrecht, 1983).

EXHIBIT V-2 (Continued)
Strategy Attributes for Enacting a Graduated Licensing System (P)

Technical Attributes	
Potential Difficulties	In most states, there has been relatively little opposition to GDL legislation. However, legislators representing more rural areas sometimes express concern that GDL places an undue burden on their constituents. In rural areas, teens must travel longer distances to get to work, school, and other activities, and alternative forms of transportation (e.g., mass transit, walking, bicycling) may be impractical or unavailable. However, surveys suggest that parents living in rural areas express the same strong approval of GDL as parents living in urban/suburban areas (Foss, 2001). There a widespread misconception that roads in rural areas, with light traffic, are safer than more congested urban roads. In fact, per unit of travel, rural roads are generally less safe, making GDL even more important for beginning drivers in those areas. Rural roads tend to be less well-maintained, built to lower safety standards, have higher travel speeds, and poorer nighttime lighting. Moreover, in rural areas it takes longer for emergency medical services to be notified and to respond to a crash (Foss, 2001).
Appropriate Measures and Data	Implementing a GDL system should decrease crashes and fatalities for the age group affected (16- to 17-year-olds). Reductions in crashes may not be observed immediately; it may take several years before all new drivers are licensed under the new system. Because of the complex nature of GDL systems and the way in which GDL changes the composition of the young driver population, it is important that special studies using appropriate, sophisticated statistical analyses be conducted to adequately determine the effect of GDL. Simple tracking of crash or injury data can be misleading.
Associated Needs	It is important that a GDL system not contain elements that can undermine its effectiveness. Some jurisdictions have provisions in their GDL systems that explicitly allow beginning drivers to reduce the length of time they must drive under various restrictions by completing some form of driver training. There are no data to suggest that the benefits of bringing drivers along slowly can be achieved by substituting formal driving instruction for time. In fact, program evaluations indicate that individuals who take advantage of the available time discounts by obtaining formal instruction have higher crash rates than drivers who complete the prescribed length of supervised driving. For example, in Ontario, the 12 month supervised driving requirement for learners can be reduced to 8 months by taking a driver education course. Evaluation of the Ontario GDL system found a 44% higher crash rate among those drivers who obtained the time discount (Boase and Tasca, 1998). In addition, some local communities have adopted policies or practices whereby traffic violations are routinely dismissed for teen drivers who provide evidence of having taken a formal traffic safety class. These kinds of practices, although often well-meaning, serve to undercut the integrity of well-designed graduated licensing systems and, as a result, can reduce their safety benefits. Moreover, such policies also suggest to young drivers that laws are not consistently enforced and that stated consequences for committing violations can often be avoided. Finally, given that beginning drivers are highly likely to crash, preventing injury in the event of a crash is particularly important. Safety belt use is a simple and effective way of reducing or preventing injury. Accordingly, states should seriously consider including provisions in their GDL systems requiring that all occupants be properly restrained when the driver has a GDL license. For this to be most effective, violations of this provision should delay the young driver from progressing to the next, less restrictive, licensing level. More information about safety belts and young drivers can be found under Strategy 1.1 B3 of this guide, and also in *NCHRP Report 500, Volume 11: A Guide for Increasing Seatbelt Use*.

EXHIBIT V-2 (Continued)
Strategy Attributes for Enacting a Graduated Licensing System (P)

Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	As noted above, policies regarding prosecution of traffic violations need to be reviewed to ensure that they do not undercut the mechanisms by which GDL produces safety benefits.
Issues Affecting Implementation Time	The main factor affecting implementation time is the need to pass enabling legislation. Once legislation is in place, this strategy can be initiated relatively quickly. However, there is usually a "grandfather" clause in legislation to avoid imposing restrictions on drivers who have begun the licensing process without these conditions. If such a clause is included, the benefits of a new or improved GDL system will be delayed. These delays can extend well beyond the formal "grandfathering" period since the effects of GDL develop gradually over a period of months or years subsequent to its enactment.
Costs Involved	To implement this strategy, computer databases will need to be revised to reflect new license types and the formal linkage between them. These databases need to be sufficiently advanced to allow "real time" tracking of GDL drivers by DMVs, police and other relevant parties. In addition, new licenses will need to be designed to reflect the new license types along with their conditions. Typically, the costs of these tasks are covered by small fees paid by young drivers at the time of licensure.
Training and Other Personnel Needs	Driver license examiners will need training on any changes to the licensing system for new drivers. In addition, training will be needed for police officers, judges and prosecutors to ensure they are familiar with the law. Finally, young drivers and their parents must be informed about the new licensing system, including the specific provisions, exceptions to restrictions, and penalties for violations. This can be achieved through driver education instructors, driver licensing offices, and in the absence of a driver education program, through high schools.
Legislative Needs	Most elements of this strategy require legislative action.

Other Key Attributes
None identified.

Information on Agencies or Organizations Currently Implementing this Strategy

All but a few states currently have implemented some form of GDL. A list of young driver licensing requirements for all 50 states is maintained by the Insurance Institute for Highway Safety. The list can be found here: http://www.iihs.org/laws/state_laws/grad_license.html.

Strategy 1.1 A2—Require at Least 6 Months of Supervised Driving for Beginners Starting at Age 16 (P)

General Description

A primary goal of graduated driver licensing (GDL) is to ensure that teens obtain substantial driving experience in a variety of situations before they begin unsupervised driving. One way to achieve this is by requiring an appropriately lengthy learner period under the first stage of GDL. Driving with an adult supervisor enables novice drivers to gain needed "real world" driving experience in a reasonably safe fashion; research shows that novice drivers rarely crash while they are being supervised by an adult driver (Mayhew and Simpson, 2002;

Williams et al., 1997). Prior to the mid-1990s, many states required beginning teen drivers to have a learner permit for no more than 30 days, while in other states a permit was optional. Being a safe driver requires making continuous informed judgments based on accurate interpretations of numerous, subtle elements of the driving environment. Accordingly, substantial amounts of practice are needed—at least 6 months or more—before a novice driver begins to develop the savvy required to be a proficient and safe driver. As an indication of how long it takes for beginners to develop the judgment and experience needed, a recent study in North Carolina showed that even after teens had held a learner's permit an average of 4 months, and had accumulated roughly 50 hours actual driving practice, most parents were still uncomfortable about their teen's readiness to drive unsupervised in a variety of situations, such as in heavy traffic, in rain, or on a freeway/interstate highway (Goodwin et al., 2006).

To give novice drivers more time to gain experience, Sweden increased its learner's permit stage from 6 months to an optional 18 months, while retaining the licensing age of 18. Teens who took advantage of the extended permit period obtained three times as much driving practice. Following licensure they showed a 40 percent lower crash risk, compared to teens who did not obtain the early permit (Gregerson et al., 2000). Although teens in this study were self-selected, the findings suggest the potentially dramatic benefit of extended practice. In 1997, Connecticut began requiring learners to hold their permit for at least 6 months (4 months for those who completed formal driver education). Fatal/injury crashes decreased by 22 percent among 16-year-old drivers following the change to this longer learner permit period (Ulmer et al., 2001).

To lengthen the permit phase for beginning drivers, some states have lowered the starting age at which permits can be obtained. This has the potential to increase—rather than decrease—the risk of a crash for novice drivers, since it results in more driving at a younger age. At present, the starting age for the learner's stage ranges from 14 to 16 among states that have adopted graduated licensing. The Insurance Institute for Highway Safety and Traffic Injury Research Foundation recommends that states maintain or raise the starting age for learner drivers to 16 (IIHS and TIRF, 2002). This is consistent with the findings from the experimental early licensing program in Sweden.

EXHIBIT V-3
Strategy Attributes for Requiring at Least 6 Months of Supervised Driving for Beginners Starting at Age 16 (P)

Technical Attributes	
Target	Novice drivers under the age of 18
Expected Effectiveness	Available studies suggest that crash rate decreases of 22%–40% are possible with substantially extended learner periods.
Keys to Success	Although research has not yet determined the ideal duration of the learner (supervised driving) stage, the Insurance Institute for Highway Safety and Traffic Injury Research Foundation recommends a minimum of 6 months (IIHS and TIRF, 2002). At least 6 months of supervised driving practice—and probably more—is needed before teens have sufficient experience and driving "savvy" to drive safely without supervision. It is essential that supervision only be conducted by a responsible adult driver who is capable of playing a parental role; siblings and licensed peers are not appropriate supervisors for novice teen drivers. Through the presence of a mature "chaperone," teen

EXHIBIT V-3 (Continued)
Strategy Attributes for Requiring at Least 6 Months of Supervised Driving for Beginners Starting at Age 16 (P)

Technical Attributes	
	driver caution is encouraged and impulsiveness is discouraged. In addition, the supervisor should be required to sit in the front seat adjacent to the driver, with nobody in between so that the steering wheel can be reached in an emergency situation.
Potential Difficulties	In enacting an extended learner stage, legislators are sometimes concerned that parents and teens will not support such a measure. However, several studies have shown that parents and teens approve of longer learner's permits. For example, a recent survey in California found that 95% of parents and 85% of teens favored that state's 6-month holding period for a learner's permit (Williams et al., 2002). In North Carolina, where the permit phase is 12 months, 80% of parents reported that they thought the 12 month requirement was "about right"; an additional 10% said that 12 months was "not long enough" (Foss et al., 2002).
Appropriate Measures and Data	Implementing an extended learner period should decrease crashes and fatalities for the age group affected. However, it may be difficult to determine whether the decrease is the result of safer driving by young persons, or simply the fact that young people are doing less driving. Research clearly shows that young people drive less when they have a permit than a license (Preusser, 1988). Further, the effect of an extended learner period may be difficult to assess because this strategy is often implemented as just one component of a larger GDL system. The proportion of a young age cohort (e.g., 16- and 17-year-olds) that possesses a learner permit rather than a partially or completely unrestricted license is a good proxy measure for the desired outcome of fewer crashes.
Associated Needs	Some states require that parents certify that their teens received a certain amount of driving practice, usually 30 to 50 hours, before they are permitted to obtain an intermediate license. In some states, a certain number of these hours must be accumulated in specific situations (e.g., at nighttime). Although such requirements may encourage some parents to increase the amount of practice they give their teen, there is some concern that this requirement may simply encourage parental "fudging" in reporting their teen's experience. Moreover, there is no research evidence to indicate that 50 hours of practice is sufficient during the learner's phase. One study in Sweden found that teens who had obtained an average of 118 hours of supervised driving had lower crash rates than those who had about 40 hours supervised driving experience (Gregersen, 1997). Not all teens learn to drive at the same pace; a level of practice that may be adequate for one teen may be too little for another. If parents view state requirements as a "gold standard," some teens may receive less practice than needed to become safe drivers. In sum, although it is important that teens obtain as much practice as possible during the learner's phase, there is no research confirming that teens obtain either a sufficient amount, or the mandated amount, of practice in states that require parental certification. For the learner stage to be maximally useful, some indication of adequate performance, rather than simply passing time, accumulating hours or reaching a particular age, should be required for novice drivers to move to the next, less restricted and less protected licensing level. [See Strategy 1.1 A1 of this guide regarding the need for successive licenses to be earned by maintaining a safe driving record.] Although parents support the extended learner stage, it will be important to find ways to assist parents in appropriately supervising novice drivers. See Strategy 1.1 C1 in this guide for more information on this issue.

EXHIBIT V-3 (Continued)
Strategy Attributes for Requiring at Least 6 Months of Supervised Driving for Beginners Starting at Age 16 (P)

Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	Legislators should avoid lowering of the initial learner permit age in legislation to provide for an extended period of supervised driving.
Issues Affecting Implementation Time	The main factor affecting implementation time is the need to pass enabling legislation. Once legislation is in place, this strategy can be implemented relatively quickly by the licensing agency.
Costs Involved	Some re-programming of driver license databases may be required. These costs can be supported by licensing fees.
Training and Other Personnel Needs	Driver licensing examiners will need training on any changes to the licensing system for new drivers. Since most states already require a learner's permit, there should be adequate staff in place to handle permit applications. Parents will need assistance in how to effectively supervise their teen's driving during the learner permit stage (see Strategy 1.1 C1 in this guide).
Legislative Needs	This strategy will require legislative action if not already implemented in a state, or if the current learner's stage is less than 6 months or begins before age 16.

Other Key Attributes
None identified.

Information on Agencies or Organizations Currently Implementing this Strategy

Nearly all states now require a period of supervised driving prior to full licensure. The details of these requirements vary substantially from state to state. A list of young driver licensing requirements for all 50 states is maintained by the Insurance Institute for Highway Safety. The list can be found here: http://www.iihs.org/laws/state_laws/grad_license.html.

Strategy 1.1 A3—Implement a Nighttime Driving Restriction that Begins at 9 p.m. (P)

General Description

The keystone of graduated licensing is the intermediate license, which allows a novice to drive without an adult in the vehicle but restricts driving to less risky conditions. An important component of the intermediate licensing stage is the restriction on nighttime driving. Although only about 15 percent of the miles driven by 16- and 17-year-olds are between 9 p.m. and 6 a.m., more than 40 percent of their fatal crashes take place during these hours (Williams and Preusser, 1997). Nighttime driving is more dangerous for a variety of reasons: driving in the dark is a more difficult task, even for adult drivers; many young drivers have had less experience driving at nighttime; and additional risk factors such as fatigue, alcohol use, and recreational driving involving multiple teen passengers are more common at nighttime. A nighttime driving restriction is not a curfew, it is a restriction only on driving and only for novices during their first few months driving without an adult supervisor.

An evaluation of the initial effects of GDL in two states demonstrates the expected effectiveness of nighttime driving restrictions. In North Carolina, the nighttime restriction begins at 9 p.m. for teens with an intermediate license. After GDL was introduced, crashes between 9 p.m. and 5 a.m. decreased by 43 percent among 16-year-old drivers, whereas daytime crashes decreased by 20 percent (Foss et al., 2001). Michigan's nighttime restriction begins at midnight. Following GDL, there was a 24 percent reduction in 16-year-old driver crashes during the daytime (5 a.m.—8:59 p.m.), a nearly identical 21 percent reduction in crashes during the evening (9 p.m.—11:59 p.m.) and a 53 percent reduction in nighttime crashes (midnight—4:59 a.m.) (Shope et al., 2001). The findings from these two states suggest that (1) young driver crashes can be substantially reduced by introducing a nighttime driving restriction, and (2) declines in crashes correspond closely to the time that the nighttime restriction begins. In both Michigan and North Carolina, not all 16-year-old drivers were covered by the nighttime restrictions, which last only 6 months. In view of this, the overall reduction in crashes of 40 to 50 percent during the restricted hours is impressive and encouraging.

Starting times for nighttime restrictions on intermediate drivers vary substantially from state to state. Midnight is the most common start time, although several states have nighttime restrictions that begin as late as 1 a.m. In the United States, about three-quarters of young driver nighttime crashes occur before midnight as is evident in Exhibit V-4, which shows the hourly distribution of young driver crashes prior to enactment of GDL systems that restricted nighttime driving. Thus, restrictions beginning at midnight or later are too late to affect the majority of nighttime crashes. To effectively achieve the desired protection from high risk driving conditions that GDL is designed to provide for novice drivers, nighttime driving restrictions that begin at 9 p.m. are needed.

EXHIBIT V-4
Distribution of young (16- and 17-year-old) driver nighttime crashes in 1995 (Williams, 2003).

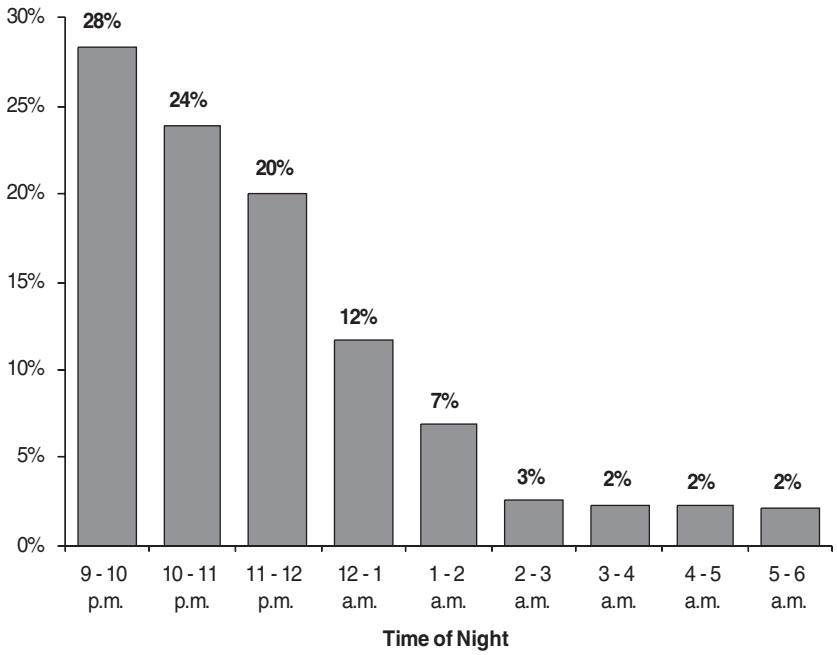


EXHIBIT V-5
Strategy Attributes for Implementing a Nighttime Driving Restriction that Begins at 9 p.m. (P)

Technical Attributes	
Target	Novice drivers under the age of 18
Expected Effectiveness	Based on available evidence, crash reductions of 40 to 50% among the group to which it applies can be expected during the hours covered by a nighttime driving restriction. However, there is no evidence that this principle applies to time periods earlier than 9 p.m. or for durations longer than 6 months. Caution should be exerted in considering extensions beyond those boundaries.
Keys to Success	The key to nighttime driving restrictions is that they begin no later than 9 p.m. Nighttime restrictions beginning at midnight or 1 a.m. can still reduce crashes among young drivers. However, 16- and 17-year-olds do very little driving (and hence, have relatively few crashes) during those hours. In all GDL systems, nighttime driving is permitted with adult supervision, and many states allow one or more trip-specific exemptions to their nighttime driving restriction. For example, young persons may be permitted to drive to or from work, or there may be exemptions for school activities, religious events or volunteer duties. Because some of these situations are relatively uncommon, exemptions of this nature should not greatly increase crash risks for young drivers. The purpose of nighttime restrictions is not to forbid essential driving, but to limit high-risk recreational driving. Exceptions for "school activities," however, can substantially undermine the value of a nighttime restriction since they can be frequent and may well involve exactly the kinds of increased risks that the restriction is designed to reduce (driving in darkness, with the distraction of friends in the vehicle). Unlike work-related driving, a school activity exemption can also present enforcement difficulties, as the veracity of a claimed exception cannot easily be checked by a law enforcement officer. A nighttime restriction should cover the first 6 months of unsupervised driving. If the teen maintains a safe driving record for the full 6 months (i.e., no citations or at-fault crashes) the nighttime restriction can be removed. A longer period than 6 months might provide more protection, but at some point protective restrictions must be removed and it is important that the restrictions be seen as reasonable by teens and parents. Limits that are considered unreasonably long will be disregarded by many. Presently in the United States, only one state has a nighttime restriction lasting longer than 6 months. Recent research in North Carolina suggests that a 6 month, 9 p.m. to 5 a.m. nighttime restriction is considered to be reasonable and is widely respected by parents and teens alike (Goodwin and Foss, 2004).
Potential Difficulties	The main concern with nighttime restrictions is the potential inconvenience they might cause for parents and teens who may need to travel at nighttime. Exceptions for driving to or from work can help address this concern. Surveys show that parents and teens overwhelmingly support nighttime driving restrictions, and a majority prefer restrictions that start before midnight (Ferguson and Williams, 1996; Williams et al., 1998).
Appropriate Measures and Data	Implementing a nighttime restriction should decrease crashes and fatalities among young drivers during the hours that the restriction is in effect. Hence, the number of crashes among the affected age group during restricted hours is a direct measure of the effectiveness of the restriction.
Associated Needs	For this restriction to be most effective, it is important that it be enforced. Parents can ensure their teen (or at least the family car) is home before the nighttime restriction begins (see Strategy 1.1 C2 of this guide). Police officers can also enforce this restriction through routine traffic enforcement (see Strategy 1.1 B1 of this guide).

EXHIBIT V-5 (Continued)
Strategy Attributes for Implementing a Nighttime Driving Restriction that Begins at 9 p.m. (P)

Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	None identified
Issues Affecting Implementation Time	The main factor affecting implementation time is the need to pass enabling legislation. Once legislation is in place, this strategy can be put in place quickly. However, as with most elements of GDL, its effect on crashes will lag the official implementation date.
Costs Involved	There may be some minor costs involved in educating police officers and the general public about a new or changed nighttime driving limit.
Training and Other Personnel Needs	Parents and teens will need to be informed about this restriction. This can be achieved through materials provided at DMV offices, driver education classes, and through schools if there is no state driver education program. Educational efforts must be sustained, because there is a continuously changing cohort of new young drivers. In addition, police will need training about the nighttime restriction and other provisions under their state's GDL system.
Legislative Needs	This strategy will require legislative action to implement a new, or revise an existing, nighttime driving restriction.
Other Key Attributes	
None identified.	

Information on Agencies or Organizations Currently Implementing this Strategy

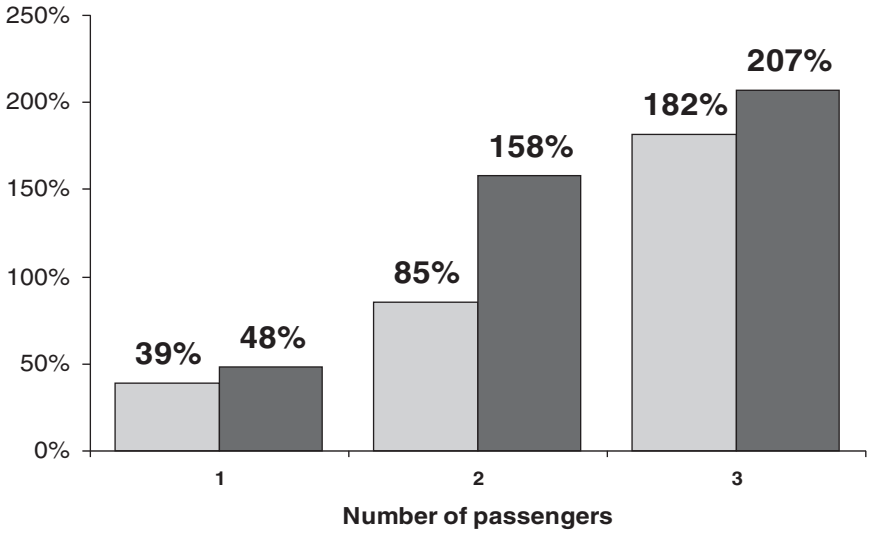
Most states now have a nighttime driving restriction as part of an intermediate licensing stage, though most of them begin too late to provide adequate protection for young beginning drivers. The details of these restrictions vary substantially from state to state. A list of young driver licensing requirements for all 50 states is maintained by the Insurance Institute for Highway Safety. The list can be found here: http://www.iihs.org/laws/state_laws/grad_license.html.

Strategy 1.1 A4—Implement a Teenage Passenger Restriction Allowing No Young Passengers (T)

General Description

In addition to risks of nighttime driving for young drivers, research completed in the past few years has clearly identified another particularly high risk circumstance for young drivers: carrying teenage passengers. The figure below shows the increased likelihood of a young driver being killed in a crash in relation to the number of passengers in the vehicle. A 16-year-old driver, for example, is 85 percent more likely to be killed in a crash if he or she has two passengers; a 17-year-old driver is 158 percent more likely to be killed in a crash while carrying two passengers (Chen et al., 2000). Because of the dramatic increase in the risk of a driver fatality when carrying passengers, many states now include a restriction on carrying young passengers for drivers with an intermediate license.

EXHIBIT V-6
Increased risk of driver death by driver age and number of passengers, United States, 1992 - 1997 (Source: Chen, Baker, Braver and Li, 2000)



The increased risk of a serious crash appears to result from distractions that young passengers inevitably create for novice drivers, who are both more easily distracted and need to concentrate more than experienced drivers on the multiple tasks involved in driving. Passengers may also encourage the driver to take risks that he or she would not ordinarily take when driving alone. A survey of young drivers found that dangerous driving behaviors such as speeding, intentionally skidding, and running a red light were strongly associated with the presence of teen passengers (Farrow, 1987). Distraction and risky behavior can be especially dangerous for inexperienced beginning drivers.

Whereas a nighttime driving restriction protects young drivers from the variety of risks involved in nighttime driving, a passenger restriction should further reduce young driver crashes by reducing the risk that carrying passengers creates during the hours not covered by a nighttime restriction. This is important since many crashes involving young drivers occur during the daytime, particularly during the hours immediately before and after school (Williams, 2003). Additionally, reducing the number of passengers riding with high risk drivers reduces injuries to passengers even when crashes do occur. Thus, a nighttime driving restriction alone is not sufficient to reduce known high risk conditions for young drivers; restrictions on carrying teen passengers are also needed. At present, only 15 U.S. states limit novice drivers to no young passengers (except family members) during the first 3 months of unsupervised driving, but 17 other states allow only one young passenger.

Recent studies in California and North Carolina indicate that passenger restrictions reduce the injury risk resulting from young drivers' high crash propensity. In North Carolina, multi-teen-occupant crashes declined by 30 percent among 16-year-old drivers and by 13 percent among 17-year-old drivers following enactment of a restriction that limited intermediate level drivers to carrying a single young passenger (Foss et al., 2002). In California, the prohibition on carrying any young passengers for the first 6 months of unsupervised driving resulted in a 25 percent decrease in the total number of teenage passengers riding with 16-year-old drivers who were involved in crashes (Cooper, Atkins

and Gillen, 2005). The California passenger restriction also resulted in a 6.4 percent decrease in the proportion of 16- and 17-year-old driver injury crashes involving a young passenger (Masten and Hagge, 2004). To date, no studies have documented a decrease in crashes per se following enactment of a passenger restriction.

EXHIBIT V-7
Strategy Attributes for Implementing a Teenage Passenger Restriction Allowing No Young Passengers (T)

Technical Attributes	
Target	Novice drivers under the age of 18
Expected Effectiveness	Although many studies have shown the sizeable crash reductions that follow implementation of a GDL system, it has been difficult to determine the specific effect of passenger restrictions. This is due, in part, to the fact that passenger restrictions are implemented as just one component of a larger GDL system; they are also more recent than GDL systems. It appears that teens exposed to injury as passengers while riding with young teen drivers may decline 15-20% although the magnitude of the decline will depend on details of the restriction. One study estimated that 83 to 493 lives could be saved annually in the United States if 16- and 17-year-old drivers were not allowed to carry passengers under the age of 20 (Chen et al., 2001). The exact number of lives saved would depend on the degree of compliance with this restriction and whether teen passengers chose to drive themselves or find another means of transportation.
Keys to Success	Some states limit novice drivers to carry one or two young passengers. Although permitting one young passenger has the potential to reduce crashes, carrying *any* young passenger appears to increase the risk of a crash. This suggests that prohibiting all young passengers for a period of time would be the ideal passenger restriction. An additional benefit of the passenger restriction is that it reduces the number of occupants exposed to injury in the event of a crash. Most states exclude young family members from passenger restrictions. Although there are occasions when a young, inexperienced driver may need to transport a sibling, there is no reason to believe that siblings are less likely to create distractions for the driver. Such an exemption also puts more than one child from a single family in a risky situation. This issue should be considered carefully when deciding whether to prohibit young inexperienced drivers from carrying young family members. As with a nighttime restriction, a passenger restriction should cover the first 6 months of unsupervised driving during which the novice driver is most prone to crashing and vulnerable to distractions from passengers. If the teen maintains a clean driving record for the full 6 months (i.e., no violations or at-fault crashes) the restriction should be removed.
Potential Difficulties	Compliance with passenger restrictions is somewhat lower than for nighttime restrictions. Studies from California and New Zealand, both of which allow no teen passengers, have revealed that up to 80% of young drivers acknowledge violating this restriction at least once (Begg et al., 1995; Williams et al., 2002). Although violations are considerably lower in North Carolina where one teen passenger is permitted (Goodwin and Foss, 2004), it is not known whether the reduced protection from allowing one teen passenger is offset by the greater compliance with the restriction. Another concern with passenger restrictions is that they are less enthusiastically endorsed by parents. Nonetheless, approval is well over 50% and support for the restriction grows among parents whose teens have gone through the restriction

EXHIBIT V-7 (Continued)
Strategy Attributes for Implementing a Teenage Passenger Restriction Allowing No Young Passengers (T)

Technical Attributes	
	(Ferguson et al., 2001; Williams et al., 1998). Lack of parental support for restrictions appears to dilute teen compliance with them and compliance appears to decrease over time (Williams et al., 2002). A number of other concerns have been expressed about passenger restrictions. Among these are that passenger restrictions prevent double-dating and the use of designated drivers, they may compromise the safety of young women by requiring them to travel alone, and they could potentially *increase* the total number of teen crashes by forcing more young drivers onto the road. There is no empirical evidence that supports any of these concerns. In fact, one study indicates that the increased risk resulting from more teens driving themselves is outweighed by the dramatically higher crash risk faced by teens who drive with multiple passengers (Chen et al., 2001). Allowing one young passenger, rather than none, may alleviate several of the concerns about passenger restrictions. Currently there is empirical evidence regarding the differential effects of allowing one vs. zero passengers.
Appropriate Measures and Data	Multiple passenger crashes involving teen drivers and passenger injuries in teen driver crashes should both decrease. Crashes among teens with restricted licenses should also decline.
Associated Needs	As with the other restrictions under GDL, it is important that the passenger restriction be actively enforced by parents and police. For more information regarding enforcement, see Strategies 1.1 B1 and 1.1 C2 of this guide.
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	None identified
Issues Affecting Implementation Time	The main factor affecting implementation time is the need to pass enabling legislation. Once legislation is in place, this strategy can be put in place quickly. However, as with most elements of GDL, its effect on crashes will lag the official implementation date.
Costs Involved	There may be some minor costs involved in educating police officers, and the general public about a new or changed passenger restriction.
Training and Other Personnel Needs	Parents and teens will need to be informed about this restriction. This can be achieved through materials provided at DMV offices, driver education, and through schools if there is no state driver education program. Educational efforts must be sustained, because there is a continuously changing cohort of new young drivers. In addition, police will need training about the passenger restriction and other provisions under their state's GDL system.
Legislative Needs	This strategy will require legislative action to implement a passenger restriction, or modify an existing restriction.
Other Key Attributes	
None identified.	

Information on Agencies or Organizations Currently Implementing this Strategy

A list of young driver licensing requirements for all 50 states, including up-to-date information on passenger restrictions, is maintained by the Insurance Institute for Highway Safety. The list can be found here: http://www.iihs.org/laws/state_laws/grad_license.html.

Strategy 1.1 A5—Prohibit Cell Phone Use by Drivers with a GDL License (T)

General Description

In the United States, the use of cell phones while driving is commonplace. One in three drivers reports using a cell phone while driving on at least some trips, and one in four uses a cell phone on at least one-half of all trips (Royal, 2003). Moreover, use of cell phones by drivers is increasing. An observational study of several thousand drivers in 2002 found that 5 percent were talking on a hand held phone at any given time during daylight hours, up from 3 percent in 2000 (Glassbrenner, 2005). Cell phone use is particularly common among young drivers—8 percent of drivers estimated to be 16 to 24 years old were observed talking on a cell phone at any given time in 2002.

Cell phones can be both physically and cognitively distracting for a driver. Experimental studies using driving simulators have shown that cell phone use is associated with delayed reaction times and impaired performance (Alm and Nilsson, 1995; Consiglio et al., 2003; Strayer et al., 2003). However, determining whether cell phone use is causally related to crashes has been difficult. Cell phone records are generally unavailable in the United States, and drivers who have been involved in a crash are understandably reluctant to admit they were using a phone at the time of the crash. A recent study conducted in Australia, where cell phone records are available to researchers, found that cell phone use is associated with a fourfold increase in the likelihood of a serious crash resulting in hospitalization of the driver (McEvoy et al., 2005). The increased risk of a crash was similar for men and women, and applied to both handheld and hands-free phones. An earlier study, conducted in Canada, also found that the risk of collision was four times higher when a cell phone is being used (Redelmeier and Tibshirani, 1997). Again, hands-free phones offered no safety advantage over handheld phones. Results of the recently completed "100-car Naturalistic Driving Study," which closely monitored driver behaviors during a year of driving in the Washington, DC metropolitan area, indicate that using a mobile phone accounted for more than 7 percent of all crash and near-crash incidents (Klauer et al., 2006).

Talking on a cell phone while driving may be particularly dangerous for young, inexperienced drivers. These drivers, by necessity, must devote most of their attention to the task of driving, thus making them more susceptible to the distractions posed by conducting a telephone conversation. In recent years, a growing number of states have passed legislation prohibiting any cell phone use (that is, either handheld or "hands-free") by drivers with a GDL license, including Colorado, Connecticut, Delaware, District of Columbia, Illinois, Maine, Maryland, Minnesota, New Jersey, North Carolina, Rhode Island, Tennessee, Texas and West Virginia. At present, Connecticut, New York, New Jersey, and the District of Columbia prohibit handheld cell phone use for *all* drivers.

EXHIBIT V-8
Strategy Attributes for Prohibiting Cell Phone Use by Drivers with a GDL License (T)

Technical Attributes	
Target	Novice drivers under the age of 18
Expected Effectiveness	The expected effectiveness of legislation prohibiting the use of cell phones by drivers with a GDL license is currently unknown.
Keys to Success	It is important that the restriction apply to all types of mobile phones, including hands-free phones (i.e., head sets and ear pieces); it is the cognitive distraction and not simply the physical aspects of mobile phone use that increase the risk of a crash. Several studies indicate that there is no safety advantage associated with using hands-free devices rather than handheld phones. To be effective, this restriction will need to apply to teens with *any type* of GDL license, rather than being limited to those with a permit or restricted license. Consequently, in most states the restriction would apply to all drivers under the age of 18. However, based on the growing evidence of the dangers of operating a cell phone while driving, some states have opted to apply this restriction to all drivers.
Potential Difficulties	Lack of compliance with laws prohibiting cell phone use is a major problem. In New York, drivers' use of hand held cell phones declined measurably during the first few months after the law prohibiting cell phone use took effect; however, use had returned to previous levels one year later (McCartt and Geary, 2004). In Washington, D.C., cell phone use declined by approximately 50% after a law prohibiting drivers' use of handheld cell phones went into effect (McCartt et al., 2006). In view of compliance with other prohibitions designed to increase young driver safety, it is likely that a prohibition on cell phone use by young drivers will be partially enforced by parents and complied with by many young drivers. Nonetheless, universal compliance should not be expected. Although publicized enforcement of cell phone laws for young drivers may help to encourage compliance, such laws will be difficult for police to enforce. It can be difficult to determine, for example, whether a driver is talking on a phone if a hands-free device is being used. In addition, until a driver has been stopped, it is impossible to know whether he or she is prohibited from using a mobile phone. In recent years several promising technologies have been developed that could increase compliance with cell phone laws. For example, it is possible to prevent cell phones from operating while a car is in use. States should consider whether they want to incorporate technological mechanisms to ensure that drivers who are legally prohibited from talking on a phone while their vehicle is in motion cannot do so.
Appropriate Measures and Data	The effect of this strategy will be difficult to assess since it is usually not possible to determine whether a driver was using a cell phone at the time of a crash. This information is not routinely collected on crash reports and even when it is, the veracity of self-report is low. Although overall crashes among teenage drivers covered by the prohibition should decline somewhat following implementation of this strategy, determining whether any change is the result of a phone use prohibition or other factors will require a special study.
Associated Needs	None identified.
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	To be most effective, a technological mechanism to prevent using a mobile phone while a vehicle is in motion will be needed. This will require a policy decision by legislators and implementation will require the cooperation of several public agencies and private organizations.

EXHIBIT V-8 (Continued)
Strategy Attributes for Prohibiting Cell Phone Use by Drivers with a GDL License (T)

Organizational and Institutional Attributes	
Issues Affecting Implementation Time	The main factor affecting implementing time is the amount of time needed to pass enabling legislation. Once legislation is in place, this strategy can be carried out very quickly. If technological enforcement is to be included, implementation will take substantially longer.
Costs Involved	There may be some minor costs involved in educating police officers, judges and the general public about the cell phone restriction. A technologically enforced prohibition would entail additional costs, but these would accrue mostly to industry and perhaps to individuals rather than to state agencies.
Training and Other Personnel Needs	Parents and teens will need to be informed about this restriction. This can be achieved through materials provided at DMV offices, driver education, and through schools if there is no state driver education program. Educational efforts must be sustained, because there is a continuously changing cohort of new young drivers. In addition, police will need training about cell phone use laws and other provisions under their state's GDL system.
Legislative Needs	This strategy will require legislative action.

Other Key Attributes
None identified.

Information on Agencies or Organizations Currently Implementing this Strategy

A list of young driver licensing requirements for all 50 states, including up-to-date information on cell phone restrictions, is maintained by the Insurance Institute for Highway Safety. The list can be found here: http://www.iihs.org/laws/state_laws/grad_license.html.

Objective 1.1 B—Publicize, Enforce, and Adjudicate Laws Pertaining to Young Drivers

Strategy 1.1 B1—Publicize and Enforce GDL Restrictions (E)

General Description

Although GDL has been highly effective in reducing crashes and fatalities among young teen drivers, research suggests that compliance with restrictions—although generally quite good—is far from universal. Recent studies have found that between 23 percent and 50 percent of young drivers report occasionally violating nighttime restrictions, and between 34 percent and 80 percent acknowledge violating passenger restrictions (Begg et al., 1995; Goodwin and Foss, 2004; Mayhew et al., 1998; Williams et al., 2002). Violation rates vary by the nature of the restriction. For example, the zero passenger restriction

in California appears to be violated more frequently than the one passenger limit in North Carolina. To the extent that teens do not comply with these protective restrictions, the safety benefits of GDL systems are reduced.

Parents play an important role in enforcing GDL restrictions by setting driving limits for their teen and governing access to the car (see sections 1.1 C1 and 1.1 C2 of this guide). However, it can be difficult for parents to monitor their teen's driving behavior once the supervision phase ends. For example, one study found that parents were often unaware that their teen had engaged in such risky driving behaviors as not wearing safety belts, driving too fast, and being distracted by friends/passengers (Beck et al., 2001). Violations of this nature may be easier for police to detect and enforce.

Little is currently known about the enforcement of GDL restrictions by police. Among teens with restricted licenses in New Zealand who violated one or more conditions of GDL, 19 percent said they had been apprehended by police and 57 percent of these individuals said they were penalized (Begg et al., 1995). In North Carolina, a survey of 900 teenagers and their parents found that most families had little idea whether police enforce GDL restrictions (Goodwin and Foss, 2004). Interviews with police officers in that same study revealed that officers were highly supportive of GDL but unfamiliar with many of the specific provisions. Moreover, enforcement of GDL restrictions did not appear to be a high priority. Although the extent of enforcement in other states is currently unknown, it is unlikely that the situation in North Carolina is unique.

Compliance with GDL restrictions can be encouraged through stepped-up enforcement efforts such as checkpoints and nighttime saturation patrols coupled with publicity to raise awareness for that enforcement. One such "high visibility" enforcement program was implemented in a North Carolina county in 2004 (Goodwin et al., 2006). Enforcement included checkpoints near high schools at the time that students were dismissed and nighttime saturation patrols in locations that were popular among young drivers. To raise awareness of this enforcement, a multi-faceted public information campaign was carried out involving media, schools and Division of Motor Vehicle (DMV) offices. Following the program, both parents and teenagers were more likely to believe that police enforce nighttime and passenger restrictions. In addition, decreases in the number of passengers carried by young drivers were also observed, although these changes were relatively modest when compared with another community where the intervention did not occur.

In Iowa, teen drivers are referred to a remedial driver improvement process if they receive a moving violation or are involved in a crash to which the driver contributed. Both the teen driver and a parent/guardian must participate in an interview with a DOT official who, based on the circumstances of the incident, may impose additional driving restrictions or recommend license suspension. At a minimum, the teen driver must maintain a crash- and violation-free driving period after the incident before qualifying for the next licensing level. The remedial driver improvement process in Iowa has not yet been formally evaluated (Stutz, 2007).

EXHIBIT V-9
Strategy Attributes for Publicizing and Enforcing GDL Restrictions (E)

Technical Attributes	
Target	Novice drivers under the age of 18
Expected Effectiveness	Enforcement accompanied by extensive publicity has been successfully employed to increase safety belt use (Williams and Wells, 2004) and reduce alcohol impaired driving (Lacey, Jones and Smith, 1999). It therefore seems plausible that high visibility law enforcement can encourage young drivers to adhere to the constraints placed on their GDL license. Only one such effort has been attempted so there is little evidence on which to base an estimate of the magnitude of effect that might be expected from this strategy. Nonetheless, it is highly likely that a measurable increase in compliance would result from the use of this approach.
Keys to Success	Enforcement of GDL restrictions needs be part of a sustained effort to increase compliance. Each year a new cohort of teenagers obtains a driver's license. These young drivers need to see and hear the message that police actively enforce GDL restrictions. To be effective, the enforcement activity must be widely publicized. The goal of enforcement is not to "get tough" on teens and issue citations, but rather to deter GDL license holders from violating restrictions by increasing the perception that violators will be apprehended. Effective enforcement programs employ multiple approaches both to enforcement activities and to their publicity. Checkpoints held near high schools can enforce safety belt laws and passenger restrictions. Of equal importance, they provide concrete, highly visible evidence of enforcement. Such checkpoints could be held during lunchtime or after school as students are dismissed. Many schools have a school resource officer (i.e., police officer or sheriff's deputy) who is assigned to the school and who can assist in conducting checkpoints. To enforce nighttime driving restrictions, checkpoints and saturation patrols can be employed in the evening in areas with high concentrations of teen drivers (e.g., after school sporting events). Finally, enforcement of GDL restrictions can be a part of routine traffic enforcement. Publicity for enforcement activities should focus on media outlets that are most likely to reach young drivers, such as radio, the Internet, and school publications/newspapers. It is important that the judicial system supports these law enforcement efforts. Programs, or judges, that allow violations to be dropped if teens agree to take a traffic safety class can contribute to a perception that committing a GDL violation is of little consequence.
Potential Difficulties	Establishing and sustaining a GDL enforcement program requires resources that law enforcement officials may be reluctant to divert from other priorities. In addition, police may be reluctant to issue tickets to beginning drivers [this is addressed below in the "Organizational" section]. Conversely, if implemented without adequate publicity, a program to rigidly enforce GDL restrictions could provoke criticism from the community.
Appropriate Measures and Data	Careful collection and reporting of process data from checkpoints, saturation patrols and other enforcement activities is useful for tracking how well GDL restrictions are enforced. The ultimate outcome should be increased compliance with GDL restrictions, and a reduction in nighttime and multi-passenger crashes involving young drivers.
Associated Needs	To assist officers in enforcing GDL restrictions, it is important that young driver restrictions be clearly listed on the license itself. Ideally, a checkbox would also be included on the officer's citation form for "GDL violation." Otherwise, officers may be uncertain about how to appropriately cite such violations.

EXHIBIT V-9 (Continued)
Strategy Attributes for Publicizing and Enforcing GDL Restrictions (E)

Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	Support from high ranking officers increases the likelihood that GDL restrictions will be consistently enforced by most officers. Some officers are reluctant to cite teenage drivers for GDL restrictions, preferring to give warnings instead. They may be influenced by their own experiences when they were a teenager, or they may believe it is unfair to target young drivers. Appropriate education about the rationale for GDL and its restrictions can help to alleviate this problem. Judges and prosecutors also must be aware of (and support) the enforcement of GDL restrictions by police. If judges or prosecutors frequently dismiss GDL violations, police enforcement will do little to increase compliance with restrictions.
Issues Affecting Implementation Time	Some planning is involved, but if there is support for this type of program it can be implemented relatively quickly. Making sure all officers receive training on their state's GDL system will also take some time.
Costs Involved	Funds are needed to cover law enforcement salaries, publicity costs and other program expenses.
Training and Other Personnel Needs	Training officers is a critical component of any enforcement program. One recent study showed that many officers were not familiar with the details of their state's GDL system (Goodwin and Foss, 2004). To properly enforce GDL, officers must be well acquainted with the restrictions, provisions and exceptions to the laws involved in GDL, as well as the rationale for the GDL approach itself. Officers must also be knowledgeable regarding requirements of statutory and case law when conducting checkpoints if they are to be used. Training judges and prosecutors is also key to a successful program. If judges or prosecutors do not understand the importance of enforcing GDL restrictions, they may be unwilling to follow through with prescribed sanctions for GDL violations. This can undermine the success of an enforcement program and the GDL system in general.
Legislative Needs	License checkpoints are permitted in most states. However, in states where checkpoints are not permitted (usually by provisions in the state's constitution, or by enacted statute), efforts may be made to remove this legal barrier.
Other Key Attributes	
None identified.	

Information on Agencies or Organizations Currently Implementing this Strategy

Clermont County, Ohio, has implemented a court-based program called "Last Chance." The program is aimed at 16- to 24-year-olds who have received multiple driving violations. Currently 1,800 teens have participated, with an 80 percent success rate. The program is the combined effort of many different agencies including the county sheriff, juvenile court, safe communities, OSHP, child focus, and MADD. (Details are available from the Ohio Governor's Highway Safety Office.)

In 2005, law enforcement officers in Maine began a program known as Project Safeguard, in which officers call parents of teens found to be violating various traffic safety laws.

The Raleigh, North Carolina Police Department has experimented with a program where parents received a letter from the police department when their teen was found to be in violation of GDL.

Strategy 1.1 B2—Publicize and Enforce Laws Pertaining to Underage Drinking and Driving (P)

General Description

Underage drinking and driving is an enduring concern among public safety and public health officials. Although young drivers are less likely than persons older than 21 to drive after drinking, those who do are more likely to be involved in a serious crash (Mayhew et al., 1986; Zador et al., 2000). For example, a recent projection combining crash data with BAC measurements from a national roadside survey suggests that males ages 16 to 20 who have a BAC between .08 percent and .10 percent are more than 20 times as likely as sober teen drivers to be involved in a fatal crash; females with a similar BAC are estimated to be about 6 times more likely to be in a fatal crash (Zador et al., 2000). The dangers from drinking and driving for young drivers are likely due to their relative inexperience coupled with their greater propensity toward risky driving behaviors. In addition, the presence of passengers is associated with alcohol-related fatal crashes among young drivers (Preusser et al., 1998).

Raising the minimum legal drinking age to 21 in all 50 states has been credited with saving nearly 23,000 lives from 1975 through 2003 (Du Mouchel et al., 1987; NHTSA, 2004; Williams et al., 1983). Even so, numerous studies indicate that underage persons can obtain alcohol relatively easily. For that reason, much more rigorous enforcement of laws restricting sales of alcohol to underage persons is needed through well-publicized compliance checks of alcohol retailers. Because most younger teens obtain alcohol indirectly rather than buying it themselves, additional enforcement of laws prohibiting provision of alcohol to underage persons is also needed. For more information about compliance checks, see strategy 15.1 A3 in *NCHRP Report 500, Volume 16: A Guide for Reducing Alcohol-Related Collisions.*

Currently, all 50 states prohibit individuals under age 21 from driving with any amount of alcohol in their system (so called "zero tolerance" laws). Several studies have documented the effectiveness of these laws in reducing alcohol-related crashes and fatalities involving young drivers (Lacey et al., 2000; Voas et al, 2002). However, lack of awareness about these laws and the perception that police do not enforce them limits their full potential (Ferguson and Williams, 2001). Thus, much greater publicity and enforcement of zero tolerance is currently needed. For more information about zero tolerance, see strategy 15.1 B3 in the *Guide for Reducing Alcohol-Related Collisions*.

A number of other proven and promising strategies for reducing alcohol-involved crashes are detailed in the *Guide for Reducing Alcohol-Related Collisions*.

Strategy 1.1 B3—Publicize and Enforce Safety Belt Laws (P)

General Description

Properly worn safety belts can dramatically reduce the risk of injury or death to vehicle occupants in the event of a crash. Although belt use has climbed to record levels, research

has consistently shown that safety belt use is lower among young drivers than adult drivers (Williams et al., 2003; Womack et al., 1997). Because teenage drivers have a substantially higher crash risk than adult drivers, failure to wear safety belts makes them (and their passengers) especially vulnerable to injury or death. A recent study examining fatal crashes in the United States between 1986 and 1998 found that the risk of death for belted occupants was 61 percent lower than for unbelted occupants (Cummings et al., 2003).

Carefully designed enforcement programs have increased the use of safety belts for all age groups, including teen drivers. Well-publicized enforcement campaigns such as "Click It or Ticket" have been successfully employed to increase safety belt use among the general driving population (Reinfurt, 2004; Williams and Wells, 2004). Partially as a result of these programs, safety belt use in the United States reached an all-time high of 80 percent in 2004. Such a high belt use rate was previously thought to be unattainable. As recently as the early 1980s, before belt use laws were in effect, safety belt use was roughly 15 percent in most U.S. cities.

Primary safety belt laws, which allow police officers to stop and cite a motorist solely for an observed safety belt violation, have also proven effective at increasing belt use among teens. In 1984, New York became the first state in the United States to enact a primary safety belt law. Observations of teen drivers entering high school parking lots found a belt use rate of 14 percent before the law was adopted compared to 60 percent 1 month after the law took effect (Preusser et al., 1987). A more recent study found that safety belt use among fatally injured drivers age 16 to 19 was higher in primary law states than in secondary law states—47 percent versus 30 percent (McCartt and Northrup, 2004).

A belt use requirement for all occupants riding with a young driver would be a useful addition to graduated driver licensing programs in many states, especially those where belt use laws do not cover rear seat occupants or those above a certain age. Because novice drivers have a much higher crash rate, Colorado, North Carolina, Rhode Island, Tennessee, and Wisconsin included this requirement for all passengers who ride with a GDL driver (i.e., all drivers younger than 18)—regardless of age or seating position—as a way of providing added protection for passengers. Moreover, a violation of the safety belt provision can delay the GDL license holder from progressing to the next, less restrictive, licensing level.

Agencies may consider implementing an associated sanction for safety belt violations among novice teen drivers, such as delayed graduation to the next GDL phase should such a violation occur.

More information about enforcement of safety belt laws can be found in the *NCHRP Report 500, Volume 11: A Guide for Increasing Seatbelt Use*.

In addition, an excellent manual with guidance for implementing a well-publicized safety belt enforcement program is available from Buckle Up America (http://www.nhtsa.dot.gov/people/injury/airbags/buckleplan/bua_website/index.htm).

Finally, for additional information about safety belts and teens, see the 2003 NHTSA fact sheet (http://www.nhtsa.dot.gov/people/injury/airbags/buasbteens03/BUA%20SBTeens.pdf) or a recent review from NHTSA on this issue at http://www.nhtsa.dot.gov/people/injury/NewDriver/TeenBeltUse/index.htm (Fell et al., 2005).

Information on Agencies or Organizations Currently Implementing this Strategy

Wisconsin and Tennessee are currently implementing programs to increase familiarity with the safety belt provision in their respective GDL systems. Results of an evaluation of these efforts are expected to be available in 2007.

Objective 1.1 C—Assist Parents in Managing Their Teens' Driving

Strategy 1.1 C1—Facilitate Parental Supervision of Learners (T)

General Description

Young driver experts are in substantial agreement that more effective parental involvement in mentoring teen drivers holds substantial promise for further reducing young driver crashes (Hedlund, Shults and Compton, 2003; Simons-Morton, 2002). Several studies show that teens are practicing and gaining driving experience, as intended, during the learner permit stage of GDL—often more than is required by the state's GDL provisions (Chaudhary et al., 2004; Goodwin et al., 2006; Mayhew et al., 1999; McCartt et al., 2001; Waller et al., 2000; Williams et al., 2002). However, little is currently known about the nature and quality of parental supervision during the learner stage.

An abundance of materials has been developed to assist parents as supervisors. For example, most large insurance companies have booklets, handouts or CDs that are available to parents of beginning drivers. However, few of these materials have been evaluated, and only a handful of studies have investigated how (and whether) parents actually use them. Unfortunately, the results of these studies have not been encouraging. Although parents appreciate receiving educational materials, these materials do not appear to have a discernible effect on teen driving practice or the degree of parental involvement during the learner stage (Chaudhary et al., 2004; Goodwin et al., 2006). Hence, simply distributing educational materials to parents is not sufficient; more persuasive techniques are needed to encourage parents to make use of the materials and guidance that are available to them.

The lack of demonstrated effectiveness, so far, of programs designed to influence parents' supervisory behaviors parallels the failure of evaluations of GDL systems to find clear evidence of improved driving behaviors among newly licensed teen drivers. Presently, the impressive success of GDL in reducing young driver crashes appears to be largely attributable to a reduction in the amount of driving that 16- and 17-year-olds do under high risk conditions (McKnight et al., 2002). The benefits potentially available from the practical learning that can be achieved during an extended period of supervised driving have yet to be realized.

Providing the encouragement and support for parents to give their teens the most effective supervision may require developing community-based programs analogous to those that have been established to promote and support the correct use of child safety seats. The risks to young relatively inexperienced drivers are higher than the risks to young children riding unrestrained. The latter are, for the most part, riding with experienced and substantially safer drivers than is the case for young teen drivers and their passengers.

EXHIBIT V-10
Strategy Attributes for Facilitating Parental Supervision of Learners (T)

Technical Attributes	
Target	Parents of novice drivers under the age of 18
Expected Effectiveness	No proven effective technique for improving parental supervision of their teen's driving is presently available. The few evaluations to date have shown that simply distributing educational/advisory materials to parents does not appear to influence their behavior as supervisors (Chaudhary et al., 2004; Goodwin et al., 2006). Efforts to improve upon this situation are needed.
Keys to Success	To increase the likelihood that parents will adopt recommended supervisory practices, an approach is needed that not only makes appropriate information easily accessible to parents, but which also motivates them to use it. One possibility is to engage parents through a credible authority who already has a formal relationship with parents, such as family physicians or pediatricians. Through "brief interventions," physicians can personally distribute materials to parents and, most importantly, encourage them to follow the recommended approach to ensure the safety of their son or daughter. Brief interventions have been shown to be effective in reducing children's injuries (Bass et al., 1993). Driver education instructors also may be well-positioned to help parents, given their familiarity with a teen's driving and their status as an expert in driving instruction. Some driver education programs require parental involvement, to varying degrees, before teens are allowed to graduate from a driver education class. In Virginia, after all requirements have been completed and conditions met, both the parent and teen must appear in court before a judge to receive the teen's driver license, emphasizing the seriousness of the license and formally emphasizing the responsibility of the parent for the teen's driving behavior. Finally, it may be possible to develop community-based support programs for parents of teen drivers comparable to those that have been established to support and encourage the use of child safety seats.
Potential Difficulties	There is currently no infrastructure in the United States for helping parents of beginning drivers. Until a proven mechanism is in place, parents will be largely responsible themselves for finding and making use of assistance during the learner stage. The greatest stumbling block at present to establishing an effective system to motivate and guide parents is the lack of clearly established guidelines for what they should do as a driving supervisor. See associated needs below.
Appropriate Measures and Data	The ultimate goal of facilitating parental supervision of learners is to reduce crashes among young drivers. However, crash rates are extremely low when novice drivers are being supervised by a parent or guardian (Mayhew et al., 2003). Hence, the safety benefit resulting from enhanced parental supervision will be apparent in a decreased crash rate during the first several months of driving after adult supervision is no longer required (i.e., during the "intermediate" license stage).

EXHIBIT V-10 (Continued)
Strategy Attributes for Facilitating Parental Supervision of Learners (T)

Technical Attributes	
	Simple tracking or process data will not be sufficient to document the effectiveness of this strategy. Too often, studies examining the effectiveness of information dissemination programs simply ask persons who receive the information or materials whether they find them to be helpful. This approach is inadequate. Although individuals often report that information is helpful, more careful analysis usually reveals that persons who receive materials do not behave differently from those who do not receive the information. Thus, it will be important to conduct special studies that include appropriate comparison groups and measure specific behaviors of interest relating to parental supervision during the learner licensing stage (e.g., how much driving practice teens obtain) to assess whether this strategy is effective.
Associated Needs	At present, there is a great deal of information available to parents of beginning drivers. Few of these materials have been evaluated, however, and it may be difficult for parents to know which materials they should choose. Parenting and teen driving experts generally agree that materials should emphasize the following principles: • Novice drivers need extensive driving practice in a wide range of situations. The amount of driving required in several state GDL systems (e.g., 30–50 hours behind the wheel) may not be nearly enough. A study from Sweden showed that teenagers who amassed an average of 118 hours supervised practice subsequently had a 35% lower crash risk after licensure than those who averaged 41 hours practice (Gregersen, 1997). • Parents should carefully control when and where driving practice occurs for months, not just the first few drives when the teen is obviously a complete novice. It is the responsibility of parents to ensure their teen stays safe and is not placed in a situation he or she is not yet ready to handle. • Communication between parents and teens is critical. Parents need to know how best to talk with their teens during this potentially stressful period. In general this means being calm, supportive, patient and avoiding distracting the young driver by talking too much. • Parents should be good role models for their teen driver. Ideally, parents should review their own driving habits long before their teen is learning how to drive because their driving demeanor will be adopted by the teen.
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	Sizeable organizational efforts may be required, depending on the mechanism established to assist parents.
Issues Affecting Implementation Time	Many educational materials have been developed to help parents of a beginning driver. These materials can be provided to parents very quickly. However, identifying the most useful information and the most effective format and mechanism for delivering those materials and encouraging their use will take time.
Costs Involved	The primary costs associated with this strategy are for the materials provided to parents and the mechanism to ensure the information is effectively used. In most cases, at present, parents pay for these materials themselves, although sometimes they are provided free-of-charge by insurance companies or other agencies. Until a mechanism is found to ensure that information is adequately adopted, it is not possible to estimate the kinds of costs that will be involved.

EXHIBIT V-10 (Continued)
Strategy Attributes for Facilitating Parental Supervision of Learners (T)

Organizational and Institutional Attributes	
Training and Other Personnel Needs	Training and personnel to staff programs to assist parents will be needed. The extent and nature of these needs will depend on the particular mechanism chosen.
Legislative Needs	Legislation is probably not needed to implement this strategy. However, there may be ways in which legislation can contribute to the effectiveness of this approach. For example, mandating a program to assist parents as part of the state's GDL law can ensure that such a program is developed. Legislation can also provide explicitly for funding of such a program.

Other Key Attributes
None identified.

Information on Agencies or Organizations Currently Implementing this Strategy

Examples of materials that are available for parents:

"Novice Driver's Road Map" from the Network of Employers for Traffic Safety: http://www.trafficsafety.org/Novice.asp.

"Family Guide to Teen Driver Safety" from the National Safety Council: http://www.nsc.org/teendriversafety/pdf/NSC_Guide_Front.pdf.

Delaware has a GDL orientation program for parents to learn about GDL and about teen driving issues more generally. The program lasts about 90 minutes. Contact the Delaware Division of Motor Vehicles for more information. http://www.dmv.de.gov.

Strategy 1.1 C2—Facilitate Parental Management of Intermediate (Provisional) Drivers (E)

General Description

Despite having obtained substantial practical driving experience during many months of supervised driving now required by GDL systems in most states, teen drivers experience a dramatic increase in crashes when they first begin driving alone. The first several months of unsupervised driving compose the period of greatest risk for novice drivers (Mayhew et al., 2003; McCartt et al., 2003). Although protective restrictions such as limits on nighttime driving and carrying passengers can reduce this risk, parents also can play a key role in reducing young driver crashes by closely monitoring their teen's driving during this stage.

Several studies indicate that the extent of parental involvement in the licensing process is associated with teen safety belt use, traffic violations and motor vehicle crashes (Beck et al., 2001; Hartos et al., 2000; Hartos et al., 2002). For example, a study of 261 adolescents revealed that those who engage in high risk driving such as speeding, following too closely and running red lights were twice as likely to report low parental restrictions and three times more likely to report low parental monitoring (Hartos et al., 2002).

There are many ways in which parents manage their teen's driving. Parents determine the timing of licensure and they govern their teen's access to vehicles. They can also set limits on when, where, and under what conditions their teen is allowed to drive. In many states parents must give permission for their teen under age 18 to obtain a driver license and can ask the state to revoke the license at any time. In the state of Virginia, anyone under age 18 must participate in a licensing ceremony at juvenile court to receive their first driver's license. In this ceremony, teenage drivers and their parents or legal guardians appear before a judge to receive a permanent driver's license. The ceremony is symbolic, as it makes it clear to the teen driver that the license is a privilege that may be taken away (Virginia Driver's Manual, 2006).

One of the most promising approaches for effective monitoring of teen driving is for parents and teens to negotiate a parent-teen driving agreement that clearly spells out the expectations and responsibilities of both parents and teens. The "Checkpoints Program" is one successful program that employs a parent-teen driving agreement (Simons-Morton et al., 2002; Simons-Morton and Hartos, 2003). The program strives to motivate parents to closely manage their teen's driving by persuading them that teen driving is risky, that parental restrictions on teen driving are normative (i.e., commonly used by parents), and that driving agreements are an important tool for keeping teens safe. In a demonstration trial in Connecticut, parents received a video that discusses teen driving risks and introduces the program, followed by periodic newsletters that emphasize the need for parental restrictions on teen driving. Shortly before teens are licensed to drive without supervision, families received an example of a parent-teen driving agreement to assist them in establishing clearly defined driving rules, consequences for violations, and targets for lifting restrictions. Both parents and teens reported greater parental restrictions on teen driving as a result. In particular, parents in the Checkpoints group required their teens be home earlier at nighttime on weekends and did not allow as many teen passengers (Simons-Morton et al., 2005).

Another promising area is the emergence of devices that allow vehicle information and, thereby, driver behavior to be recorded and monitored. This presents the opportunity to improve young driver behaviors. Devices can monitor vehicle speeds and changes in g-forces that indicate emergency braking, swerves, high-speed turns, and rapid acceleration. Cameras can record activity within the driver compartment as well as in front of and behind the vehicle. The location of vehicles can also be tracked and reported using GIS devices. This technologic capability appears to hold great promise for monitoring teen driving, and possibly for improving it as well. For example, a program is currently being evaluated in Iowa that employs an event data recorder called "DriveCam." A DriveCam is a palm-sized video camera that is mounted on the windshield behind the rearview mirror. Although the camera runs continuously, it only saves information when a triggering "event" such as sudden braking, abrupt turns or a crash occurs. In the Iowa study, parents and teens receive weekly reports on these "events." Results are presented both individually and in aggregate form so teens can see how they rank with their peers. Preliminary data suggest that this routine feedback reduces the number of events that are recorded by the cameras over time (McGehee et al., 2007).

In sum, the Checkpoints Program and emerging technologies show potential for encouraging and facilitating parental management of intermediate drivers. However, this strategy will not achieve its full traffic safety potential until these new approaches are effectively integrated into formal systems that ensure they are used widely and correctly.

EXHIBIT V-11
Strategy Attributes for Facilitating Parental Management of Intermediate Drivers (E)

Technical Attributes	
Target	Parents of novice drivers under the age of 18
Expected Effectiveness	The expected effectiveness of parental management of intermediate drivers in reducing teen crashes has not yet been established. Although results from the Checkpoints Program are encouraging, the differences between treatment and comparison groups are generally modest, and group differences appear to diminish over time (Simons-Morton et al., 2003; Simons-Morton et al., 2005). Furthermore, it has not yet been demonstrated that novice drivers experience fewer crashes after participation in the Checkpoints Program. Although several new technologies are currently available that can assist parents in monitoring a teen driver (and more are being developed and improved), awareness for these technologies is currently limited and none of these technologies have been systematically evaluated.
Keys to Success	For programs to encourage effective parental monitoring of teen drivers to have a broad safety benefit, they must be integrated into existing traffic safety or health care systems to ensure they are used widely and correctly. Driver licensing offices, insurance companies and other organizations can provide information and materials to parents about these approaches and their potential benefits, but for these approaches to reduce crashes within a state they will need to be integrated into some formal structural framework that can ensure their widespread use.
Potential Difficulties	Close monitoring of teen drivers requires active involvement by parents; some parents may be unwilling to put forth this effort. In the Checkpoints Program, for example, approximately half of all families fail to complete the parent-teen driving agreement. Although the reasons why they did not do so are unknown, research shows that many parents do not understand the risks involved in teen driving (Simons-Morton and Hartos, 2003). There is also no certainty that parents will adopt new technologies. Many devices require some degree of technological savvy on the part of parents. New technologies can also be expensive. Until they become widely adopted and the price decreases, they will be beyond the budget of some families. Even among parents who can afford these technologies, there is sometimes a reluctance to use them because of concerns that such devices are an invasion of privacy. Some parents may feel that technological monitoring displays a lack of trust in the young driver. Although keeping a young driver safe is a high priority, it is also important to maintain an effectively functioning relationship between parents and teens. This is one function of developing a parent-teen driving agreement: to ensure that families work together to establish mutually agreed upon standards of behavior for both parents and teens.
Appropriate Measures and Data	Because this is an experimental strategy, it will be necessary to conduct dedicated studies using appropriate study designs to rule out alternative explanations and to determine whether there is any benefit. Where programs are put in place it will be important to track process measures of success, such as the percent of families who complete a driving agreement and the types of protective restrictions and monitoring devices that are used. These cannot address the traffic safety benefits of the programs, but they are important adjuncts to help explain effects, or the lack thereof, on crashes. The most direct measure of effectiveness for monitoring programs would be a decrease in crashes among drivers in their first year of driving without the requirement of an adult supervisor in the vehicle.

EXHIBIT V-11 (Continued)
Strategy Attributes for Facilitating Parental Management of Intermediate Drivers (E)

Technical Attributes	
Associated Needs	A well-designed graduated licensing program should make it easier for parents to manage their teen's driving during the intermediate license stage. The protective restrictions under GDL can support parents' efforts to establish and enforce driving restrictions for their teenager. One recent study showed that parents impose stricter limits regarding teen passengers and nighttime driving on weekends in a state that has a GDL system compared to a state without GDL (Hartos et al., 2005).
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	An institutional or organizational base will need to be established for programs to encourage parents to effectively monitor teen drivers and to provide advice and assistance in the most useful ways to do so.
Issues Affecting Implementation Time	Materials recommending that parents closely monitor their teens' driving can be provided to parents relatively quickly through driver licensing offices. Several devices that allow parents to electronically monitor their teens' driving are available now. However, it will likely take considerable time to develop programs that actively involve parents in monitoring their teens' driving and helping them to know how to do that most effectively. The critical elements that need to be developed are (1) identification of the best/most important information for parents to have regarding how to monitor their teen driver's behavior and (2) a structure by which this information can be provided to parents and which will also motivate them to use it. Both of these are long-term questions. Further results from the Checkpoints program are expected soon and these may provide useful information regarding the most effective way to encourage parents to use parent-teen driving agreements.
Costs Involved	The primary costs associated with this strategy are for the development and design of programs and materials to assist parents in monitoring their teens' driving. Materials can be produced at relatively low cost, but their development is more costly. Using electronic technology to monitor teen drivers can be relatively costly, though these costs are likely to be borne by parents in the near future. In addition to purchase or rental costs, the use of these devices may require professional installation, maintenance and sometimes the expense of downloading recorded data.
Training and Other Personnel Needs	Additional personnel will be needed to implement programs. To be effective these cannot be handled as an additional responsibility by individuals who have other duties. Program personnel, whether they be in state or private agencies, will need to be trained.
Legislative Needs	Legislation is not needed to implement this strategy.
Other Key Attributes	
None identified.	

Information on Agencies or Organizations Currently Implementing this Strategy

Travelers Insurance provides information to guide parents in choosing the safest vehicle for their teen at http://www.travelers.com/tcom/tips/docs/PLtips_safecarforteens.pdf.

The law enforcement community in Maine began the SAFE Guard program in 2005 in an effort to increase teen driver safety by partnering with parents. Police call the parents of teen

drivers and their passengers following a traffic violation. Contact the Maine State Police at 207-624-7203 for more information or visit http://www.maine.gov/education/edletrs/2006/ilet/06ilet003.htm.

Some auto manufacturers now offer reminder systems ("Belt minders") on some models that involve chimes and flashing lights to remind drivers to buckle their safety belts when the vehicle is started. These have been shown to increase belt use (http://www.iihs.org/sr/pdfs/sr3702.pdf). Ensuring that their teen drives a vehicle with such a device is a way in which parents can use technology to increase a child's safety.

Strategy 1.1 C3—Encourage Selection of Safer Vehicles for Young Drivers (E)

General Description

Given the increased crash risk of young beginning drivers, one important way to reduce injuries and deaths is to ensure that they drive the safest vehicles possible. Unfortunately, because of cost and other considerations, teens often drive vehicles that are relatively old and small (Cammisa et al., 1999; Williams et al., 2006). Older vehicles are less likely to have important safety features such as front and side airbags, which can greatly reduce the risk of injury in the event of a crash (NHTSA, 2003). In addition, small cars are associated with a higher risk of fatality than large cars (NHTSA, 2002).

Pickups and SUVs can also be dangerous for young drivers because of the increased risk for a rollover crash. They are also required to meet to less exacting safety standards than traditional passenger vehicles. A recent survey found that 22% of the vehicles driven by young drivers in Connecticut were pickups or SUVs (Williams et al., 2006). Additionally, a NHTSA study of SUV crashes found that drivers ages 16 to 24 were 68% more likely to have experienced rollovers than drivers ages 25 and older (Kindelberger and Eigen, 2003). These vehicles, which are built on truck frames with a higher center of gravity, are also more dangerous to occupants of other vehicles when they collide. Combining the high crash propensity of young drivers with vehicles that are more dangerous for other road users multiplies the overall injury risk to the general driving population.

It is well-known that motorcycles are the most dangerous motor vehicles for persons of any age. Although teens are less likely than older persons to ride a motorcycle, 300 motorcycle operators ages 15 to 20 were killed and 8,000 injured in 2004 (NHTSA, 2005). These high numbers, despite relatively low ridership in this age group, are at least partly explained by a recent study which found that cyclists ages 15-17 are at much higher risk than those 21-34 for severe and at-fault crashes (Yannis et al., 2005). Many graduated licensing systems effectively prevent the youngest drivers from riding a motorcycle, requiring a full (adult) license before allowing motorcycle riding (although this does not apply to low powered scooters that do not require a license to operate). Nonetheless, it is important to understand the dangers of motorcycling when younger drivers select a vehicle. In an era of increasing fuel costs, the temptation to select a vehicle based on high fuel efficiency should be tempered with safety considerations. See the *Guide for Preventing Motorcycle Crashes* (to be published) for more on this issue.

Parents not only influence the type of vehicle their teen will drive, but they also usually decide whether their teen will be the primary "owner" (driver) of the vehicle. Vehicle ownership (or having a vehicle completely at their own disposal) by teenagers is

associated with a variety of risk factors. Teenagers who own their own vehicle drive more miles than non-owners, they are more likely to report having raced their vehicle and driven more than 90 miles per hour, and they are more likely to have received a moving violation and to have been involved in a crash as a driver (Cammisa et al., 1999; Williams et al., 2006).

A program that encourages the greatest possible use of safer vehicles by young drivers holds substantial promise for reducing deaths and injuries among teen drivers and their passengers. Several organizations provide advice for parents about safe vehicle selection for young drivers, including the Insurance Institute for Highway Safety and the National Safety Council (see links below). In addition, many state driver licensing agencies and insurance companies produce documents that contain advice on vehicle selection. At present, however, there appear to have been no efforts to systematically encourage parents to choose safe vehicles for their teens. There are no studies that look at whether the available advice on vehicle selection has had any effect on the vehicles teens drive. There is, however, an abundant literature indicating that programs that rely exclusively on simple information dissemination to promote or alter human behaviors rarely achieve their goal (Etzioni, 1972; National Committee for Injury Prevention and Control, 1989). In some way, motivation in addition to information must be included if behavior is to be altered.

EXHIBIT V-12
Strategy Attributes for Encouraging Selection of Safer Vehicles for Young Drivers (E)

Technical Attributes	
Target	Young drivers and their parents
Expected Effectiveness	The expected effectiveness of this strategy is currently unknown. If the strategy is limited to simply disseminating information about vehicle choice, this strategy will have little measurable effect by itself, though it might be a useful adjunct to other programs.
Keys to Success	Although several organizations provide advice for parents about safe vehicle selection for young drivers, a documented effective way to influence parents and young drivers in their vehicle choice is needed. At present, no mechanism for accomplishing that is known.
Potential Difficulties	Affordability is perhaps the greatest obstacle to parents choosing the “right” type of vehicle for their teen. Instead of driving the newest, safest vehicle in the family, teens often get the oldest vehicle with the fewest safety features. In some cases, this may be all the family (or the teen) can afford. Teens may also be reluctant to drive relatively safe vehicles. Such vehicles may not be considered desirable by teens.
Appropriate Measures and Data	The extent to which this program is effective would be indicated by a decrease in the proportion of smaller, older, more rollover-prone vehicles involved in young driver crashes. The proportion of young driver injuries should also decline, as should injuries to passengers carried by young drivers.
Associated Needs	Given the dangers associated with the first few months of unsupervised driving (Mayhew et al., 2003; McCartt et al., 2003), it is important that the teenager use the same vehicle during the provisional license stage that he or she used while being supervised. According to one study, 60% of licensed teenagers reported driving a different vehicle than the one they used for practice (Cammisa et al., 1999).

EXHIBIT V-12 (Continued)
Strategy Attributes for Encouraging Selection of Safer Vehicles for Young Drivers (E)

Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	None identified.
Issues Affecting Implementation Time	The primary factor affecting implementation time is the choice of a mechanism to deliver information and encouragement to parents and teenagers. A program to effectively motivate parents to use the information about vehicle choice will take more time to develop than simply providing informational materials.
Costs Involved	There will be some cost for producing informational materials. There will also be costs associated with delivering this information, but those will depend heavily on the mechanism chosen.
Training and Other Personnel Needs	A program that actively engages parents and encourages them to act on information will require training individuals to implement the program. In addition, some personnel time will be required to develop the original program.
Legislative Needs	This strategy will not likely require legislation

Other Key Attributes
None identified.

Information on Agencies or Organizations Currently Implementing this Strategy

Information about vehicle selection for young drivers is available from a *Status Report* and a *News Release* from the Insurance Industry for Highway Safety:

http://www.iihs.org/sr/pdfs/sr3908.pdf

http://www.iihs.org/news/1999/iihs_news_092199.pdf

To view comments from the "Car Talk" guys on National Public Radio regarding this issue, see: http://www.cartalk.com/content/features/Safety/CarsPowerKids/janet.html.

Objective 1.1 D—Improve Young Driver Training

Strategy 1.1 D1—Improve Content and Delivery of Driver Education/Training (E)

General Description

Traditional driver education, as provided in the United States, involves 30 hours of formal classroom training and 6 hours of driving practice. Well-controlled research studies on driver education effectiveness almost universally indicate that those who take a driver education class have no fewer crashes than those who do not (see reviews of these evaluation studies: Christie, 2001; Mayhew and Simpson, 1996; Vernick et al., 1999; Williams and Ferguson, 2004). These findings have led some to conclude that driver education programs, especially traditional ones, have limited or no safety benefits and need to be "redesigned" in order to be effective. Others maintain that driver education should be

viewed simply as that—training in the rules of the road and the essential skills in driving, rather than as a way to control traffic crashes (Waller, 2003).

In recent years, advanced driving courses that focus on emergency handling skills such as skid control have proliferated in the private sector. These courses, often taught by former police officers or race car drivers, usually take place over 1 or 2 days at a test track facility. Although few of these courses have been evaluated, available research points to a safety *disbenefit*; that is, crash involvement appears to increase, rather than decrease, among young drivers who participate in these courses (Christie, 2001; Mayhew and Simpson, 1996; Williams and Ferguson, 2004). It has been suggested that training in vehicle-handling skills, particularly advanced skills, leads to overconfidence, which may offset or even replace normally cautious behavior by young drivers (Mayhew and Simpson, 2002).

If driver education and training are to produce a safety benefit, it is clear that something needs to be done differently. Research conducted in the past decade has provided some guidance as to the kinds of training that might help to produce safer drivers. For example, inexperienced drivers—especially young inexperienced drivers—clearly make poor judgments in their first many months of driving, resulting in a high crash rate. These failed judgments often represent mistakes in assessing, or in even noticing, hazards in the driving environment. They also reflect misconceptions about drivers' limited abilities and their susceptibility to crashing. Therefore, a promising approach for improving young driver safety may lie in more effectively training them to perceive hazards and to respond accordingly (Fisher et al., 2002; 2006), rather than focusing on the kinds of basic vehicle control skills that are frequently and mistakenly equated with safe driving. As a reflection of this perspective, efforts to improve driver training in Norway and Sweden (Sagberg and Gregersen, 2005) focus on producing "wise" drivers rather than simply "skilled" drivers. Although vehicle-handling skills are seen as necessary, a combination of both the ability and the predisposition to make good judgments is more closely related to safe driving. Another relatively new approach called "insight training" has produced some promising initial results (Senserrick and Haworth, 2005). This approach is designed to help young drivers recognize and understand their limitations, and it attempts to provide greater insight and awareness of risk when driving.

In addition to revising the content of driver education and training, there is a need to reconsider and update the manner in which that content is delivered. Perhaps one of the most important issues is the timing of education/training and its relationship to the course content. Although the importance of "higher-order skills," such as hazard detection, is increasingly acknowledged, it is also recognized that attempts to teach these skills to individuals who have limited or no driving experience have little chance of succeeding. Accordingly, it has been suggested that driver education/training could benefit from a multi-stage approach. In particular, it is suggested that pre-licensing driver education focus on basic vehicle handling skills. After licensing, when some driving experience has been gained, the focus would shift to the acquisition of more advanced cognitive/judgment skills. In this way, the content of the program is more appropriately linked to the experience of the young driver. This two-stage approach to driver education aligns nicely with the multi-stage approach to licensing—graduated driver licensing (GDL)—that is now embraced in most states. To date, only Michigan has adopted a two-stage approach to driver education as part of their GDL system. However, the Michigan program is quite rudimentary, with the second stage involving only a few hours of additional classroom instruction.

Another central issue involves the amount of practical driving experience obtained through driver education. The original approach to driver education in the United States was developed in the late 1940s and has remained largely unchanged since that time. In recent years it has become increasingly recognized that 6 hours of in-vehicle, on road, practice with a formal instructor is inadequate to produce safer drivers. One of the primary suggestions for altering training approaches is to integrate formal instruction provided by professional trainers with substantial practical experience obtained while driving with an adult supervisor (typically a parent). Many graduated licensing systems require a minimum number of hours of supervised driving practice—e.g., 50 hours, 10 of which must be at nighttime. However, these generally are not integrated with a driver education program. There is a need for driver education courses to emphasize the value of additional experience and to examine ways to more effectively integrate that requirement into the curriculum. This is important because, as recent research in Oregon suggests, driver education may be viewed as a substitute for supervised driving practice. Moreover, teens who complete formal driver training may accumulate fewer total hours of driving practice than those who do not, as was found in Oregon (Mayhew et al., 2006). And in some jurisdictions, GDL systems explicitly allow shorter learner periods for individuals who complete a formal driving course.

Finally, there is some evidence that new technology-based training techniques, such as computer-based simulations, can be effective for acquainting new drivers with a variety of dangerous situations without having to face them in real-world settings. Although simulation-based experience cannot replace real-world practice, a few recent studies have shown that young drivers who participate in simulation-based training efforts tend to behave more like experienced drivers than like other young drivers (Fisher et al., 2002, 2006).

EXHIBIT V-13
Strategy Attributes for Improving Content and Delivery of Driver Education (E)

Technical Attributes	
Target	Novice drivers, state transportation and education officials, and driver education instructors and administrators
Expected Effectiveness	The expected effectiveness of this strategy is unknown.
Keys to Success	To effectively train teen drivers, it is essential that a program address how teens learn rather than simply offering information in a traditional format that may be convenient to deliver, but which is ineffective in training drivers to perceive hazards, make good judgments, and understand their limitations. A program should also tailor the learning experience to novice drivers' individual needs, adapting how they are taught to both their existing ability level and their individual characteristics.
Potential Difficulties	Among the major difficulties in implementing this strategy is the substantial problem of ensuring that what appears to be effective training, if conducted properly, is effectively delivered. To ensure that high quality training is provided, states need to re-establish, or develop anew, an oversight mechanism by which they can ensure that both public and privately offered driver training for young drivers adheres to important standards. The infrastructure for doing this has deteriorated in the past two decades; re-establishing that infrastructure and obtaining the requisite funding to do so are major obstacles. Many state driver education programs exist within a well-entrenched bureaucracy to which changes are difficult and complex to make. The increasing trend toward driver

EXHIBIT V-13 (Continued)
Strategy Attributes for Improving Content and Delivery of Driver Education (E)

Technical Attributes	
	training and education being handled by the private sector makes effective monitoring and oversight somewhat more problematic. As new vendors proliferate it is increasingly difficult to keep track of what they are doing.
Appropriate Measures and Data	Useful process measures would be evidence of the establishment of a standard, required curriculum or standards for driver training. Other interim measures would be the proportion of new drivers who receive appropriate training in the higher order cognitive skills that are critical in good driving. Ultimately, the most important measures would be an overall reduction in crashes during the first six months of unsupervised driving by novices; this would also be reflected in a reduced crash rate among 16- to 18-year-old drivers since this is the age when most individuals in the United States begin driving. However, evaluating the effects of driver education programs is particularly difficult (Peck, 2006). To detect effects clearly will likely require a dedicated study (Lonero and Clinton, 2006).
Associated Needs	An adequate infrastructure through which to monitor the delivery of driver training will be important to the success of this strategy. There is also a need for appropriate state agencies to mandate and certify the kind of training offered. As mentioned under strategy A1, special privileges for novice drivers who complete driver education (e.g., time discounts) should be eliminated. These are associated with an increase, rather than a decrease, in young driver crashes.
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	State policy identifying the kinds of skills that should be incorporated in driver training and, perhaps, how that should be done will be needed. This may require legislative action in some states. Ensuring that the many individuals and organizations that provide driver training follow guidelines requires organizational capability and commitment at the state level. It is important that there be consistency across instructors in what is taught and how. Establishment of certification and monitoring procedures for all organizations that provide driving training is important to ensure uniformity and high quality of course offerings. In addition, establishing a uniform cost for driver training classes may be an effective way of preventing private sector vendors from offering low quality courses that attract students by charging low fees.
Issues Affecting Implementation Time	The speed with which NHTSA and the U.S. Department of Education can produce definitive guidelines on how driver training might most effectively be done will influence how quickly states can act to follow any guidelines that are developed. Beyond this fundamental issue, it is difficult to determine the factors that will be important since it is not yet known what needs to be done.
Costs Involved	Developing or re-establishing an infrastructure to provide driver training to all novices will require funding for personnel to provide training to driver instructors. Funding will also be needed in many states for personnel to monitor compliance with established requirements. It is also important that funding be available for evaluating new programs to determine their operational and safety effectiveness and for improving them based on the results of the evaluations.
Training and Other Personnel Needs	To adequately include the most beneficial content and procedures in driver training will require new or additional training for most individuals who currently provide driver training. The infrastructure through which driver education instructors were trained in the past—in university-based programs—has largely been dismantled in the past two decades, as traditional driver education has lost favor in many states. Consequently, a

EXHIBIT V-13 (Continued)
Strategy Attributes for Improving Content and Delivery of Driver Education (E)

Organizational and Institutional Attributes	
	mechanism for providing training to new driver education/training instructors will need to be developed and implemented.
Legislative Needs	Legislation may be required to establish or modify mandatory content criteria for driver training. Additionally, legislation will likely be required in many states to develop and fund an infrastructure to ensure that driver trainers are qualified to offer this training.
Other Key Attributes	
	Useful details for how states will most beneficially develop and implement this strategy are expected to be available after completion of efforts by NHTSA in conjunction with the U.S. Department of Education to determine the most effective approach to driver training, as spelled out in the recent transportation authorization bill (SAFETEA-LU). Numerous efforts are presently under way to develop new approaches to young driver training that may produce crash reductions (Transportation Research Board, 2006). Accordingly, evidence-based guidance for revising or implementing driver training programs may become available in the next few years.

Information on Agencies or Organizations Currently Implementing this Strategy

Information about the Oregon DOT's driver education program is available at: http://www.oregon.gov/ODOT/TS/drivers_ed.shtml.

Objective 1.1 E—Employ School-Based Strategies

Strategy 1.1 E1—Eliminate Early School Start Times (i.e., before 8:30 a.m.) (T)

General Description

Driving while sleepy or tired can result in decreased alertness, slowed reaction times, failure to notice emergency situations and, in the extreme, falling asleep. Recent studies suggest that even moderate sleep deprivation, of the sort experienced by the end of a long day, can impair drivers' cognitive abilities comparably to having a blood alcohol concentration (BAC) at the legal limit of .08 percent (Faletti et al., 2003; Williamson and Feyer, 2000). Accurate data on the role of fatigue or drowsiness in crashes are difficult to obtain from existing databases. However, according to NHTSA's Crashworthiness Data System (CDS), from 2000 to 2003 approximately 4 percent of crashes involved a driver who was either sleepy or had fallen asleep. Drivers younger than 25 are responsible for a majority of drowsy driving crashes (Pack et al., 1995) (see *NCHRP Report 500, Volume 14: A Guide for Reducing Crashes Involving Drowsy and Distracted Drivers*).

Recent developments in understanding human sleep needs indicate that teenagers need more sleep than either younger children or adults, and they need to be asleep in the early morning hours (e.g., 6 a.m.; Jenni et al., 2005; National Sleep Foundation, 2000). As a result of this new knowledge, school systems throughout the United States have begun to reverse the decades-long trend toward earlier high school start times. The results of moving start times back from 7:30 a.m. or earlier to 8:30 a.m. or later have been dramatic

improvements in both academic performance and behavior (Dexter et al., 2003; Wolfson and Carskadon, 1998).

Studies in North Carolina and Kentucky have found that another benefit of later school start times is a reduction in teen driver crashes. In both cases, when county-wide school systems revised school start times, motor vehicle crashes involving high-school age drivers decreased. In North Carolina when a moderate sized county changed the school start time from 7:30 a.m. to 8:45 a.m., the per capita crash rate of 16- and 17-year-olds declined 18 percent. This compares with a 7.6 percent decline in three other comparable counties over the same time period (apparently reflecting the effect of a change in young driver licensing that took effect at the same time). A similar effect was seen in Kentucky (Danner, 2002).

EXHIBIT V-14
Strategy Attributes for Eliminating Early School Start Times (i.e., before 8:30 a.m.) (T)

Technical Attributes	
Target	High school age drivers
Expected Effectiveness	Two studies suggest that delaying school start times from 7:30 a.m. or earlier until 8:30 a.m. or later may result in as much as a 20% decline in crashes among 16- and 17-year-old drivers. However, both these studies were confounded by decreases resulting from changes in teen driver licensing policies so it is difficult to provide a precise estimate of likely effects in the absence of such policies. Moreover, it is not known whether there is a linear relationship between crash rates and school start times or whether there may be a threshold below which changes may produce no effect. Hence, changing start time by 15 minutes or delaying an already late start time may produce no benefits.
Keys to Success	Creating a group of key stakeholders to work in support of local or statewide policy change will likely be crucial. Given that later school start times are associated with improved academic performance (Wolfson and Carskadon, 2003: Millman et al., 2005), there is a natural opportunity for partnerships with the education community. Teachers, parent groups and school administrators may be allies of transportation safety organizations to support a strategy that promotes both safety and learning.
Potential Difficulties	School start times are carefully arranged to make use of school buses and to take a variety of other factors into account. Although many school systems have switched to later start times for high schools, community-specific issues and concerns may interfere with alterations of school schedules.
Appropriate Measures and Data	A useful process measure is the number of driving age students affected by later school start times. The main outcome measures are the number and rates of crashes among drivers of high school age (typically those younger than 18).
Associated Needs	
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	Altering early school start times can reduce young driver crashes, but other policy decisions can counterbalance these benefits if young driver safety is not considered. For example, some high schools have open-lunch policies that allow some or all students to leave campus during their lunch period. One reason for such policies is to relieve congestion in school cafeterias. Not surprisingly, open-lunch policies are associated with

EXHIBIT V-14 (Continued)
Strategy Attributes for Eliminating Early School Start Times (i.e., before 8:30 a.m.) (T)

Organizational and Institutional Attributes	
	more frequent vehicle crashes among young drivers. A recent study compared crashes involving teen drivers in three counties in North Carolina: two with open lunch policies and one without. The rate of crashes was three times higher between the hours of 12 p.m. and 2 p.m. in the two counties with open-lunch policies (Stone and Runyan, 2005). Also of note, teens were carrying more passengers with them at the time of the crash in the counties with open-lunch policies. To reduce expenses, some school systems are also encouraging more students to drive themselves to school rather than ride a school bus. This will inevitably result in more crashes involving young drivers. Research shows that school buses are the safest form of transportation for teens. On a per-trip basis, students are 44 times more likely to be killed in a vehicle with a teen driver than while riding on a school bus (Transportation Research Board, 2002).
Issues Affecting Implementation Time	The main factor affecting implementation time is the need to discuss, debate, and enact a policy. It is also likely that such a policy would only be enacted at the beginning of a school year, causing some additional lag time.
Costs Involved	There may be added school transportation costs resulting from a decreased ability to use the same school buses to transport younger students and high school students.
Training and Other Personnel Needs	None identified.
Legislative Needs	To implement this as a statewide policy, legislation may be needed. Local school boards generally control school schedules and can implement this strategy on their own.
Other Key Attributes	
	None identified.

Information on Agencies or Organizations Currently Implementing this Strategy

Many local school systems throughout the United States have discontinued early high school start times. These include Edina and Minneapolis, Minnesota; Ithaca, New York; South Burlington, Vermont; Forsyth County, North Carolina; and Fayette County, Kentucky.

Strategy 1.1 E2—Review Transportation Plans for New/Expanded High School Sites (E)

General Description

Each year, approximately 450 teens are killed and 78,000 injured in crashes during normal school travel hours (Transportation Research Board, 2002). Teen drivers represent only about 15 percent of the trips and miles traveled to and from schools, yet they account for more than 50 percent of the injuries and fatalities related to school travel (Committee on School Transportation Safety, 2002). Because some of these crashes occur on or near school property, efforts to manage driving risk in and around schools can play a role in reducing young driver crashes.

When new schools are built—or existing schools expanded or redesigned—there is an opportunity for state and local transportation agencies to become involved as transportation plans are developed. Although the focus of such plans is to ensure that road users can get into and out of the school efficiently and safely, it is important to take into account that there will be a high concentration of inexperienced teens driving in the vicinity of the high school. Careful layout of entrances and exits to parking lots as well as the roadway configurations in the immediate vicinity can reduce crashes by preventing conditions that are more difficult for young drivers to navigate. For example, separating student parking lots from bus traffic and drop-off/pick-up locations—with their congestion and myriad of extra-vehicular distractions to which young drivers are particularly vulnerable—may help to reduce crashes. It is also important to consider the heavy pedestrian traffic near schools and to ensure that pedestrians and traffic are separated as much as possible. In addition, young drivers are involved in a disproportionate number of crashes involving left turns; hence, long left turn lanes with adequate sight distances are needed, and left turns across traffic should be avoided (where possible). Other engineering measures such as speed bumps, one-way roads and angled parking spaces have the potential to improve young driver safety.

At present, only a few jurisdictions involve city/county DOTs when new schools are built or existing schools are expanded. In New Mexico, for instance, DOT personnel are sometimes invited to review transportation plans for new schools in the city of Santa Fe. In Maine, the Department of Education provides 10 year plans to DOT personnel to help identify and prevent traffic problems near schools. Establishing formalized procedures to institutionalize collaboration between DOTs and the public school systems will more effectively ensure that traffic safety considerations are factored into transportation plans in the vicinity of high schools; young driver safety issues should always be considered during this process.

EXHIBIT V-15
Strategy Attributes for Reviewing Transportation Plans for New/Expanded High School Sites (E)

Technical Attributes	
Target	High school age drivers, Transportation Planners, and Local School Boards
Expected Effectiveness	The expected effectiveness of this strategy is currently unknown.
Keys to Success	To ensure that DOTs are involved in the transportation plans of all new and expanded schools, it is important that formal agreements be established between DOTs and public school systems. Mechanisms are needed that will inform DOTs early in the process of new school design/construction. Although this strategy is most easily employed with new schools, it is also important that transportation plans be reviewed whenever existing schools are expanded or modified. Many existing schools have dangerous traffic patterns that can most easily be improved in conjunction with new construction.
Potential Difficulties	Each school will have different characteristics that affect teen driver risk. Thus, the same safety solutions cannot be applied to all schools. In urban areas, for example, traffic around the school may be high, and there may be fewer options for designing egress and ingress points. In rural areas, flexibility may be greater in designing traffic patterns; however, students may be dispersed onto two-lane roads with high speed limits that entail substantial risk for novice drivers.

EXHIBIT V-15 (Continued)
Strategy Attributes for Reviewing Transportation Plans for New/Expanded High School Sites (E)

Technical Attributes	
Appropriate Measures and Data	As with other strategies, the main outcome measures are the number and rates of crashes among drivers of high school age (typically those younger than 18). Decreases in crashes should occur on weekdays during normal school travel hours. Crash data available from local law enforcement agencies will provide a more sensitive measure of the effects of this highly localized strategy.
Associated Needs	None identified.
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	When designing a transportation plan for new or expanding schools, it is important to involve key groups in the process such as parents, school staff, law enforcement representatives and residents of adjoining neighborhoods. These groups can give important input and feedback regarding critical safety-related factors at the school location, local traffic patterns and transportation needs of the nearby community. They can also provide valuable feedback about the viability of draft transportation plans. One method for ensuring that all relevant groups are involved is to conduct well-publicized, open meetings to address the issue.
Issues Affecting Implementation Time	It may take some time to establish formal agreements between DOTs and the public school system. However, this strategy can be implemented quickly once these agreements are in place.
Costs Involved	The main cost associated with this strategy is DOT staff time to review and modify transportation plans.
Training and Other Personnel Needs	This strategy may require considerable time on the part of DOT personnel, particularly in fast growing communities where school systems are expanding quickly. This could result in the need for additional personnel.
Legislative Needs	To implement this as a statewide policy, legislation may be needed.
Other Key Attributes	
	None identified.

Information on Agencies or Organizations Currently Implementing this Strategy

The Texas DOT has implemented the "Precious Cargo Program," which is designed to ensure that TxDOT staff review school site plans and make recommendations before schools are built. Since the program's inception, more than 180 schools in the state have seen traffic safety improvements around their schools or future school sites. For further information, see: http://tti.tamu.edu/documents/0-4286-S.pdf.

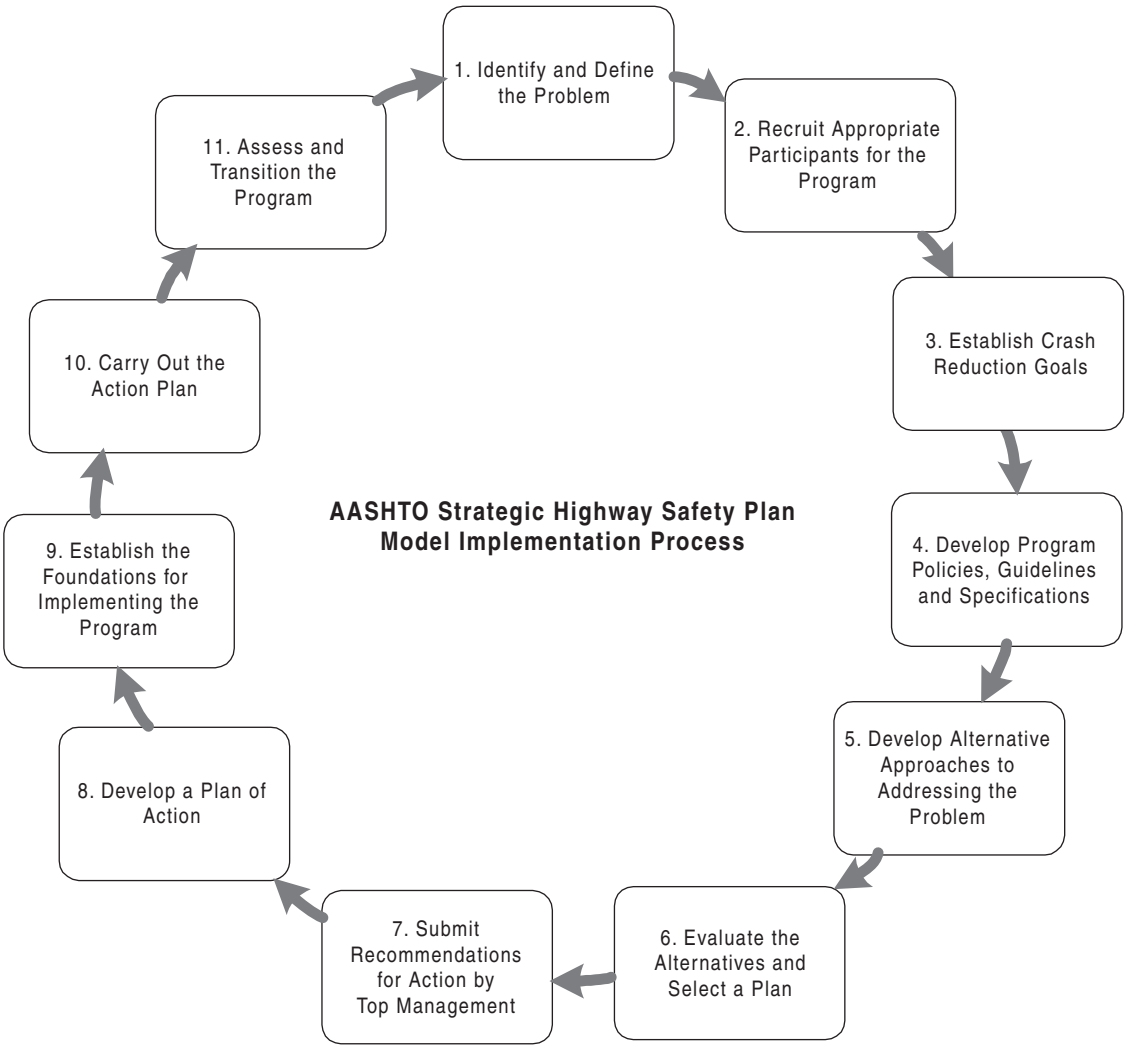
SECTION VI

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



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/reports/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 (a*pprovals 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 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 Appendix G 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 are 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

SECTION VII

Key References

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Appendixes

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

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
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Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation