U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: INFORMATION: Safety Data, Legislation, and "Countermeasures that Work" Document

Date: March 5, 2008

From: Jeffrey A. Lindley
Associate Administrator for Safety

In Reply Refer To: HSSI

To: Division Administrators
Directors of Fields Services

As States advance fully comprehensive and data-driven highway safety programs, improved access to sources of data and strategy evaluation information is extremely valuable. One important element of this expanded access to information has been the strong relationships among US DOT agencies, and we are distributing the following materials provided by the National Highway Traffic Safety Administration (NHTSA):

- The attached "Data Support for States' HSP Development" memorandum is provided annually to NHTSA field offices to provide guidance on sources of significant data to help each State in developing data-driven highway safety plans (HSPs). NHTSA reaches out to the FHWA Office of Safety to include highway safety data especially relating to infrastructure priorities, and the attachment to this memorandum includes fatality data relating to roadway departure, intersections, pedestrians, and speeding characteristics.
- State-level enactment and enforcement of highly-effective highway safety laws is critically important for successful programs, and the attached "Traffic Safety Laws/Facts" includes information on such legislation. The format is designed to support use as a convenient 'pocket card'. Note that 'MCH' is motorcycle helmet law, 'PSB' is primary seatbelt law, 'GDL' is graduated license legislation, and 'SobrChckPt' indicates whether the State allows traffic stops for sobriety check points.
- The "Countermeasures that Work – A Highway Safety Countermeasure Guide for State Highway Safety Offices; Third Edition, 2008" is the most recent version of a basic reference to assist State Highway Safety Offices in selecting effective, science-based traffic safety countermeasures for major highway safety problem areas. In addition to the attached (electronic) version of the report, it is also available at: http://www.nhtsa.gov/staticfiles/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/HS810891.pdf. We expect to receive printed copies of the report from NHTSA soon, and plan to send several copies to each FHWA division office.

MOVING THE AMERICAN ECONOMY

We hope you find this information valuable. In the interest of furthering a fully comprehensive approach to highway safety, I encourage you to share these materials with your partners at the State if they have not received them from NHTSA sources.

3 Attachments

Memorandum

U.S. Department
of Transportation
National Highway
Traffic Safety
Administration

FEB 19 2008

Subject: Data Support for States' HSP Development

Reply to Attn. of

From: Marlene Markison
Associate Administrator
Regional Operations and Program Delivery

To: NHTSA Regional Administrators

Section 2008 of SAFETEA-LU, "NHTSA Accountability," states: "In order to provide guidance to State highway safety agencies on matters that should be addressed in the goals and initiatives of the State highway safety program, the [Agency] shall provide data-based recommendations to each State at least 90 days before the date on which the program is to be submitted for approval." This memo supports the SAFETEA-LU directive and continues the practice, now in its fifth year, of presenting the Regions with significant state-by-state safety data sources each year that should be provided to each State for use in developing data-driven highway safety plans (HSPs).

When working with your States, please emphasize that the performance measures used to set goals and select appropriate countermeasures in their HSPs should be the same measures used in their annual evaluation reports. Furthermore, remind the States that NHTSA and the Governors Highway Safety Association are developing voluntary guidance on a minimum set of performance indicators to be used by Federal, State and local governments in developing and implementing highway safety plans and programs. The goal is to agree by August 2008 on a set of measures that NHTSA and the States will use in plans for FY 2010 and beyond.

The National Center for Statistics and Analysis (NCSA) has posted its State-by-State data sheets for 2006, which contain the most recent data, on the web as noted below, as well as a link to the Fatality Analysis Reporting System (FARS) data. Additional data is available from the Federal Motor Carrier Administration and the Federal Highway Administration. The available data elements include major highway safety indicators such as total fatalities and rates, safety belt use, alcohol-related fatalities and rates, as well as large truck fatalities and intersection fatalities.

To obtain specific information, please use the following instructions:

- State-by-State profile of traffic safety data and other information crash statistics – Go to http://www.nhtsa.dot.gov/stsi. Click on individual States for specific information.

- From the FARS Website Encyclopedia, FARS statistical reports extracted – by State – as published in the Traffic Safety Facts Annual Report. Go to http://www-fars.nhtsa.dot.gov . Under "Reports", scroll down to "States" for a sub-menu of specific State data reports.

- National Emergency Medical Services Information System (NEMSIS) – Go to http://www.nemsis.org to locate the full NEMSIS Data Dictionary, XML standard, progress of States, and compliant EMS software. Visitors to the site can also access the NEMSIS Revision Wiki to suggest changes to the next version of the Database.

- State Specific Large Truck Crash Information – Go to http://ai.volpe.dot.gov/. Click on the "a&i" logo. Click on "Crash Statistics." Click on an individual State for specific information.

- Other NCSA Reports – At the NHTSA website, http://www.nhtsa.dot.gov/, click on the "NCSA" on the menu bar at the top of the page. Scroll down to view listing of available reports.

- FHWA State Safety Indicators for 2006 -- FHWA has provided the attached table of Selected Characteristics for 2006, which includes data on priority topics such as roadway departure, intersection, pedestrian and speeding fatalities. This information is not separately available on the web, but most elements are included as part of the State-by-State profile data noted in the first bullet above.

Please provide each of your States with the appropriate data sheets or websites as soon as possible. Then, work with your States to ensure that this information is used to craft highway safety plans with data-driven countermeasures that will address State needs most effectively. Their plans should also build upon the data and information generated by the state traffic safety information system supported by the Section 408 program. In addition, notify your data contractors concerning the information in this memo and use them to provide technical assistance to you and your States in this process.

Finally, make sure the States know that our Data Analysis and Evaluation Course remains available through TSI. The course provides an understanding and working knowledge and skills in data analysis and evaluation techniques relevant to State highway safety offices. The data analysis techniques are used for accurate and appropriate problem identification and trend analysis, and the evaluation processes presented should be included as an integral part of every highway safety project and program at the State level.

If you have any questions concerning the information in this memo, please call Jack Oates at (202) 366-2730.

Attachment

Calendar 2006 Highway Fatalities - Selected Characteristics

State	All Fatalities				Fatalities by Crash Characteristic							
	Total	Overall Fatality Rate	Rural Fatality Rate	Urban Fatality Rate	Roadway Departure		Intersection		Pedestrian		Speeding	
					Total	% of Total	Total	% of Total	Total	% of Total	Total	% of Total
Alabama	1,208	2.00	2.70	1.33	778	64%	196	16%	78	6%	567	47%
Alaska	74	1.49	1.82	1.17	38	51%	18	24%	9	12%	30	41%
Arizona	1,288	2.06	3.24	1.51	585	45%	301	23%	167	13%	578	45%
Arkansas	665	2.01	2.49	1.26	450	68%	97	15%	31	5%	96	14%
California	4,236	1.29	2.60	1.00	2,158	51%	851	20%	717	17%	1,403	33%
Colorado	535	1.10	1.98	0.69	296	55%	110	21%	59	11%	182	34%
Connecticut	301	0.95	1.26	0.91	191	63%	65	22%	36	12%	92	31%
Delaware	148	1.57	3.01	0.97	102	69%	47	32%	27	18%	34	23%
District of Columbia	37	1.02	NA	1.02	7	19%	23	62%	17	46%	3	8%
Florida	3,374	1.66	3.61	1.21	1,383	41%	1,016	30%	546	16%	714	21%
Georgia	1,693	1.49	2.05	1.17	940	56%	321	19%	148	9%	407	24%
Hawaii	161	1.58	2.64	1.24	94	58%	29	18%	31	19%	77	48%
Idaho	267	1.76	2.19	1.10	165	62%	62	23%	8	3%	83	31%
Illinois	1,254	1.17	1.70	0.98	763	61%	283	23%	138	11%	555	44%
Indiana	899	1.26	1.47	1.04	498	55%	225	25%	73	8%	194	22%
Iowa	439	1.40	1.80	0.80	267	61%	109	25%	25	6%	31	7%
Kansas	468	1.55	2.56	0.64	281	60%	122	26%	23	5%	128	27%
Kentucky	913	1.91	2.51	1.10	641	70%	143	16%	52	6%	160	18%
Louisiana	982	2.16	2.40	1.98	583	59%	156	16%	96	10%	257	26%
Maine	188	1.25	1.50	0.60	146	78%	23	12%	10	5%	72	38%
Maryland	651	1.16	1.98	0.87	403	62%	151	23%	94	14%	237	36%
Massachusetts	430	0.78	1.14	0.75	279	65%	71	17%	61	14%	148	34%
Michigan	1,085	1.04	2.03	0.59	608	56%	246	23%	136	13%	219	20%
Minnesota	494	0.87	1.27	0.51	286	58%	129	26%	38	8%	128	26%
Mississippi	911	2.20	2.65	1.48	693	76%	137	15%	56	6%	365	40%
Missouri	1,096	1.59	2.42	0.91	706	64%	200	18%	76	7%	470	43%
Montana	263	2.33	2.88	0.53	195	74%	38	14%	12	5%	112	43%
Nebraska	269	1.39	1.87	0.73	160	59%	88	33%	9	3%	64	24%
Nevada	432	1.98	2.97	1.66	214	50%	103	24%	52	12%	159	37%
New Hampshire	127	0.93	1.25	0.69	93	73%	22	17%	6	5%	42	33%
New Jersey	772	1.02	1.54	0.97	276	36%	214	28%	165	21%	56	7%
New Mexico	484	1.88	2.51	1.07	256	53%	61	13%	69	14%	173	36%
New York	1,456	1.03	1.81	0.79	762	52%	449	31%	312	21%	448	31%
North Carolina	1,559	1.54	2.86	0.74	1,099	70%	247	16%	173	11%	539	35%
North Dakota	111	1.41	1.92	0.17	64	58%	17	15%	4	4%	40	36%
Ohio	1,238	1.11	2.30	0.53	762	62%	309	25%	96	8%	253	20%
Oklahoma	765	1.57	2.53	0.70	533	70%	107	14%	46	6%	269	35%
Oregon	477	1.34	2.08	0.74	331	69%	58	12%	47	10%	145	30%
Pennsylvania	1,525	1.41	1.93	1.11	1,047	69%	333	22%	166	11%	675	44%
Rhode Island	81	0.98	1.02	0.97	49	60%	25	31%	15	19%	42	52%
South Carolina	1,037	2.07	3.60	0.56	628	61%	199	19%	125	12%	412	40%
South Dakota	191	2.08	2.44	1.11	141	74%	23	12%	7	4%	48	25%
Tennessee	1,287	1.82	2.56	1.31	859	67%	248	19%	91	7%	296	23%
Texas	3,475	1.46	2.35	0.97	1,911	55%	574	17%	379	11%	1,474	42%
Utah	287	1.11	2.18	0.62	150	52%	36	13%	29	10%	61	21%
Vermont	87	1.11	1.38	0.26	74	85%	10	11%	-	0%	33	38%
Virginia	963	1.19	1.79	0.80	608	63%	162	17%	82	9%	296	31%
Washington	630	1.11	2.18	0.68	378	60%	113	18%	66	10%	253	40%
West Virginia	410	1.96	2.87	0.66	302	74%	43	10%	20	5%	75	18%
Wisconsin	724	1.22	1.73	0.76	429	59%	169	23%	55	8%	283	39%
Wyoming	195	2.07	2.59	0.78	144	74%	18	9%	6	3%	65	33%
National / Total	42,642	1.41	2.30	0.95	24,806	58%	8,797	21%	4,784	11%	13,543	32%
Puerto Rico	507	NA	NA	NA	276	54%	10	2%	139	27%	220	43%

Source data: Fatality Analysis Reporting System (FARS). FHWA Office of Safety, w/ NHTSA NCAC assistance. As of Feb 07, 2008.

Traffic Safety Laws/Facts

Effective as of February 2008

STATE	MCH	PSB	GDL	Ig Inter*	Belt Use Rate	Sobr ChckPt
AK	1976	2006	Yes	Y	82.4%	
AL	1967	1999	Yes		82.2%	Yes
AR	1997			Y	69.9%	Yes
AZ	1976		Yes	F	80.9%	Yes
CA	1992	1993	Yes	Y	94.6%	Yes
CO	1977		Yes	Y	81.1%	Yes
CT	1976	1986	Yes	Y	85.8%	Yes
DE	1978	2003	Yes	Y	86.6%	Yes
FL	2000		Yes	Y	79.1%	Yes
GA	1969	1996	Yes	Y	89.0%	Yes
HI	1977	1985	Yes		97.6%	Yes
IA	1976	1986	Yes	Y	91.3%	
ID	1978		Yes	Y	78.5%	
IL	1969	2003	Yes	F	90.1%	Yes
IN	1977	1998	Yes	Y	87.9%	Yes
KS	1976			Y	75.0%	Yes
KY	1998	2006	Yes	Y	71.8%	Yes
LA	2004	1995	Yes	F	75.2%	Yes
MA	1967		Yes	Y	68.7%	Yes
MD	1992	1997	Yes	Y	93.1%	Yes
ME	1977	2007	Yes		79.8%	Yes
MI	1969	2000	Yes	Y	94.0%	
MN	1977			Y	87.8%	
MO	1967		Yes	Y	77.2%	Yes
MS	1974	2006	Yes	Y	71.8%	Yes
MT	1977		Yes	Y	79.6%	
NC	1968	1985	Yes	Y	88.8%	Yes

Year Repealed

*Ig Inter-Ignition Interlock
Y-Permitted; F-First Offense

NHTSA\Office of Research & Program Development Revised 02/14/2008

Traffic Safety Laws/Facts

Effective as of February 2008

STATE	MCH	PSB	GDL	Ig Inter*	Belt Use Rate	Sobr ChckPt
ND	1977			Y	82.2%	Yes
NE	1989		Yes	Y	78.7%	Yes
NH			Yes	Y	63.8%	Yes
NJ	1968	2000	Yes	Y	91.4%	Yes
NM	1977	1986	Yes	F	91.5%	Yes
NV	1972		Yes	Y	92.2%	Yes
NY	1967	1984	Yes	Y	83.5%	Yes
OH	1978		Yes	Y	81.6%	Yes
OK	1976	1997	Yes	Y	83.1%	Yes
OR	1988	1990	Yes	Y	95.3%	
PA	2003		Yes	Y	86.7%	Yes
RI	1976		Yes	Y	79.1%	
SC	1980	2005	Yes	Y	74.5%	Yes
SD	1977		Yes		73.0%	Yes
TN	1967	2004	Yes	Y	80.2%	Yes
TX	1997	1985	Yes	Y	91.8%	
UT	1977		Yes	Y	86.8%	Yes
VA	1970		Yes	Y	79.9%	Yes
VT	1968		Yes		87.1%	Yes
WA	1990	2002	Yes	Y	96.4%	
WI	1978		Yes	Y	75.3%	
WV	1971		Yes	Y	89.6%	Yes
WY	1983		Yes	Y	72.2%	
TOTAL	**20**	**26**	**46**	**45**		**38**
DC	1970	1997	Yes	Y	87.1%	Yes
PR	1960	1975			92.1%	Yes

Year Repealed

*Ig Inter-Ignition Interlock
Y-Permitted; F-First offense

NHTSA\Office of Research & Program Development Revised 02/14/2008

Countermeasures That Work:

A Highway Safety Countermeasure Guide For State Highway Safety Offices

Third Edition, 2008

NHTSA

www.nhtsa.gov

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Preface to the Third Edition (2008)

The original *Countermeasures That Work* guide was prepared in 2005 by James H. Hedlund, Ph.D., of Highway Safety North, with the assistance of Barbara Harsha, executive director of the Governors Highway Safety Association. The guide was updated in 2007 by Hedlund and William A. Leaf, Preusser Research Group. This Third Edition was prepared by the University of North Carolina Highway Safety Research Center. People contributing to this edition include Arthur H. Goodwin, William L. Hall, J. Craig Raborn, Libby J. Thomas, Scott V. Masten, and Mary Ellen Tucker.

The first seven chapters – Alcohol-Impaired Driving through Older Drivers – were included in the original guide. Chapters 8 and 9, on pedestrian and bicycle safety, were added in the Second Edition. All chapters have been revised and updated for this Third Edition. Information and research studies through May 31, 2007, have been reviewed and included as appropriate. Data has been updated to include information from the National Highway Traffic Safety Administration's (NHTSA's) Traffic Safety Facts 2005 annual report. No new chapters have been added to the Third Edition of the guide.

User Suggestions and Future Editions

NHTSA will update this guide annually and may expand it with additional problem areas and countermeasures as appropriate. In particular, NHTSA is considering adding a chapter on child passenger safety and drugs other than alcohol to the next edition. Users are invited to provide their suggestions and recommendations for the guide:

- How can it be improved, in form and content?
- Specific comments on information in the guide.
- Additional problem areas to include.
- Additional countermeasures to include for the current problem areas.
- Additional key references to include.

Please send your suggestions and recommendations to:

Countermeasures That Work
NHTSA
Office of Behavioral and Safety Research, NTI-130
1200 New Jersey Avenue SE.
Washington, DC 20590

or by e-mail to countermeasuresthatwork@nhtsa.dot.gov

Introduction

Purpose of the Guide

This guide is a basic reference to assist State Highway Safety Offices (SHSOs) in selecting effective, science-based traffic safety countermeasures for major highway safety problem areas. The guide:

- describes major strategies and countermeasures that are relevant to SHSOs;
- summarizes their use, effectiveness, costs, and implementation time; and
- provides references to the most important research summaries and individual studies.

The guide is not intended to be a comprehensive list of countermeasures available for State use or a list of expectations for SHSO implementation. For a description of an optimal State countermeasure program, SHSOs should refer to the *Highway Safety Program Guidelines*, which delineate the principal components of each of the major program areas.

States should identify problem areas through systematic data collection and analysis and are encouraged to continue to apply innovation in developing appropriate countermeasures. The evaluations summarized in this guide allow SHSOs to benefit from the experience and knowledge gained by others and to select countermeasure strategies that either have proven to be effective or that have shown promise. States choosing to use innovative programs can contribute to the collective knowledge pool by carefully evaluating the effectiveness of their efforts and publishing the findings for the benefit of others.

How to Use the Guide

What's included: The guide contains a chapter for each problem area. Each chapter begins with a brief overview of the problem area's size and characteristics, the main countermeasure strategies, a glossary of key terms, and a few general references. Next, a table lists specific countermeasures and summarizes their use, effectiveness, costs, and implementation time. Each countermeasure is then discussed in approximately one page.

The guide provides an overview and starting point for readers to become familiar with the behavioral strategies and countermeasures in each program area. It has attempted to include countermeasures that have the most evidence of effectiveness as well as those that are used most regularly by SHSOs. Only those countermeasures that could be supported by traditional highway safety grant programs have been considered. In addition, updates to the guide are based only on published research. Unpublished programs and efforts are not included in this edition.

Some countermeasure areas are covered in more depth than others due to the availability of published research. For example, impaired driving has a long and rich research history while other topics, such as driver distraction and fatigue, have received less attention. This difference in the availability of published research findings is due to a number of factors, including the relative scale of the problem areas, the availability of reliable data on the frequency and characteristics of

some safety problems, and the challenge of conducting scientifically valid studies in certain behavioral areas.

References are provided for each countermeasure. When possible, summaries of available research are cited, with Web links where available, so users can find most of the evaluation information in one place. If no summaries are available, one or two key studies are cited. There has been no attempt to list all research, current studies, or program information available on any countermeasure. Readers interested in any problem area or in specific countermeasures are urged to consult the references.

What's not included: Since the guide is intended as a tool for SHSO use, it does not include countermeasures for which SHSOs have little or no authority or responsibility, or that cannot be supported under typical highway safety grant programs. For example, the guide does not include vehicle- or roadway-based solutions. Also, it does not include countermeasures that already are in place in every State, such as .08 blood alcohol concentration (BAC) laws. Finally, the guide does not include administrative or management topics such as traffic safety data systems and analyses, program planning and assessments, State and community task forces, or comprehensive community traffic safety programs.

What the effectiveness data mean: The effectiveness of any countermeasure can vary immensely from State to State or community to community. *What* is done is often less important than *how* it is done. The best countermeasure may have little effect if it is not implemented vigorously, publicized extensively, and funded satisfactorily. Evaluation studies generally examine and report on high-quality implementation because there is little interest in evaluating poor implementation. Also, the fact that a countermeasure is being evaluated usually gets the attention of those implementing it, so that it is likely to be done well. *The countermeasure effectiveness data presented in this guide probably shows the maximum effect that can be realized with high-quality implementation*. Many countermeasures have not been evaluated well, or at all, as noted in the effectiveness data.

NCHRP Guides: The National Cooperative Highway Research Program (NCHRP) is developing a series of guides for State Departments of Transportation (DOTs) to use in implementing the American Association of State Highway and Transportation Officials (AASHTO) Strategic Highway Safety Plan. As of summer 2005, 13 guides had been published and several more were being prepared. This guide draws heavily on the published NCHRP guides and on several draft guides. It differs from the NCHRP guides because it is written for SHSOs, contains only behavioral countermeasures, and is considerably more concise. Readers are urged to consult the NCHRP guides relevant to their interests. They are available at
http://safety.transportation.org/guides.aspx

Disclaimers: As with any attempt to summarize a large amount of sometimes-conflicting information, this guide is highly subjective. All statements, judgments, omissions, and errors are solely the responsibility of the authors and do not necessarily represent the views of the Governors Highway Safety Association (GHSA) or NHTSA. Users who disagree with any statement or who wish to add information or key references are invited to send their comments and suggestions for future editions (see bottom of page vi for details).

New traffic safety programs and research appear almost weekly. Web sites change frequently. This means that this guide was out of date even before it was published. Readers interested in a specific problem area or countermeasure are urged to contact NHTSA for up-to-date information.

Abbreviations, acronyms, and initials used throughout:

- AAA: was the American Automobile Association but now the organization uses only the initials
- AAAFTS: AAA Foundation for Traffic Safety
- AAMVA: American Association of Motor Vehicle Administrators
- AARP: was the American Association of Retired Persons but now the organization uses only the initials
- AASHTO: American Association of State Highway and Transportation Officials
- ADTSEA: American Driver and Traffic Safety Education Association
- ALR: administrative license revocation
- ALS: administrative license suspension
- AMA: American Medical Association
- ASA: American Society on Aging
- BAC: blood alcohol concentration, measured in grams per deciliter (g/dL)
- CDC: Centers for Disease Control and Prevention
- CPSC: Consumer Product Safety Commission
- CTIA: Cellular Telecommunications and Internet Association
- DOT: Department of Transportation (Federal or State)
- DWI: driving while intoxicated/driving while impaired
- DWS: driving while driver's license is suspended
- FHWA: Federal Highway Administration
- FMCSA: Federal Motor Carrier Safety Administration
- GDL: graduated driver licensing
- GHSA: Governors Highway Safety Association
- HOS: hours of service
- IIHS: Insurance Institute for Highway Safety
- ITS: Intelligent Transportation Systems
- MAB: medical advisory board
- MSF: Motorcycle Safety Foundation
- NCHRP: National Cooperative Highway Research Program
- NCSDR: National Center for Sleep Disorders Research
- NCUTLO: National Committee on Uniform Traffic Laws and Ordinances
- NHTSA: National Highway Traffic Safety Administration
- NIAAA: National Institute on Alcohol Abuse and Alcoholism (NIH)
- NIH: National Institutes of Health
- NMSL: National Maximum Speed Limit
- NSC: National Safety Council

- NSF: National Sleep Foundation
- NTSB: National Transportation Safety Board
- SFST: Standardized Field Sobriety Tests
- SHSO: State Highway Safety Office
- SMSA: National Association of State Motorcycle Safety Administrators
- STEP: selective traffic enforcement program
- TIRF: Traffic Injury Research Foundation
- TRB: Transportation Research Board
- UVC: Uniform Vehicle Code

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1. Alcohol-Impaired Driving

Overview

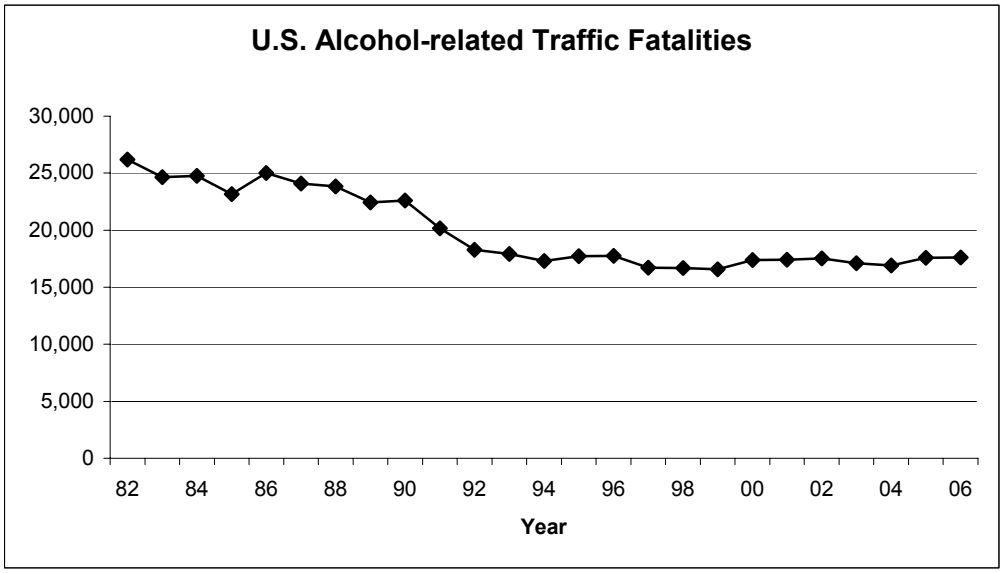
Alcohol-impaired drivers were involved in about one-quarter of U.S. traffic fatalities in 2006 (NHTSA, 2007a, Table 19):

- 14,840 alcohol-involved drivers in fatal crashes (26% of all drivers in fatal crashes);
- 12,491 drivers in fatal crashes with a BAC over .08 grams per deciliter (22% of all drivers in fatal crashes).

The number of fatalities in alcohol-related crashes increased slightly in 2006, from 17,590 in 2005 to 17,602 in 2006 (NHTSA, 2007a, Table 13). See NHTSA's most recent *Traffic Safety Facts* (NHTSA, 2007a) and *State Alcohol Estimates* (NHTSA, 2006b) for the latest national and State data.

Trends. Alcohol-impaired driving dropped steadily from 1982 to the mid-1990s for many reasons. Substantial public attention, the growth of grassroots organizations such as Mothers Against Drunk Driving (MADD) and Remove Intoxicated Drivers (RID), increased Federal programs and funding, State task forces, tougher laws and increased sanctions, increased enforcement, and intensive publicity all combined to help address this critical traffic safety problem. (For a recent overview of MADD's history and effectiveness in reducing alcohol-impaired driving, see Fell and Voas 2006.)

Unfortunately, as the chart shows, impaired driving levels have changed very little since 1992. The easy gains have been made. Public attention and government resources have been redirected to other social problems.



Source: FARS

There is one age group that has recently shown a decrease in alcohol-related traffic fatalities. Between 1996 and 2005, the percent of fatally-injured 16-year-old drivers with a positive BAC de-

creased by 16 percent (Ferguson, Teoh, & McCartt, 2007). It should be noted that most States implemented graduated driver licensing (GDL) systems during this time period. GDL systems have had a substantial impact on reducing the crash risk of young, beginning drivers. (For more information on young drivers and GDL, see Chapter 6.)

Drinking and driving characteristics. Drinking and driving is common, with at least 80 million trips made annually by drivers who are over .08 BAC. Arrests are rare, with less than one arrest for every 50 trips by a driver over .08 BAC (Hedlund & McCartt, 2002).

Many drinking drivers are "high risk," with one or more of the following characteristics:

- Half of drinking drivers in crashes or arrests have a BAC of .15 or higher.
- One-third of drinking drivers in crashes or arrests have a prior DWI conviction.
- One-quarter of drinking drivers in surveys have some indication of an alcohol problem.

Alcohol-impaired driving is affected by several external factors, including geography, urbanization, road structure and conditions, and economic activity, as well as by a State's laws and programs. For all of these reasons, both the current level of alcohol-impaired driving and the progress in reducing alcohol-impaired driving vary greatly from State to State. For example, comparing all 50 States and the District of Columbia (NHTSA, 2006b):

- The proportion of drivers in fatal crashes with a BAC of .08 or higher in 2005 ranged from 9 percent in the lowest States to 33 percent in the highest.
- The change in traffic fatalities involving any alcohol from 1982 to 2005 ranged from a decrease of 64 percent in the best State to an increase of 5 percent in the worst.

Strategies to Reduce Alcohol-Impaired Driving

Five basic strategies are used to reduce alcohol-impaired driving crashes and consequences:

- Deterrence: enact, publicize, enforce, and adjudicate laws prohibiting alcohol-impaired driving so that people choose not to drive impaired;
- Prevention and intervention: reduce drinking, keep drinkers from driving;
- Communications and outreach: inform the public of the dangers of impaired driving and establish positive social norms that make driving while impaired unacceptable;
- Alcohol treatment: reduce alcohol dependency or addiction among drivers; and
- Other traffic safety measures: implement strategies that affect alcohol-impaired drivers and other drivers as well.

This chapter includes countermeasures for the first four strategies. Deterrence countermeasures are divided into four sections: (1) laws, (2) enforcement, (3) prosecution and adjudication, and (4) offender treatment, monitoring, and control. Prevention, intervention, communications, and outreach countermeasures are combined in a single section. Alcohol treatment is included in the offender section. The Underage Drinking and Alcohol-Related Driving section includes deterrence, prevention, and communications measures specific to this age group.

Many other traffic safety countermeasures help reduce alcohol-related crashes and casualties but are not discussed in this chapter. Behavioral countermeasures, such as those that increase seat belt use and reduce speeding, are discussed in other chapters. Vehicle and environmental coun-

termeasures, such as improved vehicle structures and centerline rumble strips, are not included because State Highway Safety Offices (SHSOs) have little or no authority or responsibility for them. See the series of National Cooperative Highway Research Program (NCHRP) Report 500 guides for the American Association of Motor Vehicle Administrators (AASHTO) Strategic Highway Safety Plan, especially the impaired-driving guide (NCHRP, 2005), for detailed discussions of environmental measures.

This chapter does not consider drugs other than alcohol. Other drugs pose quite different and difficult issues at every step, from estimating their prevalence and effect on driving, to developing effective laws and strategies for enforcement, prevention, and treatment. Nevertheless, at least some of the countermeasures discussed herein may also help to deter drug-impaired driving.

Key terms

- BAC: Blood alcohol concentration in the body, expressed in grams of alcohol per deciliter (g/dL) of blood, usually measured with a breath or blood test.
- DWI: the offense of driving while impaired by alcohol. In different States the offense may be called Driving While Intoxicated, Driving Under the Influence (DUI), or other similar terms.
- MADD: Mothers Against Drunk Driving.
- PAS: Passive alcohol sensor, a device to detect alcohol presence in the air near a driver's face, used to estimate whether the driver has been drinking.
- PBT: Preliminary breath test device, a small handheld alcohol sensor used to estimate or measure a driver's BAC.
- RID: Remove Intoxicated Drivers
- SFST: Standardized Field Sobriety Tests, a battery of three simple tests (One-Leg Stand, Walk-and-Turn, and Horizontal Gaze Nystagmus) used by law enforcement at the roadside to estimate whether a driver is over the legal limit of .08 BAC.
- Illegal per se law: A law that makes it an offense to operate a motor vehicle with a BAC at or above a specified level.

Countermeasures That Work

Countermeasures to reduce alcohol-impaired driving are listed below and discussed individually in the remainder of this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information.

1. Deterrence: laws

Countermeasure	Effectiveness	Use	Cost	Time
1.1 ALR/ALS	Proven	High	High	Medium
1.2 BAC test refusal penalties	Proven-refusals	Unknown	Low	Short
1.3 High-BAC sanctions	Uncertain	Medium	Low	Short
1.4 Open containers	Uncertain	High	Low	Short
1.5 DWI code review	Likely	Low	Medium	Medium

2. Deterrence: enforcement

Countermeasure	Effectiveness	Use	Cost	Time
2.1 Sobriety checkpoints	Proven	Medium	High	Short
2.2 Saturation patrols	Proven-arrests	High	Medium	Short
2.3 Integrated enforcement	Likely	Unknown	Low	Short
2.4 Preliminary Breath Test devices (PBT)	Proven-arrests	High	Medium	Short
2.5 Passive sensors (PAS)	Proven-detection	Unknown	Medium	Short

3. Deterrence: prosecution and adjudication

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Sanctions	Varies	Varies	Varies	Varies
3.2 Diversion, plea agreement restrictions	Proven-convictions	Medium	Low	Short
3.3 DWI courts	Likely	Low	High	Medium
3.4 Court monitoring	Proven-convictions	Low	Low	Short

4. Deterrence: DWI offender treatment, monitoring, and control

Countermeasure	Effectiveness	Use	Cost	Time
4.1 Alcohol problem assessment, treatment	Proven	High	Varies	Varies
4.2 DWI offender monitoring	Proven-recidivism	Unknown	High	Medium
4.3 Alcohol interlocks	Proven	Medium	Medium	Medium
4.4 Vehicle and license plate sanctions	Varies	Medium	Varies	Medium
4.5 Lower BAC limit for repeat offenders	Uncertain	Low	Low	Short

5. Prevention, intervention, communications and outreach

Countermeasure	Effectiveness	Use	Cost	Time
5.1 Responsible beverage service	Likely	Medium	Medium	Medium
5.2 Alternative transportation	Unknown	Unknown	Medium	Short
5.3 Designated drivers	Unknown	Medium	Low	Short
5.4 Alcohol screening and brief interventions	Proven	Medium	Medium	Short
5.5 Mass-media campaigns	Proven *	High	High	Medium

* High-quality campaigns supporting other program activities, such as enforcement

6. Underage drinking and alcohol-related driving

Countermeasure	Effectiveness	Use	Cost	Time
6.1 Age 21 enforcement	Varies	Varies	Varies	Varies
6.2 Zero-tolerance enforcement	Likely	Unknown	Medium	Short
6.3 School education programs	Uncertain	Unknown	Low	Long
6.4 Youth programs	Uncertain	High	Varies	Medium

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results
Likely: balance of evidence from high-quality evaluations or other sources
Uncertain: limited and perhaps ambiguous evidence
Unknown: no high-quality evaluation evidence
Varies: different methods of implementing this countermeasure produce different results

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise. See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities
Medium: between one-third and two-thirds of States or communities
Low: less than one-third of the States or communities
Unknown: data not available

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources
Medium: requires some additional staff time, equipment, facilities, and/or publicity
Low: can be implemented with current staff, perhaps with training; limited costs for equipment, facilities, and publicity

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year
Medium: more than three months but less than one year
Short: three months or less

These estimates do not include the time required to enact legislation or establish policies.

Deterrence

Deterrence means enacting laws that prohibit driving while impaired, publicizing and enforcing those laws, and punishing the offenders. Deterrence works by changing behavior through the fear of apprehension and punishment. If drivers believe that impaired driving is likely to be detected and that impaired drivers are likely to be arrested, convicted, and punished, many will not drive while impaired by alcohol. This strategy is sometimes called *general deterrence* because it influences the general driving public through well publicized and highly visible enforcement activities and subsequent punishment. In contrast, *specific deterrence* refers to efforts to influence drivers who have been arrested for impaired driving so that they will not continue to drive while impaired by alcohol.

Deterrence works when consequences are swift, sure, and severe (with swift and sure being more important in affecting behavior than severe). All States have the basic laws in place to define impaired driving, set illegal per se limits at .08 BAC, and provide standard penalties.

Deterrence, however, is far from straightforward, and complexities can limit the success of deterrence measures. For instance:

- Detecting alcohol-impaired drivers is difficult. Alcohol-impaired driving is a common behavior, law enforcement agencies have limited resources, and (except at checkpoints) officers must observe some traffic violation or other aberrant behavior before they can stop a motorist.
- Conviction also may be difficult. DWI laws are extremely complicated (20 pages in some State codes); the evidence needed to define and demonstrate impairment is complex; judges and juries may not impose specified penalties for an action that they do not believe is a "real crime."
- The DWI control system is complex. There are many opportunities for breakdowns in the system that allow impaired drivers to go unpunished.

DWI control system operations and management.

The DWI control system consists of a set of laws together with the enforcement, prosecution, adjudication, and offender follow-up policies and programs to support the laws. In this complicated system, the operations of each component affect all the other components. Each new policy, law, or program affects operations throughout the system, often in ways that are not anticipated.

This guide documents 16 specific impaired-driving countermeasures in the deterrence section, in four groups: laws, enforcement, prosecution and adjudication, and offender treatment, monitoring, and control. But the overall DWI control system, including its management and leadership, is more important than any individual countermeasure.

Recent studies have highlighted the key characteristics of an efficient and effective DWI control system (Hedlund & McCartt, 2002; Robertson & Simpson, 2003):

- Training and education for law enforcement, prosecutors, judges, and probation officers;

- record systems that are accurate, up-to-date, easily accessible, and able to track each DWI offender from arrest through the completion of all sentence requirements;
- adequate resources for staff, facilities, training, equipment, and new technology; and
- coordination and cooperation within and across all components.

A few of the countermeasures discussed in this guide, such as BAC test refusal penalties (Chapter 1, Section 1.2), DWI code review (1.5), and DWI courts (3.2), are directed at improving DWI system operations. Most, though, are not. The most important action many SHSOs can take to reduce alcohol-impaired driving may be to review and improve DWI control system operations, perhaps using a State DWI task force and/or a State alcohol program assessment.

Ulmer, Hedlund, and Preusser (1999) investigated why some States reduced alcohol-related traffic fatalities more than others. They concluded that there is no "silver bullet," no single critical law, enforcement practice, or communications strategy. Once a State has effective laws, high-visibility enforcement, and substantial communications and outreach to support them, the critical factors are strong leadership, commitment to reducing impaired driving, and adequate funding. SHSOs should keep this in mind as they consider the specific countermeasures in this chapter.

1.1 Administrative License Revocation or Suspension (ALR or ALS)

Effectiveness: Proven	Use: High	Cost: High	Time: Medium

Administrative license revocation (ALR) or administrative license suspension (ALS) laws allow law enforcement and driver licensing authorities to revoke or suspend a driver's license if the driver fails or refuses to take a BAC test. The license revocation or suspension occurs very quickly: usually the arresting officer takes the license at the time that a BAC test is failed or refused. The driver typically receives a temporary license that allows the driver time to make other transportation arrangements and to request and receive an administrative hearing or review. In most jurisdictions, offenders may obtain an occupational or hardship license during part or all of the revocation or suspension period (NCHRP, 2003; NHTSA, 2006c; McCartt, Geary, & Nissen, 2002). NHTSA recommends that ALR laws include a minimum license suspension of 90 days. A model ALR law is provided by National Committee on Uniform Traffic Laws and Ordinances [NCUTLO] (2007).

ALR and ALS laws provide for swift and certain penalties for DWI, rather than the lengthy and uncertain outcomes of criminal courts. They also protect the driving public by removing some DWI offenders from the road (but see the discussion of driving with a suspended license, under other issues, below).

Use: As of June 2007, 41 States and the District of Columbia had some form of ALR or ALS law. An additional two States had an alternative method for removing the license quickly, before criminal action in court (MADD, 2007; McCartt, Geary, & Nissen, 2002; NHTSA, 2006d).

Effectiveness: A summary of 12 evaluations through 1991 found that ALR and ALS laws reduced crashes of different types by an average of 13 percent (Wagenaar, Zobek, Williams, & Hingson, 2000). Studies that evaluated ALR in combination with other laws found similar effects. Voas and Tippetts found that ALR laws in combination with other laws reduced alcohol-related fatal crashes by about 30 percent over the period 1982-1997 (Jones & Lacey, 2001). There is some evidence that ALR laws also are effective in reducing repeat offenses (Jones & Lacey, 2001). The Centers for Disease Control and Prevention concluded that ALR and ALS effectiveness is so well established that a synthesis of the evaluation evidence is not needed.

Costs: ALR laws require funds to design, implement, and operate a system to record and process administrative license actions. In addition, a system of administrative hearing officers must be established and maintained. Some States have recovered ALR system costs through offender fees (Century Council, 2003; NHTSA, 2006d).

Time to implement: Six to 12 months are required to design and implement the system and to recruit and train administrative hearing officers.

Other issues:

- **Two-track system:** Under ALR or ALS laws, drivers face both administrative and criminal actions for DWI. The two systems operate independently. Drivers whose licenses have been suspended or revoked administratively still may face criminal actions

that also may include license suspension or revocation. This two-track system has been challenged in some States. All State supreme courts have ruled against these challenges (NHTSA, 2006d).

- **Driving with a suspended license:** Many DWI offenders continue to drive with a suspended or revoked license, though there is some evidence that they drive less frequently and/or more carefully than before their license action. Both administrative and criminal laws that remove a driver's license should be accompanied by strategies to reduce driving with a suspended or revoked license (see NCHRP, 2003, for a thorough discussion of ten potential strategies; see also Chapter 1, Sections 4.3, 4.4 and 5.2).
- **Hearings:** An effective ALR system will restrict administrative hearings to the relevant facts: that the arresting officer had probable cause to stop the car and require a BAC test and that the driver refused or failed the test. Such a system will reduce the number of hearings requested, reduce the time required for each hearing, and minimize the number of licenses that are reinstated. When administrative hearings are not restricted in this way they can serve as an opportunity for defense attorneys to question the arresting officer about many aspects of the DWI case. This may reduce the chance of a criminal DWI conviction (Hedlund & McCartt, 2002). Officers often spend substantial time appearing in person at ALR hearings, and cases may be dismissed if an officer fails to appear. Some States use telephonic hearings to solve these problems (Wiliszowski, Jones, & Lacey, 2003).

1.2 BAC Test Refusal Penalties

Effectiveness: Proven-refusals	Use: Unknown	Cost: Low	Time: Short

A driver's BAC is a critical piece of evidence in any alcohol-impaired driving action. A positive BAC provides evidence of alcohol presence that supports the basic DWI charge. All States have enacted per se laws under which it is illegal to drive with a BAC of .08 or greater, with no other evidence required. Many States have established more severe penalties for drivers with BACs that exceed a specific higher BAC level, typically .15 or .16 (see Chapter 1, Section 1.3, High-BAC Sanctions). Finally, administrative license revocation or suspension (ALR or ALS) laws are based entirely on the driver's BAC level.

All States have implied consent laws stipulating that people implicitly consent to be tested if they are suspected of impaired driving (NHTSA, 2007b). However, many drivers refuse to provide a breath or blood sample for a BAC test. In 2001, about 25 percent of all drivers arrested for DWI refused the BAC test (Zwicker, Hedlund, & Northrup, 2005). Two States had test refusal rates over 80 percent.

All States have established separate penalties for BAC test refusal, typically involving administrative license revocation or suspension. If the penalties for refusal are less severe than the penalties for failing the test, many drivers will refuse (see also Simpson & Robertson, 2001). The Model DWI code sets a more severe penalty for test refusal than for test failure (NCUTLO, 2007).

Use: The relative penalties in each State for failing and refusing a BAC test cannot be categorized in a straightforward manner due to the complexity of State alcohol-impaired driving laws and the differences in how these laws are prosecuted and adjudicated. All States except Nevada impose administrative sanctions for test refusal (NHTSA, 2007b). Zwicker et al. (2005) summarize each State's laws as of 2001 in Appendices A and B. NHTSA (2006c) gives more detail on each State's laws.

Effectiveness: Zwicker et al. (2005) found that test refusal rates are lower in States where the consequences of test refusal are greater than the consequences of test failure. These consequences are determined both by the statutory penalties for test refusal and failure and by operational considerations of the DWI system. Operational considerations include issues such as whether test refusal is admissible in court as part of the DWI proceedings and whether hardship licenses are routinely available for drivers whose licenses are suspended for test refusal.

Reduced test refusal rates will help the overall DWI control system by providing better BAC evidence. This in turn reduces pleas to non-alcohol offenses and may increase DWI and high-BAC DWI convictions, increases the likelihood that prior DWI offenses will be properly identified, and provides the court with better evidence for offender alcohol assessment.

Costs: There are no direct costs of increasing penalties for BAC test refusal.

Time to implement: Increased BAC test refusal penalties can be implemented as soon as appropriate legislation is enacted.

Other issues:

- **Criminalizing test refusal:** BAC test refusal is a criminal offense in 15 States (NHTSA, 2007b; see also Zwicker et al., 2005, Appendix A; Century Council, 2003, p. 31; NCHRP, 2005, Strategy C2). Criminalizing test refusal decreases the likelihood that drinking drivers can avoid penalties by refusing to be tested. It also ensures the drinking driver will be identified as a repeat offender upon subsequent arrests.

1.3 High-BAC Sanctions

Effectiveness: Uncertain	Use: Medium	Cost: Low	Time: Short

Many States increase the penalties for the standard impaired driving (DWI) offense for two classes of drivers. Almost all States increase the penalties for repeat offenders. Recently, some States also have increased the penalties for drivers with a high BAC, typically .15 or .16 or higher.

High-BAC sanctions are based on the observation that many high-BAC drivers are habitual impaired driving offenders, even though they may not have a record of previous arrests and convictions. Moreover, drivers with high BACs put themselves and other road users at risk: a driver with a BAC of .15 or higher is at least 20 times more likely than a sober driver to be involved in a fatal crash (NHTSA, 2006e). Enhanced sanctions for high-BAC drivers vary by State, and may include mandatory assessment and treatment for alcohol problems, close monitoring or home confinement, installation of an ignition interlock, and vehicle or license plate sanctions (see Chapter 1, Sections 4.1, 4.2, 4.3 and 4.4).

Use: As of January 2006, 31 States and the District of Columbia had high-BAC laws (NHTSA, 2006e). MADD (2007) lists 39 States and the District of Columbia.

Effectiveness: In the only evaluation of high-BAC sanctions to date, McCartt and Northrup (2003, 2004) found that Minnesota's law appears to have increased the severity of case dispositions for high-BAC offenders, although the severity apparently declined somewhat over time. They also found some evidence of an initial decrease in recidivism among high-BAC first offenders. The BAC test refusal rate declined for first offenders and was unchanged for repeat offenders after the high-BAC law was implemented. The authors point out that Minnesota's law has a high threshold of .20 BAC, relatively strong administrative and criminal sanctions, and strong penalties for BAC test refusal.

Costs: High-BAC sanctions will produce increased costs if the high-BAC penalties are more costly per offender than the lower-BAC penalties. Over a longer period, if high-BAC sanctions reduce recidivism and deter alcohol-impaired driving, then costs will decrease.

Time to implement: High-BAC sanctions can be implemented as soon as appropriate legislation is enacted.

Other issues:

- **Test refusal:** High-BAC sanctions may encourage some drivers to refuse the BAC test unless the penalties for test refusal are at least as severe as the high-BAC penalties. See Chapter 1, Section 1.2.

1.4 Open Containers

Effectiveness: Uncertain	Use: High	Cost: Low	Time: Short

Open-container laws prohibit the possession of any open alcoholic beverage container and the consumption of any alcoholic beverage by motor vehicle drivers or passengers. These laws typically exempt passengers in buses, taxis, and the living quarters of mobile homes.

In 1998, Congress required States to enact open-container laws or have a portion of their Federal aid highway construction funds redirected to alcohol-impaired driving or hazard elimination activities (23 U.S.C. § 154; NHTSA, 2006f).

Use: As of January 2006, 39 States and the District of Columbia had open-container laws that complied with the Federal requirements (NHTSA, 2006f). MADD (2007) lists 40 States and the District of Columbia.

Effectiveness: The only study of open-container law effectiveness (Stuster, Burns, & Fiorentino, 2002) examined four States that enacted laws in 1999. It found that the proportion of alcohol-involved fatal crashes appeared to decline in three of the four States during the first six months after the laws were implemented, but the declines were not statistically significant. In 1999, the proportion of alcohol-involved fatal crashes was higher in States with no open-container law than in States with a law. Survey data show strong public support for open-container laws in both law and no-law States.

Costs: Open-container law costs depend on the number of offenders detected and the penalties applied to them.

Time to implement: Open-container laws can be implemented as soon as appropriate legislation is enacted.

1.5 Alcohol-Impaired Driving Law Review

Effectiveness: Likely	Use: Low	Cost: Medium	Time: Medium

Alcohol-impaired driving laws in many States are extremely complex. They are difficult to understand, enforce, prosecute, and adjudicate, with many inconsistencies and unintended consequences. In many States, a thorough review and revision would produce a system of laws that would be far simpler and more understandable, efficient, and effective.

DWI laws have evolved over the past 30 years to incorporate new definitions of the offense of driving while impaired (illegal per se laws), new technology and methods for determining impairment (BAC tests, Standardized Field Sobriety Tests), and new sentencing and monitoring alternatives (electronic monitoring, alcohol ignition interlocks). Many States modified their laws to incorporate these new ideas without reviewing their effect on the overall DWI control system. The result is often an inconsistent patchwork. Robertson and Simpson (2003) summarized the opinions of thousands of law enforcement officers, prosecutors, judges, and probation officials across the country: "Professionals unanimously support the simplification and streamlining of existing DWI statutes" (p. 18). See also Hedlund and McCartt (2002).

The National Committee on Uniform Traffic Laws and Ordinances (NCUTLO) has prepared a model DWI law, which has been incorporated into the Uniform Vehicle Code (NCUTLO, 2007). It addresses BAC testing, BAC test refusals, higher penalties for high-BAC drivers, ALR hearing procedures, and many other issues of current interest. States can use the NCUTLO model as a reference point in reviewing their own laws. In addition, TIRF recently released a guidebook to assist policymakers in leading a strategic review of DWI systems, with the goal of streamlining systems and closing loopholes that can be exploited by offenders (www.trafficinjuryresearch.com/publications/PDF_publications/TIRF_Booklet.pdf).

Use: Minnesota and Virginia recently reviewed and revised their DWI laws.

Effectiveness: The effect of a law review will depend on the extent of inconsistencies and inefficiencies in a State's current laws. A law review may be the most important single action a State can take to address its alcohol-impaired driving problem, because a thorough law review also will review the function of the entire DWI control system and will identify problem areas. The immediate effect of a law review will be a more efficient and effective DWI control system.

Costs: The review itself will require substantial staff time. Outside groups, such as the defense bar and citizen groups, should be asked to participate, through a mechanism such as a State-level task force. Implementation costs of course will depend on the extent to which the laws are changed.

Time to implement: The review will require four to six months. Its recommendations must then be enacted by the legislature and implemented.

2.1 Sobriety Checkpoints

Effectiveness: Proven	Use: Medium	Cost: High	Time: Short

At a sobriety checkpoint, law enforcement officers stop vehicles at a predetermined location to check whether the driver is impaired. They either stop every vehicle or stop vehicles at some regular interval, such as every third or tenth vehicle. The purpose of checkpoints is to deter driving after drinking by increasing the perceived risk of arrest. To do this, checkpoints should be highly visible, publicized extensively, and conducted regularly. Fell, Lacey, and Voas (2004) provide an overview of checkpoint operations, use, effectiveness, and issues.

Use: Sobriety checkpoints are used occasionally in most of the 40 States and the District of Columbia in which they are permitted (MADD, 2007), but few States conduct them regularly. Fell, Ferguson, Williams, and Fields (2003) found that 37 States and the District of Columbia conducted checkpoints at least once in the year 2000 but only 11 States conducted them on a weekly basis. The main reasons given for not using checkpoints more frequently were lack of law enforcement personnel and lack of funding. Some States have increased checkpoint operations recently. For example, each of the six jurisdictions in NHTSA's Mid-Atlantic Region (the District of Columbia, Delaware, Maryland, Pennsylvania, Virginia, and West Virginia) conducted weekly checkpoints for much of 2003.

Effectiveness: CDC's systematic review of 11 high-quality studies (Elder et al., 2002) found that checkpoints reduced alcohol-related fatal, injury, and property damage crashes each by about 20 percent. A recent statewide campaign in Connecticut involving sobriety checkpoints and extensive paid media found a decrease in alcohol-related fatalities following the program as well as fewer drivers with a positive BAC at roadside surveys (Zwicker, Chaudhary, Maloney, & Squeglia, 2007).

Costs: The main costs are for law enforcement time and for publicity. A typical checkpoint requires several hours from each law enforcement officer involved. Officers must either be diverted from other duties or paid overtime. Law enforcement costs can be reduced by operating checkpoints with 3 to 5 officers, perhaps supplemented by volunteers, instead of the 10 to 12 or more officers used in some jurisdictions (NHTSA, 2002; NHTSA, 2006j; Stuster & Blowers, 1995). Recently, police agencies in two rural West Virginia counties were able to sustain a year-long program of weekly low-staff checkpoints (Lacey, Ferguson, Kelley-Baker, & Rider, 2006). The proportion of nighttime drivers with BACs of .05 and higher was 70 percent lower in these counties compared to drivers in comparison counties that did not operate additional checkpoints.

Checkpoint publicity can be costly if paid media are used.

Time to implement: Checkpoints can be implemented within three months if officers are trained in detecting impaired drivers, SFST, and checkpoint operational procedures. See NHTSA (2002) for implementation information.

Other issues:

- **Legality:** Checkpoints currently are permitted in 39 States and the District of Columbia (NHTSA, 2002). Checkpoints are permitted under the U.S. Constitution but some State courts have held that checkpoints violate their State's constitution. Other State legislatures have not authorized checkpoints. States where checkpoints are not permitted may use saturation patrols (see Chapter 1, Section 2.2).
- **Publicity:** Checkpoints must be highly visible and publicized extensively to be effective. Communication and enforcement plans should be coordinated. Messages should clearly and unambiguously support enforcement. Paid media may be necessary to complement news stories and other earned media, especially in a continuing checkpoint program (NCHRP, 2005, Strategy B1).
- **Arrests:** The purpose of checkpoints is to deter impaired driving, not to increase arrests. Impaired drivers detected at checkpoints should be arrested and arrests should be publicized, but arrests at checkpoints should not be used as a measure of checkpoint effectiveness.
- **Other offenses:** Checkpoints may also be used to check for valid driver licenses, seat belt use, outstanding warrants, stolen vehicles, and other traffic and criminal infractions.

2.2 Saturation Patrols

Effectiveness: Proven-arrests	Use: High	Cost: Medium	Time: Short

A saturation patrol (also called a blanket patrol, "wolf pack," or dedicated DWI patrol) consists of a large number of law enforcement officers patrolling a specific area for a set time to detect and arrest impaired drivers. The purpose of saturation patrols is to arrest impaired drivers and also to deter driving after drinking by increasing the perceived risk of arrest. To do this, saturation patrols should be publicized extensively and conducted regularly. A less-intensive strategy is the "roving patrol" in which individual patrol officers concentrate on detecting and arresting impaired drivers in an area where impaired driving is common or where alcohol-involved crashes have occurred (Stuster, 2000). A "how-to" guide for planning and publicizing saturation patrols and sobriety checkpoints is available from NHTSA (NHTSA, 2002).

Use: The Century Council (2003) survey reported that 44 States used saturation patrols.

Effectiveness: Saturation patrols can be very effective in arresting impaired drivers. For example, in 2001 Minnesota's 96 saturation patrols stopped 13,681 vehicles and arrested 566 impaired drivers (Century Council, 2003). The effects of saturation patrols on alcohol-related crashes or injuries have not been evaluated.

Costs: The main costs are for law enforcement time and for publicity. Saturation patrol operations are quite flexible in both the number of officers required and the time that each officer participates in the patrol. As with sobriety checkpoints, publicity can be costly if paid media is used.

Time to implement: Saturation patrols can be implemented within three months if officers are trained in detecting impaired drivers and in SFST. See NHTSA (2002) for implementation information.

Other issues:

- **Legality:** Saturation patrols are legal in all jurisdictions.
- **Publicity:** Saturation patrols should be publicized extensively to be effective in deterring impaired driving. Communication and enforcement plans should be coordinated. Messages should clearly and unambiguously support enforcement. Paid media may be necessary to complement news stories and other earned media, especially in a continuing saturation patrol program (NCHRP, 2005, Strategy B1).
- **Other offenses:** Saturation patrols are effective in detecting other driving and criminal offenses.

2.3 Integrated Enforcement

Effectiveness: Likely	Use: Unknown	Cost: Low	Time: Short

Impaired drivers are detected and arrested through regular traffic enforcement and crash investigations as well as through special impaired driving checkpoints and saturation patrols. A third opportunity is to integrate impaired-driving enforcement into special enforcement activities directed primarily at other offenses such as speeding or seat belt nonuse, especially since impaired drivers often speed or fail to wear sear belts.

Use: There are no data on how frequently integrated enforcement methods are used.

Effectiveness: Jones, Joksch, Lacey, Wiliszowski, and Marchetti (1995) evaluated a three-site evaluation of integrated impaired driving, speed, and seat belt use enforcement. They found that the sites that combined high publicity with increased enforcement reduced crashes likely to involve alcohol (such as single-vehicle nighttime crashes) by 10 percent to 35 percent. They concluded that the results were encouraging but not definitive. See also Jones and Lacey (2001, pp. 113-115), NCHRP (2005, Strategy B2), and Stuster (2000).

The Massachusetts Saving Lives comprehensive programs in six communities used integrated enforcement methods. The programs reduced fatal crashes involving alcohol by 42 percent (Hingson et al., 1996). About half the speeding drivers detected through these enforcement activities had been drinking and about half the impaired drivers were speeding.

Costs: As with other enforcement strategies, the primary costs are for law enforcement time and for publicity.

Time to implement: Impaired driving can be integrated into other enforcement activities within three months if officers are trained in detecting impaired drivers and in SFST.

Other issues:

- **Publicity:** Integrated enforcement activities should be publicized extensively to be effective in deterring impaired driving and other traffic offenses. Paid media may be necessary to complement news stories and other earned media, especially in an ongoing program (NCHRP, 2005, Strategy B2).
- **Priorities:** Integrated enforcement activities send a message to the public and to law enforcement officers alike that traffic safety is not a single-issue activity.

2.4 Preliminary Breath Test Devices (PBTs)

Effectiveness: Proven-arrests	Use: High	Cost: Medium	Time: Short

A preliminary breath test (PBT) device is a small handheld alcohol sensor used to estimate or measure a driver's BAC. Law enforcement officers use PBTs in the field to help establish evidence for a DWI arrest. The driver blows into a mouthpiece and the PBT displays either a numerical BAC level, such as .12, or a BAC range, such as a red light for BACs above .08.

Several PBT models are available commercially. They are quite accurate and generally reliable. NHTSA maintains a "Conforming Products List" of alcohol testing and screening instruments, including PBTs, that meet accuracy and reliability standards (NHTSA, 2004).

Use: PBTs are used in 39 States to provide evidence of alcohol use to support a DWI arrest (Century Council, 2003). This evidence of alcohol use is admissible in court in approximately half the States, but in most States PBT evidence cannot be used to establish a driver's BAC. California allows officers to use PBT evidence to enforce zero-tolerance laws for drivers under the age of 21: officers at the roadside can issue a citation and seize the driver's license (Ferguson, Fields, & Voas, 2000).

Effectiveness: Law enforcement officers generally agree that PBTs are useful. Sixty-nine percent of the 2,731 law enforcement officers surveyed by Simpson and Robertson (2001) supported greater PBT availability and use. PBTs are especially valuable for two classes of drivers who may appear to perform normally on many tasks: drivers with a high tolerance to alcohol (Simpson & Robertson, 2001) and drivers under 21 who may be in violation of zero-tolerance laws (Ferguson et al., 2000). PBTs also can be useful at crash scenes where a driver is injured and unable to perform a Standardized Field Sobriety Test. There is some direct evidence that PBT use increases DWI arrests and reduces alcohol-involved fatal crashes (Century Council, 2003).

Costs: PBTs cost from $450 to $750 apiece. Many law enforcement departments have only a limited number of PBTs and many patrol officers do not have regular access to them. Officers surveyed by Simpson and Robertson (2001) estimated that three-fourths of all DWI arrests occur on routine patrol, so that DWI detection would be substantially improved if every patrol officer had a PBT.

Time to implement: PBTs can be used as soon as they are purchased and officers are trained in their use and maintenance. PBT instruments must have regular calibration checks. Most law enforcement agencies have the facilities to conduct these checks.

Other issues:

- **The "one test" rule:** Some State statutes allow only one chemical BAC test to be taken from a driver arrested for DWI. These States do not use PBTs because an evidential BAC test cannot be requested if an officer previously has taken a PBT test in the field.
- **Other drugs:** A PBT will not detect the presence of drugs other than alcohol.

2.5 Passive Alcohol Sensors

Effectiveness: Proven-detection	Use: Unknown	Cost: Medium	Time: Short

A passive alcohol sensor (PAS) is a device to detect alcohol presence in the air. The sensor usually is integrated into a flashlight or clipboard. Officers hold the flashlight or clipboard near the driver's mouth, where it measures alcohol presence in the air where the driver is breathing. The PAS can be used without the driver's knowledge and without any probable cause because the PAS is considered "an extension of the officer's nose" and records information that is "in plain view" (Preusser, 2000). The PAS displays its results using lights of different colors to indicate different alcohol concentration ranges.

Several PAS models are available commercially. They generally are reliable and effective at detecting alcohol in the surrounding air. In one recent study, both breath samples and PAS measures were obtained from over 12,000 drivers. Results showed that PAS scores were a strong predictor of a driver's BAC status, leading to the conclusion that "the PAS can be an effective tool for officers when deciding whether to initiate a DWI investigation" (Voas, Romano, & Peck, 2006). NHTSA does not maintain a list of PAS models.

Use: PAS units typically are used at the car window after a traffic stop or at a checkpoint. A PAS report of alcohol presence gives the officer probable cause to request further examination with SFSTs or a PBT device. No data are available on how many PAS units are in use.

Effectiveness: The PAS is especially effective at checkpoints, where officers must screen drivers quickly with little or no opportunity to observe the drivers on the road. Several evaluations show that officers using a PAS at checkpoints can detect 50 percent more drivers at BACs of .10 and above than officers not using a PAS (Fell et al., 2004; Century Council, 2003). The PAS can help officers avoid detaining drivers with BACs of .04 or below. The PAS also assists officers on routine patrol in detecting alcohol-impaired drivers (Preusser, 2000). The PAS can be used to help enforce zero-tolerance laws for drivers under 21, where violators may have relatively low BAC levels.

Costs: PAS units cost from $500 to $750 apiece.

Time to implement: PAS units can be used as soon as they are purchased and officers are trained in their use and maintenance.

Other issues:

- **Acceptance by law enforcement:** Some officers dislike using a PAS because they believe it requires them to be closer to the driver than they wish to be, it requires some portion of the officer's attention at a time when the officer has several other things to be concerned about (including personal safety), or it may keep the officer from having a hand free. Other officers believe they can detect the odor of alcohol accurately without assistance from a PAS (Preusser, 2000).
- **Other drugs:** As with a PBT, a PAS will not detect the presence of drugs other than alcohol.

3.1 Sanctions

Effectiveness: Varies	Use: Varies	Cost: Varies	Time: Varies

The standard court sanctions for DWI offenses are driver's license suspension or revocation, fines, jail, and community service. All States use some combination of these sanctions. Details of each State's laws may be found in NHTSA's *Digest of Impaired Driving and Selected Beverage Control Laws* (NHTSA, 2006c), which is updated annually. MADD summarizes current alcohol-related laws by State and by topic (MADD, 2007). Some States set mandatory minimum levels for some sanctions, which often increase for second and subsequent offenders.

DWI offenders also may have their driver's licenses revoked or suspended administratively and may have sanctions imposed on their vehicles or license plates. See Chapter 1, Section 1.1, Administrative License Revocation or Suspension, and Chapter 1, Section 4.4, Vehicle and License Plate Sanctions, for discussions of these sanctions. See also NHTSA's *Guide to Sentencing DWI Offenders* (NHTSA, 2006k) for an overview of sanctions and sentencing practices for judges and prosecutors, with extensive references. The *Guide* also includes screening and brief intervention, alcohol treatment, and DWI courts.

License suspension or revocation: All States allow post-conviction license actions. Twenty-eight States set a mandatory minimum length for first offenders. This suspension or revocation typically runs concurrently with any administrative license action. In most States, offenders may obtain an occupational or hardship license during part of all of the revocation or suspension period (McCartt et al., 2002; NHTSA, 2006c).

Both court-imposed and administrative license actions are highly effective in reducing crashes. See Chapter 1, Section 1.1 for details. Court-imposed license actions have few direct costs. As with administrative license actions, they should be accompanied by strategies to reduce driving with a suspended or revoked license.

Fines: Most States impose fines on DWI offenders. Twenty-eight States have mandatory minimum fines for first offenders, typically ranging from $250 to $500. In addition to fines, offenders often face substantial costs for license reinstatement, mandated alcohol education or treatment, insurance rate increases, and legal fees.

The scanty information available suggests that fines at the levels currently imposed have little effect on reducing alcohol-impaired driving (Century Council, 2003).

Jail: All States allow some DWI offenders to be sentenced to jail. Eighteen States require some jail time for first offenders, though 11 of these States allow community service in lieu of jail. Forty-nine States require jail for third offenders, though even these offenders can substitute community service in 9 States.

Jail is the most severe and most contentious of the DWI sanctions. Jail is expensive: about $16,500 per offender per year in Maryland and $27,500 in New Mexico, for example (Century Council, 2003). Judges and prosecutors may be reluctant to use limited jail space for DWI of-

fenders rather than "real" criminals. Offenses with mandatory jail terms may be pled down, or judges simply may ignore the mandatory jail requirement (Robertson & Simpson, 2002b).

Research on the effectiveness of jail is equivocal at best (Jones and Lacey, 2001, p. 119; National Transportation Safety Board [NTSB], 2000). Very short (48-hour) jail sentences for first offenders may be effective (NTSB, 2000) but other jail policies appear to have little effect. Wagenaar et al. (2000) reviewed 18 studies and concluded: "The balance of the evidence clearly suggests the ineffectiveness of mandatory jail sentence policies" (p. 12). In fact, they find "numerous studies that indicate that [mandatory jail] might be a counterproductive policy" (p. 12) that increases alcohol-related crashes.

Community service: Many States allow community service as part of a DWI offender's sentence and 11 States allow community service in lieu of mandatory jail for first-time offenders. Community service can provide benefits to society if offenders perform useful work, but even if appropriate jobs can be found there are costs for program operation, offender supervision, and liability. The effects of community service programs on alcohol-impaired driving have not been evaluated (Century Council, 2003).

3.2 Diversion and Plea Agreement Restrictions

Effectiveness: Proven-convictions	Use: Medium	Cost: Low	Time: Short

Diversion programs defer sentencing while a DWI offender participates in some form of alcohol education or treatment. In many States, charges are dropped or the offender's DWI record is erased if the education or treatment is completed satisfactorily.

Negotiated plea agreements are a necessary part of efficient and effective DWI prosecution and adjudication. However, plea agreements in some States allow offenders to eliminate any record of a DWI offense and to have their penalties reduced or eliminated.

Effective DWI control systems can use a variety of adjudication and sanction methods and requirements. The key feature is that an alcohol-related offense must be retained on the offender's record (Hedlund & McCartt, 2002; NCHRP, 2005; NTSB, 2000; Robertson & Simpson, 2002a).

Use: As of July 2006, 33 States provide for diversion programs in State law or statewide practice, and local courts and judges in some additional States also offer diversion programs (NHTSA 2006i; see also Century Council, 1997). Eighteen States restrict plea agreements in at least some DWI cases (MADD, 2007). The Century Council (2003) documented diversion programs and plea agreement restrictions in several States.

Effectiveness: There are no studies that demonstrate that diversion programs reduce recidivism (NTSB, 2000) and there is substantial anecdotal evidence that diversion programs, by eliminating the offense from the offender's record, allow repeat offenders to avoid being identified (Hedlund & McCartt, 2002). Eliminating diversion programs should remove a major loophole in the DWI control system. Wagenaar et al. (2000) reviewed 52 studies of plea agreement restrictions applied in combination with other DWI control policies and found that they reduced various outcome measures by an average of 11 percent. However, the effects of plea agreement restrictions by themselves cannot be determined in these studies. The only direct study of plea agreement restrictions was completed over 15 years ago (NHTSA, 1989; NTSB, 2000). It found that plea agreement restrictions reduced recidivism in all three study communities.

Costs: Costs for eliminating diversion programs can be determined by comparing the per-offender costs of the diversion program and the non-diversion sanctions. Similarly, costs for restricting plea agreements will depend on the relative costs of sanctions with and without the plea agreement restrictions. In addition, if plea agreements are restricted, some charges may be dismissed or some offenders may request a full trial, resulting in significant costs.

Time to implement: Eliminating diversion programs and restricting plea agreements statewide may require changes to a State's DWI laws. Once legislation is enacted, policies and practices can be changed within three months. Individual prosecutor offices and courts also can change local policies and practices without statewide legislation.

3.3 DWI Courts

Effectiveness: Likely	Use: Low	Cost: High	Time: Medium

A dedicated DWI court provides a systematic and coordinated approach to prosecuting, sentencing, monitoring, and treating DWI offenders. A DWI court's underlying goal is to change offenders' behavior by identifying and treating their alcohol problems and by holding offenders accountable for their actions.

Prosecutors and judges in DWI courts specialize in DWI cases. Probation officers monitor offenders closely and report any probation infraction to the judge immediately for prompt action. Restrictions and monitoring are relaxed as offenders demonstrate responsible behavior. DWI courts follow the model established by the more than 1,600 drug courts around the nation (Huddleston, Freeman-Wilson, Marlowe, & Roussell, 2005; National Association of Drug Court Professionals [NADCP], 2005; NCHRP, 2005, Strategy D3). See Brunson and Knighten (2005), Practice #1, for an excellent overview of DWI courts and the National Drug Court Institute (NDCI, 2006) for a more complete description.

DWI courts can reduce recidivism because judge, prosecutor, probation staff, and treatment staff work together as a team to assure that alcohol treatment and other sentencing requirements are satisfied. DWI courts can be more efficient and effective than regular courts because judges and prosecutors are familiar with the complex DWI laws, evidentiary issues, and sentencing options. NHTSA (2003) describes the operation of a DWI court in Albuquerque, New Mexico.

Over half the judges in Robertson and Simpson's survey (2002b) recommended DWI courts, as did participants in NHTSA's Criminal Justice Summit (NHTSA, 2003).

Use: As of July 2007, NDCI reported 81 designated DWI courts and 249 hybrid DWI/drug courts, which are drug courts that also take DWI offenders (NDCI, 2007).

Effectiveness: Some individual program evaluations show that DWI courts are quite successful, with low recidivism rates. Graduates of the Bernalillo County, New Mexico, DWI/Drug Court program, most of whom were referred for DWI offenses, had substantially lower DWI recidivism rates than a comparison group (Guerin, 2002).

Evaluations have shown that close monitoring and individualized sanctions for DWI offenders reduce recidivism (see Chapter 1, Section 4.2). When these are incorporated within a comprehensive DWI court program, their effect is likely to be even greater.

Costs: DWI court costs are difficult to estimate and compare with regular courts. Court operations may become more efficient as judges and prosecutors specialize in DWI cases. Follow-up costs may be greater because probation officer caseloads may need to be reduced to provide close monitoring and because judges must allocate time to meet regularly with probationers and to deal with any probation violations. Offenders can bear some of the monitoring and treatment costs (see Chapter 1, Sections 4.1, 4.2, and 4.3). DWI courts may reduce long-term system costs substantially if they decrease DWI recidivism as expected. Offenders in DWI court programs

definitely cost far less than offenders in jail. For example, the cost per offender in the Anchorage, Alaska, DWI court is less than 10 percent of the cost of jail (NDCI, 2007).

Time to implement: DWI courts can be implemented four to six months after the participating organizations agree on the program structure if enough trained prosecutors, judges, probation officers, and treatment providers are available. Otherwise, planning and implementation may require a year or more.

3.4 Court Monitoring

Effectiveness: Proven-convictions	Use: Low	Cost: Low	Time: Short

In court monitoring programs, citizens observe, track, and report on DWI court or administrative hearing activities. Court monitoring provides data on how many cases are dismissed or pled down to lesser offenses, how many result in convictions, what sanctions are imposed, and how these results compare across different judges and different courts. Court monitoring programs usually are operated and funded by citizen organizations such as MADD, though Mississippi funds a statewide court monitor (Century Council, 2003). MADD is preparing a policy and procedures manual for its court monitoring programs, which is scheduled to be available in 2008.

Use: Court monitoring programs are active in at least 13 States (Syner, 2006). It is generally believed that court monitoring has decreased substantially since the mid-1980s, when Probst, Lewis, Asunka, Hershey, and Oram (1987) identified over 300 programs in the United States.

Effectiveness: Shinar (1992) found that court-monitored cases in Maine produced higher conviction rates and stiffer sentences than unmonitored cases. Probst et al. (1987) found that judges, prosecutors, and other officials in 51 communities believed that court monitoring programs helped increase DWI arrests, decrease plea agreements, and increase guilty pleas.

Costs: The main requirement for a court monitoring program is a reliable supply of monitors. Monitors typically are unpaid volunteers from MADD, RID, or a similar organization. Modest funds are needed to establish and maintain court monitoring records and to publicize the results.

Time to implement: Court monitoring programs can be implemented very quickly if volunteer monitors are available. A few weeks will be required to set up the program and train monitors.

4.1 Alcohol Problem Assessment and Treatment

Effectiveness: Proven	Use: High	Cost: Varies	Time: Varies

It is widely recognized that many DWI first offenders and most repeat offenders are dependent on alcohol or have alcohol use problems. They likely will continue to drink and drive unless their alcohol problems are addressed. A DWI arrest provides an opportunity to identify offenders with alcohol problems and to refer them to treatment as appropriate. However, treatment should not be provided in lieu of other sanctions or as part of a plea bargain or diversion program that eliminates the record of a DWI offense (see Chapter 1, Section 3.2).

Alcohol problem assessment can take many forms, from a brief paper-and-pencil questionnaire to a detailed interview with a treatment professional. Alcohol treatment can be even more varied, ranging from classroom alcohol education programs to long-term inpatient facilities. For brief overviews of alcohol assessment and treatment programs and further references see Century Council (2003), Dill and Wells-Parker (2006), Jones and Lacey (2001), and NCHRP (2006, Strategy C4).

Use: Forty-two States require alcohol assessment for some DWI offenders (MADD, 2007; Century Council 2003). Though data on the use of alcohol treatment is not available, some judges in all States probably assign some form of treatment to some DWI offenders.

Effectiveness: Even the best of the many assessment instruments currently in use is relatively inaccurate. Chang, Gregory, and Lapham (2002) found that none correctly identified more than 70 percent of offenders who were likely to recidivate. Wells-Parker , Bangert-Drowns, McMillan and Williams (1995) reviewed the studies evaluating treatment effectiveness. They found that, on average, treatment reduced DWI recidivism and alcohol-related crashes by 7 to 9 percent. Treatment appears to be most effective when combined with other sanctions and when offenders are monitored closely to assure that both treatment and sanction requirements are met (Century Council, 2003; Dill & Wells-Parker, 2006).

Costs: Trained personnel are required to assess offenders. Treatment expenses vary widely depending on program type. Offenders can bear some of the costs of both assessment and treatment, though provisions must be made for indigent offenders. Both assessment and treatment require good record systems to track offenders and monitor progress.

Time to implement: Implementation time also varies depending on program type. The simplest can be implemented in several months, while others may take years.

Other issues:

- **Treatment options:** Alcohol assessment and treatment programs are long-term and expensive investments. States and communities should carefully weigh the costs and benefits of the many options available before implementing any such programs. Implementation time will depend on the specific programs chosen.
- **DWI Courts:** Alcohol problem assessment and treatment are an integral part of DWI courts. Conversely, a DWI court can sanction offenders who fail to complete assigned treatment programs. See Chapter 1, Section 3.3.

4.2 DWI Offender Monitoring

Effectiveness: Proven-recidivism	Use: Unknown	Cost: High	Time: Medium

The most successful methods for controlling convicted DWI offenders and reducing recidivism have the common feature that they monitor offenders closely. Close monitoring can be accomplished at various levels and in various ways, including a formal intensive supervision program, home confinement with electronic monitoring, dedicated detention facilities, and individual oversight by judges. DWI courts and alcohol ignition interlocks, which are discussed in Chapter 1, Sections 3.3 and 4.3, also assist in monitoring offenders closely.

Use: There are no data showing how extensively these programs are used.

Effectiveness: All four methods cited above have been evaluated in individual settings and show substantial reductions in DWI recidivism. For example, recidivism was reduced by one-half in two intensive supervision programs, by one-third in an electronic monitoring program, by one-half in a dedicated detention facility, and by one-half by a judge's individual oversight. The references cited below provide additional detail.

Costs: All close monitoring programs are more expensive than the standard high-caseload and low-contact probation but less expensive than jail. Electronic monitoring fees typically range from $3 to $15 per day (NCHRP, 2005, Strategy 5.1 D3). New Mexico estimated that intensive supervision costs $2,500 per offender per year compared to $27,500 per offender per year for jail (Century Council, 2003). Dedicated detention facility costs can approach jail costs: $13,500 annually in Maryland for dedicated detention compared to $16,500 for jail (Century Council, 2003). Offenders can bear some program costs, especially for the less expensive alternatives (Century Council, 2003).

Time to implement: All close monitoring programs require many months to plan and implement. Dedicated facilities require years to plan and build.

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Individual judicial oversight

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4.3 Alcohol Interlocks

Effectiveness: Proven	Use: Medium	Cost: Medium	Time: Medium

An alcohol ignition interlock prevents a car from starting unless the driver provides a breath sample with a BAC lower than a pre-set level, usually .02. Interlocks typically are used as a condition of probation for DWI offenders, to prevent them from driving while impaired by alcohol after their driver's licenses have been reinstated.

Interlocks are highly effective in allowing a car to be started by sober drivers but not by alcohol-impaired drivers. A "running retest" requires the driver to remain sober while driving. A data recorder logs the driver's BAC at each test and can be used by probation officers to monitor the offender's drinking and driving behavior. Beirness and Marques (2004) provide an overview of interlock use, effectiveness, operational considerations, and program management issues. Marques (2005), Beirness and Robertson (2005), and Robertson, Vanlaar, and Beirness (2006) summarize interlock programs in the United States and other countries and discuss typical problems and solutions. See also Brunson and Knighten (2005), Practice #5.

Use: As of June 2007, 45 States and the District of Columbia allow interlocks to be required for some DWI offenders (MADD, 2007). As of July 2006, about 100,000 interlocks were in use, on the cars of perhaps 10 percent of eligible offenders (Marques, 2006).

Effectiveness: Beirness and Marques (2004) summarized 10 evaluations of interlock programs in the United States and Canada. Interlocks cut DWI recidivism at least in half, and sometimes more, compared to similar offenders without interlocks. After the interlock was removed, the effects largely disappeared, with interlock and comparison drivers having similar recidivism rates. A Cochrane review of 11 completed and 3 ongoing studies reached similar conclusions (Willis, Lybrand, & Bellamy, 2006). Thus, interlocks are an effective method for preventing alcohol-impaired driving while they are installed.

Costs: Interlock programs are managed by private interlock equipment providers. Costs in 2006 averaged about $175 to install an interlock and $2.25 per day while the interlock is installed. The offenders usually pay these costs (Marques, 2006).

Time to implement: Interlock programs may require enabling legislation. Once authorized, interlock programs require four to six months to implement a network of interlock providers.

Other issues:

- **Barriers to use:** Interlocks have demonstrated their effectiveness in controlling impaired driving while they are installed. In light of this success, their limited use may be due to several factors, such as long license suspension periods during which offenders are not eligible for any driving, judges who lack confidence in the interlock technology or who fail to enforce "mandatory" interlock requirements, and interlock costs. See Beirness and Marques (2004), Beirness and Robertson (2005), and NCHRP (2003, strategy C2) for discussion.

4.4 Vehicle and License Plate Sanctions

Effectiveness: Varies	Use: Medium	Cost: Varies	Time: Short

In recent years many States have implemented sanctions affecting a DWI offender's license plate or vehicle. These sanctions both prevent the offender from driving the vehicle while the sanctions are in effect and also deter impaired driving by the general public. Vehicle and plate sanctions include:

- Special license plates for drivers whose licenses have been revoked or suspended. The plates allow family members and other people to drive the offender's car but permit law enforcement to stop the car to verify that the driver is properly licensed.
- License plate impoundment. Officers seize and impound or destroy the license plate.
- Vehicle immobilization: vehicles are immobilized on the offender's property with a "boot" or "club."
- Vehicle impoundment. Vehicles are stored in a public impound lot.
- Vehicle forfeiture. Vehicles are confiscated and sold at auction.

Voas, Fell, McNight, and Sweedler (2004) give an overview of all vehicle and license plate sanctions currently in use and are the basic reference for the information provided below. See also Brunson and Knighten (2005), Practice #4. All vehicle and license plate sanctions require at least several months to implement.

Use, effectiveness, and costs:

- Special license plates: Used in some jurisdictions in Hawaii, Iowa, Minnesota, and Ohio (NHTSA, 2006i). A 2004 law in Ohio requires special plates for all first-time offenders with a BAC of 0.17 and above and for all repeat offenders. Effectiveness and costs have not been evaluated in any State. In the 1990s Oregon and Washington adopted a version of this strategy by allowing arresting officers to place a "zebra stripe" sticker on the license plate at the time of arrest. Oregon's program proved effective in reducing DWI recidivism but Washington's did not. Use has been discontinued in both States (NCHRP, 2003, Strategy B1; NHTSA 2006g).
- License plate impoundment: Used in 20 States including Minnesota, where it has been shown to reduce recidivism (MADD, 2007). Since plate impoundment does not involve the courts, it occurs quickly, consistently, and efficiently (NCHRP, 2003, Strategy B2; NHTSA, 2006g; NTSB, 2000). Twenty-seven other States and the District of Columbia allow for impounding a vehicle's registration (NHTSA, 2006i).
- Vehicle immobilization: Laws in 17 States allow vehicle immobilization but it is currently used only in a few States (NHTSA, 2006i). An evaluation in Ohio found that immobilization reduced recidivism. Costs are minimal compared to impoundment or forfeiture (NCHRP, 2003, Strategy C1; NHTSA, 2006g; NTSB, 2000).
- Vehicle impoundment: 26 States and the District of Columbia allow for vehicle impoundment and some use it extensively (MADD, 2007). Vehicle impoundment reduces recidivism while the vehicle is in custody and to a lesser extent after the vehicle has been released. The strategy is costly, as storage fees can be $20 daily and owners may abandon low-value vehicles rather than pay substantial storage costs (NCHRP, 2003, Strategy C1; NHTSA, 2006g; NTSB, 2000). In California, impoundment programs are administered

largely by towing contractors and supported by fees paid when drivers reclaim their vehicles or by the sale of unclaimed vehicles.

- Vehicle forfeiture: Vehicle forfeiture has been applied to first-DWI offenders in New York City, to first Driving While Suspended (DWS) offenders in Portland, Oregon, and to second-DWS offenders in California. Thirty States have provisions allowing vehicle forfeiture but there is little information on its use or effectiveness (MADD, 2007). Vehicle forfeiture programs must pay storage costs until the vehicles are sold or otherwise disposed (NCHRP, 2003, Strategy C1; NHTSA, 2006g; NTSB, 2000).

Other issues:

- **To whom are vehicle sanctions applied:** Most vehicle sanctions have been applied to repeat offenders rather than first offenders, although some States also apply vehicle sanctions to high-BAC first offenders (e.g., a BAC of .20 or higher). All vehicle and license plate sanctions must address the issue of what action to take when a DWI offender is driving a vehicle registered to someone else or when the offender transfers the title to any vehicles before vehicle sanctions can be applied.
- **Administrative issues:** All license plate and vehicle sanctions require an administrative structure to process the license plates or vehicles.

4.5 Lower BAC Limits for Repeat Offenders

Effectiveness: Uncertain	Use: Low	Cost: Low	Time: Short

All States now have an illegal per se BAC limit of .08. All States also have a BAC limit of .02 or lower for drivers under the age of 21. These laws reinforce the minimum drinking age 21 laws in all States that prohibit people under 21 from purchasing or possessing alcohol in public. Five States also lower the BAC limit for people convicted of DWI, to emphasize that they should not be driving after drinking even moderate amounts.

Use: As of June 2007, five States have established lower BAC limits for some drivers with one or more DWI offenses (MADD, 2007).

Effectiveness: In 1988, Maine established a .05 BAC limit for 1 year after a first DWI offense and for 10 years after a subsequent offense. Violators receive an administrative license suspension. In 1995 this BAC limit was lowered to .00. Hingson, Heeren, and Winter (1998) evaluated the 1988 law and concluded that it reduced the proportion of repeat offender drivers in fatal crashes by 25 percent. Jones and Rodriguez-Iglesias (2004) evaluated the overall effects of both laws, using data from 1988-2001. They also concluded that the laws contributed to a reduction in the proportion of repeat offenders in fatal crashes, primarily due to a reduction in drivers at BACs of .10 and higher.

Costs: Implementation and operation costs are minimal. Jones and Rodriguez-Iglesias (2004) found that Maine's laws had little or no effect on the operations of the DWI control system.

Time to implement: Lower BAC limit laws can be implemented as soon as legislation is enacted.

Prevention, Intervention, Communications, and Outreach

Prevention and intervention.

Prevention and intervention strategies seek to reduce drinking, especially drinking associated with driving, or to prevent driving by people who have been drinking. Prevention and intervention work through laws, policies, and programs that:

- control alcohol sales hours, locations, and promotions;
- implement responsible alcohol service practices;
- control alcohol purchase and use through increased alcohol taxes and restrictions on consumption in public locations such as parks and sports facilities; or
- provide alternatives to driving for people who have been drinking.

Prevention and intervention measures are especially important for those under 21. These are discussed in the Youth section that follows.

Many prevention and intervention measures fall under the authority of a State's alcohol control board rather than the SHSO. However, the SHSO can be a critical partner in many prevention and intervention activities. Only countermeasures directly associated with drinking and driving are discussed in this section. For information regarding more general countermeasures directed at alcohol see Grube and Stewart (2004), Toomey and Wagenaar (1999), and Alcohol Epidemiology Program (2000).

Communications and outreach.

Communications and outreach strategies seek to inform the public of the dangers of driving while impaired by alcohol and to promote positive social norms of not driving while impaired. As with prevention and intervention, education through various communications and outreach strategies is especially important for youth under 21. Education may occur through formal classroom settings, news media, paid advertisements and public service announcements, and a wide variety of other communication channels such as posters, billboards, Web banners, and the like.

Communications and outreach strategies are a critical part of many deterrence and prevention strategies. This section discusses only stand-alone communications and outreach countermeasures.

5.1 Responsible Beverage Service

Effectiveness: Likely	Use: Medium	Cost: Medium	Time: Medium

Responsible beverage service covers a range of alcohol sales policies and practices that prevent or discourage restaurant and bar patrons from drinking to excess or from driving while impaired by alcohol. Server training programs teach servers how to recognize the signs of intoxication and how to prevent intoxicated patrons from further drinking and from driving. Management policies and programs include limits on cheap drinks and other promotions, support for designated driver programs, strong commitment to server training, and strong support for servers who refuse alcohol to intoxicated patrons.

NCHRP (2005, Strategy A2) provides an overview of responsible beverage service. Server training programs are the only segment of responsible beverage service for adults that has been documented and evaluated well. Activities directed at people under 21 are discussed separately in Chapter 1, Section 6.1.

Use: As of June 2007, 17 States and the District of Columbia had some form of mandatory server training programs (MADD, 2007). As of 2000, 10 States had non-mandatory programs that provided some liability protection to participating establishments (Alcohol Epidemiology Program, 2000).

Effectiveness: In their systematic review, Shults et al. (2001) found five high-quality evaluations of server training programs. They concluded that "intensive, high-quality, face-to-face server training, when accompanied by strong and active management support, is effective in reducing the level of intoxication in patrons" (p. 80). The one evaluation of a statewide server training program, in Oregon, showed that it reduced single-vehicle nighttime injury crashes by 23 percent (Holder & Wagenaar, 1994). Jones and Lacey (2001) note that no other evaluations have attempted to measure the effects of server training programs on alcohol-related crashes.

Costs: A typical alcohol server course takes about four hours. Course costs can be borne by the servers themselves, their employers, or the State.

Time to implement: Server training courses are offered by several private vendors and can be implemented in a few weeks. A statewide requirement for server training or more general responsible beverage service policies would require time to enact any necessary legislation, establish policies, and provide for program administration.

Other issues:

- **Program quality:** The quality of responsible beverage service programs can vary enormously, from excellent to abysmal. Management support can vary from enthusiastic to nonexistent. Shults et al. (2001) clearly limit their conclusions to high-quality programs with strong management support. Alcohol Epidemiology Program (2000) cites some server training program evaluation studies that found no effect and notes that these programs may have been poorly supported or implemented.

- **Responsible beverage service is more than server training:** Grube and Stewart (2004) emphasize that management policy and its implementation may be at least as important as server training in determining responsible beverage service program effectiveness.
- **Enforcement of responsible beverage service:** Enforcement is important to ensure that alcohol retailers follow responsible serving practices. For example, an enforcement program in Michigan resulted in a three-fold increase in refusals of service to "pseudo-patrons" who simulated intoxication (McKnight & Streff, 1994).

5.2 Alternative Transportation

Effectiveness: Unknown	Use: Unknown	Cost: Medium	Time: Short

Alternative transportation describes methods by which people can get to and from places where they drink without having to drive. Alternative transportation supplements normal public transportation provided by subways, buses, taxis, and other means.

Ride service programs transport drinkers home from, and sometimes to and between, drinking establishments using taxis, private cars, buses, tow trucks, and even police cars. Some will drive the drinker's car home along with the drinker. For an overview, see Jones and Lacey (2001, pp. 133-134). Most operate only for short periods of the year, such as the Christmas and New Year's holidays. Many are free; some charge users a minimal fee; some are operated commercially on a for-profit basis.

Use: There are no data on current ride service programs, but more than 300 were in operation at some time in the 1980s (Jones & Lacey, 2001).

Effectiveness: Unless a ride service program operates for a long period of time or over a large area it is difficult to determine whether it has any effect on alcohol-related crashes. Three studies have evaluated ride service programs (Jones & Lacey, 2001). The first examined one year-round and one holiday program. Both functioned smoothly and delivered rides but neither demonstrated any effect on crashes. The second study examined a year-round program in Aspen, Colorado, and concluded that it reduced injury crashes in the surrounding county by 15 percent (Lacey, Jones, & Anderson, 2000). Finally, a recent study in Wisconsin evaluated a program that provided rides to and from bars using older luxury vehicles. The program resulted in a 17-percent decline in alcohol-related crashes during the first year, and the program became largely self-sustaining through fares and tavern contributions (Rothschild, Mastin, & Miller, 2006; see also NCHRP, 2003, Strategy E1).

Costs: The major ride service program costs are for the rides that are provided. Short-term ride service programs can be operated largely with donated rides. Year-round programs need enough steady funding to accommodate demand (NCHRP, 2003, Strategy E1).

Time to implement: Short-term ride service programs can be established and operated informally in a few weeks. Longer-term programs need to establish long-term strategies for funding and managing the program.

5.3 Designated Drivers

Effectiveness: Unknown	Use: Medium	Cost: Low	Time: Short

Designated drivers are individuals who agree not to drink so they can drive their friends who have been drinking. Formal designated driver programs in drinking establishments provide incentives such as free soft drinks for people who agree to be designated drivers. Usually, though, designated driver arrangements are completely informal.

Use: The designated driver concept is widely understood and accepted. Surveys show that designated driver use is common: for example, about one-third of college students in a national survey in 1993 reported that they had served as a designated driver and one-third of students who drink had ridden with a designated driver (Hedlund et al., 2001).

Effectiveness: The designated driver concept has been questioned on two grounds: that it may encourage passengers to drink to excess and that the designated driver may drink, though perhaps less than the passengers. In a survey of drinkers age 21 to 34, 62 percent did not drink the last time they served as a designated driver, and only 3 percent had three or more drinks. However, almost half reported drinking more than usual the last time someone else served as the designated driver (Rivara et al., 2007). Because designated drivers are informally determined and somewhat imprecisely defined, it's no surprise there appear to be no data on the impact of designated drivers on crashes. CDC's systematic review found insufficient evidence to determine the effectiveness of designated driver programs (Ditter et al., 2005).

Costs: The only costs associated with informal designated driver programs are for publicity. Designated drivers can be promoted independently or can be included with other impaired driving publicity. Establishments that operate formal designated driver programs have minimal costs for the drinks provided and for publicity.

Time to implement: Designated driver promotion can be implemented in a few weeks and formal programs can be established equally quickly.

5.4 Alcohol Screening and Brief Interventions

Effectiveness: Proven	Use: Medium	Cost: Medium	Time: Short

Alcohol screening is a quick assessment which estimates the level and severity of alcohol use and also identifies the appropriate level of treatment (SAMHSA, 2007). Brief interventions are short, one-time encounters with people who may be at risk of alcohol-related injuries or other health problems. Brief interventions focus on the awareness of the problem and motivation toward behavior change (SAMHSA, 2007). The combination of alcohol screening and brief intervention is most commonly used with injured patients in emergency departments or trauma centers. Patients are usually screened for alcohol use problems. If appropriate, they may be counseled on how alcohol can affect injury risk and overall health and may be referred to a follow-up alcohol treatment program. Brief interventions take advantage of a "teachable moment" when a patient can be shown that alcohol use can have serious health consequences. Dill et al. (2004) provide an extensive summary and bibliography of alcohol screening and brief intervention studies.

Use: Approximately one-half of trauma centers screen patients for alcohol problems and one-third use some form of brief intervention (NCHRP, 2005, Strategy A4; Schermer et al., 2003). Alcohol screening and brief interventions also are used in colleges, primary care medical facilities, and social service settings (NCHRP, 2004, Strategy A4; Jones & Lacey, 2001). NHTSA offers a toolkit to assist in conducting screenings and brief interventions on college campuses (www.nhtsa.dot.gov/people/injury/alcohol/StopImpaired/3672Toolkit/).

Effectiveness: Many studies show that alcohol screening and brief interventions in medical facilities can reduce drinking and self-reported driving after drinking (D'Onofrio & Degutis, 2002; Moyer, Finney, Swearingen, & Vergun, 2002; Wilk, Jensen, & Havighurst, 1997). Dill et al. (2004) reviewed nine studies that evaluated alcohol screening and brief intervention effects on injury. These studies generally found that alcohol screening and brief interventions reduced both drinking and alcohol-related traffic crashes and injuries.

Costs: Alcohol screening and brief interventions in medical facilities require a person trained in alcohol screening and brief intervention to administer the intervention.

Time to implement: Procedures for alcohol screening and brief interventions are readily available, for example from American College of Emergency Physicians [ACEP] (2006) or the National Institute on Alcohol Abuse and Alcoholism [NIAAA] (2005), and can be implemented as soon as staff is identified and trained.

Other issues:

- **Alcohol exclusion laws:** An alcohol exclusion law (Uniform Accident and Sickness Policy Provision Law [UPPL]) allows insurance companies to deny payment to hospitals for treating patients who are injured while impaired by alcohol or a non-prescription drug. These laws may make hospitals reluctant to determine the BAC of an injured driver and may limit the use of alcohol screening. As of January 2006, alcohol exclusion laws were in effect in 37 States and the District of Columbia, though the extent to which insurance companies do deny payment is not known (NHTSA, 2006h).

5.5 Mass Media Campaigns

Effectiveness: Proven*	Use: High	Cost: High	Time: Medium

* High-quality campaigns supporting other program activities, such as enforcement

A mass media campaign consists of intensive communications and outreach activities regarding alcohol-impaired driving that use radio, television, print, and other mass media, both paid and/or earned. Mass media campaigns are a standard part of every State's efforts to reduce alcohol-impaired driving. Some campaigns publicize a deterrence or prevention measure such as a change in a State's DWI laws or a checkpoint program. Others promote specific behaviors such as the use of designated drivers, illustrate how impaired driving can injure and kill, or simply urge the public not to drink and drive. Campaigns vary enormously in quality, size, duration, funding, and every other way imaginable. Effective campaigns identify a specific audience and communications goal and develop messages and delivery methods that are appropriate to and effective for the audience and goal.

Use: Most States use some form of alcohol-impaired driving mass media campaign every year. Mass media campaigns are an essential part of many deterrence and prevention countermeasures that depend on public knowledge to be effective.

Effectiveness: Most mass media campaigns are not evaluated. Elder et al. (2004) studied the few available high-quality evaluations. The campaigns being evaluated were carefully planned, well funded, well executed, achieved high levels of audience exposure (usually by using paid advertising), had high-quality messages that were pretested for effectiveness, and were conducted in conjunction with other impaired-driving activities. These mass media campaigns reduced alcohol-related crashes by about 13 percent. Levy, Compton, and Dienstfrey (2004) documented the costs and media strategy of a high-quality national media campaign and its effects on driver knowledge and awareness.

Costs: High-quality and effective mass media campaigns are expensive. Funds are needed for market research, design, pretesting, and production. Paid advertising expenses depend on the media chosen and the media markets needed to reach the target audience.

Time to implement: A high-quality mass media campaign will require at least six months to research, plan, produce, and distribute.

Other issues:

- **Campaign quality:** *These conclusions apply only to high-quality and well-funded mass media campaigns that complement other impaired driving activities.* Poor-quality or stand-alone campaigns are likely to be ineffective. Public service announcements (PSAs) may be an easy way to spend money quickly and to appear to be doing something about impaired driving but they are likely to be aired infrequently, reach small audiences, and have little or no effect.
- **Comprehensive media strategy:** Mass media campaigns should be planned as part of an overall communications and outreach strategy that supports specific impaired driving activities.

Underage Drinking and Alcohol-Related Driving

In addition to the deterrence, prevention, intervention, communications, and outreach countermeasures that apply to all drivers, some countermeasures are directed specifically to those under 21.

Since 1987, minimum-drinking-age laws in all States prohibit youth under 21 from purchasing alcohol or consuming it in public. These laws influence all youth impaired-driving strategies. For people over 21, drinking is legal but driving while impaired by alcohol is not. With a BAC limit of .08, drivers know they should not drive after drinking "too much," but are faced with mixed messages at low levels of alcohol, because a BAC of .05 is not illegal per se. The message for those under 21 is unambiguous: they should not be drinking at all, and certainly should not be driving after drinking.

Zero-tolerance laws in all States reinforce this message by setting a maximum BAC limit of .02 or less for drivers under 21. This effectively prohibits driving after drinking *any* amount of alcohol. Many policies and programs reinforcing the no-drinking message are directed primarily at youth (beer keg registration) or take place in schools or youth organizations (Students Against Destructive Decisions [SADD] clubs, alcohol-free prom and graduation parties). Youth receive education and information about alcohol and alcohol-impaired driving in schools and colleges and through media directed to youth.

The minimum-drinking-age laws and the no-drinking message for youth mean that youth impaired-driving activities must work hand-in-hand with activities to control youth drinking. With the exception of zero-tolerance law enforcement, all the countermeasures discussed below require cooperative activities between traditional highway safety organizations, such as law enforcement and motor vehicle departments, and community, health, and educational organizations with a broader social agenda than traffic safety.

6.1 Minimum Drinking Age 21 Law Enforcement

Effectiveness: Varies	Use: Varies	Cost: Varies	Time: Varies

The minimum legal drinking age (MDA) has been 21 in all States since 1987. There is strong evidence that MDA-21 laws reduced drinking, driving after drinking, and alcohol-related crashes and injuries among youth (Hingson et al., 2004; Shults et al., 2001). In fact, MDA-21 laws reduced youth drinking and driving more than youth drinking alone (using the measurements of self-reporting and testing of drinking drivers in fatal crashes). Drinking and driving has become less socially acceptable among youth, and more youth have separated their drinking from their driving (Hedlund et al., 2001).

The specific laws implementing MDA 21 for alcohol vendors, adults, and youth differ substantially from State to State. See Alcohol Epidemiology Program (2000) and Century Council (2005) for State-by-State summaries of some of the key provisions.

MDA-21 law enforcement is very limited in many communities (Hedlund et al., 2001). Enforcement can take several forms, as summarized by Stewart (1999):

- Actions directed at alcohol vendors: compliance checks to verify that vendors will not sell to youth.
- Actions directed at youth: "use-and-lose" laws that confiscate the driver's license of an underage drinker, "Cops in Shops" directed at underage alcohol purchasers, law enforcement "party patrols" using party dispersal techniques, and penalties for using false identification.
- Actions directed at adults: beer keg registration laws, enforcement of laws prohibiting purchasing alcohol for youth, shoulder tap operations, and programs to limit parties where parents provide alcohol to youth.

While these enforcement strategies have been used frequently, few have been evaluated. Four strategies with some research evidence are discussed below, followed by a recent program and a discussion of comprehensive, multi-strategy community programs.

Alcohol vendor compliance checks: In a compliance check or "sting," law enforcement officers watch as underage people attempt to purchase alcohol and cite the vendor for an MDA-21 violation if a sale is made. Vendors can include on-premise retailers (e.g., bars and restaurants) or off-premise outlets (e.g., convenience stores or liquor stores). Several studies document that well-publicized and vigorous compliance checks reduce alcohol sales to youth (NCHRP, 2005, Strategy A3; Stewart, 1999). Compliance checks require strong community support, education for alcohol vendors on their responsibilities under MDA 21, and publicity to underage youth. They require staff time from traffic or alcohol beverage control staff. See NCHRP (2005, Strategy A3) for a full discussion.

"Use and lose" laws: These laws allow confiscation of the driver's license or postpone licensure for a period of time for youth who violate a State's MDA-21 law. In the only study to date, Ulmer et al. (2001) investigated "use and lose" law implementation and effects in Missouri and Pennsylvania. Missouri suspended the driver's licenses of most youth arrested for DWI but

rarely suspended the licenses of youth who violated the MDA-21 law by drinking but not driving. Pennsylvania, in contrast, applied the "use and lose" law to violations of the MDA-21 both for youth arrested while driving and youth arrested while not driving. Pennsylvania's "use and lose" license suspensions appeared to reduce subsequent traffic violations and crashes. "Use and lose" laws can be implemented quickly and inexpensively once enacted. To be effective, they should be publicized extensively. As of 2006, 29 States have "use and lose" laws and another 10 States and the District of Columbia have "use and lose" authority that may be applied in varying circumstances (NHTSA, 2006i).

Keg registration laws: These laws link beer keg purchasers to an identification number on the keg, which provides a method of identifying adults who supply beer to parties attended by youth. As of July 2007, 32 States and the District of Columbia have keg registration laws, as do many communities in other States (MADD, 2007; Alcohol Epidemiology Program, 2000). The only known study, of 97 communities, found that keg registration laws reduced traffic fatality rates (Grube & Stewart, 2004). However, Grube and Stewart conclude that the evidence for the effectiveness of keg registration "is best considered inconclusive."

Media campaigns: Ohio has conducted a statewide media campaign, *Parents Who Host Lose the Most*, since 2000. The campaign informs parents and youth about Ohio's underage drinking laws and attempts to discourage parents from providing alcohol to underage drinkers at parties. Telephone surveys in 2004, the campaign's fifth year, showed that about two-thirds of parents and youth had heard messages about underage drinking (Seufert et al., 2004). About two-thirds of those who had heard a message said that it prompted a conversation between parents and their teenagers about drinking. The evaluation did not investigate any changes in behavior.

Underage Drinking Tipline: In 2006 Kansas launched a statewide underage drinking tipline, 866-MustB21. The toll-free tipline operates 24 hours a day, seven days a week, for citizens to report parties involving underage drinking, plans to purchase alcohol for underage people, and willingness of retailers to sell alcohol to underage people. See www.ksdot.org/burTrafficSaf/1866mustb21.pdf for a program poster.

Comprehensive community programs: Several comprehensive community initiatives have reduced youth drinking and alcohol-related problems (Hingson et al., 2004). These initiatives typically bring together several community government departments, such as schools, health, and law enforcement, with alcohol sellers, parents, youth, and citizen organizations. They may include school-based programs, law enforcement, media, and other intervention strategies. They require strong leadership and organization. They may take many months to plan and implement. Costs depend on the activities included.

6.2 Zero-Tolerance Law Enforcement

Effectiveness: Likely	Use: Unknown	Cost: Medium	Time: Short

Zero-tolerance laws set a maximum BAC of .02 or less for drivers under 21. Violators have their driver's licenses suspended or revoked. There is strong evidence that zero-tolerance laws reduce alcohol-related crashes and injuries (Jones & Lacey, 2001; NCHRP, 2005, Strategy B3; Shults et al., 2001).

However, zero-tolerance laws often are not actively enforced or publicized (Hedlund et al., 2001; Jones & Lacey, 2001). Studies have found that young drivers are not arrested in proportion to their involvement in alcohol-related crashes (Hingson et al., 2004). One exception is the State of Washington, where a recent study found that arrests for alcohol violations among 16- to 20-year-old drivers increased by about 50 percent after the zero-tolerance law went into effect (McCartt et al., 2006). Enforcement may be greater in Washington because drivers can be tested based on suspicion of violating either the DWI or zero-tolerance law. In other States where drivers can only be tested if DWI is suspected, zero-tolerance laws may be more difficult to enforce.

Use: Zero-tolerance laws have been in effect in all States since 1998. The degree to which zero-tolerance laws are enforced in States is unknown.

Effectiveness: An early study in Maryland found that alcohol-involved crashes for drivers under the age of 21 dropped by 21 percent in six counties after the zero-tolerance law was implemented. After the law was publicized extensively, these crashes dropped by an additional 30 percent (Jones & Lacey, 2001). No other studies have examined the effect of increasing enforcement and publicity for an existing zero-tolerance law. Lacey et al. (2000) document how zero-tolerance laws are administered and enforced in four States. Highly publicized enforcement has proven effective in increasing compliance with many traffic safety laws and reducing crashes and injuries: see for example checkpoints (Chapter 1, Section 2.1) and seat belt use mobilizations (Chapter 2, Section 2.1).

Costs: Zero-tolerance laws can be enforced on regular patrol or on special patrols directed at times and areas when young drinking drivers may be present. Enforcement will require moderate costs for appropriate training, publicity, and perhaps equipment (see Other Issues).

Time to implement: Enforcement programs can be implemented within three or four months, as soon as appropriate training, publicity, and equipment are in place.

Other issues:

- **Zero-tolerance-law provisions:** Zero-tolerance laws are far easier to enforce if the offense is an administrative rather than criminal violation and if law enforcement officers can use PBTs at the roadside to determine if the law has been violated and to seize the driver's license if it has (Jones and Lacey, 2001). Some State laws require the same probable cause as for a standard DWI arrest, or even require a full DWI arrest, before a BAC test for a zero-tolerance-law violation can be administered. In these States, the zero-tolerance law is not enforced independently of the standard DWI law, and in fact young drivers may not be aware of the zero-tolerance law (Hingson et al., 2004).
- **PBT and PAS:** PBTs are critical to effective and efficient enforcement in States that allow PBT use for zero-tolerance laws. PAS units can help officers detect violators with BAC levels below .08. See Chapter 1, Sections 2.4 and 2.5.
- **Holding juveniles in custody:** A complication of enforcing zero-tolerance laws is deciding how and where to hold young offenders once they are taken into custody. NHTSA has helped produce an implementation guide for developing a juvenile holdover program. The guide is available at http://www.nhtsa.dot.gov/people/injury/alcohol/juvenile/index.html.

6.3 School Education Programs

Effectiveness: Uncertain	Use: Unknown	Cost: Low	Time: Long

Elementary and secondary schools often include education on alcohol, impaired driving, and traffic safety as regular topics in health and driver education courses.

Use: Health education is a standard course for most students, but the coverage of impaired-driving issues is not known. Driver education is an elective course in some schools and is not offered in others. Commercial instructors offer driver education courses in many communities. In each, the coverage of impaired-driving issues is not known.

Effectiveness: Evaluations generally have found that prevention curricula have weak and inconsistent effects on alcohol use (Stewart, 1999). CDC's systematic review found that education programs are effective in reducing riding with a drinking driver. There was insufficient evidence to determine the programs' effectiveness in reducing drinking and driving (Elder et al., 2005).

Costs: Many education programs or course units are available. They must compete with other pressing educational needs for space in a crowded school curriculum.

Time to implement: School education programs require at least a year to plan, schedule, acquire material, and train teaching staff.

6.4 Youth Programs

Effectiveness: Uncertain	Use: High	Cost: Varies	Time: Medium

States and communities have conducted extensive youth drinking-and-driving-prevention programs over the past 25 years. These programs seek to motivate youth not to drink, not to drink and drive, and not to ride with a driver who has been drinking. Although some programs use scare tactics, many employ positive messages and methods: providing positive role models that discourage alcohol use, promoting positive norms that do not involve alcohol, and encouraging youth activities that do not involve or lead to alcohol use.

The best-known youth program is SADD, founded in 1981 as Students Against Driving Drunk, then renamed Students Against Destructive Decisions. In 1994 an estimated 16,000 U.S. high schools had SADD chapters (Hedlund et al, 2001). Some States conducted similar activities under different names, such as Students Taking a New Direction (STAND) in Colorado and Stopping Automobile Fatalities Through Youth Efforts (SAFTYE) in WashingtonState. MADD's Youth n Action program is active in 43 States (www.youthinaction.org/index.cfm?cID=home). One specific activity, operated either by a youth program or independently, is Project Graduation, which provides alcohol-free prom and graduation parties for high school students. See Hedlund et al. (2001) for brief examples of State programs.

One relatively new type of youth program, so-called "social norms" or "normative feedback" programs, are based on studies showing that students often overestimate alcohol use among their peers. By providing students with accurate information about drinking, social norms programs reduce the pressure that light- or non-drinkers feel to drink, and help heavier drinkers realize that their drinking is atypical (Perkins 2002, 2003). Although many social norms programs focus on alcohol or other substance use, a few have addressed drinking and driving. Examples of social norms programs can be found at the National Social Norms Resource Center (www.socialnorms.org).

Use: Youth programs of some type are conducted in most, if not all, States.

Effectiveness: CDC's systematic review found that there was insufficient evidence to determine the effectiveness of youth programs (Elder et al., 2005). Two studies have attempted to evaluate SADD's activities and effects. One study, in two schools, found that neither school implemented the model SADD program well and found no evidence of SADD effects on any drinking and driving measure. The second study, in six schools, found that SADD affected drinking and driving attitudes as well as self-reported drinking and driving (Hedlund et al., 2001).

One study has examined the long-term effects of a social norms program on drinking and driving. Breath samples were taken from students at a large public university as they returned home late at night. Following the social norms program, there was a marginally significant decrease in drivers who registered a positive BAC, from 15.3 percent to 10.8 percent. Among drivers who had been drinking, self-reported number of drinks consumed and measured BACs decreased, as did the number of drinking-drivers who reported having five or more drinks at one sitting on the night of the survey (Goodwin, 2004).

Costs: Youth program costs can vary substantially depending on the size and nature of the individual activities. States have spent substantial sums on youth drinking-and-driving programs overall: $10 million in Federal funds in 1993, $21 million in 1994, and $22 million in 1995. These figures include a special $8 million appropriation in both 1994 and 1995 (Hedlund et al., 2001). In each year, States also spent substantial non-Federal funds on youth drinking-and-driving programs. These funds were used for a variety of youth education, enforcement, and program activities.

Time to implement: With model programs available and organizations such as SADD and MADD available for assistance, youth programs can be started easily in six months.

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2. Seat Belt Use

Overview

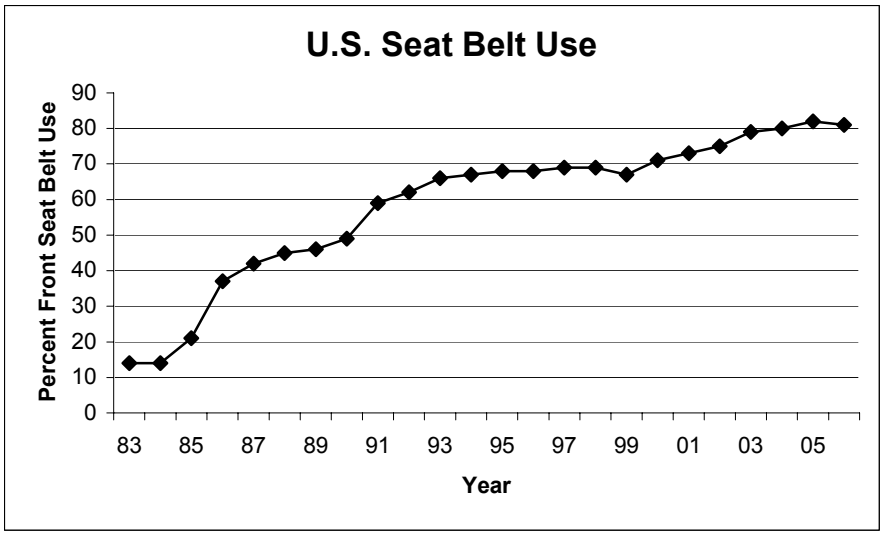
Wearing a seat belt is the single most effective way to save lives and reduce injuries in crashes. NHTSA (2001) estimates that seat belts in passenger cars (a manual lap-and-shoulder-belt combination) reduce serious injuries by 69 percent and fatalities by 45 percent. In comparison, air bags without seat belts reduce serious injuries by 30 percent and fatalities by 14 percent. Seat belts are similarly effective for pickup truck and other light-truck occupants.

The challenge is to convince all passenger vehicle occupants to buckle up. Current data show that for adult drivers and passengers:

- seat belt use nationwide was 81 percent in 2006 (NHTSA, 2007);
- in 2006, belt use was greater than 90 percent in seven States (California, Hawaii, Michigan, New Jersey, Oregon, Texas and Washington); but
- in 2006, belt use was less than 70 percent in four States (Arkansas, Kentucky, Massachusetts, and Wyoming) (NHTSA, 2007).

Belt use data for some States are not available. See NHTSA's most recent reports (NHTSA, 2007) for the latest national and State data.

This chapter addresses only seat belt use by adults and older children, in general children older than 15. Younger children require infant, child safety, or booster seats appropriate to their size and weight and are covered by separate restraint use laws. Many issues and strategies for increasing child occupant protection are quite different from those raised by adult belt use.



Source: NHTSA, Office of Impaired Driving and Occupant Protection

Trends. All new passenger cars had some form of seat belts beginning in 1964, shoulder belts in 1968, and integrated lap and shoulder belts in 1974 (Automotive Coalition for Traffic Safety [ACTS], 2001). Few occupants wore the belts: surveys in various locations recorded belt use of about 10 percent. The first widespread survey, taken in 19 cities in 1982, observed 11-percent

belt use for drivers and front-seat passengers (Williams & Wells, 2004). This survey became the benchmark for tracking belt use nationwide. The chart shows the best available estimate of national belt use annually since 1982.

New York enacted the first belt use law in 1984. Other States soon followed. In a typical State, belt use rose quickly to about 50 percent shortly after the State's belt law went into effect. Over the next year the rate usually decreased slightly, on average by about 4 percentage points (Nichols, 2002).

High-visibility short-duration belt law enforcement programs, often called STEPs (Selective Traffic Enforcement Programs), "STEP waves," or "blitzes," were demonstrated in individual communities in the late 1980s. North Carolina's *Click It or Ticket* program took this model statewide beginning in 1993 and raised the use rate above 80 percent (Williams & Wells, 2004). Statewide, multi-State, and national enforcement programs increased through the 1990s under different names and sponsors. These enforcement programs typically raised belt use by 13 to 26 percentage points, with greater gains where belt use was lower (Dinh-Zarr et al., 2001; Nichols, 2002). Belt use often decreased by about 6 percentage points after the enforcement program ended.

The *Click It or Ticket* model expanded nationwide in 2003 (Solomon, Compton, & Preusser, 2004). Recent programs have used extensive paid advertising as part of their communications and outreach strategies and have included strategies designed specifically to increase seat belt use among low belt use groups such as pickup truck drivers (Nichols, 2005). The national belt use rate increased to 82 percent in 2005 (Glassbrenner, 2005a), although it decreased slightly to 81 percent in 2006 (NHTSA, 2007).

Recent research has focused on the contrasts between daytime and nighttime crashes in terms of fatality rates and restraint use. According to 2005 NCSA and FARS data, almost two-thirds (64%) of people killed at nighttime did not use restraints. In contrast, the percentage of fatally injured passenger vehicle occupants during daytime crashes who were unrestrained was just under one-half (47%) (Varghese & Shankar, 2007). Strategies are being developed to increase restraint use among nighttime drivers, but evaluations documenting the effectiveness of these programs have not been completed at this time.

For more information on the history of belt systems, belt use laws, enforcement programs, and belt use trends, see ACTS (2001), Solomon et al. (2004), Milano, McInturff, and Nichols (2004), (NCHRP, 2004), NHTSA (2001, 2003), Nichols and Jones (in review), and Williams and Wells (2004).

Belt use laws. As of May 2007, all States except New Hampshire required adult passenger vehicle occupants to wear belts. The laws in 27 States and the District of Columbia permit law enforcement to stop and cite some or all nonusers. These are called standard or primary enforcement laws. The remaining 22 States have secondary enforcement laws that allow nonusers to be cited only after they first have been stopped for some other traffic violation (Insurance Institute for Highway Safety [IIHS], 2007). In 2005, minimum fines in primary law States ranged from $10 to $101 with a fine of $25 or more in all but four States. Minimum fines in secondary law States ranged from $10 to $75 with a fine of $25 or less in all but two States (Glassbrenner, 2005b). Some laws cover only front-seat occupants or allow other exemptions. See also NHTSA (2006b) for details on State laws.

Strategies to Increase Belt Use

The most effective basic strategy for achieving and maintaining high belt use is highly publicized high-visibility enforcement of strong belt use laws. As referenced above, this strategy's effectiveness has been documented repeatedly in the United States and abroad. The strategy's three components – laws, enforcement, and publicity – cannot be separated: effectiveness decreases if any one is weak or lacking. The sections in this chapter discuss each component's key features. Some communications and outreach and incentive programs directed to well-defined and limited audiences such as schools, businesses, and communities have been moderately successful and also are discussed in this chapter. NCHRP (2004) discusses several of these strategies and provides links to additional information.

Seat belt use may also be affected by vehicle design features such as the comfort and convenience of belt systems, and by lights or buzzers to remind occupants to buckle up (NHTSA, 2003). These vehicular countermeasures are not included in this guide because SHSOs have little or no authority or responsibility for them.

Key terms

- Primary enforcement: laws that permit seat belt use law violators to be stopped and cited by a law enforcement officer independently of any other traffic behavior.
- Secondary enforcement: laws that permit seat belt use law violators to be cited only after they have been stopped for some other traffic violation.

Countermeasures That Work

Countermeasures to increase seat belt use are listed below and discussed individually in this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information on each item.

1. Seat belt use laws

Countermeasure	Effectiveness	Use	Cost	Time
1.1 State primary enforcement belt use laws	Proven	Medium	Low	Short
1.2 Local primary enforcement belt use laws	Likely	Low	Low	Short
1.3 Increased belt use law penalties	Likely	Low	Low	Short
1.4 Coverage: seating position, vehicles, ages	Unknown	Medium	Low	Short

2. Seat belt law enforcement

Countermeasure	Effectiveness	Use	Cost	Time
2.1 Short high-visibility belt law enforcement	Proven	Medium*	High	Medium
2.2 Sustained enforcement	Likely	Unknown	Varies	Varies
2.3 Combined enforcement, nighttime	Likely	Unknown	High	Medium

* Used in many jurisdictions but often only once or twice each year

3. Communications and outreach

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Supporting enforcement	Proven	Medium	Varies	Medium
3.2 Strategies for low belt use groups	Uncertain*	Unknown	Unknown	Medium

* For stand-alone programs not supporting enforcement

4. Other strategies

Countermeasure	Effectiveness	Use	Cost	Time
4.1 Employer and school programs	Proven*	Unknown	Varies	Varies
4.2 Incentive programs	Proven*	Low	Varies	Medium

* In low belt use settings with no belt use law

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results.
Likely: balance of evidence from high-quality evaluations or other sources.
Uncertain: limited and perhaps ambiguous evidence.
Unknown: no high-quality evaluation evidence.
Varies: different methods of implementing this countermeasure produce different results.

Effectiveness is measured by increases in observed seat belt use. See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities.
Medium: between one-third and two-thirds of States or communities.
Low: fewer than one-third of the States or communities.
Unknown: data not available.

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources.
Medium: requires some additional staff time, equipment, and/or facilities.
Low: can be implemented with current staff, perhaps with training; limited costs for equipment or facilities.

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year.
Medium: more than three months but less than one year.
Short: three months or less.

These estimates do not include the time required to enact legislation or establish policies.

1.1 State Primary Enforcement Belt Use Laws

Effectiveness: Proven	Use: Medium	Cost: Low	Time: Short

Primary enforcement belt use laws permit seat belt use law violators to be stopped and cited independently of any other traffic behavior. Secondary enforcement laws allow violators to be cited only after they first have been stopped for some other traffic violation.

Use: As of May 2007, 27 States and the District of Columbia had primary belt use laws, 22 States had secondary enforcement laws, and New Hampshire had no belt use law applicable to adults (IIHS, 2007). Some of the primary laws are secondary for drivers and passengers older than a specified age.

Effectiveness: In June 2005, belt use averaged 85 percent in the 21 States and the District of Columbia (the States with primary laws at that time; South Carolina's primary law became effective in December 2005 and Mississippi's in May 2006) and averaged 75 percent in the 27 secondary law States (Glassbrenner, 2005b). Studies of five States that changed their belt use laws from secondary to primary enforcement found that belt use increased from 12 to 18 percentage points where all passenger vehicles were covered by the law and 8 percentage points in one State where pickup trucks were excluded (Nichols, 2002). The Center for Disease Control and Prevention's [CDC] systematic review of 13 high-quality studies (Shults, Nichols, Dinh-Zarr, Sleet, & Elder, 2004) found that primary laws increase belt use by about 14 percentage points and reduce occupant fatalities by about 8 percent compared to secondary laws. In the most recent study, Farmer and Williams (2005) found that passenger vehicle driver death rates dropped by 7 percent when States changed from secondary to primary enforcement.

Recent research (Masten, 2007) has provided strong support that changing from secondary to primary enforcement seat belt laws increases occupant seat belt use during the nighttime hours as well as the daytime hours when most observational surveys of seat belt use are conducted.

Costs: Once legislation has been enacted to upgrade a secondary law to primary, the costs are to publicize the change and enforce the new law. Publicity costs to inform the public of the law change should be low because the media will cover the law change extensively. Law enforcement can adapt its secondary law enforcement strategies for use under the primary law or may be able to use new strategies permitted by the primary law. States wishing to increase enforcement and publicity to magnify the effect of the law change will incur additional costs: see Chapter 2, Section 2.1.

Time to implement: A primary belt use law can be implemented as soon as the law is enacted.

Other issues:

- **Opposition to primary belt laws:** In most States there is substantial opposition to changing a secondary law to a primary belt use law. Opponents claim that primary laws impinge on individual rights and provide opportunities for law enforcement to harass minority groups. Studies in several States have found that minority groups were ticketed at similar or lower rates than others after a primary law was implemented (Shults et al., 2004). When Michigan changed from a secondary to a primary law, harassment complaints were very uncommon both before and after the law change. The proportion of seat belt use citations issued to minority groups decreased under the primary law. In a telephone survey, the vast majority of people who actually received seat belt citations did not feel that they were singled out on the basis of race, age, or gender. However, some minorities and young drivers reported perceptions of harassment (Eby et al., 2004).
- **Effect on low-belt-use groups:** Studies in States that changed their law from secondary to primary show that belt use increased across a broad range of drivers and passengers. In some States, belt use increased more for low-belt-use groups, including Hispanics, African-Americans, and drinking drivers, than for all occupants (Shults et al., 2004).

1.2 Local Primary Enforcement Belt Use Laws and Ordinances

Effectiveness: Likely	Use: Low	Cost: Low	Time: Short

In some States with secondary enforcement belt use laws, individual communities have enacted and enforced community-wide primary laws or ordinances. These laws differ from statewide laws only in that they are enacted, publicized, and enforced locally.

Use: No data is available on how many communities have primary laws. NHTSA's Great Lakes Region reports that 47 communities in Illinois, with a combined population of 1.3 million residents, had local primary laws in effect before the Illinois statewide law was enacted. Similarly, Memphis had a primary law before Tennessee's statewide primary law (Lacey et al., 2005).

Effectiveness: While there are no formal studies of local primary belt laws, the available evidence suggests that they increase belt use. See also NCHRP (2004, strategy A3).

- Illinois: The statewide primary belt use law was enacted in 2003. From 1997 to 2002, Illinois Department of Transportation data show that average belt use was higher in communities with local primary belt use laws. In the annual statewide belt use surveys over these six years, average belt use in the 39 sites with local laws was 5.6 percentage points higher than the statewide belt use rate (Nassirpour, 2005).
- Tennessee: The University of Tennessee conducted regional belt use surveys before and after the 2003 combined seat belt and impaired-driving campaigns. At this time Tennessee did not have a statewide primary belt law. The western region of the State is dominated by Memphis, where a local primary belt law was in place. The other three regions had no local belt use laws. Belt use was substantially higher in the western region than in the other regions before the campaigns: 74 percent in the west compared to 55 percent, 66 percent, and 68 percent in the other regions. The media campaign in the west used only the *You Drink & Drive. You Lose*. impaired-driving message and no belt use message. Belt use in the west slipped slightly to 72 percent after the campaign. The media campaigns in the other three regions used the *Click It or Ticket* seat belt message either alone or together with the *You Drink & Drive. You Lose.* message. Belt use in these regions increased slightly to 62 percent, 67 percent, and 70 percent, respectively, still lower that the west's 72 percent (Lacey et al., 2005).

Costs: As with a statewide law, the costs are for publicity and enforcement. Both must be directed to the community itself.

Time to implement: As with a statewide law, a local law can be implemented as soon as it is enacted. The law's debate and passage likely will generate initial publicity.

Other issues: See the discussion under Chapter 2, Section 1.1, Primary Enforcement Belt Use Laws.

1.3 Increased Belt Use Law Penalties: Fines and Driver's License Points

Effectiveness: Likely	Use: Low	Cost: Low	Time: Short

Penalties for most belt use law violations are low. As of November 2005, a violation resulted in a typical fine of $25 or less in all but nine States (Glassbrenner, 2005b). Low fines may not convince nonusers to buckle up. They also may send a message that belt use laws are not taken seriously.

Most States penalize serious traffic law violations by assessing demerit points against a driver's license. Drivers lose their licenses if they accumulate more than a specified number of points within a specified period of time. In a national survey in 2000, drivers who were not regular belt users considered license points the most effective way to increase their belt use. License points were considered more effective than increased fines or increased enforcement, in both primary and secondary law States (ACTS, 2000).

Use: As of November 2005, seven primary law States and two secondary law States had a minimum fine of $30 or more. Three other States allowed a fine of $30 or more in some circumstances. Three jurisdictions assessed driver's license points: New Mexico, New York, and the District of Columbia (Glassbrenner, 2005b).

Effectiveness: Houston and Richardson (2005) studied the effects of belt law type (primary or secondary), fine level, and coverage (front seat only or front and rear seats) using belt use data from 1991 to 2001. They found that primary belt laws and higher fines increase belt use.

Evidence from 2005 is mixed. In primary law States, belt use averaged 4.1 percentage points higher in the 7 States with fines of $30 or more compared to the 15 States with fines of $25 or less (89.3% compared to 85.2%). In secondary law States, the 2 States with fines of $30 or more averaged lower belt use than the 26 States at $25 or less: 74.3 percent compared to 77.1 percent (Glassbrenner, 2005b). The laws may be publicized and enforced more vigorously in primary law States with higher fines, and the enforcement and publicity may account for some or all of the differences in usage rates.

In a national survey in 2000, 42 percent of drivers who did not use belts regularly said they would definitely be more likely to wear belts if the fine were increased. Another 25 percent of these drivers said they would probably be more likely to wear their belts (ACTS, 2001). Surveys in North Carolina also found that some nonusers would buckle up if the fine were doubled to $50 (Williams & Wells, 2004).

The effect of driver's license points on belt use has not been evaluated. The evidence from 2005 sheds little light on the effectiveness of points. All three jurisdictions with points had primary laws. Belt use averaged 86.1 percent in the three jurisdictions with points and 86.6 percent in the remaining primary law States (Glassbrenner, 2005b).

In the 2000 national survey, 49 percent of drivers who were not regular belt users said they would definitely be more likely to wear their seat belts if violators were assessed driver's license points. Another 27 percent of these drivers said they would probably be more likely to wear their

belts (ACTS, 2001). In a North Carolina survey, 62 percent of nonusers said they always would wear their belts if violations led to driver's license points (Williams & Wells, 2004).

Costs: The direct costs associated with increasing fine levels or assessing driver's license points are minimal.

Time to implement: Both measures can be implemented as soon as they are publicized and appropriate changes are made to the motor vehicle records systems.

Other issues:

- **Balance:** If penalties are excessively low, then they may have little effect. If they are excessively high, then law enforcement officers may be reluctant to issue citations and judges may be reluctant to impose them. States should choose penalty levels that strike an appropriate balance.
- **Penalty levels are part of a system:** Penalty levels are part of the complete system of well-publicized enforcement of strong belt use laws. Appropriate penalty levels help make strong laws. But without effective enforcement, judicial support, and good publicity, increased penalties may have little effect.

1.4 Belt Use Law Coverage: Seating Positions, Vehicles, Ages

Effectiveness: Unknown	Use: Medium	Cost: Low	Time: Short

Belt use laws do not cover adult rear seat passengers in more than half of the States (Glassbrenner, 2005b). Most States' laws exempt some vehicles, such as those designed for more than 10 passengers, taxis, postal delivery vehicles, farm vehicles, pickup trucks, or vehicles not required to have seat belts (Glassbrenner, 2005b).

Most State belt use laws cover passengers over a specified age and are designed to work in combination with child passenger safety laws covering younger passengers. Some States exempt passengers for specified medical or physical reasons (Glassbrenner, 2005b). Many States make belt use mandatory under their Graduated Driver Licensing laws for beginning drivers (see Chapter 6, Section 1.1).

A good belt use law should be comprehensive, covering all seating positions equipped with a seat belt in all passenger vehicles (ACTS, 2001; National Committee on Uniform Traffic Laws and Ordinances [NCUTLO], 2004; NHTSA, 2003). Such a law sends a clear and consistent message to the public.

Use: In many States, belt use laws exempt adult passengers in some seating positions or in some passenger vehicles (Glassbrenner, 2005b).

Effectiveness: Since belt use surveys observe only front seat occupants, there is no direct survey evidence on whether belt laws that include rear seat adult passengers affect belt use. In NHTSA's 2003 national telephone survey, rear-seat passengers who thought they were covered by their State's law reported higher belt use than those who did not: 62 percent "always use belts" compared to 45 percent (Boyle & Vanderwolf, 2003, p. 130).

In general, belt use is lower in pickup trucks than in other passenger vehicles: in 2005, belt use nationwide was 73 percent in pickup trucks compared to 83 percent in cars and 85 percent in vans and SUVs (Glassbrenner, 2005a). However, there are no available State-level data on whether pickup truck belt use is affected by a pickup truck or farm vehicle belt use law exemption.

Costs: The costs of expanding a belt use law to include all seating positions in all passenger vehicles are minimal.

Time to implement: Expanded belt use law coverage can be implemented as soon as the law is enacted and publicized.

2.1 Short-Term, High-Visibility Belt Law Enforcement

Effectiveness: Proven	Use: Medium*	Cost: High	Time: Medium

* Used in many jurisdictions but often only once or twice each year

The most common high-visibility belt law enforcement method consists of short (typically lasting for two weeks), intense, highly publicized periods of increased belt law enforcement, frequently using checkpoints (in States where checkpoints are permitted), saturation patrols, or enforcement zones. These periods sometimes are called STEP waves (Selective Traffic Enforcement Programs) or blitzes. The method was developed in Canada in the 1980s (Boase, Jonah, & Dawson , 2004) and demonstrated in several United States communities (Williams & Wells, 2004). It was implemented statewide in North Carolina in 1993 using the *Click It or Ticket* slogan (Reinfurt, 2004), and subsequently adopted in other States under different names and sponsors (Solomon et al., 2004). NHTSA's *Click It or Ticket* high-visibility enforcement model is described in detail in Solomon, Chaudhary, and Cosgrove (2003) and Solomon and Chaffe (2006).

Use: Most States currently conduct short-term, high-visibility belt law enforcement programs in May of each year as part of national seat belt mobilizations (Solomon et al., 2004; Solomon & Chaffe, 2006). In previous years, two mobilizations were conducted each year, in May and November. In recent years the Air Bag and Seat Belt Safety Campaign and NHTSA have supported these campaigns. Approximately 12,000 law enforcement agencies took part in the May 2006 campaign (NHTSA, 2006c). See Milano et al. (2004) for a detailed account of the history and evolution of the national campaigns.

Effectiveness: CDC's systematic review of 15 high-quality studies (Dinh-Zarr et al., 2001; Shults et al., 2004) found that short-term, high-visibility enforcement programs increased belt use by about 16 percentage points, with greater gains when pre-program belt use was lower. CDC noted that many of the studies were conducted when belt use rates were considerably lower than at present, so that new programs likely will not have as large an effect. Belt use often dropped by about 6 percentage points after the enforcement program ended. Short-term, high-visibility enforcement programs thus typically have a ratchet effect: belt use increases during and immediately after the program and then decreases somewhat, but remains at a level higher than the pre-program belt use.

NHTSA evaluated the effects of the May 2002, 2003, and 2004 *Click It or Ticket* campaigns on belt use in the States. In 2002, belt use increased by 8.6 percentage points across 10 States that used paid advertising extensively in their campaigns. Belt use increased by 2.7 percentage points across 4 States that used limited paid advertising and increased by 0.5 percentage points across 4 States that used no paid advertising (Solomon, Ulmer & Preusser, 2002).

The 2003 campaign used extensive paid advertising: about $8 million nationally and $16 million in individual States (Solomon et al., 2003, Technical Summary). The advertising strongly supported the campaign with clear enforcement images and messages. Nationally, belt use following the 2003 campaign was 79 percent compared to 75 percent at the same time in 2002 (Glassbrenner, 2005a). Twenty-eight States conducted small belt use surveys immediately before the May 2003 campaign. Across these States, belt use was 75.2 percent in 2002, 72.8 percent before the

2003 campaign and 78.5 percent immediately after the campaign. These results show the typical ratchet effect, with belt use dropping gradually after the 2002 campaign and then rising rapidly immediately after the 2003 campaign to a higher level than after the previous campaign (Solomon et al., 2003, Chapter IV).

The 2004 campaign increased paid advertising to about $12 million nationally and $20 million in the States (Solomon & Chafee, 2006). As in 2003, the advertising strongly supported enforcement activities. Belt use nationally reached 80 percent following the campaign (Glassbrenner, 2005a). Across the 50 States and the District of Columbia, belt use increased in 42 jurisdictions compared to the same time in 2003. When averaged across all 51 jurisdictions, belt use increased by 2.4 percentage points (Solomon & Chafee, 2006).

For the 2005 campaign, paid media valued at $9.7 million nationally and $22 million in States delivered a strong enforcement related message. Overall, seat belt use rates improved in 2005 in a majority of States (35 of 47). The level of improvement was slightly higher among primary law States compared to secondary law States (+2.0 versus +1.2, median point change). Among 22 primary law States, 18 showed an increase while among 25 secondary enforcement States, 17 showed an increase (Solomon et al 2007). Nationally, the seat belt use increased to 82% in 2005.

Activities were similar in 2006, with approximately $12 million in national paid advertising and $20 million in the States each year (NHTSA, 2006c).

Costs: High-visibility enforcement campaigns are expensive. They require extensive time from State highway safety office and media staff and often from consultants to develop, produce, and distribute publicity and time from law enforcement officers to conduct the enforcement. Paid advertising increases a campaign's effectiveness, as discussed above, but can be quite expensive. Averaged across all States, paid advertising costs were about $125,000 per State for the 2002 campaign and over $400,000 in 2004 (Solomon & Chafee, 2006).

Time to implement: A high-visibility enforcement program requires four to six months to plan and implement.

Other issues:

- **Effects in primary and secondary belt law States:** High-visibility enforcement campaigns are effective in both primary and secondary law States. NHTSA's 2003 evaluation found that belt use increased by 4.6 percentage points across the primary law States and by 6.6 percentage points across the secondary law States; the primary law States had higher use rates before the campaigns (Solomon et al., 2003; see also Nichols, 2002). The 2004 evaluation found that the campaign increased belt use in 25 secondary jurisdictions by an average of 3.7 percentage points. Belt use decreased in the remaining 5 jurisdictions by an average of 2.3 percentage points (Solomon & Chafee, 2006).
- **Effects on low-belt-use groups:** CDC's systematic review observed that short-term, high-visibility enforcement campaigns increased belt use more among lower-belt-use groups, including young drivers, rural drivers, males, African-Americans, and Hispanics, than among higher-belt-use drivers such as older drivers, suburban drivers, females, and Caucasians (Shults et al., 2004). NHTSA's Great Lakes Region (GLR) implemented a

Rural Demonstration Program (RDP) prior to the May 2005 *Click It or Ticket* (CIOT) mobilization. The goal of the RDP was to evaluate strategies for increasing seat belt usage in rural areas. Paid media was used to notify rural residents that seat belt laws were being enforced. Active enforcement was included during the initial phase in three of the six GLR States (Illinois, Indiana, Ohio), but only the paid media component was implemented in the remaining three States (Minnesota, Michigan, Wisconsin). During the RDP phase, States that had intensified enforcement had significant increases in usage in their rural targeted areas. All six GLR States intensified enforcement during the CIOT mobilization, but States that had intensified enforcement during RDP showed substantially greater overall statewide gains during the CIOT phase than did the States that had not intensified enforcement during the Rural Demonstration Program (Nichols, Ledingham & Preusser, 2007).

2.2 Sustained Enforcement

Effectiveness: Likely	Use: Unknown	Cost: Varies	Time: Varies

Some jurisdictions, including California, Oregon, and Washington, enforce their belt use laws vigorously as part of standard traffic enforcement activities.

Use: The extent of vigorous sustained belt law enforcement, with or without extensive publicity, is unknown.

Effectiveness: There are no studies of the effectiveness of sustained enforcement (Hedlund, Preusser, & Shults, 2004). California, Oregon, and Washington, States reported to use sustained enforcement, have recorded statewide belt use well above national belt use rates since 2002 (California: 90-92%; Oregon: 88-93%; Washington: 93-95%) (Glassbrenner, 2005b).

Costs: Sustained enforcement may require funds for publicity. As with short-term, high-visibility enforcement programs, publicity costs will depend on the mix of earned and paid media. Paid media can be expensive.

Time to implement: Sustained enforcement by law enforcement officers can be implemented immediately. Extensive publicity will take three or four months to plan and implement.

2.3 Combined Enforcement; Nighttime Enforcement

Effectiveness: Likely	Use: Unknown	Cost: High	Time: Medium

Short-term, high-visibility belt law enforcement programs (Chapter 2, Section 2.1) require substantial funding and law enforcement resources, so they can be difficult to sustain over a period of several years (Nichols, 2002). These programs also have been conducted almost exclusively during the daylight hours, and the limited available data suggest that belt use is lower at night (Chaudhary, Alonge, & Preusser, 2005; Hedlund et al., 2004). Continual enforcement (Chapter 2, Section 2.2), in which belt law violations are enforced as standard part of regular traffic patrol, is one way to address these issues.

A second way is to retain the short-term, high-intensity enforcement model but include other traffic safety issues such as impaired driving (DWI) and excessive speed, especially since the same drivers tend to drink, speed, and not buckle up. In particular, combined DWI and belt law checkpoints, saturation patrols, or enforcement zone operations could be conducted at night, when belt use is lower, DWI higher, and crash risk greater than during the day.

Another way to increase belt use at night is to use new night-vision technology for nighttime enforcement. The first demonstration of this strategy took place in 2004 in Reading, Pennsylvania (Chaudhary et al., 2005).

Use: There is no available information on how frequently the multifocused high-visibility enforcement strategy is used. A single demonstration of a nighttime program was conducted in 2004 (Chaudhary et al., 2005).

Effectiveness: The one study of combined high-visibility enforcement, in three demonstration sites, produced "encouraging but inconclusive" overall results (Jones, Joksch, Lacey, Wiliszowski, & Marchetti, 1995; Jones & Lacey, 2001). Each site targeted belt use, speeding, and alcohol-impaired driving (DWI). One site maintained the planned high-intensity enforcement directed at all three behaviors and saw reduced DWI and speeding while maintaining a high belt use rate. A second site conducted only high-visibility DWI enforcement, which had an effect only on DWI. The third site failed to conduct high-visibility enforcement of any type and saw no effect.

A 2004 nighttime high-visibility belt enforcement program in Reading, Pennsylvania, increased nighttime front-seat-occupant belt use by 6 percentage points, from 50 percent to 56 percent. Daytime belt use increased by 3 percentage points, from 56 percent to 59 percent (Chaudhary et al., 2005).

Costs: The costs of combined high-visibility enforcement programs are similar to and probably somewhat greater than the costs of programs directed exclusively at belt law violators (Chapter 2, Section 2.1). Publicity must be directed at different offenses in turn, and law enforcement officers must have the training and equipment to address different offenses. Nighttime and daytime programs should have similar costs.

Time to implement: As with standard belt law short-term, high-visibility enforcement programs, combined or nighttime programs require four to six months to plan and implement.

3.1 Communications and Outreach Supporting Enforcement

Effectiveness: Proven	Use: Medium	Cost: Varies	Time: Medium

Effective, high-visibility communications and outreach are an essential part of successful seat belt law high-visibility enforcement programs (Solomon et al., 2003). Paid advertising can be a critical part of the media strategy. Paid advertising brings with it the ability to control message content, timing, placement, and repetition (Milano et al., 2004).

Use: All high-visibility enforcement programs include communications and outreach strategies that use some combination of earned media (news stories) and paid advertising. Communications and outreach can be conducted at local, state, regional, or national levels.

Effectiveness: As discussed in Section 2.1, the May 2002 *Click It or Ticket* campaign evaluation demonstrated the effect of different media strategies. Belt use increased by 8.6 percentage points across 10 States that used paid advertising extensively in their campaigns. Belt use increased by 2.7 percentage points across 4 States that used limited paid advertising and increased by only 0.5 percentage points across 4 States that used no paid advertising (Solomon et al., 2002). Milano et al. (2004) summarize an extensive amount of information from national telephone surveys conducted in conjunction with each national campaign from 1997 through 2003.

Costs: As discussed in Chapter 2, Section 2.1, paid advertising can be quite expensive. In the average State, paid advertising costs were about $125,000 for the 2002 campaign and over $400,000 in 2004 (Solomon & Chafee, 2006).

Time to implement: An effective media campaign requires four to six months to plan and implement.

3.2 Communications and Outreach Strategies for Low-Belt-Use Groups

Effectiveness: Uncertain*	Use: Unknown	Cost: Varies	Time: Medium

* For stand-alone programs not supporting enforcement

With belt use at 82 percent nationally and 70 percent or higher in 45 States and the District of Columbia, the large majority of drivers and passengers use their belts on every trip. The challenge is to reach the minority who still do not buckle up regularly.

Observations and telephone surveys show who these nonusers are. NHTSA's 2003 national observation survey found lower use for males (77%) than females (81%), lower use for drivers age 16 to 24 (75%) than those 25 to 69 (80%), lower use for rural drivers (74%) compared to urban (79%) and suburban (84%) drivers (all data from Glassbrenner, 2004, Table 5), and lower use for passengers (77%) than for drivers (80%) (Glassbrenner, 2003, Table 1). Belt use is lower for pickup truck drivers (69%) than passenger car drivers (81%) (Glassbrenner, 2003, Table 1). Available data from the 2005 survey confirm these differences for the categories reported (Glassbrenner, 2005a). NHTSA's 2003 national telephone survey found the same patterns, with males, young drivers, rural drivers, pickup truck drivers, and passengers reporting lower belt use (Boyle & Vanderwolf, 2003, p. iv). In the telephone survey, no ethnic or racial group reported substantially lower than average belt use (Boyle & Vanderwolf, 2003). In a 2002 observation survey in Michigan, Vivoda, Eby, and Kostyniuk (2004) found significantly lower belt use among front seat occupants identified as Black (76%) compared to those identified as White (82%) or Other (84%).

Most nonusers do wear belts some of the time, or at least say they do. In NHTSA's 2003 national telephone survey, only 2 percent of drivers and front-seat passengers said they never used their belts and another 2 percent said they rarely used them (Boyle & Vanderwolf, 2003). Backseat passengers are more frequently unbelted: 13 percent said they never use belts and another 8 percent said they rarely use them, while only 53 percent reported wearing belts all the time (Boyle & Vanderwolf, 2003). The most frequent reasons given for not wearing a belt were forgetting to buckle up (55% of drivers and 44% of passengers), only driving a short distance (56% and 34%), in a hurry (40% and 31%), and uncomfortable belts (32% and 30%) (Boyle & Vanderwolf, 2003).

In the 1960s and 1970s, during the period of low belt use before belt use laws were enacted, communications and outreach campaigns did not increase belt use (ACTS, 2001). More recently, many communications efforts that do not carry an enforcement message have been used in attempts to raise the belt use of low-belt-use groups but few have been evaluated.

High-visibility enforcement programs generally have been effective in increasing belt use among these lower-use groups (see Chapter 2, Section 2.1; Shults et al., 2004). Their publicity messages and placement can be directed at specific lower-belt-use groups. Two 2001 programs successfully targeted pickup trucks as part of high-visibility seat belt enforcement activities. The "Pick Up the Buckle, Each Time, Every Time" campaign in South Dakota increased belt use in pickup trucks from 33 percent to 49 percent and the "When you get in a truck, you'd better buckle up" campaign in Florida increased use from 47 percent to 68 percent (NHTSA, 2005).

North Dakota's "Pick Up the Habit for Someone You Love" campaign in 2003 provides the best-documented example of a successful communications and outreach program not directly connected to enforcement. It was directed at male pickup drivers, whose pre-program belt use was 20 percentage points lower than the statewide 63-percent rate. A survey of these drivers identified effective message goals (*choose* and *remember* to buckle up), message strategies (motivation through loved ones, sometimes using humor), and message placement (combining paid and earned radio and television, posters, and public relations events). The program increased observed belt use of male pickup drivers by 7 percentage points at a total cost of $295,000 (North Dakota DOT, 2004).

The five States of NHTSA's South Central Region conducted a two-week "Buckle Up in Your Truck" paid advertising campaign immediately before their May 2004 *Click It or Ticket* campaign. The truck campaign's message complemented the *Click It or Ticket* message by focusing on the dangers of riding unrestrained in a truck and stressing the usefulness of belts in rollover crashes. The campaign spent nearly $600,000 for paid advertising in the five States. Surveys at the end of the campaign, before any enforcement-based *Click It or Ticke*t publicity, showed that belt use increased in pickup trucks by about 2 percentage points. Belt use in pickup trucks increased by another 6 percentage points after the *Click It or Ticket* publicity (Solomon & Chaffe, 2006).

In a follow-up study, an intensive campaign using the same "Buckle Up in Your Truck" message was conducted in Amarillo, Texas, in November 2004. The campaign used paid advertising emphasizing belt law enforcement as well as earned media featuring local law enforcement officers. Belt use in pickup trucks increased by 12 percentage points in Amarillo and belt use in cars increased by 8 percentage points. At the same time, belt use in a comparison community increased by 5 percentage points for pickup truck occupants and by 4 percentage points for car occupants (Solomon & Chafee, 2006).

Use: Communications and outreach campaigns directed at low-belt-use groups probably are quite common, but no summary is available.

Effectiveness: Uncertain. The North Dakota and Amarillo campaigns are the only well-documented and successful examples. They used all the characteristics of effective communications and outreach campaigns: good target audience research, effective and creative message development, and good message placement using both paid and earned media. The overall South Central Region campaign produced only modest gains.

Costs: As with enforcement-related communications and outreach, costs vary depending on program quality and delivery. Paid advertising can be expensive.

Time to implement: A good media campaign will require four to six months to plan and implement.

4.1 Employer and School Programs

Effectiveness: Proven*	Use: Unknown	Cost: Varies	Time: Varies

* In low belt use settings with no belt use law

Employers, schools, and similar institutions provide well-defined and somewhat controlled audiences for seat belt use programs. Education and other communications strategies can be tailored to a specific audience. Seat belt use policies can be implemented and enforced in certain settings. Incentive programs can be conducted (Chapter 2, Section 4.2).

Little information is available on what employer and school programs have been conducted recently and how effective they have been. The few high-quality published studies were conducted more than 15 years ago, in a low belt use environment (Nichols, 2002).

Use: There are no data on the number of employer and school programs operating currently.

Effectiveness: Employer and school programs in a low belt use environment with no belt use law have increased belt use substantially: by an average of 24 percentage points in five corporate programs and by 6 to 28 percentage points in several school programs (Nichols, 2002).

Costs: Program costs will depend on the size of the target audience and the components of the program.

Time to implement: Employer and school policies can be implemented immediately. Complete programs will require at least four months to plan and implement. School programs may require a full year.

Other issues:

- **Employer and school programs in high-belt-use settings:** As noted above, there is little information on employer and school programs in a setting with a belt use law and high baseline belt use. No evaluations appear to have been conducted since 1994.

4.2 Incentive Programs

Effectiveness: Proven*	Use: Low	Cost: Varies	Time: Medium

* In low belt use settings with no belt use law

Incentive programs use rewards of some sort as an inducement to wear seat belts. Incentive programs have been implemented by employers, in schools, and across entire communities. Rewards have included cash, coupons for merchandise or food, T-shirts or other promotional items, and raffle tickets for valuable prizes. Rewards typically have been given to people observed to be wearing their belts but sometimes have been given for a pledge to buckle up. Incentive programs usually are accompanied by seat belt communications and outreach and may also be combined with seat belt use policies (Nichols, 2002).

Hagenzieker et al. (1997) summarized 34 incentive program evaluations published between 1978 and 1992. Almost all (95%) programs were conducted in the United States. Almost all (83%) were conducted when no belt use law was in effect, so that pre-program belt use was low. No incentive program evaluations appear to have been conducted since 1992 (Hagenzieker, Bijleveld, & Davidse, 1997; Nichols, 2002).

Use: Incentive programs were popular before belt use laws were implemented but most appear to have been discontinued. There are no data on the number of incentive programs operating currently.

Effectiveness: In the situations studied – low baseline belt use and no belt use law in effect – incentive programs raised belt use immediately by 12 percentage points on average. As with enforcement programs, belt use subsequently decreased somewhat, so that the average long-term belt use increase was 9 percentage points (Hagenzieker et al., 1997; Nichols, 2002). In general, the effects were greater when baseline belt use was lower and when the target population was more confined: elementary school programs had the greatest impact, followed by employers, colleges, and finally entire communities.

Costs: Incentive program costs will depend on the size of the target audience, the nature of the incentives, and the nature and amount of publicity required. Sponsors can be sought to donate incentive rewards or otherwise offset program costs.

Time to implement: An incentive program should take four to six months to plan and implement.

Other issues:

- **Incentive programs in high-belt-use settings:** As noted above, there is little or no information on incentive programs in a setting with a belt use law and high baseline belt use. No incentive program evaluations appear to have been conducted since 1992.

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3. Aggressive Driving and Speeding

Overview

Aggressive driving is generally understood to mean driving actions that markedly exceed the norms of safe driving behavior and that directly affect other road users by placing them in unnecessary danger. Aggressive driving may also involve driver anger, attempts to gain an advantage over other drivers, and deliberate violations and deviations from normal traffic speeds (National Cooperative Highway Research Program [NCHRP, 2003a). It has proven challenging to come up with a working definition of aggressive driving. Not every moving violation is considered aggressive driving. However, multiple violations such as speeding, following too closely, making unsafe lane changes and running red lights, either on one occasion or over a period of time, may indicate a pattern of aggressive driving. Although some states have passed laws criminalizing aggressive driving, it should not be confused with road rage: an intentional assault by a driver or passenger with a motor vehicle or a weapon that occurs on the roadway or is precipitated by an incident on the roadway.

Causes of aggressive driving can include both personal and environmental triggers. A predisposal to immature and 'selfish' driving that puts others at risk might be the norm for a small proportion of drivers, while the vast majority may be provoked to drive aggressively at least occasionally by exceptional congestion, work zones, poorly-timed traffic signals and other frustrating conditions. The perceived rise in aggressive driving is likely to be related, at least in part, to increasingly crowded roadways, longer commute times, and increases in personal trips.

The legal definition of speeding is exceeding the posted speed limit. In practice, law enforcement officers seldom write citations for speeds less than 5 or sometimes 10 mph over the posted limit (Governors Highway Safety Association [GHSA], 2005). Speeding becomes aggressive driving when a vehicle's speed is too high for conditions or substantially exceeds the prevailing travel speeds of other vehicles. Speeding is the most frequently-cited aggressive-driving infraction, and has been incorporated into most aggressive driving laws as one of the infractions required to invoke an aggressive driving offense. The Transportation Research Board [TRB] special report 254 summarizes much of the past research regarding the effects of speed on crashes and practices for setting speed limits and managing speeds (TRB, 1998). See Aarts and van Schagen (2006) for a more recent review of studies of how individual vehicle speeds, average travel speeds, and speed variation affect crash risk.

Problem size. Speeding is common, and on some roads almost universal. About three-quarters of all drivers in NHTSA's 2002 national survey reported that they exceeded the posted speed limit on interstates, non-interstate multilane roads, two-lane roads, and city streets during the past month. About one-third reported speeding on these roads on the day of the interview (Royal, 2004). In addition, one-third of all drivers reported that they often or sometimes drive at least 10 mph faster than most other vehicles (Royal, 2004). Yet two-thirds of drivers felt that other speeding drivers pose a major threat to their personal safety (Royal, 2004; NHTSA, 2003). NHTSA estimated that speeding, as determined by the investigating officer, was a contributing factor in 31 percent of fatal crashes in 2006 (NHTSA, 2007a). This figure has changed little over the

years. In-depth investigations found speeding to be a causal factor in 19 percent of a sample of serious crashes in 1996-1997 (Hendricks et al., 2001a; Hendricks et al., 2001b).

Speeding can be dangerous on all roads. In 2006, 47 percent of the speed-related traffic fatalities occurred on roads posted at 50 mph or less and more than one-fifth occurred on roads posted at 35 mph or less (NHTSA, 2007b, Table 118). Young males tend to be most involved in fatal speed-related crashes (NHTSA, 2007a).

Aggressive driving actions other than speeding also are common, though they are more difficult to measure accurately. In NHTSA's survey, 40 percent of drivers reported that they sometimes or often enter an intersection "just as the light turned from yellow to red." In the same survey, 10 percent reported sometimes or often cutting in front of another driver (Royal, 2004; NHTSA, 2003). About one-third of drivers reported that they feel threatened by other drivers at least several times monthly (Royal, 2004). NHTSA estimated that two-thirds of traffic fatalities involve behaviors commonly associated with aggressive driving such as speeding, red-light running, and improper lane changes (NHTSA, 2001a).

Strategies to Reduce Aggressive Driving and Speeding

Aggressive driving, speeding, and red-light running all involve traffic law violations. Therefore, deterrence through traffic law enforcement is the basic behavioral strategy that has been used to control them. This strategy involves the same components used to deter alcohol-impaired driving or seat belt nonuse: highly publicized and highly visible enforcement of practical, sound, and broadly accepted laws. In particular, speed limits should be set carefully and rationally, taking into account the road segment's design speed, vulnerable users, traffic operations, and environmental conditions; if not, many drivers may lose respect for and exceed the speed limit. Additionally, NCHRP (2003a) suggests that successful anti-aggressive driving programs place an emphasis on enforcing all traffic laws. Such a strategy increases respect for all laws and the public's expectation that laws should be obeyed.

Enforcement can be conducted through regular traffic patrols; sustainable levels of widespread, randomized enforcement; intense, highly publicized enforcement periods; or automated speed or red-light enforcement. The sections in this chapter discuss the relevant laws and sanctions, enforcement techniques, and publicity. General communications and outreach campaigns urging tolerant and non-aggressive driving behavior have also been used in attempts to reduce aggressive driving and speeding.

Environmental and vehicular measures also can be effective. As examples, traffic calming measures can reduce speeds, especially on local roads (TRB, 19983). A variety of measures to reduce congestion, such as mass-transit or ride-sharing, can diminish driver frustration that leads to aggressive driving (Shinar & Compton, 2004). Advance warnings of congestion or delays may also decrease unexpected frustration. Well-coordinated traffic signals can improve traffic flow and reduce red-light running. Adequately designed turn bays and entrance and exit ramps can reduce improper merging and driving on the shoulder (NCHRP, 2003, Strategy B1). Company policies, backed up with speed monitors and logs or even speed regulators, can reduce commercial vehicle speeding. These environmental and vehicular strategies are not included in this guide because

State Highway Safety Offices [SHSOs] have little or no direct authority or responsibility for them. However, managing traffic operations in general and speeds in particular requires cooperative efforts between State Departments of Transportation [DOTs] and SHSOs. SHSOs are encouraged to act cooperatively with State DOTs to identify their aggressive driving and speeding problems and to adopt comprehensive plans and programs to address them. See NCHRP (2003) for examples of cooperative strategies.

The same cooperative methods can be useful in addressing local aggressive driving or speeding concerns, for example in a neighborhood or on a road segment or corridor. Working together, State and community traffic engineers, law enforcement, safety officials, community leaders, and concerned citizens can develop comprehensive plans and programs.

The Department of Transportation's 2005 Speed Management Strategic Initiative (U.S. DOT, 2005) contains a comprehensive set of engineering, enforcement, and education strategies to reduce speeding-related fatalities and injuries. The Department, together with GHSA and several national organizations, sponsored a National Forum on Speeding in June 2005. The forum's invited presentations documented speed-related issues and summarized speed management practices in Australia, Canada, and the Netherlands. The presentations are available at www.nhtsa.dot.gov/people/injury/enforce/Speed_Forum_Presentations/. The forum report (NHTSA, 2005) presents an action agenda.

Countermeasures That Work

Countermeasures to reduce aggressive driving and speeding are listed below and discussed individually in this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information.

1. Laws

Countermeasure	Effectiveness	Use	Cost	Time
1.1 Speed limits	Proven*	High	Low	Short
1.2 Aggressive driving laws	Unknown	Low	Low	Short

* When enforced and obeyed

2. Enforcement

Countermeasure	Effectiveness	Use	Cost	Time
2.1 High-visibility enforcement	Uncertain*	Low	High	Medium
2.2 Automated enforcement	Proven	Medium	High†	Medium
2.3 Other enforcement methods	Varies	Unknown	Varies	Varies

*Proven for DWI and restraint-use

† Can be covered by income from citations

3. Penalties and Adjudication

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Penalty types and levels	Uncertain	High	Varies	Low
3.2 Diversion and plea agreements	Unknown	Unknown	Varies	Varies

4. Communications and Outreach

Countermeasure	Effectiveness	Use	Cost	Time
4.1 Supporting enforcement	Likely	Medium	Varies	Medium

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results.
Likely: balance of evidence from high-quality evaluations.
Uncertain: limited and perhaps ambiguous evidence.
Unknown: no high-quality evaluation evidence.
Varies: different methods of implementing this countermeasure produce different results.

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise.
See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities.
Medium: between one-third and two-thirds of States or communities.
Low: fewer than one-third of the States or communities.
Unknown: data not available.

Cost to implement:

High: requires extensive new facilities, staff, or equipment, or makes heavy demands on current resources.
Medium: requires some additional staff time, equipment, and/or facilities.
Low: can be implemented with current staff, perhaps with training; limited costs for equipment or facilities.

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year.
Medium: more than three months but less than one year.
Short: three months or less.

These estimates do not include the time required to enact legislation or establish policies.

1.1 Speed Limits

Effectiveness: Proven*	Use: High	Cost: Low	Time: Short

*When enforced and obeyed

Speed limits are only one part of the system that attempts to control driving speeds. Without broad public acceptance and active enforcement they have little effect. With public acceptance and enforcement, lower speed limits can reduce travel speeds and casualties.

Speed limits are set both by legislation and by administrative action. General speed limits apply to all roads in a class, such as rural interstates or local streets. They are set by State, municipal, or even at times by Federal law based on tradeoffs between safety, travel efficiency, and community concerns, taking into account the design characteristics of each road class. GHSA (2005) and the Insurance Institute for Highway Safety [IIHS] (2006a) summarize each State's maximum speed limits and NHTSA (2006) provides each State's complete speed limit laws. Speed zones apply to road segments where the general speed limit is thought to be inappropriate. Speed limits in these zones usually are set by administrative action based on the road segment's free-flowing travel speeds, crash experience, road and land use conditions, and other factors. Speed limits in many speed zones are set near the 85th percentile travel speed: the speed at or below which 85 percent of vehicles travel in good weather, with no congestion (TRB, 1998).

The effects of maximum speed limits on speeds, crashes, and casualties have been studied extensively over the past 30 years. In 1974 the 55 mph National Maximum Speed Limit (NMSL) was enacted to conserve fuel. Travel decreased, speeds decreased on roads where the speed limit was lowered to 55 mph, and total traffic fatalities decreased by 9,100 from 1973. The slower and more uniform speeds due to the 55 mph limit are judged to have saved between 3,000 and 5,000 lives in 1974 (TRB, 1984). As fuel became plentiful again, travel increased and compliance with the 55 mph limit decreased markedly (TRB, 1984). In 1987 Congress allowed States to raise speed limits to 65 mph on rural interstate highways. States that raised their limits generally saw increases of about 4 mph in average speeds and 85th percentile speeds and statistically significant increases in traffic fatalities on these roads (TRB, 1998). In 1995, Congress repealed the NMSL and returned full authority to set speed limits back to the States. Again, increased speed limits produced modest increases in both average and 85th percentile speeds and increases in traffic fatalities (TRB, 1998; for the most recent analysis, see TRB, 2006).

Few studies have examined the effects of speed limit changes on lower-speed roads. Earlier studies found little effect on driving speeds or crash rates when speed limits were raised to near the 85th percentile travel speed or lowered to near the 35th percentile speed, either on rural roads or on urban and suburban arterials (TRB, 1998, p. 6). A recent study found that crashes increased by 20-30 percent when speed limits were increased from 50 to 70 kph (31 to 43 mph) or from 70 to 80 kph (43 to 50 mph) on 19 urban road segments in Hong Kong (Wong, Sze, Lo, Hung & Loo, 2005).

Use: A speed limit is in effect on all road segments in all States.

Effectiveness: Lower maximum speed limits definitely reduce crashes and casualties when the limits are obeyed. The same holds true on any road: if a lower speed limit is obeyed, then crashes and casualties will drop. But lower speed limits by themselves may not reduce travel speeds.

Costs: The immediate costs of changing speed limits are for new signage and for publicizing the new limit. Enforcing the new limit may involve substantial costs.

Time to implement: Speed limit changes can be implemented quickly, as soon as signage is in place and the new limits are publicized.

Other issues:

- **Public acceptance, roadway characteristics, enforcement, and publicity:** Speed limit changes may not by themselves affect speeding, whether defined either as average travel speed or as the proportion of drivers traveling substantially faster than the average speed. Speed limits can reduce speeding if most drivers believe that the limits are reasonable and if the threat of enforcement is great enough to affect the few drivers who would not comply voluntarily. It is generally very difficult to enforce and obtain general compliance with a lower speed limit on a roadway designed for higher speeds (TRB, 1998). Thus, speed limits must be considered as part of a system including broad public acceptance, roadway characteristics, active enforcement, and publicity (TRB, 1998).
- **Rational speed limits:** Speed limits on many road segments are frequently not obeyed, and average travel speeds on these segments substantially exceed the speed limit. One strategy that has been proposed to increase overall safety is to increase the speed limit to a generally accepted level on selected road segments and at the same time aggressively publicize and enforce this speed limit. The strategy's goal is to increase the public's overall acceptance of speed limits while reducing the number of people driving at speeds considerably higher than the limit.

1.2 Aggressive Driving Laws

Effectiveness: Unknown	Use: Low	Cost: Low	Time: Short

Aggressive driving actions are covered by specific traffic laws such as speeding, improper lane changes, and following too closely, or by general laws such as reckless driving. Specific traffic laws typically carry less harsh penalties than reckless offenses and may be difficult to prosecute (NHTSA, 2001a, Statutory Strategies; Flango & Keith 2004). Aggressive drivers often can be identified as those who violate traffic laws repeatedly or whose violations lead to crashes producing serious injury or death. The traffic law strategy to address aggressive driving is to assure that more severe penalties are available for repeat offenders and for violations causing death or serious injuries.

NHTSA's 1999 Symposium on Aggressive Driving and the Law (NHTSA, 2001a, Statutory Strategies) recommended that States implement this strategy by providing for:

- enhanced penalties for repeat offenders, including increased driver's license points, license suspension or revocation, higher fines, and jail or probation; and
- felony charges for violations resulting in serious injury or death.

The symposium developed a model aggressive driving statute that defines aggressive driving as three moving violations in a single driving incident. The NCHRP Aggressive Driving Guide also recommends increased sanctions for repeat offenders and serious offenses (NCHRP, 2003, Strategy A3).

Use: In general, States provide for increased penalties for repeat offenders and for violations with serious consequences. Thirteen States have implemented formal aggressive driving laws (GHSA, 2007a). Among these, Florida's is a 'defining statute' only; there is no aggressive driving charge, but there is a notation on the citation that aggressive driving was involved. Two other States have laws relating to assault-type crimes involving motor vehicles.

Effectiveness: There are no studies of the effects of aggressive driving laws in general or of increased penalties in particular on aggressive driving, traffic law violations, or crashes. See Chapter 3, Section 3.1 for a discussion of the effects of driver improvement actions in general.

Costs: The only immediate costs of the recommended law changes are to publicize the new laws. Additional costs may result as drivers are sentenced to more costly sanctions.

Time to implement: Law changes can be implemented quickly, as soon as they are publicized.

Other issues:

- **Public acceptance, enforcement, and publicity:** Law changes by themselves cannot reduce aggressive driving. Traffic laws in general and aggressive driving laws in particular are essential to, but only a part of, a system that includes broad public acceptance, active enforcement, and publicity (NHTSA, 2001a, Executive Summary).

2.1 High-Visibility Enforcement

Effectiveness: Uncertain*	Use: Low	Cost: High	Time: Medium

*Proven for DWI and restraint use

High-visibility enforcement campaigns have been used to deter aggressive driving and speeding. In the high-visibility enforcement model, law enforcement targets selected high-crash or high-violation geographical areas using either expanded regular patrols or designated aggressive driving patrols. This model is based on the same principles as high-visibility seat belt and alcohol-impaired-driving enforcement: to convince the public that speeding and aggressive driving actions are likely to be detected and that offenders will be arrested and punished (see Chapter 1, Alcohol-Impaired Driving, Sections 2.1 and 2.2, and Chapter 2, Seat Belt Use, Section 2.1).

In the high-visibility enforcement model, officers focus on drivers who commit common aggressive driving actions such as speeding, following too closely, and running red lights. Enforcement is publicized widely. The strategy is very similar to saturation patrols directed at alcohol-impaired drivers (Chapter 1, Section 2.2). Because speeding and aggressive driving are moving violations, officers cannot use checkpoints. Rather, they must observe driving behavior on the road.

Use: No data are available on the number of jurisdictions operating high-visibility aggressive driving enforcement campaigns, but it is likely that they are not common. NCHRP (2003, Strategy A1) provides a few examples of recent aggressive driving enforcement programs.

Effectiveness: Some effectiveness evidence comes from NHTSA demonstrations in three communities. All three demonstrations lasted six months and included extensive publicity but differed in other respects. Milwaukee was the most successful. Red-light running decreased at targeted intersections. Crashes in the city dropped by 12 percent in targeted corridors and by 2 percent in comparison corridors (NHTSA, 2002; McCartt, Leaf, Witkowski, & Solomon, 2001). The Indianapolis demonstration was not a success. Average speeds dropped slightly. Total crashes *increased* 32 percent over the previous year. Crashes increased *more* in the demonstration area than in other areas, and the proportion of crashes involving aggressive driving behaviors also increased in the demonstration areas (Stuster, 2004). Tucson had mixed results. Average speeds dropped moderately. Total crashes *increased* 10 percent in the demonstration areas and *decreased* in comparison areas. However, the proportion of crashes involving aggressive driving behaviors decreased by 8 percent in the demonstration areas (Stuster, 2004).

More recently, Davis et al. (2006) report on a high-visibility enforcement program in Fresno, California in 2003 and 2004. The program increased traffic citations significantly and reduced crashes, injuries, total fatalities, and fatalities related to speed. It reduced hospital admissions resulting from crashes and reduced the injury levels, length of stay in hospital, and hospital charges for those crash victims who were hospitalized. Taken together, the evaluation evidence suggests that high-visibility aggressive driving enforcement campaigns have promise but success is far from guaranteed.

Costs: As with alcohol-impaired driving and seat belt use enforcement campaigns, the main costs are for law enforcement time and for publicity. The Milwaukee demonstration received a $650,000 grant and the other two demonstrations each received a $200,000 grant.

Time to implement: High-visibility enforcement campaigns may require four to six months to plan, publicize, and implement.

2.2 Automated Enforcement

Effectiveness: Proven	Use: Medium	Cost: High*	Time: Medium

*Can be covered by income from citations

Automated enforcement is used in some jurisdictions to reduce red-light running and speeding. At intersections with traffic lights, automated cameras take photographs of vehicles entering the intersection on a red light. Citations are sent to the vehicle's registered owner. FHWA's Red-Light Running Cameras (FHWA, 2005a) and Red-Light Camera Systems Operational Guidelines (FHWA, 2005b) and the National Campaign to Stop Red-Light Running's Guide to Red-Light Camera Programs (National Campaign to Stop Red Light Running [NCSRLR], 2002) provide information on red-light camera program costs, effectiveness, implementation, and other issues. Maccubbin, Staples, and Salwin (2002) provide more detailed information on programs operating in 2001. Speed cameras, also called photo radar, operate similarly, recording a vehicle's speed using radar or other instrumentation and taking a photograph of the vehicle.

Use: As of June 2007, 15 states plus the District of Columbia had passed laws specifically permitting automated enforcement (GHSA, 2007b). Red-light cameras are used extensively in other industrialized countries and were first employed in the United Sates in 1993 (NCSRLR, 2002). As of August 2007, red-light cameras were used in more than 200 U.S. communities in 23 States and the District of Columbia (IIHS, 2007). Speed cameras also are used extensively in other countries (WHO, 2004). As of August 2007, speed cameras were used in about 30 U.S. communities (IIHS, 2007).

Effectiveness: Red-light camera effectiveness has been studied fairly extensively. Summary reviews conclude that they increase rear-end crashes, reduce side-impact crashes, and reduce overall crash severity (Aeron-Thomas & Hess, 2006; Decina, Thomas, Srinivasan, & Staplin, in press; FHWA, 2005b; Maccubbin et al., 2001; McGee & Eccles, 2003; Retting, Ferguson, & Hakkert, 2003; WHO, 2004).

Speed cameras also reduce crashes substantially. Decina et al. (in press) critically reviewed 13 safety impact studies of photo speed enforcement using fixed, conspicuous cameras, and found that the best-controlled studies suggest injury crash reductions are likely to be in the range of 20 – 25%. Covert, mobile enforcement programs also result in significant crash reductions, and may have the added benefit that drivers do not adapt to cameras by taking alternate routes or speeding up after passing a camera. Earlier, Pilkington and Kinra (2005) reviewed 14 studies of speed camera programs in Australia, Canada, New Zealand, Norway, and the United Kingdom and concluded that speed cameras reduce traffic crashes, injuries, and fatalities. Wilson, Willis, Hendrikz, and Bellamy (2006) reviewed 26 evaluations of enforcement using any kind of speed-detection technology, and also concluded that these technologies are effective at reducing crashes and injuries.

Costs: In 2001, red-light cameras cost about $50,000 to $60,000 to purchase and $25,000 to install. Monthly operating costs were about $5,000 (Maccubbin et al., 2001). Most jurisdictions contract with private vendors to install and maintain the cameras and use a substantial portion of the income from red-light citations to cover program costs. Speed camera costs probably are similar. Chen (2005) provides an extensive analysis of the costs and benefits of the British Co-

lumbia speed camera program. Gains, Heydecker, Shrewsbury and Robertson (2004) reported on costs and benefits and program factors of a cost-recovery program used in the U.K.

Time to implement: Once any necessary legislation is enacted, automated enforcement programs probably require four to six months to plan, publicize, and implement.

Other issues:

- **Laws:** Many jurisdictions using automated enforcement are in States with laws authorizing its use. Some States permit automated enforcement without a specific State law. A few States prohibit some forms of automated enforcement (IIHS, 2007b). See NCUTLO (2004) for a model automated enforcement law. The National Campaign to Stop Red-Light Running newsletter, *Safety Focus*, provides periodic summaries of State automated enforcement legislative activity (www.stopredlightrunning.com).
- **Public acceptance:** Public surveys typically show strong support for red-light cameras and somewhat weaker support for speed cameras (IIHS, 2005; Royal, 2004). Support appears highest in jurisdictions that have implemented red-light or speed cameras. However, efforts to institute automated enforcement often are opposed by people who believe that speed or red-light cameras intrude on individual privacy or are an inappropriate extension of law enforcement authority. They also may be opposed if they are viewed as revenue generators rather than methods for improving safety. Delaney, Diamantopoulou, and Cameron (2005) discuss how Australia and the United Kingdom dealt with the opponents of speed cameras.
- **Legality:** State courts have consistently supported the constitutionality of automated enforcement.

2.3 Other Enforcement Methods

Effectiveness: Varies	Use: Unknown	Cost: Varies	Time: Varies

Many traffic enforcement operations help to deter speeding and aggressive driving as well as other traffic offenses. In addition to high-visibility enforcement campaigns (Chapter 3, Section 2.1) and automated enforcement (Section 2.2), a number of new technologies have been recommended to address speeding and aggressive driving (NHTSA, 2001a). Law enforcement agencies around the country have also conducted innovative and effective aggressive driving enforcement programs (NHTSA, 2000).

New technology: Improved technology may help in several ways.

- In-car video equipment in patrol cars allows law enforcement to record aggressive driving actions and can enhance the ability to prosecute and convict offenders (NHTSA, 2001a).
- Laser speed measuring equipment can provide more accurate and reliable evidence of speeding (NHTSA, 2001a).
- Unstaffed speed display devices, also known as speed trailers, can show drivers that they are speeding and may encourage some drivers to slow down. They may also suggest to drivers that speeds are being monitored or enforcement is nearby. Signs that provided either an implication that speeds were being monitored or a social norms message (average speed at the site; your speed) were effective at reducing speeds in a 50 km/h zone although not as much as in earlier studies (Wrapson, Harre, & Murrell, 2006). Other recent studies have shown that speed trailers can be effective in reducing speeds in work zones (Brewer, Pesti, & Schneider, 2006, Mattox, Sarasua, Ogle, Eckenrode, & Dunning, 2007) and school zones (Lee, Lee, Choi, & Oh, 2006). Automated speed display monitors also provide a method to collect location-specific travel speed data.
- Both in-vehicle driver warning systems as well as traditional cruise control are widely available technologies that may be well-accepted by drivers to help govern their speeds (Young & Regan, 2007).
- Lease cars in the Netherlands were equipped with technology that continuously monitored and displayed whether drivers were allowing a safe following distance and complying with the speed limit. Rewards were given by the lease company for good driving behavior over a 16 week period. Drivers were about 20% more likely to drive within posted speed limits and 25% more likely to maintain adequate following distances when receiving feedback and rewards (Mazureck & van Hattem, 2006).
- Drone radar - A recent study of the use of this technology in work zones suggests that it may be effective at reducing overall speed of the traffic stream, with particularly large speed reductions among vehicles equipped with radar detectors (Eckenrode, Sarasua, Mattox, Ogle, & Chowdhury, 2007).

Many jurisdictions use some of these new technologies. Each has costs for new equipment and training. Each can be implemented quickly as soon as equipment is purchased and training completed.

Innovative enforcement programs: NHTSA (2000) provided brief descriptions of 12 aggressive driving enforcement programs around the country. See NHTSA's *Aggressive Driving Programs* (NHTSA, 2001b) for additional examples.

- The Albuquerque, New Mexico, Safe Streets program used saturation patrols in four high-crash and high-crime areas. On freeways they observed speeding and aggressive driving from a "cherry picker" platform and radioed to patrol officers.
- The Arizona Department of Public Safety's Operation Chill used both marked and unmarked patrol vehicles backed up with an extensive publicity campaign.
- The Colorado State Patrol ADAPT (Aggressive Drivers Are Public Threats) campaign used unmarked patrol vehicles, motorcycles, airplanes, and motorist calls to *277 to detect aggressive drivers. The campaign was publicized extensively.
- The Maryland State Police used a special ADVANCE (Aggressive Driving Video and Non-Contact Enforcement) vehicle equipped with lasers to determine a vehicle's range and speed and a computer system to record video images of the vehicle.
- The Massachusetts State Police 3D Program, (Dangerous Drunk and Drugged Driving) used unmarked patrol vehicles as well as unmarked or nontraditional vehicles, equipped with in-car video cameras and radar units, and emergency lights, working in cooperation with two or more marked patrol vehicles.
- The Milwaukee, Wisconsin, Police Department used an "angel patrol" (for those drivers who "drive faster than their guardian angel can fly"), a "flasher patrol" for those drivers who do not use their turn signals when turning or switching lanes, and a "basket patrol" for the drivers who like to weave in and out of traffic. See Chapter 3, Section 2.1 for evaluation data.
- The Ohio State Highway Patrol's Operation TRIAD (Targeting Reckless, Intimidating, and Aggressive Drivers) used a large, fixed-wing aviation division and local highway patrol officers to target aggressive driving.
- The Oklahoma City Police Department's RAAID (Reduction of Accidents and Aggressive and Inconsiderate Drivers) used dedicated law enforcement teams to target 10 high-crash areas.
- The Pennsylvania State Police used two programs. Operation Centipede stationed 8 to 10 officers one to two miles apart along a roadway, in both marked and unmarked vehicles. TAG-D (Ticket the AGgressive Driver) used saturation patrols with marked and unmarked law enforcement vehicles, a vehicle that appears disabled, radar, fixed-wing aircraft, and pursuit vehicles.
- The Richardson, Texas, Police Department used a downstream light system to reduce red-light running. A white light on the back of a traffic light was activated when the light turned red. Officers across the intersection or downstream from the traffic light could then tell when the light turned red and wait for the red-light runners to reach them.
- The St. Petersburg, Florida, Police Department's "Where's Jockers?" program featured Patrol Officer Mike Jockers, equipped with a radar gun and handheld radio, sitting in unexpected places to observe aggressive driving and call ahead to marked patrol vehicles. Locations included on lawn mowers and bus benches, and in road construction vehicles.
- The greater Washington, DC, area multi-agency Smooth Operator program used shared publicity and coordinated enforcement waves with marked and unmarked patrol vehicles as well as nontraditional vehicles.

3.1 Penalty Types and Levels

Effectiveness: Uncertain*	Use: High	Cost: Varies	Time: Low

*for general traffic offenses

Penalty types and levels for speeding and the various traffic offenses included under aggressive driving are part of each State's overall driver control system. Penalties typically are low for first offenses that do not produce serious crashes and casualties and include small fines and perhaps a few demerit points assessed against the driver's license. When violations cause a crash producing serious injury or death, the offense may carry criminal charges and sanctions may be more severe. As discussed in Chapter 3, Section 1.2, NHTSA's Aggressive Driving Symposium and NCHRP's Aggressive Driving Guide recommend enhanced penalties for repeat aggressive driving offenders and felony charges for offenses resulting in serious injury or death (NHTSA, 2001a, Statutory Strategies; NCHRP, 2004, Strategy A3).

States use the demerit point system in an attempt to prevent drivers from committing repeated traffic offenses. As drivers accumulate demerit points, States use various actions and penalties such as warning letters, educational brochures, group counseling meetings, individual counseling, administrative hearings, and driver's license suspension or revocation (Masten & Peck, 2004). Penalty levels and types for speeding and aggressive driving offenses should be considered within the context of a State's overall driver control and problem driver remediation system.

Use: Each State has a system of penalties for traffic offenses. Each system includes more severe penalties for significant individual offenses, such as those producing serious injury or death, and for repeated offenses, often determined through accumulated driver's license demerit points.

Effectiveness: Generally, for penalties to be effective, perceived risk of getting caught must be high. Evidence is mixed about effectiveness of varying severity of penalties. Masten and Peck (2004) reviewed the effectiveness evidence for different driver improvement and driver control actions, including penalty levels and types, from 35 high-quality studies of 106 individual actions and penalties. They found that, taken together, all actions and penalties reduced subsequent crashes by 6 percent and violations by 8 percent. Even simple warning letters have some effect on both violations and crashes. The effect increased as the "obtrusiveness" of the action increased, with license suspension or revocation the most effective by far. The authors noted that the threat of license suspension probably is responsible for the effectiveness of the weaker actions such as warning letters. Educational brochures by themselves had no effect. Finally, administrative penalties imposed by the driver licensing agency were more effective than penalties imposed by the courts.

A recent study in Maryland found that legal consequences for speeding had little impact on future citations (Lawpoolsri & Li, 2007). Drivers who received legal consequences had the same likelihood of receiving another speeding citation as drivers who escaped legal consequences. Only fines coupled with probation before judgment (PBJ) was associated with a reduced risk of receiving a subsequent speeding ticket (Lawpoolsri & Li, 2007). Most evidence suggests that there is at least a population of drivers for whom penalties do not seem to have the desired deterrent effect.

Repeat offenders: Repeat speeding and aggressive driving offenders may therefore be especially difficult to deter. Recommended methods to reach them include:

- Enhanced penalties, including increased driver's license points, immediate license suspension or revocation, higher fines, and jail or probation. See Chapter 3, Sections 1.2 and 3.1, for more information.
- Improved traffic record systems, to better identify repeat offenders and to allow patrol officers to immediately access a driver's complete driving record (NHTSA, 2001a). There are no studies of the effects of improved record systems on repeat offenders. Costs and implementation time will vary.

Costs: Costs vary by penalty type. For example, warning letters are very cheap once a record system has been established to identify drivers who should receive letters. Individual counseling and administrative hearings may require substantial staff time. Some costs may be recovered through offender fees.

Time to implement: Most changes in penalty levels can be implemented quickly within a State's overall driver improvement system.

Other issues:

- **Public acceptance, enforcement, and publicity:** Changes in speeding and aggressive driving penalty types and levels by themselves cannot reduce speeding and aggressive driving. Traffic laws, penalty types, and penalty levels are essential to, but only a part of, a system that includes broad public acceptance, active enforcement, and publicity (NHTSA, 2001a, Executive Summary).

3.2 Diversion and Plea Agreement Restrictions; Traffic Violator School

Effectiveness: Unknown	Use: Unknown	Cost: Varies	Time: Varies

In many jurisdictions, drivers who accumulate enough demerit points on their driver's licenses are allowed to attend a Traffic Violator School. In most instances, drivers who complete Traffic Violator School have their traffic offenses dismissed or removed from their driving record (Masten & Peck, 2004).

Negotiated plea agreements are a necessary part of an effective and efficient court system. However, plea agreements may allow offenders to have their penalties reduced or eliminated, for example if a driver is allowed to avoid a driver's license suspension by attending Traffic Violator School.

Use: No data are available on the number of jurisdictions in which Traffic Violator School is available or the number of offenders who use Traffic Violator School to reduce their penalties. Similarly, no data are available on the availability and use of other plea agreements for speeding or aggressive driving violations.

Effectiveness: Masten and Peck's review (2004) included high-quality studies of over 30 group meeting programs, including Traffic Violator School. Taken together, these group meeting programs reduced subsequent crashes by 5 percent and violations by 8 percent. Masten and Peck point out that Traffic Violator School programs in California increased, rather than decreased, crashes because they allowed offenders to escape more severe penalties and start again with a clean driving record. Their review was not able to determine whether other Traffic Violator School programs that dismissed an offender's violation had similar negative effects.

Costs: Costs for establishing diversion or Traffic Violator School programs will depend on the nature of the program. Costs include developing and maintaining a tracking system, notifying offenders, and administering the Traffic Violator School. Costs for limiting or eliminating diversion programs, plea agreements, and Traffic Violator School can be determined by comparing the per-offender costs of these programs with the costs of the penalties that would otherwise be applied.

Time to implement: Diversion or Traffic Violator School programs will require at least six months to establish and implement. They can be modified within a few months.

Other issues:

- **Diversion and Plea Agreement Issues in Alcohol-Impaired Driving:** Diversion and plea agreements have been discussed and evaluated more extensively for alcohol-impaired driving offenses than for speeding and aggressive driving offenses. See Chapter 1, Section 3.2 for additional discussion.
- **Public acceptance, enforcement, and publicity:** Changes in the adjudication of speeding and aggressive driving infractions, such as limiting or eliminating diversion and plea agreements, by themselves cannot reduce speeding and aggressive driving. Traffic laws

and adjudication are essential to, but only a part of, a system that includes broad public acceptance, active enforcement, and publicity (NHTSA, 2001a, Executive Summary).

4.1 Communications and Outreach Supporting Enforcement

Effectiveness: Likely	Use: Medium	Cost: Varies	Time: Medium

Effective, high-visibility communications and outreach are an essential part of successful speed and aggressive-driving enforcement programs (NCHRP, 2003; NHTSA, 2000). All the examples discussed in Chapter 3, Sections 2.1, High-Visibility Enforcement, and 2.3, Other Enforcement Methods, used extensive communications campaigns to support their enforcement efforts. Most campaigns to date have not used paid advertising. The success of paid advertising in seat belt use campaigns (Chapter 2, Section 3.1) suggests that it is worth considering for speed and aggressive driving enforcement campaigns.

Communications and outreach programs urging drivers to behave courteously or not to speed are unlikely to have any effect unless they are tied to vigorous enforcement (NCHRP, 2003, Strategy A2).

Use: All aggressive driving and speed enforcement programs have a communications and outreach component.

Effectiveness: No studies have evaluated how different communications and outreach strategies influence the effectiveness of speed and aggressive driving enforcement programs. The evidence from seat belt (Chapter 2, Sections 2.1, 2.2, and 3.1) and alcohol-impaired driving (Chapter 1, Sections 2.1 and 2.2) enforcement programs strongly suggests that good communications and outreach are essential to a successful enforcement program. The objective should be to provide information about the program, including expected safety benefits, and to persuade motorists that detection and punishment for violators are likely. See also NCHRP (2003a, Strategy A2).

Costs: Good media campaigns can be expensive. See Chapter 2, Section 3.1.

Time to implement: An effective media campaign requires four to six months to plan and implement.

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4. Distracted and Fatigued Driving

Overview

Distracted and fatigued driving are common, though both are difficult to define, measure, and sometimes observe. Both distracted and fatigued driving result in large part from lifestyle patterns and choices: they are societal issues rather than just driving and transportation system issues. For these reasons, few behavioral highway safety countermeasures have been shown to reduce distracted or fatigued driving. Rumble strips and other environmental measures have proven quite successful in reducing crashes by distracted or fatigued drivers. A variety of vehicular measures may either increase or reduce distractions and fatigue.

Recent distracted driving attention and research has concentrated on cell phones, but other distractions are more common and appear to contribute more to crashes. Attention and research on fatigue has concentrated on commercial truck drivers, but the problem is far more widespread.

Problem size and characteristics: distracted driving. Distractions take a driver's attention away from driving. A distraction can be produced by something a driver sees or hears, some physical task not directly involved in driving (such as eating or operating the car radio), or mental activities (such as conversations with passengers or on a cell phone) (National Cooperative Highway Research Program [NHCRP], 2005, Section III).

NHTSA surveyed 4,010 drivers in spring 2002 and asked about a variety of potentially distracting behaviors (Royal, 2003). The vast majority reported these behaviors on some trips, often on many or most trips. The most common were:

- 81 percent talked to other passengers on some trips;
- 66 percent changed radio stations or looked for CDs or tapes;
- 49 percent ate or drank;
- 26 percent took incoming calls on a cell phone and 25 percent made outgoing calls;
- 24 percent dealt with children in the back seat;
- 12 percent read a map or directions.

About one-quarter of the drivers reported that they had been involved in a crash in the previous five years in which some vehicle was damaged. About 14 percent attributed their crash to distracted driving (Royal, 2003). Similarly, about 10 percent of the drivers in a sample of crashes involving at least one towed vehicle in 1995-1999 were classified by NHTSA investigators as having been distracted (Stutts, Reinfurt, Staplin & Rodgman, 2001). Another recent study in Australia found that driver distraction contributed to 14 percent of crashes in sample of drivers who had been hospitalized following a crash (McEvoy, Stevenson, & Woodward, 2007).

The true role of distraction in crashes probably is higher because pre-crash distractions often leave no evidence for law enforcement officers or crash investigators to observe. A recent study that monitored 100 drivers for a year, using specialized instrumentation, reported that nearly 80 percent of the 72 recorded crashes and 65 percent of the 761 near-crashes involved driver inat-

tention just prior to the incident (Dingus et al., 2006) and that driver distraction contributed to 22 percent of the crashes and near-crashes (Klauer, Dingus, Neale, Sudweeks, & Ramsey, 2006).

In crashes where distractions were reported, the most common distractions were similar in NHTSA's driver survey and crash investigations.

- 37 percent in survey, 29 percent in crashes: something outside the car, such as a street sign or another driver;
- 19 percent in survey, 11 percent in crashes: other passengers, including children;
- 16 percent in survey, 21 percent in crashes: objects or controls inside the car;
- 2 percent in survey, 2 percent in crashes: dialing or using a cell phone.

None of the leading distractions is easily addressed. Cell phone use falls well down this list.

Problem size and characteristics: fatigued or drowsy driving. Three recent national telephone surveys, two in the United States and one in Canada, provide consistent estimates of the prevalence and key characteristics of drowsy driving. Of the 1,456 adult drivers surveyed by the National Sleep Foundation (NSF) in fall 2004, 60 percent reported that they had driven while feeling drowsy at least once within the past year. Further, 37 percent said they had "nodded off or fallen asleep" while driving a vehicle at least once in their life (NSF, 2005, p. 42). Canadian responses from 1,209 drivers were similar: 57 percent had driven while tired and 20 percent had dozed off (Beirness, Simpson, & Desmond, 2005). In NHTSA's survey, 11 percent reported that they had nodded off while driving during the past year (Royal, 2003). Of those who nodded off, 66 percent said they had six or fewer hours of sleep the previous night (Royal, 2004). The NHTSA and Canadian surveys found that drivers under age 30 and male drivers were more likely than older drivers and female drivers to have dozed off at the wheel, as did a previous NSF survey (Beirness et al., 2005; NSF, 2002a; Royal, 2003) (the 2005 NSF survey did not examine driver age and gender).

The NHTSA and Canadian surveys provide additional useful information about drowsy driving. Drivers reported nodding off during both day and night. In each survey, over one-quarter of the most recent incidents occurred in the afternoon (noon to 6 p.m.) and over one-quarter between midnight and 6 a.m. In both surveys, nearly half of the drivers who nodded off had been driving for an hour or less (Royal, 2003; Beirness et al, 2005). About 0.7 percent of all drivers reported that they had been in a crash in the past five years that they attributed to their drowsy driving. That's about one-fifth as many as reported a crash that they attributed to distracted driving (Royal, 2003).

It's often difficult to determine whether drowsy driving contributed to a crash. NHTSA estimated that drowsy driving results in 40,000 injuries and 1,550 deaths each year, slightly less than 4 percent of the total traffic injuries and fatalities in the U.S. (NHTSA, 1998).The recent 100-car study reported that drowsy driving contributed to 22 to 24 percent of the crashes and near-crashes (Klauer et al., 2006).

Strategies to Reduce Distracted and Fatigued Driving

The obvious way to reduce distracted or drowsy driving crashes is to convince or require drivers to get enough sleep and to pay attention to their driving. These are very difficult goals. Drowsy driving may result from lifestyles that include insufficient or irregular sleep (shift workers, for instance) or from medical problems – issues beyond a driver's immediate control. Many drivers consider some distractions, such as eating or drinking, listening to the radio, or talking on a cell phone, to be important and common activities and are unlikely to give them up.

Behavioral strategies to reduce distracted or drowsy driving attempt to remove some of the underlying causes or to promote awareness of the risks. The standard behavioral countermeasures of laws, enforcement, and sanctions, which are used successfully for alcohol impairment, seat belt use, aggressive driving, and speeding, are unlikely to be effective for distracted or drowsy drivers. One exception is for young drivers: some graduated driver licensing provisions help reduce distractions by limiting the number of passengers or restricting cell phone use.

Distracted or fatigued driving that is related to a driver's job may be reduced through employer policies and programs. Drowsy driving caused by medical conditions such as sleep apnea or by drugs or medications may be addressed through policies, communications, and outreach. Similarly, communications and outreach may be useful in raising awareness of specific distraction or fatigue issues among certain high-risk populations. However, none of these strategies has been evaluated.

This chapter discusses these behavioral strategies. It does not include the environmental, vehicular, and regulatory countermeasures mentioned below because State Highway Safety Offices [SHSOs] do not have authority or responsibility in these areas.

Environmental strategies can address both distracted and drowsy driving. Rumble strips, both on the shoulder and the centerline, have demonstrated their effectiveness in preventing crashes caused by inattention or fatigue. Other roadway improvements, such as wide and visible edge lines, more easily visible road signs, and better lighting at night, can help drivers who are not fully alert. See National Cooperative Highway Research Program [NCHRP] (2005) for a thorough discussion and for references to other NCHRP guides.

Vehicular strategies also affect driver distraction and fatigue. In-car televisions, vehicle location and route-finding systems, and other new technologies in vehicles may create more potential distractions (Hedlund, Simpson, & Mayhew, 2006). On the other hand, in-vehicle technology in the future may be able to detect driver distraction or fatigue, by monitoring driver performance, and then alert drivers (Donmez, Boyle, & Lee, 2007; Intelligent Vehicle Initiative [IVI}, 2004a, 2004b). In-vehicle technology also may be able to warn drivers of risky situations. Automobile manufacturers and NHTSA are vigorously investigating many possibilities (NHTSA, 2000).

Driver fatigue is a critical issue for commercial drivers. The Federal Motor Carrier Safety Administration (FMCSA) attempts to control commercial driver fatigue through Hours of Service regulations, driver logs and inspections (see for example FMCSA, 2005a). FMCSA has an extensive driver fatigue research program focused on commercial drivers (FMCSA, 2005b).

As with the environmental and vehiclular countermeasures mentioned above, commercial driver countermeasures are not discussed in this guide because they do not fall under SHSO jurisdiction.

For overviews of distracted driving prevalence, risks, legislation, research, and recommended strategies, see NCHRP (2005) and Hedlund et al. (2006).

Key terms

- GDL: Graduated Driver Licensing, a three-phase system for beginning drivers consisting of a learner's permit, a provisional license, and a full license. A learner's permit allows driving only while supervised by a fully licensed driver. A provisional license allows un-supervised driving under certain restrictions.
- NCSDR: National Center for Sleep Disorders Research
- NSF: National Sleep Foundation.

Countermeasures That Work

Countermeasures to reduce distracted and fatigued driving are listed below and discussed individually in this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information.

1. Laws and enforcement

Countermeasure	Effectiveness	Use	Cost	Time
1.1 Cell phone laws	Uncertain	Low	Varies	Short
1.2 GDL requirements for beginning drivers	Proven	High	Low	Medium
1.3 General fatigue and distraction laws	Unknown	High*	Varies	Short

*Included under reckless driving; use of explicit fatigue and distraction laws is low

2. Communications and outreach

Countermeasure	Effectiveness	Use	Cost	Time
2.1 Fatigued or drowsy driving	Unknown	Unknown	Medium	Medium
2.2 Distracted driving	Unknown	Unknown	Medium	Medium

3. Other countermeasures

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Employer programs	Unknown	Unknown	Low	Short
3.2 Medical conditions and medications	Unknown	Unknown	Variable	Medium

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results.
Likely: balance of evidence from high-quality evaluations.
Uncertain: limited and perhaps ambiguous evidence.
Unknown: no high-quality evaluation evidence.
Varies: different methods of implementing this countermeasure produce different results.

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise.
See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities.
Medium: between one-third and two-thirds of States or communities.
Low: fewer than one-third of the States or communities.
Unknown: data not available.

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources.

Medium: requires some additional staff time, equipment, facilities, and/or publicity .

Low: can be implemented with current staff, perhaps with training; limited costs for equipment or facilities.

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year.

Medium: more than three months but less than one year.

Short: three months or less.

These estimates do not include the time required to enact legislation or establish policies.

1.1 Cell phone laws

Effectiveness: Uncertain	Use: Low	Cost: Varies	Time: Short

Cell phones have become an essential feature of modern life. In December 2006, about 233 million Americans had cell phones, an increase of more than 100 million in five years (CITA, 2007). In NHTSA's 2002 national telephone survey, 60 percent of drivers reported that they had cell phones and about one-third of all drivers used a cell phone at some time while driving (Royal, 2003). NHTSA's 2006 national observation survey found that 5 percent of drivers on the road at any time were using handheld cell phones, down from 6 percent in 2005, the first decline since the survey began tracking handheld cell phone use in 2000 (Glassbrenner & Ye, 2007). Several statewide surveys found similar use rates (McCartt, Hellinga, & Braitman, 2006).

While more than 125 research studies have investigated various aspects of cell phone use, they do not provide clear answers to critical questions (McCartt et al., 2006). Experiments on simulators or test tracks document that cell phone use has some effect on driving performance but these experiments cannot measure the impact on crash risk. Most studies find similar effects for handheld and hands-free phones. Most crash studies rely on driver's own reports or on law enforcement investigations to estimate whether cell phone use contributed to the crash. A recent review of these studies concluded that cell phones were reported to be involved in 1 to 4 percent of crashes, an amount consistent with the 2 percent found in NHTSA's telephone survey and crash investigations discussed in the Overview. The best studies have concluded drivers are four times more likely to be involved in a serious crash when using a cell phone, either hands-free or handheld (McCartt et al., 2006). In fact, recent research suggests that the risk of being involved in a crash while using a handheld or hands-free cell phone is comparable to the risk of driving with a blood alcohol concentration (BAC) at or above the legal limit of .08 g/dL (Blomberg, Peck, Moskowitz, Burns, & Fiorentino, 2005; Strayer, Drews, & Crouch, 2006).

While cell phone use occurs less frequently than other driver distractions (see Overview), it has been singled out for special attention, probably for several reasons. Cell phone use is a multisensory distraction, requiring a driver's eyes to locate a ringing phone, hands to hold or dial the phone, hearing to listen to the call, and attention to carry on a conversation. Handheld cell phone use is easy to observe and may send the message that drivers using cell phones are more interested in their conversations than they are in driving safely. For example, in a recent survey of 1,201 adult drivers in Canada, respondents were asked how frequently they see nine potentially unsafe driving behaviors. Talking on a cell phone topped the list, rated as more common than behaviors such as speeding, failing to signal, tailgating, and running a red light (Vanlaar, Simpson, Mayhew, & Robertson, 2007).

In response to these concerns, Connecticut, New Jersey, New York, and the District of Columbia prohibit handheld cell phone use while driving (Governors Highway Safety Association [GHSA], 2007a; Insurance Institute for Highway Safety [IIHS], 2007a). California and Washington recently passed similar laws that take effect in July 2008. A growing number of States prohibit all cell phone use by young drivers and school bus drivers. Since 2001, every State considered at least one bill related to cell phones and driving, and 28 States and the District of Columbia passed some cell phone legislation (Sundeen, 2007). No United States jurisdiction restricts

hands-free phone use for all drivers. As many as 40 countries prohibit handheld phone use (Sundeen, 2007).

Use: Connecticut, New Jersey, New York, and the District of Columbia (in addition to California and Washington beginning in 2008) prohibit handheld cell phone use for all drivers (GHSA, 2007a; IIHS, 2007a).

Effectiveness: Evaluations in New York, the District of Columbia, Finland, and the United Kingdom consistently show that cell phone laws reduced handheld phone use by about 50 percent shortly after the laws became effective (McCartt et al., 2006). Follow-up observations in New York and Finland found that handheld phone use had returned to pre-law levels a year later. The New York study noted that publicity regarding the law diminished substantially after the law was implemented and no targeted enforcement was conducted. In contrast, handheld cell phone use in the District of Columbia remained at half of pre-law levels after a year. This was largely attributed to tougher enforcement of the cell phone laws in the District of Columbia than in New York (McCartt & Hellinga, 2007).

Costs: As with any law, costs are required to publicize and enforce it. New York's experience suggests that a strong communications campaign and vigorous enforcement may be necessary to reduce cell phone use over the long term. A handheld cell phone law can be enforced during regular traffic patrol because cell phone use can be observed easily, so that enforcement costs should be minimal. Publicity can be expensive. Paid advertising supporting highly visible law enforcement may be necessary to achieve substantial effects. Paid advertising can be expensive: for example, costs for some belt use enforcement campaigns in 2003 averaged $500,000 per State (Chapter 2, Section 2.1; Solomon et al., 2003).

Time to implement: A cell phone law can be implemented quickly, as soon as it is publicized.

Other issues:

- **Handheld or hands-free:** At present, cell phone laws applying to all drivers only prohibit handheld phones, not hands-free phones. In large part, this is due to the common misperception that hands-free phones are safer than handheld phones. However, current research finds little difference in the distracting effects of handheld and hands-free phones (McCartt et al., 2006).

1.2 Graduated driver licensing requirements for beginning drivers

Effectiveness: Proven	Use: High	Cost: Low	Time: Medium

Graduated driver licensing (GDL) is a three-phase system for beginning drivers consisting of a learner's permit, then a provisional license, and finally a full license. A learner's permit allows driving only while supervised by a fully licensed driver. A provisional license allows unsupervised driving under certain restrictions. Together, IIHS and the Traffic Injury Research Foundation (TIRF) (2004) describe the key provisions of GDL laws and IIHS (2007b) summarizes State GDL laws as of July 2007. See Chapter 6, Sections 1.1 to 1.6, for a complete discussion of GDL for beginning young drivers.

GDL helps beginning drivers acquire their initial driving experience in lower-risk situations. During the provisional phase, this is accomplished by restricting driving under certain high-risk circumstances. Some of these restrictions are directly linked to fatigue and distractions. Driving at night is more dangerous overall than during the day and also may pose greater risks of drowsy driving. Passengers, especially teenage passengers, are a major source of distraction. Cell phones can distract drivers, as discussed in Chapter 4, Section 1.l.

Use: As of July 2007, all States and the District of Columbia had some GDL components in place. The laws in 45 States and the District of Columbia do not allow driving during certain nighttime hours. Laws in 39 States and the District of Columbia limit the number of passengers allowed with a driver with a provisional license. Nineteen States and the District of Columbia prohibit the use of cell phones, both handheld and hands-free, by drivers with a learner's permit or provisional license or by drivers under 18 (GHSA, 2007b, IIHS 2007b).

Effectiveness: Several studies document that nighttime and passenger GDL restrictions reduce teenage driver crashes and injuries (Hedlund & Compton, 2005; IIHS & TIRF, 2004; Lin & Fearn, 2003). There are no evaluations of GDL cell phone prohibitions.

Costs: Publicity for GDL restriction changes can be delivered directly by the Department of Motor Vehicles to young drivers as they apply for their learner's permits and provisional licenses, so costs will be minimal. Information about GDL restrictions can also be provided through driver education courses.

Time to implement: GDL nighttime, passenger, or cell phone restriction changes require several months to implement for drivers receiving a provisional license. They then will take one or two years before all provisionally licensed drivers are subject to the new restrictions.

1.3 General driver fatigue and distraction laws

Effectiveness: Unknown	Use: High*	Cost: Varies	Time: Short

*included under reckless driving; use of explicit fatigue and distraction laws is low

States implicitly prohibit driving while seriously distracted or fatigued through their reckless driving laws (NCHRP, 2005, Strategy C2). These existing laws in each State allow individuals to be cited and prosecuted if they cause a crash due to distracted or drowsy driving; however, the extent to which States currently *do* pursue cases of inattentive driving is currently unknown. Only one State, New Jersey, has a law specifically targeting the issue of fatigued drivers. In 2003, New Jersey enacted "Maggie's Law" under which drivers can be prosecuted for vehicular homicide if they have not slept in 24 hours and they cause a crash in which someone is killed (NCHRP, 2005, Strategy C2).

No studies have evaluated whether general reckless driving laws or specific drowsy or distracted driving laws have any effect (except for cell phone laws: see Chapter 4, Section 1.1). Based on extensive experience in other traffic safety areas, it is likely that these laws will have little or no effect unless they are vigorously publicized and enforced. See Chapter 1, Sections 2.1 and 5.5 on alcohol-impaired driving, Chapter 2, Sections 2.1, 3.1, and 3.2, on seat belt use laws, and Chapter 3, Sections 2.1 and 4.1, on aggressive driving and speeding laws. Enforcement of fatigued or distracted driving laws is likely to be especially difficult because fatigue and distraction often are difficult to observe, measure, and document. Nevertheless, these laws may increase the impact of communications and outreach efforts to reduce fatigued and distracted driving discussed in Chapter 4, Sections 2.1 and 2.2 (see also NCHRP, 2005, Strategy C2).

Use: New Jersey is the only State with a law explicitly addressing fatigued driving or distractions other than cell phones (Chapter 4, Section 1.1). Other States include these conditions under their laws regarding reckless driving or similar offenses.

Effectiveness: The effects of any laws on reducing drowsy or distracted driving are unknown.

Costs: Costs are required for publicity and enforcement. Enforcement costs likely will be minimal, as most enforcement likely will be included under regular traffic patrols or combined with enforcement activities directed primarily at other offenses such as alcohol-impaired or aggressive driving.

Time to implement: A new fatigued or distracted driving law can be implemented quickly, as soon as it is publicized and law enforcement patrol officers are trained.

2.1 Communications and outreach on fatigued driving

Effectiveness: Unknown	Use: Unknown	Cost: Medium	Time: Medium

Fatigued or drowsy driving occurs because drivers don't get enough sleep. This apparently obvious statement is well-documented. In NHTSA's telephone survey, 66 percent of the drivers who reported they had nodded off while driving had six or fewer hours of sleep the previous night (Royal, 2003). Stutts et al. (1999) interviewed 467 crash-involved drowsy drivers (reported as "fatigued" or "asleep" by the investigating officer) and 529 other crash-involved drivers who were not drowsy. Half of the drowsy drivers had six or fewer hours of sleep the previous night compared to fewer than 10 percent of the other drivers.

States and national organizations such as the National Sleep Foundation have conducted drowsy driving communications and outreach campaigns directed to the general public (NCHRP, 2005, Strategy C1; NSF, 2004a). Campaign goals usually include:

- raising awareness of the dangers of drowsy driving;
- motivating drivers to take action to reduce drowsy driving; and
- providing information on what drivers can do, either before they start out on a trip or if they become drowsy while driving.

NHTSA and NCSDR (NHTSA, 1998) identified three groups that are over-involved in drowsy driving crashes: drivers in their teens and 20s, shift workers, and people suffering from sleep apnea or narcolepsy. The joint NHTSA-NCSDR Report to Congress on drowsy driving recommended that communications and outreach on drowsy driving be directed to these groups, especially to young drivers (NHTSA, 1999). This information can be delivered in several ways. Driver education programs can include information on both drowsy and distracted driving, and the new model curriculum developed by NHTSA and the American Driver and Traffic Safety Education Association (ADTSEA) includes both. See Chapter 4, Sections 3.1 and 3.2, for additional discussion of shift workers and medical conditions, respectively.

Communications and outreach campaigns can be delivered in high schools, colleges, military training programs and bases, and other locations where there are many young drivers. NCHRP (2005, Strategy D2) provides examples. Many young drivers have part-time jobs, which place them at even higher risk for drowsy driving (see Chapter 4, Section 3.1). In addition, young people are among the most likely to drive after drinking alcohol, and studies suggest that even moderate alcohol intake, when combined with fatigue, can increase the risk of a serious crash (Horne, Barrett & Reyner, 2006). Finally, information about the dangers of fatigued driving can be delivered through Web sites and other media with a youthful target audience.

The ultimate goal of drowsy driving communications and outreach is to change driver behavior, but they face substantial obstacles. As discussed in other chapters, communications and outreach by themselves rarely change driving behavior (Chapter 1, Section 5.5; Chapter 2, Section 3.2; Chapter 3, Section 4.1; see also NCHRP, 2005, Strategy C1). To have any chance of success, stand-alone campaigns must have careful planning, good target audience identification and research, good message development and placement, and substantial funding.

An additional barrier is that drowsy driving is a byproduct of busy lifestyles that do not include enough sleep. The only truly effective method to prevent drowsy driving crashes is to get enough sleep (Nguen, Jauregui, & Dinges, 1998; NHTSA, 1998). Traffic safety messages urging enough sleep may be overwhelmed by the other demands on a driver's time that are responsible for insufficient sleep. Focus group discussions with young men and shift workers, two groups at high risk of drowsy driving, confirmed this conclusion (Nelson, Isaac, & Graham, 2001). Most shift workers and many young men understood well the risks caused by lack of sleep. Many had crashed or almost crashed after falling asleep at the wheel or had friends who had crashed. But neither their knowledge nor their crash experience changed their sleep habits. They sacrificed sleep for the demands of their work, families, and social lives. Campaigns directed to young drivers also must overcome the higher risk-taking behavior and overall immaturity of young drivers discussed in Chapter 6. No drowsy driving communications and outreach program for the general public has been evaluated (NCHRP, 2005, Strategies C1 and D2).

Use: Utah is the only State known to have conducted a drowsy driving campaign for the general public (see NCHRP, 2005, Strategy C1). NCHRP (2005, Strategy D2) gives examples of college programs.

Effectiveness: There are no studies of any campaign's effects on driver knowledge, attitudes, or behavior (NCHRP, 2005, Strategies C1 and D2).

Costs: A high-quality campaign will be expensive to develop, test, and implement.

Time to implement: A high-quality campaign will require at least six months to plan, produce, and distribute.

2.2 Communications and outreach on distracted driving

Effectiveness: Unknown	Use: Unknown	Cost: Medium	Time: Medium

Distracted driving communications and outreach campaigns for the general public face different, but equally difficult, obstacles than drowsy driving campaigns. All drivers "know" at some level that they should be alert. However, as discussed in the Overview, distractions come in many forms. Distractions outside the car are not under the driver's control. Many distractions inside the car also cannot be controlled easily (conversations, children), or are intentional (listening to the radio or CD player, eating). They may in fact be useful, to keep drivers alert on a long trip.

There is strong public support for communications and outreach to reduce distracted driving. For example, 80 percent of respondents in a Canadian survey agreed that greater awareness and education efforts are needed to alert drivers to the problem of distracted driving (Vanlaar, Simpson, Mayhew & Robertson, 2007). States (including California and New York) and national organizations (AAA Foundation for Traffic Safety [AAAFTS]) have conducted or provided material for distracted driving communications and outreach campaigns directed to the general public (AAAFTS, 2004; NCHRP, 2005, Strategy C1). Some carry a general "pay attention" message while others are directed at specific behaviors such as cell phone use.

Drivers in their teens and early 20s are often distracted while driving (Ferguson, 2003; NCHRP, 2005, Strategy D2). GDL passenger and cell phone restrictions directly address two sources of distractions, as discussed in Chapter 4, Section 1.2. Broader communications and outreach efforts for young drivers regarding distracted driving also have been proposed. They can be combined with or complementary to information on drowsy driving and can be delivered in the same ways. See Chapter 4, Section 2.1, and NCHRP (2005, Strategy D2) for discussion.

The ultimate goal of these campaigns is to change driver behavior, but they face substantial obstacles. As discussed in other chapters, communications and outreach by themselves rarely change driving behavior (Chapter 1, Section 5.5; Chapter 2, Section 3.2; Chapter 3, Section 4.1; see also NCHRP, 2005, Strategy C1). To have any chance, stand-alone campaigns must have careful planning, good target audience identification and research, good message development and placement, and substantial funding. A broad "stay alert" message may be too general to have any impact. Specific distractions are not linked as clearly to crashes as is falling asleep at the wheel because they are not recorded consistently in State crash data files.

Use: California and New York are known to have conducted driver alertness campaigns for the general public (see NCHRP, 2005, Strategy C1). NCHRP (2005, Strategy D2) cites a Cingular Wireless educational program aimed at young drivers on the problem of distractions.

Effectiveness: There are no studies of any campaign's effects on driver knowledge, attitudes, or behavior (NCHRP, 2005, Strategies C1 and D2).

Costs: A high-quality campaign will be expensive to develop, test and implement.

Time to implement: A high-quality campaign will require at least six months to plan, produce and distribute.

3.1 Employer programs

Effectiveness: Unknown	Use: Unknown	Cost: Low	Time: Short

Driver fatigue and distractions are critical issues for commercial drivers. As discussed in the Overview, commercial driver countermeasures, including employer policies and programs to reduce commercial driver fatigue, are not discussed in this guide because they do not fall under SHSO jurisdiction.

Shift workers are another employment group at high risk for drowsy-driving crashes. Young male drivers with part-time jobs are at especially high risk, as they satisfy two of the three high-risk conditions identified by NHTSA and NCSDR (NHTSA, 1999): shift workers; young drivers, especially males; and drivers with the medical conditions of sleep apnea or narcolepsy. "Shift workers" include people who work long or irregular hours or who work at night, including many law enforcement officers (NCHRP, 2005, Strategy D6).

A recent study documents the dangers for medical interns, who frequently work extended shifts of 24 hours or more. Barger et al. (2005) collected monthly reports from 2,737 interns. Interns were 2.3 times more likely to report a crash and 5.9 times more likely to report a near miss after an extended shift than a shorter shift. Each extended shift in a month increased the monthly risk of a crash during the commute from work by 16 percent.

NHTSA and NCSDR have produced a comprehensive workplace education program for shift workers. It includes information on sleep habits in general and drowsy driving in particular. Program material includes a video, posters, brochures for workers and their families, tip cards, a PowerPoint training session, and an administrator's guide (NHTSA and NCSDR, undated).

Focus-group discussions with shift workers highlight the difficulties faced by employer programs (Nelson et al., 2001). Most shift workers understood well the risks caused by lack of sleep. Many had crashed or almost crashed after falling asleep at the wheel or had friends who had crashed. But neither their knowledge nor their crash experience changed their sleep habits. They sacrificed sleep for the demands of their work, families, and social lives.

Use: The number of employers who use the NHTSA/NCSDR program, or any drowsy driving prevention material or program, is not known.

Effectiveness: The NHTSA/NCSDR program was tested by more than 20 U.S. companies and was well received by workers and management. It has not been evaluated further (NCHRP, 2005, Strategy D3). Gander, Marshall, Bolger and Girling (2005) evaluated the effects of a two-hour fatigue management training class given to a group of commercial light vehicle drivers and a group of petroleum tanker drivers. For both groups, the class substantially increased the drivers' knowledge of fatigue management and the knowledge gains were retained after several months. About half the drivers in each group implemented some fatigue management strategies at home, on the job, or in both places. No other employer drowsy driving program has been evaluated.

Costs: Since a comprehensive program is available at no cost, program costs will consist only of material production and employer time for training.

Time to implement: An employer program can be implemented within three months.

3.2 Medical conditions and medications

Effectiveness: Unknown	Use: Unknown	Cost: Variable	Time: Medium

Two medical conditions can cause drivers to fall asleep at the wheel (NCHRP, 2005, Strategy D6; NHTSA, 1998).

- Sleep apnea is a breathing disorder characterized by brief interruptions of breathing during sleep, perhaps as many as 20 to 60 per hour (NSF, 2002b). By fragmenting nighttime sleep, sleep apnea produces daytime sleepiness. NSF estimates that about 4 percent of men and 2 percent of women are affected by sleep apnea. It can be treated by physical or mechanical therapy or by surgery.
- Narcolepsy is a disorder of the central nervous system's sleep-wake mechanism that can cause narcoleptics to fall asleep suddenly at any time (NSF, 2004b). It is quite rare, affecting about one person in 2,000. It can be treated with medications.

The number of crashes resulting from sleep apnea or narcolepsy is not known.

Most cases of sleep apnea or narcolepsy are undiagnosed and untreated (NCHRP, 2005, Strategy D6; NHTSA, 1998). Indeed, falling asleep at the wheel may be one of the main ways to raise the possibility of a sleep disorder and motivate a driver to seek medical attention (NHTSA, 1998). Even without treatment, drivers who are aware that they have one of these disorders can take precautions to avoid falling asleep at the wheel.

Many common prescription and over-the-counter medications can cause drowsiness. Warning labels on the medications note this and caution users against driving or other activities that could be affected by drowsiness. As with sleep apnea and narcolepsy, the number of crashes resulting from or affected by drowsiness produced by medications is unknown.

The principal countermeasures to address sleep apnea, narcolepsy, and medication effects are (NCHRP, 2005, Strategy D6):

1. Communications and outreach on sleep disorders to increase overall awareness of their symptoms, consequences, and treatment.
2. Efforts with driver licensing medical advisory boards to increase their awareness of these conditions as they review driver fitness for licensing.
3. Efforts with physicians to increase their awareness of these conditions and their potential effects on driving, to treat these conditions as appropriate, and to counsel their patients to take steps to reduce the risk of drowsy driving.

Use and Effectiveness: There is no information available on how frequently these countermeasures are used or on how effective they have been in raising awareness, increasing knowledge, or affecting behavior (NCHRP, 2005, Strategy D6).

Costs: Targeted communications and outreach to drivers (through driver licensing handbooks or flyers in license renewal material) or to physicians (through medical associations) would be relatively inexpensive. A communications and outreach campaign directed at all drivers will be expensive to develop, test and implement. See Chapter 1, Section 5.5 and Chapter 2, Sections 2.1 and 3.1, for additional discussion.

Time to implement: Either targeted or general communications and outreach activities will require at least six months to plan, produce, and distribute. Efforts with driver licensing medical advisory boards could be implemented quickly.

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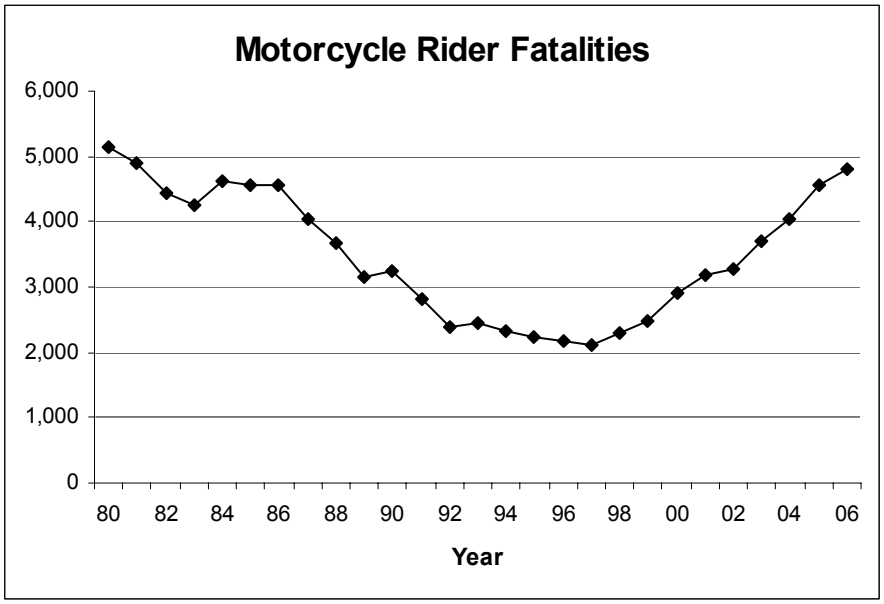
5. Motorcycle Safety

Overview

A two-wheeled motorcycle is inherently more difficult to operate than a four-wheeled passenger vehicle because it requires more physical skill. Motorcycles are also more unstable than passenger vehicles. The stability of a motorcycle is relative to speed. A motorcycle becomes more stable as speed increases, although it becomes less maneuverable. Understanding the relationship between speed, stability and maneuverability is critical in the operation of a motorcycle.

A motorcycle offers riders almost no protection in a crash. Crash data confirm these observations. NHTSA estimates that 80 percent of motorcycle crashes injure or kill a motorcycle rider, while only 20 percent of passenger car crashes injure or kill an occupant (NHTSA, 2003, p. 3). For each mile of travel in 2005, motorcycle riders were eight times more likely to be injured in a crash and 37 times more likely to die than passenger car occupants. When examining rates per registered vehicle, motorcycle riders were five times more likely to die than passenger car occupants (NHTSA, 2006a, Tables 7 and 10). In 2006, motorcycle rider fatalities increased for the ninth consecutive year, to 4,810, and now account for 11 percent of all traffic fatalities. The 88,000 motorcycle rider injuries were 3 percent of all traffic crash injuries (NHTSA, 2007).

Trends. Motorcycling has become increasingly popular over the last 10 years. Not surprisingly, there has been a corresponding increase in crashes and fatalities involving motorcycle riders. From 1997 to 2006, motorcycle rider fatalities increased by 127 percent and injuries increased by 66 percent. Motorcycle rider fatalities in 2006 reached a level not seen since 1981 (NHTSA, 2007a). The 2006 motorcycle rider fatalities increased 5 percent over 2005. Motorcycle rider fatalities have more than doubled since 1997 (NHTSA, 2007a).



Source: NHTSA

Motorcycling today is not a young person's activity. In 2006, 68 percent of the motorcycle operators involved in a fatal crash were age 30 or older and 47 percent were 40 or older (NHTSA, 2007a, Table 4). The change in only ten years is striking: in 1995, only 50 percent were 30 or older and 24 percent were 40 or older (NHTSA 2006e, Table 4).

Strategies to Increase Motorcycle Safety

Motorcycle operators should be properly trained and licensed. They should be alert and aware of the risks they face while riding; in particular, they should not be impaired by alcohol. All motorcycle riders should wear a motorcycle helmet that meets FMVSS 218 and clothing that provides both protection and visibility. These and other strategies are discussed in the National Agenda for Motorcycle Safety, NAMS (NHTSA, 2000a), a comprehensive, collaborative, and multidisciplinary blueprint for motorcycle safety. See also the NAMS Implementation Guide (Hedlund, 2007), and NHTSA's Motorcycle Safety Program Plan (NHTSA, 2006d).

Unfortunately, many motorcyclists do not take these straightforward precautionary measures. In 2006, one-quarter of the motorcycle operators involved in a fatal crash did not have a valid motorcycle operator's license (NHTSA, 2007b, Table 91). More than one-third of the motorcycle operators killed in a crash had been drinking (NHTSA, 2007b, Table 80). Forty percent of the motorcycle rider fatalities were not wearing a helmet (NHTSA, 2007b, Table 90).

The most important objectives for improving motorcycle safety are to increase helmet use, reduce alcohol impairment, and increase proper licensing and training. These all are difficult to accomplish. Universal helmet laws are extremely effective in assuring that virtually all motorcycle riders use helmets, but they also are politically difficult to enact and retain. Strategies using only communications and outreach to promote helmet use, reduce impaired motorcycling, and increase licensing and training appear to have been no more successful with motorcyclists than with other drivers. A fourth objective is to increase other drivers' awareness of motorcyclists by increasing the visibility of motorcyclists and by educating other drivers on the importance of sharing the road with motorcycles. Intelligent transport systems may also have the potential to enhance motorcycle safety, but these technologies are only just emerging and have yet to be meaningfully evaluated (Bayly, Regan, & Hosking, 2006).

Many environmental measures can affect motorcycle safety. Slippery roadway surfaces and markings, surface irregularities, unpaved shoulders, and unforgiving roadway barriers all can be dangerous. These issues are not included in this guide because State Highway Safety Offices [SHSOs] have little or no authority or responsibility for them. See National Cooperative Highway Safety Research [NCHRP] (under review) for a thorough discussion. Daytime running lights for motorcycles, in the form of headlights that are always lighted, improve motorcycle conspicuity. Most motorcycles on the road have headlights that turn on automatically when the engines are started (NCHRP, under review, Strategy D2). In addition, 24 States require daytime headlight use for all motorcycles manufactured since 1980 (Motorcycle Safety Foundation [MSF], 2007). Modulating headlights, which cause the headlight to move from high- to low beam rapidly, also increase motorcycle visibility (Olson, Halstead-Nussloch, & Sivak, 1979).

Key terms

- Motorcycle operator, motorcyclist: a person operating or driving a motorcycle.
- Passenger: a person riding on but not operating a motorcycle.
- Motorcycle rider: any person on a motorcycle, both operators and passengers.
- AAMVA: American Association of Motor Vehicle Administrators
- AMA: American Motorcyclist Association.
- BAC: Blood alcohol concentration in the body, expressed as grams of alcohol per deciliter of blood, and usually measured with a breath or blood test.
- FMVSS 218: the Federal Motor Vehicle Safety Standard that sets performance requirements for motorcycle helmets.
- MSF: Motorcycle Safety Foundation.
- NAMS: the National Agenda for Motorcycle Safety (NHTSA, 2000a).
- SMSA: National Association of State Motorcycle Safety Administrators.

Countermeasures That Work

Countermeasures to improve motorcycle safety are listed below and discussed individually in this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information.

1. Motorcycle helmets

Countermeasure	Effectiveness	Use	Cost	Time
1.1 State motorcycle helmet use laws	Proven	Medium	Low	Short
1.2 Helmet law enforcement; noncompliant helmets	Unknown	Unknown	Low	Medium
1.3 Helmet use promotion programs	Unknown	Low	Varies	Medium

2. Alcohol impairment

Countermeasure	Effectiveness	Use	Cost	Time
2.1 Alcohol impairment: detection, sanction	Unknown	Unknown	Varies	Varies
2.2 Alcohol impairment: communications	Unknown	Medium	Medium	Medium

3. Motorcycle operator licensing and training

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Operator licensing	Uncertain	High	Low	Medium
3.2 Operator education and training	Uncertain	High	Medium	Varies

4. Communications and outreach

Countermeasure	Effectiveness	Use	Cost	Time
4.1 Protective and conspicuous clothing	Unknown	Unknown	Varies	Medium
4.2 Other driver awareness of motorcyclists	Unknown	Unknown	Varies	Medium

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results.
Likely: balance of evidence from high-quality evaluations or other sources.
Uncertain: limited and perhaps ambiguous evidence.
Unknown: no high-quality evaluation evidence.
Varies: different methods of implementing this countermeasure produce different results

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise. See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities.
Medium: between one-third and two-thirds of States or communities.
Low: fewer than one-third of the States or communities.
Unknown: data not available.

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources.
Medium: requires some additional staff time, equipment, facilities, and/or publicity.
Low: can be implemented with current staff, perhaps with training; limited costs for equipment or facilities.

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year.
Medium: more than three months but less than one year.
Short: three months or less.

These estimates do not include the time required to enact legislation or establish policies.

1.1 State Motorcycle Helmet Use Laws

Effectiveness: Proven	Use: Medium	Cost: Low	Time: Short

Motorcycle helmets are highly effective in protecting motorcycle riders' heads in a crash. The latest research indicates that helmets reduce motorcycle rider fatalities by 22-37 percent and brain injuries by 41-65 percent (Coben, Steiner, & Miller, 2007; Cummings, Rivara, Olson, & Smith, 2006; Deuterman, 2004; Houston, 2007; Houston & Richardson, 2007; NHTSA, 2003; NHTSA, 2006a; NCHRP, under review, Strategy E1). Helmets do not increase neck injuries (NCHRP, under review, Strategy E1; NHTSA, 2000a; Ulmer & Preusser, 2003).

State helmet use laws are quite effective. In 2006, helmet use was 83 percent across all States with a universal helmet law that covers all riders and 50 percent across States with no law or a law covering only young riders (Glassbrenner & Ye, 2006). Studies in States that enacted universal helmet laws observed use rates of 90 percent or higher immediately after the law, compared to 50 percent or lower before the law (Ulmer and Preusser, 2003, Section II). States that repealed universal helmet laws saw the opposite effect, as use rates dropped from above 90 percent to about 50 percent (Kyrychenko & McCartt, 2006; Preusser et al., 2000, Section V; Ulmer & Preusser, 2003, Sections IV and V).

The first universal helmet law was enacted in 1966. Universal laws were in force in 47 States and the District of Columbia by 1975. After Federal penalties were eliminated in 1975 for States failing to have a universal law, about half the States repealed their laws. Several States have enacted or repealed helmet laws since then. The Insurance Institute for Highway Safety [IIHS] (2007) summarizes the helmet law history in each State through 2007.

Use: As of June 2007, 20 States and the District of Columbia had helmet laws covering all riders. Most other States had laws covering only riders under a specified age, typically 18 or 21 (IIHS, 2007). Three States (Illinois, Iowa, and New Hampshire) do not have a motorcycle helmet law.

Effectiveness: The U.S. General Accountability Office (GAO) reviewed 46 methodologically sound studies of State helmet laws published before 1990. GAO concluded that motorcycle rider fatality rates were 20 to 40 percent lower with universal helmet laws (GAO, 1991; Ulmer & Preusser, 2003, Section II). Studies since 1990 confirm these results (Cummings, et al., 2006; Houston & Richardson, 2007; Kyrychenko & McCartt, 2006; Morris, 2006; NHTSA, 2006c; Ulmer & Northrup, 2005; Ulmer & Preusser, 2003, Section II). Helmet use was low among young riders in States with laws covering only young riders (GAO, 1991; NHTSA, 2006c), and may not translate into meaningful reductions in their fatality rates (Houston, 2007). Laws covering only young riders are difficult to enforce because it is hard for law enforcement officers to estimate a motorcycle rider's age.

Costs: Once legislation requiring helmet use has been enacted, implementation costs are minimal. The inevitable controversy surrounding the legislation will publicize the new law extensively. Motorcycle helmet laws can be enforced during regular traffic patrol operations because helmet use is easily observed.

Time to implement: A universal helmet use law can be implemented as soon as the law is enacted.

Other issues:

- **Opposition to motorcycle helmet laws:** Any effort to enact a universal helmet law can expect immediate, well-coordinated, and highly political opposition (NHTSA 2003). Helmet law opponents claim that helmet laws impinge on individual rights. They also claim that helmets interfere with motorcycle riders' vision or hearing, though research shows that these effects are minimal (NHTSA, 1996). See Jones and Bayer (2007) for an excellent history of opposition to helmet laws in the U.S.
- **Noncompliant helmets:** Some riders in States with universal helmet laws wear noncompliant helmets that do not comply with FMVSS 218 in order to avoid a helmet law citation (Glassbrenner & Ye, 2006). See the discussion in Chapter 5, Section 2.2.

1.2 Motorcycle Helmet Law Enforcement; Noncompliant Helmets

Effectiveness: Unknown	Use: Unknown	Cost: Low	Time: Medium

Law enforcement officers in universal helmet law States easily can observe and cite motorcycle riders who are not wearing a helmet. This likely explains why helmet use rates are high in universal helmet law States (Chapter 5, Section 2.1). However, some helmets are noncompliant in that they do not meet the FMVSS 218 performance requirements. Many State helmet laws require motorcycle riders to wear helmets that comply with FMVSS 218, and federal regulations require all motorcycle helmets sold in the United States to meet or exceed the FMVSS 218 standards. In the latest national survey, 51 percent of motorcycle riders in 2006 used DOT-compliant helmets, while 14 percent used noncompliant helmets and 35 percent used no helmet (Glassbrenner & Ye, 2006). This means that, among riders who use helmets, over one-fifth use a helmet that is noncompliant. Motorcycle riders wearing these helmets are no safer than if they wore no helmets at all (NCHRP, under review, Strategy E1). The challenge of motorcycle helmet law enforcement in states requiring FMVSS 218 compliant helmets is to actively identify and cite motorcycle riders wearing noncompliant helmets.

In addition to flimsy construction, noncompliant helmets often cover only a portion of the rider's head and have inadequate chin straps. These features are fairly easy for an observer to identify. Some noncompliant helmets also have spikes or other protrusions that mark them as noncompliant. A NHTSA brochure (NHTSA, 2004) discusses how to identify noncompliant helmets.

Identifying a noncompliant helmet is easier than proving that it is noncompliant. Compliant helmets are formally identified by a DOT sticker on the back of the helmet. However, counterfeit DOT stickers are easily available and are found on many noncompliant helmets. As a result, it is difficult to obtain a conviction for a noncompliant helmet citation in some courts (NHCRP, under review, Strategy E1). NHTSA is considering ways to strengthen the labeling requirement to make it easier to prove that a helmet is noncompliant (NHTSA, 2006b). NHTSA also is preparing a video clip for motorcyclists and law enforcement demonstrating how to identify compliant and noncompliant helmets and how to choose a helmet that fits properly (NHTSA, 2006b).

Use: The extent of helmet law enforcement activities to identify and cite noncompliant-helmet wearers is not known.

Effectiveness: The effectiveness of an active helmet law enforcement program on noncompliant helmet use has not been evaluated.

Costs: Since helmet laws can be enforced during regular traffic patrols, the only costs will be for training law enforcement officers, prosecutors, and judges.

Time to implement: An active helmet-law enforcement program requires training for law enforcement to identify noncompliant helmets and training for prosecutors and judges to assure that citations will be prosecuted and adjudicated. This training probably will require four to six months to implement.

1.3 Motorcycle Helmet Use Promotion Programs

Effectiveness: Unknown	Use: Low	Cost: Varies	Time: Medium

A few States with no universal motorcycle helmet use law have attempted to promote helmet use through communications and outreach campaigns. NCHRP (under review, Strategy F1) provides brief information about campaigns in Washington and Wisconsin. The American Motorcyclist Association [AMA], the MSF, and NHTSA all encourage helmet use. NHTSA is developing new helmet use promotion materials and public service announcements for television and radio (NHTSA, 2006b).

Use: Few States without universal helmet laws conduct helmet use promotion campaigns (NHTSA, 2006c).

Effectiveness: There appear to be no formal evaluations of the effect of helmet use promotion programs in States without universal helmet laws (NCHRP, under review, Strategy F1). However, there also are no examples of helmet use rates much over 50 percent in States without a universal helmet law.

Costs: Good communications and outreach campaigns can be expensive to develop and implement: see Chapter 2, Section 3.1. Helmet use promotion material is available from various sources including MSF, NHTSA (2003), and States that have conducted these campaigns.

Time to implement: A good campaign, including market research, materials development, and message placement, will require at least six months to plan and implement.

2.1 Alcohol-Impaired Motorcyclists: Detection and Sanction

Effectiveness: Unknown	Use: Unknown	Cost: Varies	Time: Varies

Alcohol impairment is a substantial problem for motorcycle operators, more so than for drivers of other motor vehicles. In 2006, 27 percent of motorcycle operators involved in fatal crashes had blood alcohol concentrations (BAC) of .08 grams per deciliter (g/dL), compared to 23 percent for passenger car drivers and 24 percent for light truck drivers (NHTSA, 2007b, Table 17). An additional 7 percent of motorcycle operators in fatal crashes had at least some measurable level of alcohol in their blood (BAC .01 to .07 g/dL). The percentages of fatally-injured motorcyclists with .08 or higher BAC levels were even higher among riders ages 35 to 49 years-old (ranging from 34 to 41 percent; NHTSA, 2007a). One recent study found that alcohol-impaired motorcycle operators were 16.9 times more likely to be at fault in a crash than sober operators (NCHRP, under review, Strategy B1). Fatalities among motorcycle operators with BAC levels .08 g/dL or higher occurred more frequently during the nighttime hours. In addition, fatally-injured motorcyclists with BAC levels .08 g/dL during all times of day were less likely to wear helmets than were sober operators (NHTSA, 2007a).

Motorcyclists are included in and affected by the comprehensive strategies to reduce alcohol-impaired driving discussed in detail in Chapter 1. However, some law enforcement, sanction, and communication strategies may be especially useful for motorcyclists, while others may be relatively ineffective. This section discusses law enforcement and sanctions. Section 3.2 discusses communications.

Law enforcement officers on traffic patrol use characteristic driving behaviors, or cues, to identify drivers who may be impaired by alcohol. Some of the cues for motorcyclists, such as trouble maintaining balance at a stop, are different from those for cars and trucks. Stuster (1993) identified and validated 14 cues useful for identifying alcohol-impaired motorcyclists. NHTSA prepared a brochure discussing the cues, a law enforcement training video for roll-call use, and a pocket detection guide (NHTSA, 2000b). The cues for motorcyclists are an optional part of the Standardized Field Sobriety Tests [SFST] training given to all law enforcement officers.

Vehicle impoundment or forfeiture can be an effective deterrent to drinking and driving for all drivers (see Chapter 1, Section 4.4). It may be even more effective for motorcyclists. Recent research (Becker et al., 2003) confirmed earlier findings that many motorcyclists do not find traditional impaired driving sanctions such as fines and license suspension to be effective deterrents. However, they are strongly concerned for the safety and security of their motorcycles.

These findings suggest a potentially effective strategy to reduce alcohol-impaired motorcycling: highly publicized enforcement, using officers trained in identifying impaired motorcyclists as well as other vehicle drivers, with offender sanctions including vehicle impoundment or forfeiture. This will treat motorcyclists on an equal footing with other vehicle drivers in impaired-driving enforcement and publicity.

Use: The extent to which law enforcement agencies train officers to detect alcohol-impaired motorcyclists, or include alcohol-impaired motorcycling in any way in their traffic patrol activities, is not known. Hedlund (2007) provides examples and links of state programs that distribute the

NHTSA cue cards and brochures widely to law enforcement (Illinois), present this information in a Web-based seminar for officers (Minnesota), and regularly establish high-visibility law enforcement presence at major rider events (Ohio, Wisconsin).

Effectiveness: Some agencies have reported some success in using the cues for identifying alcohol-impaired motorcyclists, but no evaluation data are available (NCHRP, under review, Strategy B3).

Costs: Law enforcement training costs are low and training material is available. Enforcement itself can be carried out during regular traffic patrol. A major campaign including alcohol-impaired motorcyclists will require additional costs for publicity.

Time to implement: Law enforcement training can be conducted quickly. A major campaign will require four to six months to plan and implement.

Other issues:

- **Motorcyclist groups:** Motorcyclist groups likely will object strenuously to any enforcement activities that are perceived to target motorcyclists unfairly. The best strategy is to assure that motorcyclists, rider organizations, and motorcycle dealers are included in planning and publicizing impaired riding enforcement.
- **Drugs other than alcohol:** Drugs other than alcohol can impair motorcycle operators. Potentially impairing drugs include over-the-counter and prescription medications as well as illegal drugs. Beyond this, little more can be said with any confidence. Studies of vehicle drivers, typically in individual hospitals, find drug presence considerably lower than alcohol presence. Motorcycle operators usually are not separated out in these studies. The extent to which various drugs impair driving performance or contribute to crashes is not well understood, either for four-wheeled vehicles or for motorcycles. See Jones et al. (2003) for a thorough summary of current knowledge. Law enforcement should consider drugs as potential impairing agents for motorcycle operators just as for other vehicle operators.

2.2 Alcohol-Impaired Motorcyclists: Communications and Outreach

Effectiveness: Unknown	Use: Medium	Cost: Medium	Time: Medium

Alcohol impairment is a substantial problem for motorcyclists, more so than for drivers of other motor vehicles. Chapter 5, Section 3.1 discusses the problem and suggests law enforcement and sanction strategies that may help alleviate it. This section discusses communications strategies.

Many States have conducted communications and outreach campaigns directed at drinking and motorcycling. See Hedlund (2007) and NCHRP (under review, Strategy B1) for examples and links. Organizations including AMA, MSF, and SMSA have produced campaigns and material on drinking and motorcycling. Again, see Hedlund (2007) and NCHRP (under review) for examples and links. There are no evaluations of the effectiveness of any of these campaigns at any level, from awareness to knowledge and attitude change to any effect on motorcyclists' drinking and motorcycling behavior. The experience of drinking and driving campaigns directed at all drivers suggests that they are unlikely to have any effect unless they are carefully researched and planned, well funded, well executed, achieve high levels of target audience exposure (perhaps using paid advertising), use high-quality messages that are pre-tested for effectiveness, and are conducted in conjunction with other activities directed at impaired motorcyclists. See Chapter 1, Section 5.5, for further discussion.

A focus group study (Becker et al., 2002) examined motorcyclists' attitudes, beliefs, and behaviors regarding drinking and motorcycling. It concluded that many motorcyclists have strong feelings of freedom, independence, and individual responsibility and believe that drinking motorcyclists endanger only themselves. Consequently, they believe that government efforts to discourage drinking and motorcycling are inappropriate. These beliefs also limit some motorcyclists' willingness to take actions to prevent others from riding while impaired.

These findings suggest that only very high-quality drinking and motorcycling campaigns have any chance of being effective. In particular, any campaign should be researched, designed, and pre-tested thoroughly and must appeal to common motorcyclist attitudes and beliefs.

Rider groups can play a critical role in planning and implementing activities to reduce drinking and motorcycling. Some state and local rider groups sponsor alcohol-free events or adopt alcohol-free policies. As examples, the Fox Valley Wisconsin Harley Owners Group (H.O.G.) chapter has an alcohol-free policy for all organized rides and Illinois ABATE sponsors alcohol-free rides (Hedlund, 2007, Section 1).

Use: Many States have conducted drinking and motorcycling campaigns (Hedlund, 2007; NCHRP, under review, Strategy C1), but the total number of States that have done so is not known. It also is not known whether States have included messages directed to motorcyclists in their overall alcohol-impaired driving campaigns.

Effectiveness: There are no evaluations of the effectiveness of any drinking and motorcycling campaigns.

Costs: A good campaign will require substantial funds to conduct market research, design and test messages, and place campaign material where it will reach motorcyclists frequently.

Time to implement: A good campaign will require at least six months to research, design, test, and implement.

Other issues:

- **Drugs other than alcohol:** Drugs other than alcohol can impair motorcycle operators. Potentially impairing drugs include over-the-counter and prescription medications and illegal drugs. See Chapter 5, Section 3.1, for additional discussion and Jones et al. (2003) for a thorough summary of current knowledge. Drinking and motorcycling campaigns may wish to include other drugs as well as alcohol in their messages.

3.1 Operator Licensing

Effectiveness: Uncertain	Use: High	Cost: Low	Time: Medium

All 50 States and the District of Columbia require motorcyclists to obtain a motorcycle operator license or endorsement before they ride on public highways (MSF, 2002). The goal of licensing is to assure that motorcyclists have the minimum skills needed to operate a motorcycle safely (NHTSA, 2000a).

Operator licensing faces three issues.

- Many motorcyclists are not properly licensed. In 2006, 25 percent of motorcyclists involved in fatal crashes did not have a valid motorcycle license, compared to 13 percent of all vehicle drivers who were not properly licensed (NHTSA, 2007a). Many of these motorcyclists did have a driver's license, but not a separate motorcycle license or endorsement (NHTSA, 2007a). Barriers to obtaining a motorcycle license include limited and inconvenient licensing examination hours, which sometimes require appointments weeks or months in advance, and licensing systems in some States that provide no incentive to become fully licensed because learner's permits may be renewed indefinitely (NCHRP, under review, Strategy C3).
- State motorcycle licensing practices vary substantially. Most States have a learner's permit requiring only vision and knowledge tests. Motorcyclists with a learner's permit can ride only in restricted circumstances, typically some combination of no passengers, only during daylight hours, and only with the supervision of a fully licensed motorcyclist. A skills test is required for full licensure. Two-thirds of the States use one of three tests developed by the MSF and American Association of Motor Vehicle Administrators [AAMVA], while one-third use their own tests. Most States will waive the skills test, and sometimes the knowledge test, for motorcyclists who have completed an approved training course. See Baer, Cook, and Baldi (2005) for a summary of each State's licensing requirements and procedures and NCHRP (under review, Strategy C1) for brief summaries of the major skills tests currently in use.
- The goal of motorcycle operator licensing is to assure that motorcyclists have basic riding skills, but its effectiveness is not known. This is perhaps not surprising given the variability of licensing tests and procedures. NAMS recommends research to "ensure that licensing tests measure skills and behaviors required for crash avoidance" (NHTSA, 2000a, p. 22). NCHRP (under review, Strategy C3) notes that there are no evaluations of whether increasing the proportion of motorcyclists who are validly licensed would reduce motorcycle crashes or injuries.

Baer, Cook, and Baldi (2005) reviewed and summarized each State's motorcycle education and licensing programs and practices. A companion report (Baer, Baldi, & Cook, 2005) describes effective training and licensing programs and actions to promote training and licensing. Under a cooperative agreement with NHTSA, AAMVA is updating its *Motorcycle Operator Licensing System* and *Integrating Motorcycle Rider Education and Licensing* manuals, which provide guidelines for state motorcycle licensing programs (www.aamva.org).

States should encourage all motorcyclists to be validly licensed. NAMS (NHTSA, 2000a) and NCHRP (under review, Strategy C3) recommend that States:

- provide enough convenient testing times and locations to accommodate the demand, for example by offering testing during evening hours;
- waive skills and knowledge tests for graduates of approved education and training courses;
- actively enforce motorcycle operator licensing requirements; and
- promote motorcyclist licensing.

NCHRP (under review, Strategy C3) describes how Maryland and Minnesota used some of these strategies to increase proper licensing for motorcyclists. Maryland used the additional strategy of comparing their vehicle registration and driver licensing files. A letter was sent to each owner of a registered motorcycle who did not have a motorcycle operator's license. This quick and inexpensive strategy caused 1,700 owners to become licensed within four months. However a randomized controlled experiment of this intervention suggested that while the method did increase licensure, a large percentage remained unlicensed (Braver et al., 2007).

Maryland and Pennsylvania have "one-stop shops" which provide a motorcycle endorsement immediately upon successful completion of a State-approved basic riding course. For Pennsylvania's procedures, see www.pamsp.com/CourseInfo_Basic.aspx.

Use: All States require motorcyclists to obtain a motorcycle license or endorsement to ride on public highways.

Effectiveness: The effectiveness of current licensing and testing has not been evaluated.

Costs: Most States charge a small fee for the motorcycle licensing tests (MSF, 2002). The costs of changing the licensing tests and procedures depend on the extent of changes and the amount of retraining needed for licensing examiners.

Time to implement: New licensing tests and procedures likely would require 6 to 12 months to implement.

Other issues:

- **Graduated licensing:** Most States employ graduated driver licensing for beginning automobile drivers. Under GDL, new drivers must pass through learner's permit and provisional license stages before becoming fully licensed. A learner's permit allows driving only while supervised by a fully licensed driver and a provisional license allows unsupervised driving under certain conditions, such as limiting the number of passengers and prohibiting driving at night. Many States place restrictions similar to these on motorcyclists with a learner's permit or younger than a specified age (MSF, 2002). Mayhew and Simpson (2001) describe motorcyclist GDL programs in California, Maryland and South Dakota. For example, the California GDL prohibits passengers or nighttime riding during the learner permit stage, and requires all people under 25 who are seeking a motorcycle license or endorsement to take the State-sponsored motorcycle training course. Baer et al. (2005) report that 7 States had some form of graduated licensing in 2001 and five re-

stricted motorcyclists in some age groups to motorcycles of certain sizes. GDL programs for automobile drivers have been shown to be effective in reducing crashes (Hedlund, Shults, & Compton, 2003, 2006). Evaluations in New Zealand and evidence from Quebec suggest that they may do the same for motorcyclists (Mayhew & Simpson, 2001).

3.2 Operator Education and Training

Effectiveness: Uncertain	Use: High	Cost: Medium	Time: Varies

Motorcycle operator education and training has been thoroughly integrated into all aspects of motorcycle safety. The National Agenda for Motorcycle Safety calls it "the centerpiece of a comprehensive motorcycle safety program" (NHTSA, 2000a, Rider Education and Training). NHTSA's Motorcycle Safety Program Plan states that "motorcycle rider education provides an opportunity for novice riders to learn the basic skills necessary to operate a motorcycle safely and for experienced riders to refresh and refine their techniques" (p.17) and recommends that States conduct frequent and timely education and training at sites that are accessible throughout the State (NHTSA, 2006d). Education and training enjoy broad support from the motorcycle industry, motorcycle user organizations, and motorcyclists (NCHRP, under review, Strategy C1).

Forty-seven States have State-operated and legislated education and training programs and the other three have privately operated programs (Baer, Cook, & Baldi, 2005). Training also is provided by some rider organizations (for example, some American Bikers Aimed Toward Education [ABATE] and Gold Wing groups), manufacturers (Harley-Davidson's Riders Edge), and private providers. Many States encourage training either by requiring it for all motorcycle operators under a specified age or by waiving some licensing or testing requirements for motorcycle operators who complete an approved training course (Baer, Cook, and Baldi, 2005). Most training uses one of the curricula developed by MSF: BRC (*Basic RiderCourse*, introduced in 2001 to replace the RSS – *Riding and Street Skills* – course), and the ERC (*Experienced RiderCourse*).

However, it is not at all clear what constitutes good operator education and training, nor whether current training reduces crashes. As to content, the National Agenda concluded that "it is assumed, yet unknown, that the current [operator education and training] programs are teaching necessary skills to survive in traffic" (NHTSA, 2000a, Rider Education and Training). It recommended that a "uniform, educationally sound" curriculum be adopted. NHTSA (2003, p. 13) reported wide differences in training program content and administration from State to State. Baer, Cook, and Baldi (2005) summarize the curricula offered in each State. Beyond just teaching motorcycle control skills, emerging evidence suggests that better programs would also train riders to recognize potentially hazardous riding situations and encourage riders to assess their own risks and limitations, and ride within those constraints (e.g., Clarke, Ward, Bartle, & Truman, 2007; Elliott, Baughan, & Sexton, 2007).

Training effectiveness is equally uncertain. Mayhew and Simpson (1996) reviewed all available high-quality studies of motorcycle operator education and training programs. Only one of six studies in the United States showed any positive results, and only for the first six months following training. They concluded that the studies to date "have failed to provide definitive conclusions about the effectiveness of rider education and training in reducing crashes." They also summarized four studies from Canada and one from the United Kingdom that add further support to this conclusion. No major motorcycle training evaluations have been conducted in the past ten years.

Training also may not be easily available to many beginning motorcycle operators. The National Agenda for Motorcycle Safety [NAMS] (NHTSA, 2000a) estimated that no more than half of

those who wanted training received it. Both NHTSA (2003) and NCHRP (under review, Strategy C1) reported that waiting times of 3 to 12 months were not unusual. Some States increased their training offerings in recent years to accommodate their demand, but MSF reports that the waiting time in other States still can be months.

Baer, Cook, and Baldi (2005) summarized each State's motorcycle education and licensing programs and practices. A companion report (Baer, Baldi, & Cook, 2005) describes effective training and licensing programs and actions to promote training and licensing.

States should do their best to provide motorcycle training on a timely basis to all who wish to take it. See Baer, Baldi, and Cook (2005) and Hedlund (2007) for examples of successful methods to use training capacity more effectively, including creative scheduling, centralized on-line registration systems, and use of private providers. Starting in 2006, NHTSA awarded Section 2010 grants to States to support operator training (NHTSA, 2006b).

Use: 47 States have State-operated motorcycle operator education and training programs and the other three have privately-operated programs. The District of Columbia does not offer operator education and training.

Effectiveness: As discussed above, the effectiveness of current operator training programs in reducing crashes is unknown. Student evaluations regularly report that training was valuable. Some students retake the courses as a refresher (Baer, Baldi, & Cook, 2005).

Costs: Operator training programs are funded in part by the States and in part by fees paid by the students who take them. State costs per student in 2001 ranged from less than $35 to more than $200 and averaged $106.98. Student fees ranged from zero to more than $200 and averaged $106.16 (Baer, Cook, & Baldi, 2005). Many States offset some or all of their costs through motorcycle license or registration fees.

Time to implement: Operator training currently is conducted in all States. Training capacity is limited by the number of available training sites (a broad expanse of paved surface is required), qualified instructors, and motorcycles for students to use during training. Some measures to increase capacity can be implemented quickly while others may take 6 to 12 months.

Other issues:

- **Training for experienced motorcyclists:** MSF and the States offer training courses for experienced motorcyclists (www.msf-usa.org/sitemap.cfm). The courses have not been evaluated.
- **Training for other motorcycle configurations (three-wheeled motorcycles and motorcycles pulling trailers**): Several motorcycle organizations offer courses addressing these special motorcycle configurations. The courses have not been evaluated.

4.1 Communications and Outreach: Protective and Conspicuous Clothing

Effectiveness: Unknown	Use: Unknown	Cost: Varies	Time: Medium

Motorcycle riders should wear clothing that provides both protection and visibility. FMVSS 218 helmets (Chapter 5, Sections 2.1-2.3) with face shields protect the eyes from wind and foreign objects in addition to protecting the head in a crash. Well-constructed jackets, pants, boots, and gloves can prevent abrasions and bruises. If made of impact-resistant material, they even may prevent arm and leg fractures or serious torso and spinal cord injuries (NHTSA, 2000a).

A common cause of motorcycle crashes involving other vehicles is that other vehicle drivers do not see the motorcycle. This observation is reported anecdotally and confirmed in motorcycle crash causation studies (Clarke et al., 2007; NCHRP, under review, Strategy D2; NHTSA, 2000a). One easy way to increase motorcycle conspicuity is through lighted headlights. Most motorcycles on the road have their headlights always on, because most motorcycles manufactured since 1979 have this feature (NCHRP, under review, Strategy D2) and because 24 States require daytime headlight use for all motorcycles manufactured since 1980 (MSF, 2007).

A second way to increase conspicuity is to wear brightly colored clothing (for increased visibility during daylight) incorporating some retro-reflective material (for increased visibility at night). Recent studies confirm that motorcyclists wearing conspicuous clothing or helmets are less likely to be involved in a crash (NCHRP, under review, Strategy D1).

There are no data on how many motorcycle riders wear various types of protective clothing other than helmets. Only a minority wears brightly colored clothing (NHTSA, 2000a, Conspicuity); in fact, the predominant color of motorcycle clothing is black (NCHRP, under review, Strategy D1). Helmet manufacturers and distributors report that more than half the helmets sold for street use are black (NCHRP, under review, Strategy D1).

Communications and outreach campaigns promoting protective and conspicuous clothing have been conducted by States and by motorcyclist organizations. NCHRP (under review, Strategy D1) provides examples of material from Oregon and the MSF and references to additional material from the SMSA, the Gold Wing Road Riders Association, and the Motorcycle Council of New South Wales, Australia.

Use: The number of States that conduct campaigns to promote protective and conspicuous clothing for motorcycle riders is not known.

Effectiveness: There are no evaluations of the effectiveness of campaigns to increase the use of protective and conspicuous clothing (NCHRP, under review, Strategy D1).

Costs: Good communications and outreach campaigns can be expensive to develop and implement: see Chapter 2, Section 3.1. Materials promoting protective and conspicuous clothing are available from various sources including MSF, other motorcyclist organizations, and States that have conducted these campaigns (NCHRP, under review, Strategy D1).

Time to implement: A good campaign, including market research, message development and testing, and implementation, will require at least six months to plan and implement.

4.2 Communications and Outreach: Awareness of Motorcyclists

Effectiveness: Unknown	Use: Unknown	Cost: Varies	Time: Medium

When motorcycles crash with other vehicles, the other vehicle driver usually violates the motorcyclist's right-of-way (Clarke et al., 2007; Elliott et al., 2007; NCHRP, under review, Strategy F3; NHTSA, 2000a). Motorcycles and motorcyclists obviously are a smaller visual target than cars or trucks. Motorcyclists may not be conspicuous (see Chapter 5, Section 4.1). Also, drivers may not expect to see motorcycles on the road and may not anticipate how motorcycles are likely to be driven (NCHRP, under review, Strategy F3; NHTSA, 2000a).

Several States have conducted communications and outreach campaigns to increase other drivers' awareness of motorcyclists. Typical themes are "Share the Road" or "Watch for Motorcyclists." Some States build a campaign around a "Motorcycle Awareness Month," often in May, early in the summer riding season. Many motorcyclist organizations, including MSF, SMSA, the Gold Wing Road Riders Association, and State and local rider groups, have driver awareness material available. See Hedlund (2007, Section 5) and NCHRP (under review, Strategy F3) for links and references. These organizations also make presentations on drivers' awareness of motorcyclists to driver education classes.

As required by SAFETEA-LU, NHTSA developed model language on sharing the road safely with motorcyclists. The model language is appropriate for traffic safety education courses, driver manuals, and other communication and outreach activities. NHTSA is using this model language in a "Share the Road" program for states and communities, which will be available in 2008.

Use: The number of States that conduct campaigns to increase drivers' awareness of motorcycles and motorcyclists is not known. Hedlund (2007, Section 5) and NCHRP (under review, Strategy F3) provide examples or links to campaigns from a dozen States.

Effectiveness: There are no evaluations of the effectiveness of campaigns to increase driver awareness of motorcyclists (NCHRP, under review, Strategy F3).

Costs: Good communications and outreach campaigns can be expensive to develop and implement: see Chapter 2, Section 3.1. Motorcyclist awareness material is available from various sources including the MSF, other motorcyclist organizations, and States that have conducted these campaigns (NCHRP, under review, Strategy F3).

Time to implement: A good campaign, including market research, message development and testing, and implementation, will require at least six months to plan and implement.

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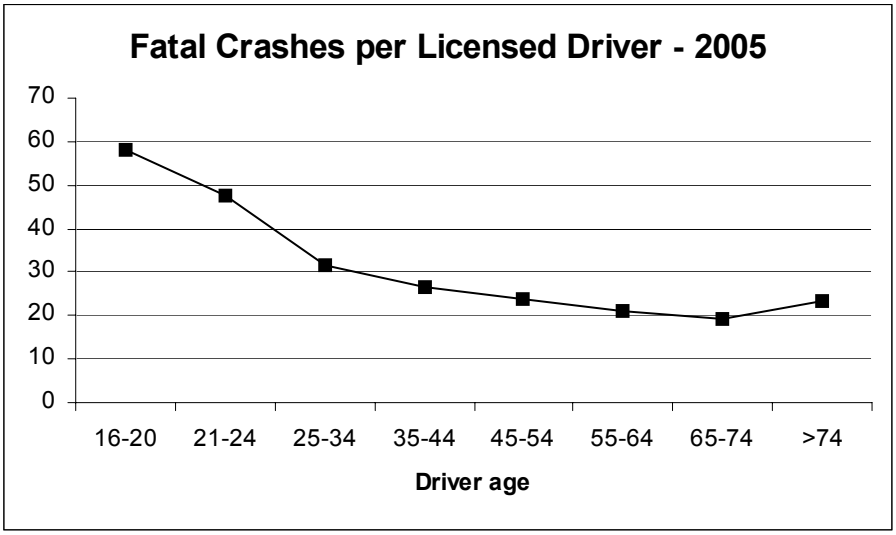
6. Young Drivers

Overview

Young drivers are substantially over-involved in crashes. In 2005, drivers age 16 to 20 were 6.3 percent of all licensed drivers in the United States, 12.3 percent of drivers in fatal crashes, and 15.5 percent of drivers in all crashes (NHTSA, 2006, Table 63).



Fatal crashes per 100,000 drivers (FARS)
Source: Traffic Safety Facts (NHTSA, 2006)

Per mile driven, young drivers are even more over-involved. From April 2001 through March 2002, young drivers were involved in 7.4 fatal crashes per 100 million miles of travel, compared to 4.3 for drivers 21 to 24 and 1.6 for drivers 30 to 69 years old (Insurance Institute for Highway Safety [IIHS], 2005).

Trends. Between 1996 and 2005, there was a 42-percent decrease in the fatal crash rate for 16-year -old drivers (from 33 to 19 per 100,000 population). For 17-year-olds, fatal crash rates declined by 23 percent. By comparison, fatal crashes rates declined by 15 percent among adult drivers ages 30-59. There was a similarly large decrease (41%) in police-reported crash involvements among 16 year-old drivers, as well as substantial decreases in nighttime fatal crashes and fatal crashes involving passengers (Ferguson, Teoh, & McCartt, 2007). The reasons for the dramatic reductions in fatal and police-reported crashes among 16 year-olds are not entirely known; however, it is noteworthy that most U.S. States implemented new, multi-stage licensing systems during this time period. Although the overall trend in young driver crashes is encouraging, drivers between the ages of 16 and 19 are still involved in approximately twice as many crashes, both fatal and non-fatal, as adult drivers (Ferguson et al., 2007).

Young-driver characteristics. Young drivers have high crash risks for two main reasons, as documented by extensive research (summarized in Hedlund, Shults, & Compton, 2003). First, they are inexperienced, just learning to drive. The mechanics of driving require much of their attention, so safety considerations frequently are secondary. They do not have experience in recognizing potentially risky situations or in reacting appropriately and controlling their vehicles in

these situations. Second, they are immature, sometimes seeking risks for their own sake, often not able or willing to think ahead to the potentially harmful consequences of risky actions. In fact, recent research on adolescent development suggests that key areas of the brain involved in judgments and decision making are not fully developed until the mid-20s (Keating, 2007; Steinberg, 2007).

Inexperience and immaturity combine to make young drivers especially at-risk in four circumstances:

- At night: Driving is more difficult and dangerous at night for everyone; young drivers have less experience driving at night than during the day; they may be tired and may have been drinking (Lin & Fearn, 2003; Williams, 2003).
- After drinking alcohol: Young drivers' inexperience with both driving and drinking means that they have a higher crash risk at all BAC levels than older drivers (Williams, 2003).
- With passengers: Teenage passengers can distract young drivers and encourage them to take risks (Lin & Fearn, 2003; Williams, 2003).
- When unbelted: Seat belts reduce the risk of injury or fatality in a crash (see Chapter 2, Overview), but teenage drivers and passengers have lower belt use rates than older drivers and passengers (Ferguson, 2003).

Strategies to Reduce Crashes Involving Young Drivers

Graduated driver licensing (GDL) addresses both the inexperience and immaturity of young drivers. GDL provides a structure in which beginning drivers gain substantial driving experience in less-risky situations. GDL raises the minimum age of full licensure and helps parents manage their teenage drivers. GDL's effectiveness in reducing crashes has been demonstrated many times (Hartling et al., 2006; Hedlund, Shults, & Compton, 2006; Shope, 2007; Shope & Molnar, 2003; Simpson, 2003).

Driver education was developed to teach both driving skills and safe driving practices. Based on evaluations to date, school-based driver education for beginning drivers does not reduce crashes. Rather, some research shows that it lowers the age at which teenagers become licensed, so its overall effect is to increase crashes (Roberts et al., 2001; Vernick et al., 1999). Current research is investigating ways to integrate driver education with GDL and is developing second-level programs for drivers who have acquired basic driving skills and have been licensed.

Parents play a key role in their teenagers' driving. In many States a parent or guardian must sign the driver's license application for a teenager under 18 and parents can withdraw their approval at any time. Parents can set limits on their teenagers' driving. Through their own driving, parents provide role models for good or bad driving practices. Parents can be involved explicitly and formally, through GDL requirements for a minimum number of hours of supervised driving practice under a learner's permit. Or they can be involved voluntarily and informally. Several parent-teen driving guide programs can provide assistance. A few driving guide programs have successfully encouraged parents to impose more driving restrictions on their teens; however, no program has yet been shown to reduce young driver crashes or fatalities (Simons-Morton, 2007).

Young drivers are subject to two traffic laws that apply only to them: GDL and the zero-tolerance BAC laws discussed in Chapter 1. In addition, they are subject to all other traffic laws. Enforcement is critical if these laws are to have any effect. The law enforcement system faces several problems when dealing with young drivers. In deciding whether to make a traffic stop, it can be difficult for law enforcement officers to determine a person's age to know whether GDL and zero-tolerance laws apply. Moreover, in some situations there may be a tendency for officers not to make arrests or for prosecutors to dismiss charges because the offender is "just a kid." Finally, the legal system imposes additional requirements for people under the age of legal adulthood (18 in most States). See NHTSA and National Institute on Alcohol Abuse and Alcoholism [NIAAA] (1999) for a discussion of these requirements and processes for alcohol-related offenses.

Young drivers are discussed in other chapters of this guide. See in particular:

- Chapter 1, Alcohol-Impaired Driving, Sections 6.1-6.4 (minimum-drinking-age-21 laws, zero-tolerance BAC laws, school and youth alcohol programs).
- Chapter 2, Seat Belt Use, Sections 3.2 and 4.1 (communications and outreach for low-belt-use groups, school and employer programs).
- Chapter 4, Distracted and Fatigued Driving, Sections 1.2, 2.2, and 3.1 (GDL requirements, communications and outreach, and employer programs).
- Chapter 5, Motorcycle Safety, Section 1.2 (GDL for motorcyclists).

Except for GDL requirements applying to automobile drivers, these discussions are not repeated in this chapter.

Environmental and vehicular strategies can improve safety for young drivers, as they can for all drivers. In recent years, several new technologies have been developed and applied to young drivers. For example, some parents are installing devices on their teenagers' vehicles to monitor the vehicle's location, speed, or other performance characteristics, or to monitor their teenagers' driving behavior (McGehee, Raby, Carney, Lee, & Reyes, 2007; Williamson, 2005).

For an overview of young-driver issues and research, see the papers in the June 2006 Supplement of *Injury Prevention* (ip.bmjjournals.com/content/vol12/suppl_1/), or the papers in the special issue of the 2007 *Journal of Safety Research* (www.nsc.org/gdl). See also Hedlund, Shults & Compton (2006) for a summary of much of the recent research on young driver issues. Additionally, a National Cooperative Highway Research Program (NCHRP) guide for reducing crashes involving young drivers should be released in 2007 (NCHRP, under review).

Countermeasures That Work

Countermeasures to improve young-driver safety are listed below and discussed individually in this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information.

1. Graduated Driver Licensing

Countermeasure	Effectiveness	Use	Cost	Time
1.1 Graduated driver licensing (GDL)	Proven	High	Medium	Long
1.2 Learner's permit length, supervised hours	Proven	High	Low	Medium
1.3 Intermediate - nighttime restrictions	Proven	High	Low	Medium
1.4 Intermediate - passenger restrictions	Proven	High	Low	Medium
1.5 Belt use requirements	Unknown	Low	Low	Medium
1.6 Cell phone restrictions	Unknown	Medium	Low	Medium
1.7 Intermediate - violation penalties	Uncertain	High	Low	Medium

2. Driver education

Countermeasure	Effectiveness	Use	Cost	Time
2.1 Pre-licensure driver education	None	Unknown	High	Long
2.2 Post-licensure driver education	Unknown	Low	High	Long

3. Parents

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Parent roles in teaching and managing	Uncertain	Medium	Low	Short

4. Traffic law enforcement

Countermeasure	Effectiveness	Use	Cost	Time
4.1 Enforcement of GDL and zero-tolerance laws	Likely	Unknown	Medium	Short

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results.
Likely: balance of evidence from high-quality evaluations or other sources.
Uncertain: limited and perhaps ambiguous evidence.
Unknown: no high-quality evaluation evidence.
Varies: different methods of implementing this countermeasure produce different results.
None: several high-quality evaluations show no effect.

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise.
See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities.
Medium: between one-third and two-thirds of States or communities.
Low: fewer than one-third of the States or communities.
Unknown: data not available.

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources.
Medium: requires some additional staff time, equipment, facilities, and/or publicity.
Low: can be implemented with current staff, perhaps with training; limited costs for equipment or facilities.

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year.
Medium: more than three months but less than one year.
Short: three months or less.

These estimates do not include the time required to enact legislation or establish policies.

1.1 Graduated Driver Licensing

Effectiveness: Proven	Use: High	Cost: Medium	Time: Long

GDL is a three-phase system for beginning drivers, consisting of a learner's permit, an intermediate license, and a full license. A learner's permit allows driving only while supervised by a fully licensed driver. An intermediate license allows unsupervised driving under certain restrictions. These usually include limits on driving at night or with teenage passengers. The learner's permit and the intermediate license each must be held for a specified minimum period of time.

GDL serves two functions: reducing risk and reducing exposure. GDL allows beginning drivers to acquire driving experience in less-risky situations, under direct supervision during the learner's permit phase. It helps young drivers avoid dangerous conditions such as late-night driving or driving with teenage passengers in the vehicle during the intermediate phase. GDL delays full licensure by requiring a minimum time in both the learner's permit and intermediate phases. Compared to earlier requirements in many jurisdictions, where beginning drivers could receive a full license at age 16 (and sometimes earlier) by passing a minimal driving test, GDL reduces the amount of driving by 16-year-old drivers. GDL also assures that young drivers are more mature when they receive their first unrestricted license.

Most States now have some form of GDL in place. The National Committee on Uniform Traffic Laws and Ordinances [NCUTLO] (2000) provides a model GDL law. IIHS and Traffic Injury Research Foundation [TIRF] (2004) summarize and discuss GDL provisions. The Governors Highway Safety Association [GHSA] (2007) and IIHS (2007) document GDL laws in each State as of July 2007. The papers in the special issue of the 2007 *Journal of Safety Research* document GDL's history, components, effectiveness, parental roles, potential enhancements, and research needs (www.nsc.org/gdl)..

Use: All States and the District of Columbia had some GDL components in place as of July 2007; 47 States and the District of Columbia had a three-phase GDL system (GHSA, 2007; IIHS, 2007). Only Arkansas, Kansas and North Dakota still have two-phase licensing systems.

Effectiveness: GDL's effectiveness in reducing crashes has been documented repeatedly (Baker, Chen, & Li, 2006; Hartling et al., 2004; Hedlund et al., 2006; Shope, 2007; Shope & Molnar, 2003; Simpson, 2003). In addition to reducing crashes, a recent study found that GDL was associated with a 36-percent decline in hospitalization rates for 16-year-old drivers, and a 31-percent decline in hospital charges (Margolis, Masten & Foss, 2007).

Costs: GDL's primary costs result from the intermediate license, which adds to licensing agency workload by requiring each beginning driver to receive three licenses in succession rather than two.

Time to implement: Licensing changes typically require more than a year to plan, publicize, and implement.

Other issues:

- **GDL provisions:** The specific provisions in current GDL systems vary substantially from State to State. GHSA (2007) and IIHS (2007) document the main provisions of each State's law. Sections 1.2-1.7 of this Chapter discuss the main provisions in more detail. Mayhew, Simpson, and Singhal (2005) describe GDL standards for Canadian provinces and compare GDL systems in Canada, United States, Australia, and New Zealand.

1.2 GDL Learner's Permit Length, Supervised Hours

Effectiveness: Proven	Use: High	Cost: Low	Time: Medium

With a learner's permit, a beginning driver can drive when supervised by a fully licensed driver at least 21 years old. The learner's permit allows and encourages beginning drivers to acquire substantial driving experience. To aid this, most States require the learner's permit to be held for a minimum period of time and most require a minimum number of supervised driving hours. NCUTLO's model GDL law suggests minimum requirements of six months holding period and 30 hours supervised driving (NCUTLO, 2000). Most States meet or exceed these recommendations.

Use: As of July 2007, 43 States and the District of Columbia required learner's permits to be held for at least six months and another 4 had minimum holding periods of two to five months. Forty States and the District of Columbia required some minimum number of supervised driving hours: 21 required at least 50 hours, 10 required 40 hours, 6 required 30 to 35 hours, and 4 required 20 to 25 hours. Some States reduced or eliminated supervised driving requirements for driver education graduates. NCUTLO's model requirements of at least six months' holding time and at least 30 hours of supervised practice seem to be generally accepted as minimum standards, met or exceeded by more than two-thirds of the States (IIHS, 2006).

Effectiveness: Several studies, summarized in Mayhew (2003), show that learner's permit drivers in various jurisdictions regularly drive under adult supervision and often exceed the minimum requirement for supervised driving hours. Thus the *combination* of a minimum learner's permit holding period and a supervised driving hour requirement is successful in achieving substantial supervised driving practice. In surveys, both parents and teenagers strongly support GDL overall. In particular, they support the learner's permit holding period and supervised driving requirements (Mayhew, 2003).

Since learner's permit drivers are being supervised, it's not surprising that crash rates during the learner's permit period are very low. For young drivers holding their first unsupervised license, the limited available evidence suggests that crash rates decreased after jurisdictions with no learner's permit holding requirement implemented a six-month requirement (Mayhew, 2003). Baker et al. (2006) found that the combination of a learner's permit holding period of at least three months and a supervised driving requirement of 30 or more hours reduced fatal crash involvements by 18 percent.

Costs: Once GDL is in place, requirements for the learner's permit can be implemented at very little cost.

Time to implement: GDL requirement changes typically require at least six months to notify the public and implement the changes.

1.3 GDL Intermediate License Nighttime Restrictions

Effectiveness: Proven	Use: High	Cost: Low	Time: Medium

Driving at night increases the fatal crash risk per mile of travel for all drivers, and especially for teenage drivers (Hedlund et al., 2003; Williams, 2003). At night, driving is more difficult; driver fatigue is more common; and alcohol is more likely to be used. Many intermediate license drivers have limited experience driving at night. For all of these reasons, a night driving restriction or prohibition is the most common intermediate license restriction.

The restricted hours vary widely, from "sunset to sunrise" or 6 p.m. to 6 a.m. in the most restrictive States, to 1 a.m. to 5 a.m. in the least restrictive (GHSA, 2007; IIHS, 2007). The most common hours are 11 p.m. or midnight to 5 or 6 a.m. The NCUTLO model law recommends a 10 p.m. starting time (NCUTLO, 2000) and the IIHS-TIRF Blueprint recommends a 9 or 10 p.m. starting time, but only 8 States start their restrictions as early as 10 p.m. A starting time earlier than midnight will prevent more crashes, especially since teenage driver crashes occur more frequently before midnight than after (Foss & Goodwin, 2003; Williams, 2003).

Use: As of July 2007, 45 States and the District of Columbia restricted intermediate license drivers from driving during specified nighttime hours. Many States allowed driving during the restricted hours for work or school-related activities (GHSA, 2007; IIHS, 2007).

Effectiveness: The effectiveness of nighttime driving restrictions in reducing both nighttime driving and nighttime crashes has been demonstrated conclusively (Hedlund et al., 2003; Hedlund & Compton, 2004; Hedlund & Compton, 2005; Lin & Fearn, 2003; Williams, 2007).

Costs: Once GDL is in place, a nighttime driving restriction can be implemented or modified at very little cost.

Time to implement: GDL requirement changes typically require at least six months to notify the public and implement the changes.

1.4 GDL Intermediate License Passenger Restrictions

Effectiveness: Proven	Use: High	Cost: Low	Time: Medium

Passengers substantially increase the crash risk for teenage drivers, especially the youngest drivers. Each additional passenger produces an additional increase in crash risk. In contrast, passengers decrease crash risk for drivers 30 to 59 years old (Williams, 2003). To reduce the risk to teen drivers, most States include a passenger restriction in their GDL requirements for intermediate licensees. NCUTLO's model law prohibits passengers younger than 20 (NCUTLO, 2000).

Use: As of July 2007, 39 States and the District of Columbia restricted in some way the number of passengers who can be carried by an intermediate license driver (GHSA, 2007; IIHS, 2007). The most common passenger restrictions limit teenage drivers to zero or just one passenger. Some restrictions apply to all passengers and some only to passengers younger than a specified age. Some restrictions apply only during the initial months of the intermediate license. A few States allow exceptions for transporting family or household members.

Effectiveness: There is growing evidence that passenger restrictions are effective in reducing young driver crashes, though the restrictions sometimes are violated (Hedlund et al., 2003; Williams, 2007). California allows no passengers younger than 20 for teenagers who hold an intermediate license. Four recent studies demonstrate the positive effects of this restriction. For example, one study showed a 38-percent decrease in 16-year-old driver crashes in California in which a teen passenger was killed or injured (Williams, 2007). In a recent national study, Baker et al. (2006) found that passenger restrictions, in combination with other GDL requirements, reduced fatal crash involvements. One recently completed NHTSA study evaluated passenger restrictions in three states: California, Massachusetts, and Virginia. Results showed that 17-year-old driver crash involvements were reduced (740 per year in CA, 173 in MA, and 454 in VA) as were motor vehicle related injuries among 15- to 17-year-olds (drivers, passengers, pedestrians, and/or bicyclists) in all three states (Chaudhary, Williams & Nissen, in press). Two additional studies in progress are evaluating the effects of passenger restrictions in four States (Hedlund & Compton, 2005).

Costs: Once GDL is in place, a passenger restriction can be implemented at very little cost.

Time to implement: GDL requirement changes typically require at least six months to notify the public and implement the changes.

1.5 GDL Belt Use Requirements

Effectiveness: Unknown	Use: Low	Cost: Low	Time: Medium

Properly worn seat belts can dramatically reduce the risk of injury or death to vehicle occupants in the event of a crash (NHTSA, 1999). Seat belts are particularly important for teenage drivers because of their elevated crash risk. Nonetheless, teenage drivers and passengers have lower seat belt use rates than older drivers and passengers (Ferguson, 2003).

Young drivers are covered by seat belt laws in all States (with the exception of New Hampshire, which only requires seat belts for people under age 18) (Williams, 2007). Six States have primary enforcement belt use laws for passengers under 18 or 19 but secondary enforcement for older passengers (Glassbrenner, 2004; see also Chapter 2, Sections 2.1 and 2.4). Some States explicitly require belt use under their GDL laws. NCUTLO's model law requires intermediate license drivers and all their passengers to be belted (NCUTLO, 2000). An explicit belt use requirement in a State's GDL law may have more influence on beginning drivers than the State's overall belt use law, especially in States with primary enforcement for young drivers and in States where seat belt violations result in delayed graduation to the next GDL phase.

Use: In 2005, GDL laws in 15 States explicitly required belt use (AAA, 2005). Sanctions for violating this requirement varied across the States.

Effectiveness: There are no evaluations of the effects of explicit belt use requirements in GDL laws. One problem is that teens (and parents) may not be aware when seat belt laws are part of a State's GDL system. For example, surveys in North Carolina have shown very high awareness for the State's nighttime and passenger restrictions, but only 3 precent of teens and 5 percent of parents are aware of the special GDL provision concerning seat belts (Goodwin & Foss, 2004). At present, a NHTSA-funded study in Tennessee and Wisconsin is examining whether increased publicity for seat belt GDL requirements leads to increased belt use (Hedlund & Compton, 2005).

Costs: Once GDL is in place, a belt use requirement can be implemented at very little cost.

Time to implement: GDL requirement changes typically require at least six months to notify the public and implement the changes.

1.6 GDL Cell Phone Restrictions

Effectiveness: Unknown	Use: Medium	Cost: Low	Time: Medium

Cell phones may distract drivers, as discussed in Chapter 4, Section 1.1. Cell phones are more commonly used by young drivers than adult drivers (NHTSA, 2005), and they may pose greater risks for young drivers for the reasons outlined in the Overview (see also Ferguson, 2003). To reduce this risk, a growing number of States include cell phone restrictions in their GDL laws. NCUTLO's model law does not include a cell phone restriction for either learner's permit or intermediate license drivers (NCUTLO, 2000). See Chapter 4, Section 1.1 for a discussion of cell phone laws applying to all drivers.

Use: Nineteen States and the District of Columbia prohibit cell phone use for some young drivers. In most States, these cell phone restrictions cover teenagers holding a learner's permit or intermediate license, although in some States the restrictions cover all drivers under a certain age, such as 18 or 19 (GHSA, 2007; IIHS 2007). Connecticut, New Jersey, New York, and the District of Columbia – and also California and Washington beginning in 2008 – prohibit handheld cell phone use by all drivers (see Chapter 4, Section 1.1).

Effectiveness: There are no evaluations of the effects of cell phone prohibitions in GDL laws.

Costs: Once GDL is in place, a cell phone restriction can be implemented at very little cost.

Time to implement: GDL requirement changes typically require at least six months to notify the public and implement the changes.

1.7 GDL Intermediate License Violation Penalties

Effectiveness: Uncertain	Use: High	Cost: Low	Time: Medium

Probationary licensing preceded graduated licensing. Probationary licensing had no intermediate phase, so that beginning drivers received a full and unrestricted license after their learner's permit. However, the initial full licensure period was probationary in that the license could be revoked or suspended, or some driver improvement actions could be required, at a lower threshold than for drivers with a standard non-probationary license (Simpson, 2003).

The probationary feature has been included in the intermediate phase of graduated licensing, typically by delaying full licensure until the intermediate licensee has demonstrated a good driving record. For example, the NCUTLO model law recommends a six-month period free of all traffic violation convictions before full licensure (NCUTLO, 2000).

Use: Almost all States penalize some GDL or traffic law violations by delaying full licensure (IIHS and TIRF, 2004).

Effectiveness: The few evaluations of early stand-alone probationary license systems generally found no substantial benefits (McKnight & Peck, 2003; Simpson, 2003). No recent evaluations have attempted to separate out the effect of penalties for GDL or other traffic law violations from the overall effects of GDL (see Chapter 6, Section 1.1). Two studies evaluated the effects on young drivers of lower-threshold driver improvement actions, with mixed results (NCHRP, under review, Strategy A4).

Another recent enforcement/education program dubbed "Ticket Today = License Delay" highlighted the resulting delay in licensure for teenagers who are convicted of a moving violation, seat belt violation or GDL violation. Although teens and their parents clearly perceived the increased enforcement, the program had only minimal effects on seat belt use and compliance with GDL restrictions (Goodwin, Wells, Foss, & Williams,, 2006). In general, it appears that awareness of penalties for license violations among parents and teens is relatively low, enforcement is lax, and licensing delays are not always applied even when violations are enforced (Goodwin & Foss, 2004; Steenbergen et al., 2001; Williams, 2007).

Costs: Once GDL is in place, penalties for violating its provisions can be changed at very little cost.

Time to implement: GDL requirement changes typically require at least six months to notify the public and implement the changes.

2.1 Pre-licensure Driver Education

Effectiveness: None	Use: Unknown	Cost: High	Time: Long

Driver education has long been advocated and used to teach both driving skills and safe driving practices. Driver education in high schools grew in popularity in the 1950s, using a standard curriculum of at least 30 hours classroom instruction and 6 hours on-the-road driving practice. By about 1970, approximately 14,000 high schools taught driver education to about 70 percent of all eligible teenagers. Many States and insurance companies encouraged driver education: States licensed graduates at an earlier age and insurance companies reduced auto insurance premiums for graduates. During the 1980s driver education offerings decreased as State and Federal funding for driver education decreased. By the early 1990s fewer than half of all high schools offered driver education and the majority of beginning drivers did not take driver education. See Smith (1994) or Mayhew (2007) for a concise review of the history of driver education in the United States.

The evaluations to date find that driver education does not improve safety. Roberts et al. (2006) concluded from three well-designed evaluations in Australia, New Zealand, and the United States that driver education lowers the age at which teenagers become licensed but does not affect their crash rates once they do become licensed. The net effect of driver education is to increase crashes because it puts more young drivers on the road. Vernick et al. (1999) reached the same conclusion from a review of nine studies, eight from the United States and one from Australia.

The study most familiar in the United States is the extensive NHTSA-sponsored study in DeKalb County, Georgia, in the late 1970s. Over 16,000 students were randomly assigned to three groups: standard driver education; an 80-hour long course including classroom, simulation, driving range, and on-the-road components; and a control group of no formal driver education. The initial analysis found no significant difference in crashes or traffic violations among the three groups (Smith, 1994). A second analysis, which tracked the students' driving records for a longer period of time, found a slight crash reduction for standard course graduates during their first months of driving only, and no difference between the long course and no course graduates (Smith, 1994). See Vernick (1999) for brief summaries of all DeKalb study analyses.

Based primarily on these results, NHTSA dropped driver education from its list of priority highway safety program areas for States (Smith, 1994). NHTSA concluded that driver education should be integrated into a GDL program. It also concluded that driver education should be "distributed over time." NHTSA proposed a two-stage driver education system, both pre-licensure and post-licensure. See Chapter 6, Section 2.2, for further discussion.

As of July 2007, 7 States encouraged driver education by lowering the minimum learners, intermediate, or unrestricted licensing age for driver education graduates or by reducing the required number of supervised driving hours (IIHS, 2007). Based on the evaluation data discussed above, these driver education "discounts" increase, rather than reduce, crashes. A recent study in British Columbia supports this conclusion. Crash rates were 27-percent higher for driver education graduates, who reduced their learner's permit holding period by three months, than for non-

graduates (Wiggins, 2004). Two other current studies are examining the same issue (Hedlund & Compton, 2005).

Use: There are no current data on the number of high schools that offer driver education or the number of teenagers who complete a driver education course. NHTSA and the American Driver and Traffic Safety Education Association (ADTSEA) plan to acquire these data shortly (Hedlund & Compton, 2005). There also are no data on commercial driver education courses or students.

Effectiveness: Driver education leads to earlier licensure but does not reduce crash rates (Mayhew, 2007; Roberts et al, 2006; Vernick et al., 1999). Nonetheless, there has been a growing interest in improving and evaluating driver education. Future directions for driver education were recently summarized in a research circular by the Transportation Research Board (TRB, 2006). In addition, the AAA Foundation for Traffic Safety has produced a series of materials that provide practical information on how to conduct evaluations of driver education (Clinton & Lonero, 2006).

Costs: Even a minimal driver education course of 30 hours in the classroom and 6 hours on the road requires extensive funds. Driver education also requires students to find time for it in their schedules of high school classes, extracurricular and summer activities, and jobs.

Time to implement: A driver education course requires at least a year to plan and implement.

2.2 Post-licensure or Second-tier Driver Education

Effectiveness: Unknown	Use: Low	Cost: High	Time: Long

As discussed in Chapter 6, Section 2.1, standard pre-licensure driver education leads to earlier licensure but does not reduce crash rates. Based on this conclusion, recent driver education research has sought to develop post-licensure driver education curricula and to integrate driver education with GDL (Smith, 1994). These "second-tier" post-licensure courses teach safety-related information, building on the on-road experience that the students have acquired in their initial months of driving. They should not be confused with "advanced driving performance" courses that teach driving skills such as panic braking, skid control, and evasive lane-changing maneuvers.

Previous post-licensure driver education courses were remedial, directed at drivers who had accumulated enough violations or crashes to warrant some attention. For this audience, driver education had no effect (Ker et al., 2005, 2006).

Initiatives in Australia and Europe may provide insight on potential approaches for post-license training for beginning drivers (Senserrick, 2007; Twisk & Stacey, 2007). Christie and colleagues have developed a model "best practice" curriculum for intermediate license drivers with at least six months of driving experience in Australia (Christie, Harrison, & Johnston, 2004). The 8-hour curriculum consists of eight modular sessions with a mentor or coach, including one-on-one driving and discussion, group observation and discussion of driving behavior, and telephone follow-up. A trial involving 14,000 intermediate drivers in New South Wales and Victoria, funded by a consortium of government bodies, insurers, industry groups, and automobile clubs, began in 2005.

NHTSA is conducting a feasibility study in anticipation of a major evaluation of the benefits of an integrated driver education and GDL program (Hedlund & Compton, 2005).

Use: Post-licensure driver education is still under development. Michigan is the only State in the U.S. that has adopted a two-stage system of driver education (Mayhew, 2007).

Effectiveness: Post-licensure driver education has not yet been evaluated.

Costs: If a post-licensure driver education program proves to be effective, it likely will require substantial funds to implement.

Time to implement: Any course requires at least a year to plan and implement.

3.1 Parental Role in Teaching and Managing Young Drivers

Effectiveness: Uncertain	Use: Medium	Cost: Low	Time: Short

Most parents are heavily involved in teaching driving skills to their beginning teenage drivers and supervising their driving while they have a learner's permit. Parents are in the best position to enforce GDL restrictions for intermediate drivers, and many parents impose additional driving restrictions on their teenagers. Parents strongly support GDL; however, many parents do not understand the dangers of high-risk situations, such as driving with teenage passengers. Parents could use guidance and assistance in teaching and managing their teenage drivers (Hedlund et al., 2003; NCHRP, under review, Strategies C1-C4). Simons-Morton and Ouimet (2006) summarize the research on parent involvement in teen driving.

Several programs to assist parents and beginning drivers have been developed recently. Five examples follow. Only two, *Checkpoints* and *The Novice Driver's Road Map*, have been evaluated.

The central feature of the *Checkpoints* program, developed by Simons-Morton and colleagues at the National Institute of Child Health and Human Development, is a written agreement that parents and teens sign. The agreement limits teens' driving under various higher-risk situations, such as driving at night, with other teens in the car, or in bad weather. A supporting video and periodic newsletter explain the risks that new drivers face and reinforce the need for parents to limit their newly licensed teens' driving under these risky conditions (Simons-Morton & Hartos, 2003).

Driving Skills for Life, developed by Ford and GHSA, emphasizes four skills: hazard recognition, vehicle handling, space management, and speed management (Ford and GHSA, 2003). The program's educational kit includes a video, guide, and brochure, and the Web site contains online learning material and parental tips and coaching guide. It has been sent to every public high school in the United States and the materials have reached an estimated 4 million teenagers and their parents.

Road Ready Teens, developed by DaimlerChrysler together with AAA, MADD, and the National Safety Council, provides a parent's guide, a parent-teen contract, and a video game and Road Ready Reality Check quiz for teens (DaimlerChrysler, 2003).

The National Safety Council released its 68-page book, *Teen Driver: A Family Guide to Teen Driver Safety,* in 2004 (NSC, 2004). The book provides information and advice to parents and teens on crash risks, how to develop a family plan and written agreement for beginning drivers, and GDL components and restrictions.

Finally, *The Novice Driver's Road Map*, produced by the Network of Employers for Traffic Safety, describes eight driving situations of increasing difficulty, from driving in an empty parking lot to driving at night and in inclement weather. Parents complete a checklist when practice has been obtained in each driving situation. *The Road Map* also includes a brief insert, called *The Coach's Gamebook*, with advice for parents of beginning drivers and a parent-teen driving contract.

Use: Checkpoints is still being tested and has not been released to the general public. *Teen Driver* and *The Road Map* can be provided to individual families upon request. *Driving Skills for Life* and *Road Ready Teens* are available on the Web.

Effectiveness: Results from testing in several States show that the *Checkpoints* program produces modest increases in parents' restrictions on teen driving (Simons-Morton & Hartos, 2003; Simons-Morton, Hartos, Leaf, & Preusser, 2005). However, a recent study in Connecticut found no differences in violations or crashes for families who participated in the *Checkpoints* program when compared with families who did not participate in the program (Simons-Morton, Hartos, Leaf & Preusser, 2006).

With *The Road Map*, two separate evaluations found the materials had little effect on parents. In each study, *The Road Map* was provided to parents of teens who had just received their learner's permits. Although parents said that the information was helpful, they used the guidance materials in only a general way. The information had no effect on the amount or type of supervised driving during the learner's stage or on parental restrictions on driving after licensure (Chaudhary, Ferguson, & Herbel , 2004; Goodwin, Waller, Foss, & Margolis, 2006).

Although evaluations of programs to assist parents have not yet shown reductions in young driver crashes, there is still reason to be optimistic. Programs such as *Checkpoints* have increased parent limit setting, and several studies show that teenagers whose parents impose more strict driving limits report fewer risky driving behaviors, traffic violations and crashes (see Simons-Morton, 2007, for a review). Educational programs alone are unlikely to produce changes in behavior. However, education in combination with other strategies may deliver stronger results.

Costs: *Driving Skills for Life* and *Road Ready Teens* are available on the Web at no cost. *Teen Driver* and *The Road Map* are available to parents and teenagers at minimal cost.

Time to implement: The Checkpoints program has not been released for use by the general public. The other four programs are available immediately.

4.1 Enforcement of GDL and Zero-Tolerance Laws

Effectiveness: Likely	Use: Unknown	Cost: Medium	Time: Short

Two traffic laws apply only to young drivers: GDL laws and zero-tolerance laws that set a maximum BAC of .02 or less for drivers under the age of 21. As discussed in Chapter 1, Section 6.2, zero-tolerance laws are not actively publicized or enforced. It's likely that increased publicity and enforcement would reduce teenage drinking and driving.

GDL laws, discussed in Chapter 6, Sections 1.1-1.7, also appear not to be enforced vigorously. Some GDL provisions such as nighttime driving restrictions are inherently difficult to enforce because violations are difficult to detect (Hedlund et al, 2003). A recent study in one State found that intermediate license drivers and their parents were quite aware of their GDL law's nighttime and passenger restrictions. Both restrictions were violated, though not frequently. Teenagers expressed little concern regarding GDL enforcement. Although surveys of law enforcement officers found that most were supportive of GDL, officers were not familiar with GDL details and considered GDL enforcement a low priority (Goodwin & Foss, 2004).

Parents are in the best position to enforce GDL requirements (Chapter 6, Section 3.1). However, some law enforcement support for GDL nighttime driving and teenage passenger restrictions may be useful to emphasize that the requirements are serious. GDL law violations are penalized by driver license actions, such as suspension or revocation of the learner's permit or intermediate license or an extension of the time before full licensure. This means that they can be applied administratively and do not involve criminal court proceedings. As noted in Chapter 1, Section 6.2, administrative penalties for zero-tolerance laws are far easier to enforce than criminal penalties.

Use: The amount of enforcement of zero-tolerance and GDL laws is unknown but probably is low.

Effectiveness: Zero-tolerance law publicity and enforcement likely will reduce teenage drinking and driving, as discussed in Chapter 1, Section 6.2. Similarly, high-visibility enforcement of GDL provisions should encourage compliance with nighttime and passenger restrictions. A recent study investigated whether well-publicized enforcement, including checkpoints near high schools, could increase compliance with seat belt laws and GDL provisions. The study found only modest increases in seat belt use and compliance with the GDL passenger restriction, although levels of compliance prior to the enforcement efforts were already high (Goodwin, Wells, Foss & Williams, 2006).

Costs: See Chapter 1, Section 6.2, for zero-tolerance law enforcement strategies and costs. GDL law enforcement costs will depend on how the enforcement is conducted. Enforcement through regular patrols will require moderate costs for training. Special patrols or checkpoints will require additional staff time. All enforcement will require good publicity to both teens and parents. Publicity to teens can be delivered through high schools, colleges, recreational venues attended by youth, and media directed to youth.

Time to implement: Enforcement programs can be implemented within three or four months, as soon as appropriate training, publicity, and equipment are in place.

Other issues:

- **Compliance with restrictions:** Several studies have shown that teenagers do not always comply with GDL restrictions (Goodwin & Foss, 2004; Williams, Nelson & Leaf, 2002). To the extent that teens do not adhere to restrictions, the effectiveness of GDL may be reduced. It should be noted, however, that GDL has been shown to be effective even in the absence of police enforcement. For example, focus groups with parents and teen drivers conducted in California, Massachusetts, and Virginia revealed that passenger restrictions were frequently violated in all three states, but even incomplete adherence to the restrictions had a positive impact on teen driver crashes (Chaudhary, Williams, & Nissen, in press). In general, compliance with restrictions will be higher in States that have well-designed GDL systems with restrictions that are considered reasonable by parents and teens (Foss & Goodwin, 2003).

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7. Older Drivers

Overview

In 2006, almost 15 percent of licensed drivers in the United States were at least 65 years old. By 2030 this proportion will rise to at least 20 percent. As drivers age, their physical and mental abilities, driving behaviors, and crash risks all change, though age itself does not determine driving performance. Many features of the current system of roads, traffic signals and controls, laws, licensing practices, and vehicles were not designed to accommodate older drivers. Older Americans are increasingly dependent on driving to maintain their mobility, independence, and health. The challenge is to balance mobility for older drivers with safety for all road users.

Trends. From 1982 to 2005, the proportion of older licensed drivers (65 and above) rose from 11.2 percent to 14.6 percent while the proportion of older drivers in fatal crashes rose slightly more rapidly, from 7.0 percent to 10.7 percent.

People 65 and older; number and proportion of total populations

65 & up	Resident Population		Licensed Drive		Drivers in Fatal Crashes	
Year	Million	Percent	Million	Percent	Million	Percent
1982	26.8	11.6 %	16.8	11.2 %	3,864	7.0 %
2005	37.3	12.5 %	29.3	14.6 %	6,215	10.5 %
2030	71.4*	19.1 %*	57- 61**	> 20 %**	-	-

Resident population: U.S. Census Bureau (2007)
Licensed drivers: FHWA Highway Statistics (1995, 2006)
Fatal crashes: NHTSA Traffic Safety Facts (2006)

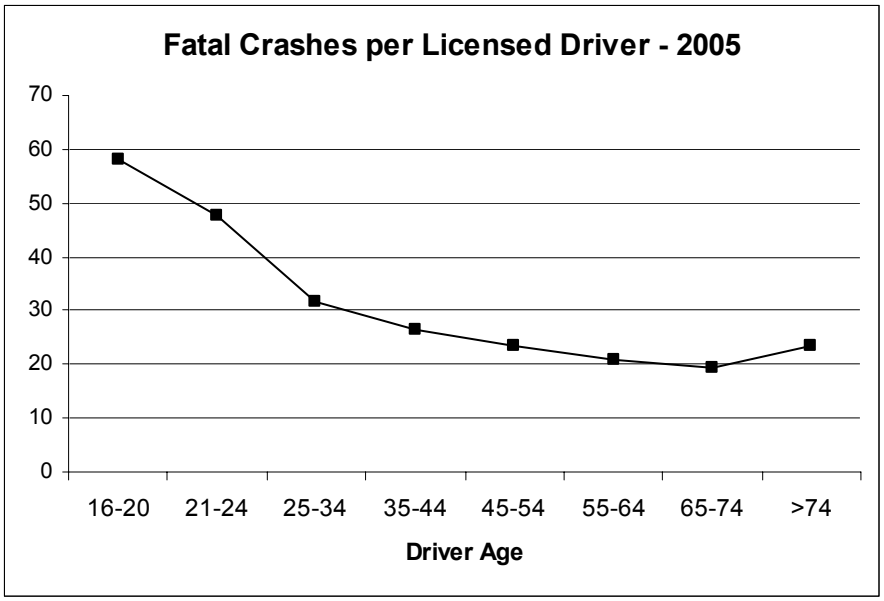
* estimated
** see discussion

By 2030, the Census Bureau estimates that the resident population over age 65 will double, to over 71 million, and will comprise 19.1 percent of the total population. The licensed driver population likely will grow even faster. The proportion of people over age 65 who held a driver's license rose from 63 percent in 1982 to 78 percent in 2005. If the licensure rate rises only to 80 percent, by 2030 there will be twice as many older drivers in the United States as there are today – as many as 57 million licensed drivers 65 and older. Currently 91 percent of people 65 to 69 are licensed, as are 87 percent of people 70 to 74. The licensure rate probably will increase because tomorrow's older people likely will be healthier and more accustomed to driving than today's. By 2030, if 85 percent of older people are licensed there will be 61 million licensed drivers at least 65 years old.

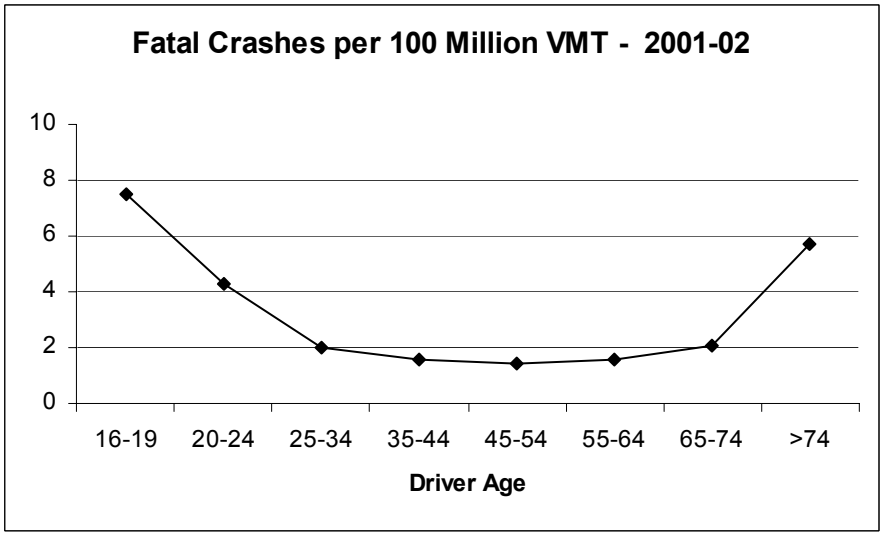
Older driver characteristics. Certain changes are inevitable as drivers age (National Cooperative Highway Research Program [NCHRP], 2004, Section III).

- Physical capabilities diminish. Hearing, muscle tone, reaction time, and vision (especially at night) all decline, though at very different rates for different people.
- Fragility increases. The same force produces more serious injuries to a 70-year-old than to a 20-year-old. Injuries take longer to heal.

- Older drivers use more medications, which may be necessary to control disease or health conditions but which also may cause drowsiness or otherwise affect driving. Older drivers are less likely than younger people to drive after drinking or using recreational drugs.
- Older drivers rarely drive aggressively or speed. But they may exhibit other risky behaviors such as driving more slowly than prevailing traffic or not accurately judging the speed of an oncoming vehicle while making a left turn.
- Most older drivers reduce their driving mileage as their lifestyles change. Many older drivers recognize and voluntarily avoid driving in situations in which they feel uncomfortable, such as at night, on high-speed roads, or in unfamiliar situations (Staplin & Lococo, 2003).



Fatal crashes per 100,000 drivers
Source: Traffic Safety Facts (NHTSA, 2006)



Source: Insurance Institute for Highway Safety [IIHS] (2005)

These characteristics produce the following results.

- The older driver crash rate per licensed driver is *lower* than for younger drivers.
- Because older drivers are more fragile, a crash is more likely to produce a serious injury or fatality than for younger drivers. Thus the *fatal* crash rate per licensed driver *increases* for the oldest drivers.
- And because older drivers drive fewer miles annually than younger drivers, their fatal crash rate *per mile traveled* is *higher* than for all but the youngest drivers.

Strategies to Reduce Crashes and Injuries Involving Older Drivers

The overall goal is to enable older drivers to retain as much mobility through driving as is consistent with safety on the road for themselves, their passengers, and other road users. "Safe mobility for life" is the phrase used in the U.S. Department of Transportation's plan (USDOT, 2003). Four behavioral strategies address this goal.

- Educate and train older drivers to assess their driving capabilities and limitations, improve their skills when possible, and voluntarily limit their driving to circumstances in which they can drive safely. This can be accomplished through formal courses or through communications and outreach provided directly to older drivers or to families, friends, and organizations that deal regularly with older drivers.
- Help drivers adapt to medical or functional conditions that may affect driving, through treatment (such as eyeglasses or cataract surgery to improve vision) or through vehicle adaptations (such as extra mirrors, extended gear shift levers, or hand controls).
- Identify older drivers who cannot drive safely, in certain situations or at all, and restrict or revoke their driver's licenses. This involves two steps:
    - Bring these drivers to the attention of the motor vehicle department through license renewal procedures or through referral from law enforcement, physicians, family, or friends.
    - At the motor vehicle department, assess their driving abilities and take appropriate action to re-issue an unrestricted license, issue a restricted license, or revoke the license.
- Increase seat belt use, because seat belts are even more effective for older than for younger occupants.

Vehicular, environmental, and societal strategies are critical to provide safety and mobility for older people. Vehicles can be designed with better crash protection for older and more easily injured occupants, with controls and displays that are easier to see and understand, and with crash warning and crash avoidance technology. These measures will make vehicles safer for everyone, not just older people. Aftermarket vehicle devices such as one-hand joystick driving controls can make driving possible or easier for people with some physical limitations. Roadways with separate left turn lanes, protected left turn signal phases, larger and more-visible signage, more-visible lane markings, rumble strips, and a host of other measures will assist all drivers. These subjects are not discussed in this guide because they do not fall under direct SHSO jurisdiction.

Of all the problem areas in this guide, older drivers are perhaps the most complex because they involve so many issues beyond traffic safety. Sooner or later, in the interest of safety, most older

drivers must restrict or eliminate driving. Frequently, this has substantial effects on the older driver's mobility and on physical and mental health. State Highway Safety Offices [SHSOs] and licensing agencies cannot act alone but must plan and implement their older driver policies and programs as part of integrated community activities to improve older people' safety, mobility, and health. As just one example, some communities have established referral centers where people can go for "one-stop" access to resources for addressing the full range of transportation safety and mobility issues, including driving skills assessment, educational courses, licensing regulations and practices, and public transportation. See Stutts (2005) for summaries of comprehensive programs for older drivers in six States.

Several recent studies and policy papers discuss these issues. See in particular the Department of Transportation's *Safe Mobility for a Maturing Society: Challenges and Opportunities* (USDOT, 2003) and NCHRP's *Guide for Addressing Collisions Involving Older Drivers* (NCHRP, 2004) for excellent summaries and references to further information. The Organisation for Economic Co-Operation and Development's [OECD's] *Ageing and Transport: Mobility Needs and Safety Issues* (OECD, 2001) presents a discussion from an international perspective. The NCHRP synthesis *Improving the Safety of Older Road Users* (Stutts, 2005) summarizes State activities as of 2005.

Key terms

- AAA: formerly the American Automobile Association; the organization now uses only the initials
- AAMVA: American Association of Motor Vehicle Administrators
- AARP: formerly the American Association of Retired Persons; the organization now uses only the initials
- AMA: American Medical Association
- ASA: American Society on Aging
- Older driver: a driver at least 65 years old

Countermeasures That Work

Countermeasures to improve older driver safety are listed below and discussed individually in this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information.

1. Communications and Outreach

Countermeasure	Effectiveness	Use	Cost	Time
1.1 Formal courses for older drivers	Uncertain	Low	Low	Short
1.2 General communications and education	Uncertain	Unknown	Low	Short

2. Licensing

Countermeasure	Effectiveness	Use	Cost	Time
2.1 License renewal policies	Unknown	Medium	High	Medium
2.2 Referring older drivers to DMVs	Proven	Low	Medium	Medium
2.3 License screening and testing	Proven	High*	Medium	Medium
2.4 Medical advisory boards	Unknown	High*	Varies	Medium
2.5 License restrictions	Likely	Unknown	Low	Short

* Quality varies considerably

3. Traffic Law Enforcement

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Law enforcement roles	Likely	Medium	Varies	Varies

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results.
Likely: balance of evidence from high-quality evaluations or other sources.
Uncertain: limited and perhaps ambiguous evidence.
Unknown: no high-quality evaluation evidence.
Varies: different methods of implementing this countermeasure produce different results.

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise.
See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities.
Medium: between one-third and two-thirds of States or communities.
Low: fewer than one-third of the States or communities.
Unknown: data not available.

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources.

Medium: requires some additional staff time, equipment, facilities, and/or publicity.

Low: can be implemented with current staff, perhaps with training; limited costs for equipment or facilities.

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year.

Medium: more than three months but less than one year.

Short: three months or less.

These estimates do not include the time required to enact legislation or establish policies.

1.1 Formal Courses for Older Drivers

Effectiveness: Uncertain	Use: Low	Cost: Low	Time: Short

Formal courses specifically for older drivers are offered by organizations including AAA, AARP, and the National Safety Council (NSC), either independently or under accreditation by States (NCHRP, 2004, Strategy D2; Stutts, 2005, Table 12). AARP's Driver Safety Program, formerly called "55-Alive," is the oldest and largest. It has been conducted since 1979 and is offered both in the classroom and online (AARP, 2006). The courses typically involve 6 to 10 hours of classroom training in basic safe driving practices and in how to adjust driving to accommodate age-related cognitive and physical changes. In 2006, 34 States and the District of Columbia mandated automobile insurance discounts for graduates of accredited courses (AARP, 2006).

Courses combining classroom and on-the-road instruction have been offered recently in a few locations (NCHRP, 2004, Strategy D2).

Use: Courses are taught in all States but reach only a small fraction of older drivers. For example, AARP reported that it conducted almost 34,000 classes in 2003 for 700,000 drivers, approximately 2.4 percent of the licensed drivers 65 and older (AARP, 2005).

Effectiveness: AARP course graduates report that they changed some driving behaviors as a result of the course (AARP, 2005). However, none of the courses has been shown to reduce crashes (NCHRP, 2004, Strategy D2). NHTSA's Older Road User Research Plan includes the high-priority research problem statement, "Do assessment and retraining programs improve driving?" (Raymond, Knobauch, & Nitzburg, 2001, Table 1). The most thorough evaluation studied approximately 200,000 course graduates and a 360,000-driver comparison group in California from 1988 to 1992. It found that course graduates had fewer citations but no fewer crashes than non-graduates (Janke, 1994; NCHRP, 2004, Strategy D2). AARP also concluded that its course reduces citations but has not been shown to reduce crashes (AARP, 2005).

A study conducted in 2004 evaluated the effects of a well-designed three-hour educational course promoting safe driving strategies for older drivers with some visual defects. Course graduates reported that they regulated their driving more following the course than a control group that did not attend the course. There was no significant difference in crash rates between course graduates and the control group (Owsley, McGwin, Phillips, McNeal, & Stalvey, 2004).

A recent study involving a systematic review of studies evaluating the effectiveness of driver retraining programs (Kua, Korner-Bitensky, Desrosiers, Man-Song-Hing, & Marshall, 2007) reached a similar conclusion as did Owsley et al, (2004). These researchers reported that while there is moderate evidence that educational interventions improve driving awareness and behavior, these interventions do not reduce crashes in older drivers. Regardless, the authors felt that the evidence regarding the effectiveness of retraining aimed at older drivers is encouraging enough warrant further research.

Costs: Courses typically charge a small fee, which may be offset by insurance discounts available to graduates.

Time to implement: Courses are offered regularly by AAA, AARP, NSC, and other organizations.

1.2 General Communications and Education

Effectiveness: Uncertain	Use: Unknown	Cost: Low	Time: Short

Many organizations offer educational material for older drivers to inform them of driving risks, help them assess their driving knowledge and capabilities, suggest methods to adapt to and compensate for changing capabilities, and guide them in restricting their driving in more risky situations (NCHRP, 2004, Strategy D2).

Self-assessment tools include:

- AAA's *Roadwise Review*, a CD-ROM and instruction booklet;
- AARP's *Older Driver Skill Assessment and Resource Guide*;
- American Medical Association's [AMA's] *Am I a Safe Driver?* one-page checklist; and
- University of Michigan's *Driving Decisions Workbook*.

See Stutts (2005) for brief descriptions and Web links.

Other programs and materials include:

- *Drive Well*, a joint program of American Society on Aging [ASA] and NHTSA;
- *Getting Around*, from Emergency Nurses CARE, on safe driving decisions, pedestrian safety, and safe medication use; and
- Information from NHTSA and many State motor vehicle offices on general issues of older drivers or specific topics such as driving with glaucoma or arthritis.

See NCHRP (2004, Strategy D2) and Stutts (2005) for examples, brief descriptions, and Web links.

Other materials are available to assist drivers and family members in understanding how aging affects driving, the effects of medications and health conditions, how to assess an older driver's skills, how to use specialized vehicle equipment to adapt to certain physical limitations, how to guide older drivers into voluntarily restricting their driving, and how to report older drivers to the department of motor vehicles if necessary (Stutts, 2005). Examples include:

- AAA's *How to Help an Older Driver*;
- AARP's *At the Crossroads: A Guide to Alzheimer's Disease, Dementia and Driving*;
- The Association for Driver Rehabilitation Specialists' series of fact sheets on issues such as driving after a stroke, driving with rheumatoid arthritis, and driving after a limb amputation; and
- New York State Office for the Aging's *When You Are Concerned: A handbook for families, friends and caregivers worried about the safety of an aging driver*.
- NHTSA's series of fact sheets and more detailed information for older drivers and their families and friends, available from NHTSA's older driver program Web site www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.31176b9b03647a189ca8e410dba046a0/.

Use: Data are not available on how frequently these programs or materials are used.

Effectiveness: The limited information available suggests that some materials may increase driver's knowledge. There are no evaluations of the effects of these materials on driving or on crashes (NCHRP, 2004, Strategy D2). As discussed in Chapter 7, Section 1.1, none of the more

structured formal courses has been shown to reduce crashes. NHTSA's Older Road User Research Plan includes the high-priority research problem statement, "Do assessment and retraining programs improve driving?" (Raymond et al., 2001).

Costs: Funds are required for producing and distributing materials.

Time to implement: Materials and programs are available and ready for use.

Other issues:

- **Seat belt use:** Seat belts are even more effective in preventing injuries and fatalities to older than to younger occupants (NCHRP, 2004, Strategy E1). While belt use among older occupants is comparable to that of younger occupants - 81 percent for occupants 70 and older in 2003, compared to 80 percent for occupants 25 to 69 (Glassbrenner, 2004, Table 5) - the fact remains that one-fifth of older occupants are unbelted. Communications and outreach on the benefits of seat belt use may be more effective with older occupants than with younger because they may be more attentive to health and safety issues. For example, signs urging seat belt use increased belt use substantially in six senior communities compared to controls, and use remained higher after four years (C. D. Cox, B. S. Cox, & D. J. Cox, 2005). No other State or local seat belt use efforts directed at older occupants have been identified (NCHRP, 2004, Strategy E1).

2.1 License Renewal Policies: In-Person Renewal, Vision Test

Effectiveness: Unknown	Use: Medium	Cost: High	Time: Medium

Driver's licenses in most States are valid for four to six years, longer in a few States. To renew an expiring license, drivers in many States must appear in person, pay the license fee, and have new pictures taken for their licenses. A few States require a vision test for license renewal. Some States allow all drivers to renew by mail or electronically.

More than half the States change license renewal requirements for drivers older than a specified age, typically 65 or 70. These changes may include a shorter interval between renewals, in-person renewal (no renewal by mail or electronically), or a vision test at every renewal. A very few States require written or road tests for some older renewal applicants. AAA (2006), IIHS (2006), and Stutts (2005, Chapter 5) summarize these requirements. NHTSA (2003b, Chapter 8) and Staplin and Lococo (2003, Appendix B) provide more detail on the requirements in effect in 2001.

License examiners report that the driver's appearance at the motor vehicle office is the single most important criterion for identifying a person of any age whose driving skills may be impaired (NCHRP, 2004, Strategy C2). This observation is supported by Morrisey and Grabowski (2005), who found that in-person license renewal reduced traffic fatalities among the oldest drivers. Frequent in-person renewals and vision tests may be more useful for older drivers than for younger drivers because their abilities may change more quickly. AAMVA recommends that all drivers renew licenses in person and pass a vision test at least every four years (Staplin & Lococo, 2003; Stutts, 2005). Very few States meet these recommendations for all drivers. As of 2001, about one-fourth of the States met them for drivers over some specified age (Staplin & Lococo, 2003). In-person renewals would be even more useful, for drivers of all ages, if they included functional ability tests as recommended in the NHTSA-AAMVA *Model Driver Screening and Evaluation Program Guidelines for Motor Vehicle Administrators* (Staplin & Lococo, 2003) (see Chapter 7, Section 2.3).

Use: At least 30 States and the District of Columbia have different license renewal requirements for older than for younger drivers (AAA, 2006; IIHS, 2006). These include 15 States with a shorter interval between renewals, 7 that require in-person renewals, and nine plus the District of Columbia that require vision tests at renewal. On the other hand, Oklahoma and Tennessee reduce or waive licensing fees for older drivers and Tennessee driver's licenses issued to people 65 or older do not expire. In 2001, about 12 States met the American Association of Motor Vehicle Administrators [AAMVA] recommendations of in-person renewal, with a vision test, at least every four years for all drivers over some specified age (Staplin & Lococo, 2003).

Effectiveness: License examiners report that in-person renewals and vision tests are effective in identifying people whose driving skills may be impaired (NCHRP, 2004, Strategy C2). No data are available on the number of potentially impaired drivers identified through these practices or on the effects of more frequent renewals and vision tests on crashes.

Costs: More-frequent license renewals or additional testing at renewal impose direct costs on driver licensing agencies. For example, a State that reduces the renewal time from 6 years to 3

years for drivers 65 and older would approximately double the licensing agency workload associated with these drivers. If 15 percent of licensed drivers in the State are 65 and older, then the agency's overall workload would increase by about 15 percent to process the renewals. If more frequent renewals and vision tests identify more drivers who require additional screening and assessment, then additional costs are imposed. See Chapter 7, Section 2.3, for additional discussion.

Time to implement: A vision test requirement for renewal or a change in the renewal interval can be implemented within months. The new requirements will not apply to all drivers for several years, until all currently valid licenses have expired and drivers appear at the driver licensing agency for licensing renewal.

Other issues:

- **Age discrimination:** A few States explicitly provide that age alone is not a justification for reexamining a driver's qualifications (AAA, 2006; IIHS, 2006). These States have the same license renewal interval for all drivers.
- **Road tests and medical reports:** Several Australian States require a medical report, a road test, or both for drivers over a specified age to renew their licenses. Langford, Fitzharris, Koppell, and Newstead (2004) compared States with and without these requirements. They found that States with these requirements had higher older-driver crash rates than States without them. They conclude that there are "no demonstrable road safety benefits" to requiring medical reports or road tests for older drivers.

2.2 Referring Older Drivers to Licensing Agencies

Effectiveness: Proven	Use: Low	Cost: Medium	Time: Medium

Older drivers come to the attention of licensing agencies at regular license renewals, as discussed in Chapter 7, Section 2.1, or when they are referred to the licensing agency for reevaluation of their driving skills.

Licensing agencies in all States accept reevaluation referrals for drivers of any age. A survey of all State licensing agencies found that 85 percent of referrals came from three sources: 37 percent from law enforcement, 35 percent from physicians and other medical professionals, and 13 percent from family and friends (Stutts, 2005). The remaining 15 percent came from crash and violation record checks, courts, self-reports, and other sources.

Law enforcement officers have the opportunity to observe drivers directly at traffic stops or crashes. With appropriate training they can identify many drivers who should be referred to the licensing agency for assessment. NHTSA has developed and field-tested a set of cues that officers can use to identify potentially impaired drivers (NHTSA, 1998; see also NCHRP, 2004, Strategy C3 and Stutts, 2005, Chapter 7).

Physicians are in an excellent position to assess if changes in their patients' physical or cognitive abilities may increase their crash risk. In addition to assessment, physicians should provide counseling and assistance on driving as needed and refer patients to the licensing agency if appropriate. In 6 States, physicians are required to report patients who have specific medical conditions such as epilepsy or dementia (NCHRP, 2004, Strategy C3). Other States require physicians to report "unsafe" drivers, with varying guidelines for defining "unsafe." Physicians must balance their legal and ethical responsibilities to protect their patient's physical and mental health and their patient confidentiality obligations with their duty to protect the general public from unsafe drivers. Physicians have been held liable for damages from crashes involving patients whom they failed to advise of medical conditions that may affect their driving or failed to report to the licensing agency (NHTSA, 2003b, Chapter 7).

NHTSA's *Physician's Guide to Assessing and Counseling Older Drivers* (NHTSA, 2003b), prepared in cooperation with the AMA, provides detailed information for physicians and medical professionals. Chapter 8 has an extensive summary of State licensing and reporting laws. Chapter 9 contains a list of medical conditions and medications that may impair driving and consensus recommendations on what action to take for each. Other chapters include information on treatment and rehabilitation options that may allow patients to continue to drive and on how to counsel patients about retiring from driving. See also Lococo (2003, Appendix C) for State-level information and NCHRP (2004, Strategy C3) for overall discussion.

Many States have established procedures for family members and friends to report drivers of any age whose abilities may be impaired. NCHRP (2004, Strategy C3) provides examples and Web links for programs in Florida, Missouri, Minnesota, and Oregon.

States can increase driver referrals by establishing and publicizing procedures for referring drivers, establishing referral policies and providing appropriate training and materials to law en-

forcement officers, and informing physicians and health professionals of their responsibilities. National Committee on Uniform Traffic Laws and Ordinances [NCUTLO's] model law on reporting drivers with a physical or mental disability (NCUTLO, 2005) describes the responsibilities of health care providers and of State Medical Advisory Boards, driver licensing agencies, and license examiners.

Use: A survey of all State licensing agencies found that fewer than 100,000 drivers 65 and older are referred each year from all sources, or fewer than 0.4 percent of the 28.6 million older licensed drivers (Stutts, 2005, Appendix E). The number of referrals varies substantially across the States, from a few hundred to 50,000.

Effectiveness: States that establish and publicize effective referral procedures will increase referrals. NCHRP (2004, Strategy C3) provides examples and Web links. As one example, Pennsylvania increased physician referrals substantially by sending letters to all physicians (NCHRP, 2004, Strategy C3).

Costs: Costs for establishing and publicizing effective referral procedures vary depending on the procedures adopted, but should not be extensive. Educational and training materials are available for use with law enforcement and medical professionals. Funds will be required to distribute these materials and for general communications and outreach. If referrals increase substantially, then licensing agency administrative costs will increase.

Time to implement: States seeking to improve referrals will require at least six months to develop, implement, and publicize new policies and procedures.

2.3 License Screening and Testing

Effectiveness: Proven	Use: High*	Cost: Medium	Time: Medium

* Quality varies considerably

State licensing agencies vary considerably in their procedures for screening and evaluating a driver's abilities and skills (NCHRP, 2004, Strategy C2). Many State guidelines are outdated, incomplete, or not based on actual functional impairment. Most do not include all the recommendations on medical conditions from the recent *Physician's Guide* (NHTSA, 2003b).

NHTSA and AAMVA have developed *Model Driver Screening and Evaluation Program Guidelines for Motor Vehicle Administrators* (Staplin & Lococo, 2003). This was the final stage in a research program that investigated the relationships between functional impairment and driving skills; methods to screen for functional impairment; and the cost, time, legal, ethical, and policy implications of the guidelines (Staplin, Lococo, Gish, & Decina, 2003a).

The *Model Driver Guidelines'* goal is to keep drivers on the road as long as they are safe, through early identification and assessment together with counseling, remediation, and license restriction when needed (Staplin & Lococo, 2003). The guidelines outline a complete process of driver referral, screening, assessment, counseling, and licensing action (Staplin & Lococo, 2003). They include nine simple visual inspection tests that licensing agency personnel can administer to screen for functional ability (Staplin & Lococo, 2003). A survey of State motor vehicle departments outlines some of the legal, policy, cost, and other criteria that must be met before the guidelines could be implemented in some States (Staplin and Lococo, 2003, Appendix C). The guidelines were tested in Maryland (Staplin, Lococo, Gish, & Decina, 2003b).

Use: All States screen and test drivers referred to them, though their procedures and criteria vary considerably (NCHRP, 2004, Strategy C2). No State appears to have implemented the model guidelines. U.S. DOT recommends that further testing and evaluation of the guidelines are needed (USDOT, 2003).

Effectiveness: There is substantial evidence that State screening and assessment programs identify some drivers who should not be driving at all or whose driving should be limited. The Maryland pilot test of the model guidelines concluded that "the analysis results ... have provided perhaps the best evidence to date that functional capacity screening, conducted quickly and efficiently, in diverse settings, can yield scientifically valid predictions about the risk of driving impairment experienced by older individuals" (Staplin et al., 2003b).

Costs: The model guideline functional screening tests can be administered for less than $5 per driver, including administrative and support service costs (Staplin, Lococo, Gish, & Decina, 2003a).

Time to implement: States should be able to modify their driver license screening and assessment procedures in four to six months.

2.4 Medical Advisory Boards

Effectiveness: Unknown	Use: High*	Cost: Varies	Time: Medium

* Quality varies considerably

Thirty-five States and the District of Columbia have medical advisory boards (MABs) to assist the licensing agencies in evaluating people with medical conditions or functional limitations that may affect their ability to drive (NCHRP, 2004, Strategy C1). MABs generally make policy recommendations on what licensing actions are appropriate for people with specific medical conditions or functional limitations. Most State MABs review individual cases, though this activity varies widely: 7 States reported that their MABs review 1,000 cases or more annually while another 7 review 10 or fewer cases (Lococo, 2003).

In 2003, NHTSA and AAMVA surveyed MAB practices in all States. Lococo (2003) contains the results: detailed documentation of how each State's medical review is organized; how drivers are identified, referred, screened, and assessed; and what licensing actions can be taken.

MABs should play a key role in each State as the link between health care professionals, licensing agencies, law enforcement, and the public. They should take the lead in defining how various medical conditions and functional impairments affect driving; defining medical assessment and oversight standards; improving awareness and training for healthcare providers, law enforcement, and the public; advising health care professionals how drivers can compensate for certain medical conditions or functional impairments; and reviewing individual cases. AAA has developed its list of best practices and recommendations for MABs based on the NHTSA-AAMVA study findings (AAA, 2004). NTSB has made similar recommendations (National Traffic Safety Board [NTSB], 2004). In June 2005, NHTSA released a summary of recommended strategies for MABs and national medical guidelines for driving, prepared in collaboration with AAMVA (Lococo & Staplin, 2005).

Use: 35 States and the District of Columbia have MABs, though some are inactive (NCHRP, 2004, Strategy C1).

Effectiveness: There are no studies evaluating the effects of MABs. Maryland's MAB reviewed over 500 individual cases in 2004 and recommended license suspension for about two-thirds of the cases (Soderstrom, personal communication, April 2005).

Costs: MABs are comprised of physicians and other health care professionals together with appropriate administrative staff. Costs will be minimal for an MAB whose activities are limited to policy recommendations. Costs for an MAB that evaluates individual cases will depend on the caseload.

Time to implement: States probably will need at least a year to establish and staff an MAB, depending on what duties the MAB undertakes. States likely can expand the functions of an existing MAB in six months.

2.5 License Restrictions

Effectiveness: Likely	Use: Unknown	Cost: Low	Time: Short

If a State licensing agency determines through screening, assessment, medical referrals, road tests, or other means that a driver poses excessive risks only in certain situations, the driver can be issued a restricted license. This process of "graduated de-licensing" preserves the driver's mobility while protecting the driver, passengers, and others on the road. Drivers whose vision is adequate during daylight hours but not at night present an obvious example. Their licenses can be restricted to daylight driving only. Other common restrictions limit driving to a specific geographical area, such as the town or county where the driver lives, or limit driving only to low-speed roads.

Iowa issues restricted licenses as part of its overall older driver program (Chaudhary, 2005). As an example, drivers referred to the licensing agency for retesting who feel uncomfortable taking a driving test in strange surroundings can arrange to be tested in their hometowns. If they pass the test, they will be issued a license restricted to that town. About 2 percent of older drivers' licenses in Iowa are restricted to daytime driving and another 2 percent to a limited geographic area.

Use: Iowa and Utah are known to issue restricted licenses (Chaudhary, 2005; Stutts, 2005; Vernon, Diller, Cook, Reading, & Dean, 2001). A survey of State licensing agencies found that two-thirds of the States said that restricted licenses would be feasible under current State policies, though two-thirds of these would require legislative changes before restricted licenses could be issued (Staplin & Lococo, 2003 C). The number of States that currently issue restricted licenses to older drivers is not known.

Effectiveness: Several studies show that driver license restrictions lower the crash risk for these drivers, though their crash risk is still higher than for similar-age drivers with unrestricted licenses (NCHRP, 2004, Strategy C2; Vernon et al., 2001).

Costs: Once drivers have been screened and assessed, the costs of issuing a restricted license are minimal.

Time to implement: Restricted licenses can be implemented as soon as any needed policy or legislation changes are enacted.

3.1 Law Enforcement Roles

Effectiveness: Likely	Use: Medium	Cost: Varies	Time: Varies

Law enforcement plays three overall roles in improving the safety of older drivers:

- Enforce traffic laws. In particular, active publicized enforcement of seat belt use laws can help increase belt use for older drivers and occupants. See Chapter 7, Section 1.2, for discussion.

- Identify drivers with potential driving impairments and refer them to licensing agencies. Traffic stops and crash investigations provide officers excellent opportunities to observe and evaluate driving behavior. See Chapter 7, Section 2.2, for discussion.

- Provide information and education. Law enforcement officers have formed many partnerships with public and private organizations to give talks, teach safe driving courses, work with media on news stories and public service announcements [PSAs], and other communications and outreach initiatives. Stutts (2005) summarizes several examples. NHTSA (2003a) lists law enforcement programs that were active in 2003. They include training for officers, training for older drivers, and community relations programs that promote safety.

NHTSA's Older Driver Law Enforcement Course is available through the Transportation Safety Institute (TSI). The four-hour course provides background on older driver issues and discusses traffic stops, referring older drivers to licensing agencies, and community outreach. The course will be available on NHTSA's older driver program Web site at www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.31176b9b03647a189ca8e410dba046a0/.

Use: NHTSA (2003a) describes older driver programs in 28 States.

Effectiveness: Enforcement activities, such as high-visibility seat belt law enforcement, probably affect older drivers even more than other drivers. Law enforcement provides more than one-third of all referrals to licensing agencies for driver screening and assessment (Chapter 7, Section 2.2).

Costs: Costs vary depending on the nature and scope of activities.

Time to implement: Implementation time varies depending on the nature and scope of activities.

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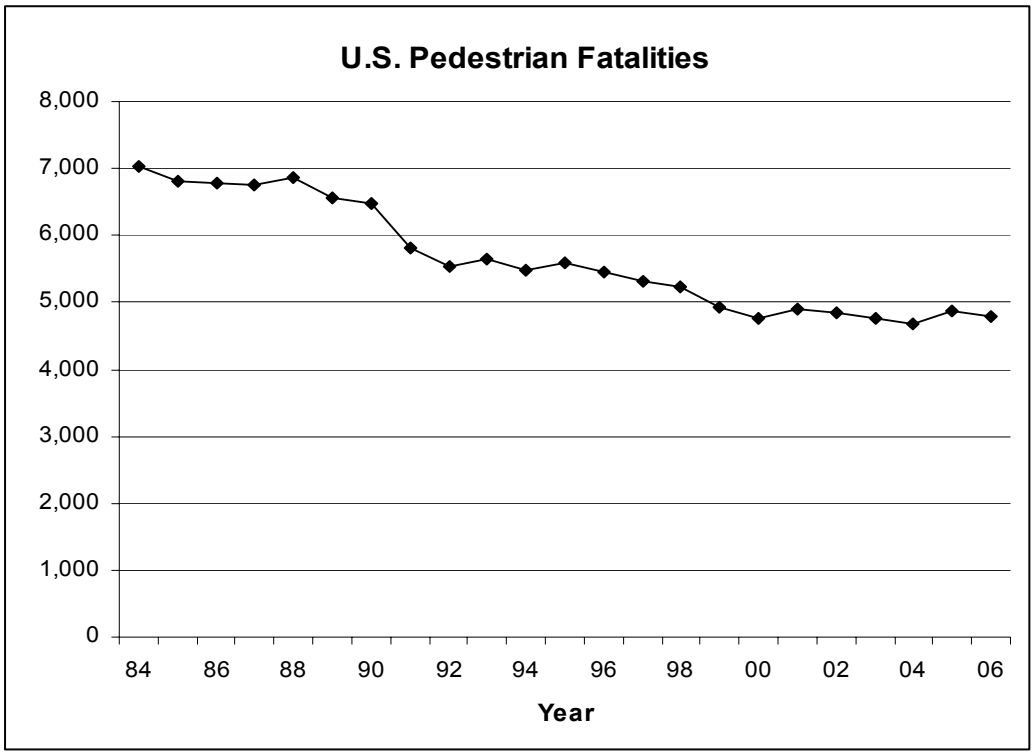
8. Pedestrians

Overview

In 2006, 4,784 pedestrians died and about 61,000 were injured in traffic crashes in the United States. Pedestrians accounted for 11 percent of total traffic fatalities and slightly more than two percent of total injuries (NHTSA, 2007). Of the pedestrian casualties:

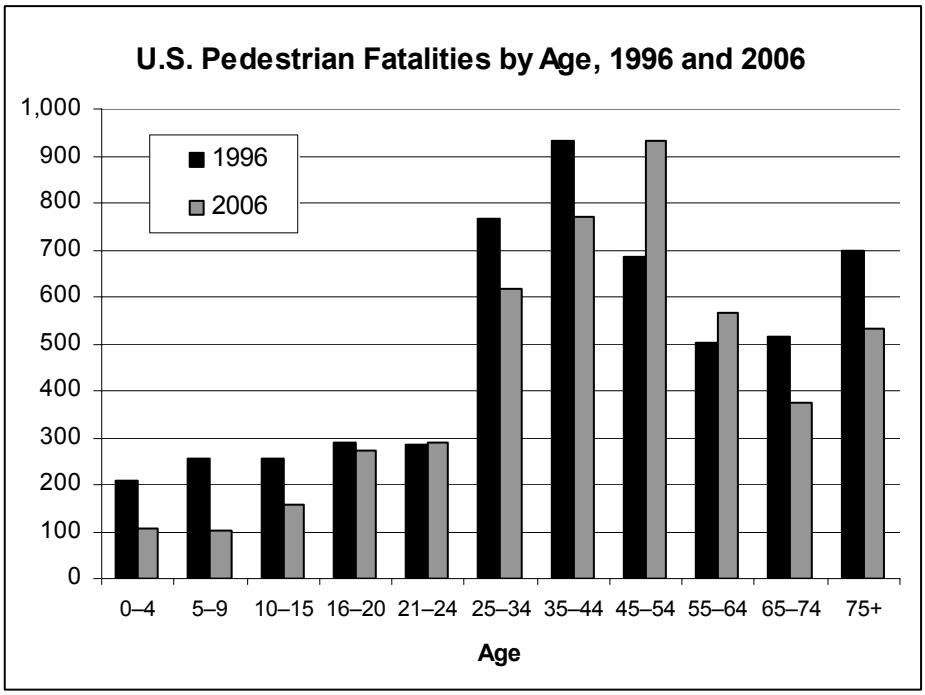
- 369 fatalities and 15,000 of the injured were children age 15 and younger;
- 966 fatalities and 6,000 of the injured were older adults age 65 and above;
- 1,642 of those fatally injured had a positive blood alcohol concentration (NHTSA, 2007).

Trends. Pedestrian fatalities have dropped gradually over the past 20 years from about 7,000 to less than 5,000 annually. The amount of walking appears to have decreased during the 1980s and then may have increased during the 1990s. Between 1980 and 1990, the percentage of commuting trips made by walking and bicycling dropped from 6.7 percent to 4.4 percent; the figure dropped again, to 3.3 percent, in 2000. However, commuting is reported to account for only about 15 percent of all trips. Total walking trips appear to have risen from 7.2 percent of all trips in 1990 to 8.7 percent in 2001 (Raborn, 2004), based on data from NHTSA's 1990 Nationwide Personal Transportation Survey (NPTS) and the 2001 successor National Household Travel Survey (NHTS), though the NPTS and NHTS surveys used somewhat different methodologies.



Source: FARS

The age distribution of pedestrian fatalities has changed over the last decade. From 1996 to 2006, pedestrian fatalities decreased for all ages except 45 to 64. In particular, child pedestrian fatalities (ages below 16) decreased 49 percent, from 722 to 369.



Source: FARS

Classifying crashes. Pedestrian crashes can be classified into types based on crash location and pedestrian and motor vehicle actions. In the early 1990s this methodology was used to classify more than 5,000 pedestrian crashes in California, Florida, Maryland, Minnesota, North Carolina, and Utah (Hunter, Stutts, Pein, & Cox, 1996, summarized in www.walkinginfo.org/pc/types.cfm). Of these pedestrian crashes:

- The largest major grouping was crashes occurring at or within 50 feet of an intersection, accounting for 32.2 percent of all crashes. Of these intersection crashes, 30 percent involved a turning vehicle; another 22 percent involved a pedestrian running across the intersection or darting out in front of a vehicle from a location where the pedestrian could not be seen, and 16 percent involved a driver violation.
- The second major grouping was crashes occurring in the middle of a block, accounting for 26.5 percent. In one-third of these, the pedestrian ran into the street and the driver's view was not obscured; one-sixth were "dart-outs" in which the pedestrian walked or ran into the street from a location where the pedestrian could not be seen.
- Only 7 percent of the crashes involved a pedestrian walking along a roadway not on a sidewalk. In three-quarters of these crashes the pedestrian was struck from behind while walking in the direction of traffic.

Different crash types at different locations can be addressed by different countermeasures. The crash typing methodology is available as the Pedestrian and Bicycle Crash Analysis Tool (PBCAT) software. States and communities can use PBCAT to analyze pedestrian crashes and

select countermeasures. PBCAT may be downloaded from www.walkinginfo.org/facts/pbcat/index.cfm.

An emerging issue likely to attract attention in future years is the increasing research establishing cell phone use as a source distraction for pedestrians. Nasar, Hecht, and Wener (2007) and Hatfield and Murphy (2007) indicate that talking on cell phones is associated with cognitive distraction that may undermine pedestrian safety. At the moment, however, no countermeasures to address this emerging issue have been evaluated.

Strategies to Increase Pedestrian Safety

Countermeasures in this Chapter are organized by pedestrian type:

- Young children;
- School-age children;
- Adults, including highway construction workers; and
- Alcohol-impaired pedestrians.

A final group contains countermeasures that may affect all pedestrians.

Basic countermeasure principles include reducing vehicle speed, which allows pedestrians and drivers more time to react and reduces impact forces if crashes do occur; reducing exposure to known risky situations; and increasing enforcement of pedestrian-friendly laws.

Countermeasures need to be tailored to diverse populations, including groups such as recent immigrants who may not be familiar with U.S. traffic laws, the U.S. traffic environment, or may not speak or read English.

This chapter is restricted to behavioral countermeasures. Many environmental and engineering strategies affect pedestrian safety substantially, but they are outside the direct authority of SHSOs. For information on engineering strategies, see Zegeer and Stutts (2004) or the Pedestrian and Bicycle Information Center (www.walkinginfo.org/). For a broad set of resources on behavioral strategies from NHTSA, see http://www.nhtsa.dot.gov/people/injury/pedbimot/ped/index.html. For information on education, engineering, vehicular, and legislative practices and recommended strategies in Europe, see Organisation for Economic Co-operation and Development [OECD] (2004).

Key terms

- NCHRP: National Cooperative Highway Research Program
- NPTS: Nationwide Personal Transportation Survey, conducted by NHTSA approximately every five years through 1995.
- NHTS: National Household Travel Survey, the successor to NPTS, conducted last in 2001.

Countermeasures That Work

Countermeasures to improve pedestrian safety are listed below and discussed individually in the remainder of this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information on each item.

1. Young children

Countermeasure	Effectiveness	Use	Cost	Time
1.1 Children's safety clubs	Uncertain	Unknown	Low	Uncertain
1.2 Child supervision	Unknown	Unknown	Low	Short

2. School-age children

2.1 Elementary school pedestrian training	Proven	Unknown	Low	Short
2.2 Safe Routes to School (SRTS)	Likely	High	Low	Short
2.3 Model "Ice cream vendor" ordinance	Likely	Low	Low	Medium
2.4 Child school bus training	Likely	High	Low	Short

3. Adults

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Model road work site law	Uncertain	Medium	Low	Short
3.2 Pedestrian safety zones	Proven	Low	High	Medium

4. Impaired pedestrians

Countermeasure	Effectiveness	Use	Cost	Time
4.1 Communications and outreach	Uncertain	Low	Medium	Medium
4.2 Pedestrian "sweeper" patrols	Unknown	Low	Medium	Short

5. All pedestrians

Countermeasure	Effectiveness	Use	Cost	Time
5.1 Reduced speed limits	Proven	High	Low	Short
5.2 Daylight saving time	Likely	High	Low	Medium
5.3 Conspicuity enhancement	Likely	Low	Low	Short
5.4 Driver training	Unknown	Low	Low	Medium
5.5 Targeted enforcement	Varies	Unknown	Medium	Short

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results
Likely: balance of evidence from high-quality evaluations or other sources
Uncertain: limited and perhaps ambiguous evidence
Unknown: no high-quality evaluation evidence
Varies: different methods of implementing this countermeasure produce different results

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise. See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities
Medium: between one-third and two-thirds of States or communities
Low: less than one-third of the States or communities
Unknown: data not available

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources
Medium: requires some additional staff time, equipment, facilities, and/or publicity
Low: can be implemented with current staff, perhaps with training; limited costs for equipment, facilities, and publicity

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year
Medium: more than three months but less than one year
Short: three months or less

These estimates do not include the time required to enact legislation or establish policies.

1.1 Children's Safety Clubs

Effectiveness: Uncertain	Use: Unknown	Cost: Low	Time: Uncertain

The purpose of children's safety clubs is to have parents and caregivers educate young children about safe walking techniques, particularly regarding traffic, while walking in real-world settings. Very young children have limited abilities to perceive traffic hazards, little experience with which to anticipate and interpret, and limited abilities to reason and react. Motor vehicle crashes involving preschool children often involve slow-moving vehicles, frequently backing up in driveways and parking lots (Agran, Winn, & Anderson, 1994; Olson, Sklar, Cobb, Sapien, & Zumwalt, 1993). It is important to teach children age-appropriate lessons about traffic. It is even more important that parents and caregivers take direct responsibility and supervise young children carefully, as discussed in the following Section 1.2 (Rivara, Bergman, & Drake, 1989).

Safety clubs are a promising way to promote understanding and to teach a specific set of appropriate behaviors for these young pedestrians. However, the knowledge and skill benefits have not been found to translate into crash and injury reductions (Gregersen & Nolen, 1994; West, Sammons, & West, 1993). An equally important outcome of safety clubs is for parents and caregivers to recognize their charges' limits and to understand their own obligation to maintain supervisory control.

NHTSA has a number of brochures on child pedestrian safety, as does Safe Kids Worldwide. The main development of safety clubs took place in Europe a number of years ago, but they have not been adopted broadly in the U.S. There do not appear to be any national or statewide standards, models, or curricula. One online game for parents and young children (Otto the Auto, from the California State Automobile Association) can be found at www.ottoclub.org. For a British traffic club source, see The Children's Traffic Club, Pin Point, 1-2 Rosslyn Crescent, Harrow, HA1 2SB; www.trafficclub.co.uk.

Use: Pedestrian safety may be a topic at many preschools, but programs are likely to be unique, without consensus objectives, materials, or curriculum.

Effectiveness: As noted, safety clubs, chiefly in Europe, have been shown to increase knowledge in young children, but the anticipated crash and injury reductions have not been demonstrated.

Costs: Only a few dollars per child for materials. If integrated into preschool programs, training for teachers may be needed.

Time to implement: Before a safety club program could be implemented, program materials must be located and adapted as necessary. Following that, a modest time period would be needed to arrange for materials, disseminate information, and train teachers.

1.2 Child Supervision

Effectiveness: Unknown	Use: Unknown	Cost: Low	Time: Short

The purpose of child supervision programs is to increase the supervision of children when they are exposed to traffic, or when they are nearby with direct access to traffic. Because children do not have the impulse control to make proper safe walking decisions, these programs can be an asset to anyone responsible for the supervision of children. The State can require such programs for teachers, day care workers, and others licensed to care for children. The programs can also be made available to parents, babysitters, or other caretakers through PTAs, churches, pediatricians, or even direct mail or Internet access.

One of the ways to "sell" these programs may be to point out that parents don't know how much their children need supervision (and effective training). Rivara et al. (1989) and Dunne, Asher, and Rivara (1992), for example, have shown that parents consistently overestimate the ability of children younger than 9-10 to negotiate in traffic.

Use: The availability and use of such programs is unknown. Two valuable resources are NHTSA, with materials like *Walking Through the Years* and *Preventing Pedestrian Crashes: Preschool/Elementary School Children*, and Safe Kids Worldwide, with *Teach Your Child Street Smarts*.

Effectiveness: Programs or materials can provide effective training for caregivers if they point out specific risks as well as guidelines for the kind and degree of oversight that are necessary, but the caregivers need to put the training into practice.

Costs: Materials for individuals are already available and quite inexpensive. Training for licensed caregivers would be inexpensive to develop and distribute.

Time to implement: Short, for existing materials; medium, to develop and disseminate a training curriculum with materials.

2.1 Elementary School Pedestrian Training

Effectiveness: Proven	Use: Unknown	Cost: Low	Time: Short

The purpose of elementary school pedestrian training is to equip school-age children with knowledge and practice to enable them to walk safely in environments with traffic and other safety hazards. A number of elementary school pedestrian training programs have been developed over the years. "Willy Whistle" was developed in the 1970s as a film to teach K-3 children to look Left-Right-Left before crossing. NHTSA-developed materials for grades 4-6 include "Keep on Looking" and "Walking with Your Eyes," both videos. All of these materials include instructor guides. Additional curricula have been developed for rural pedestrian concerns (Cleven & Blomberg, 1994).

These programs are useful to teach basic pedestrian concepts and safe behaviors at schools, churches, and other institutions with groups of elementary-age children.

Use: Unknown. The materials have been available for years, and they have been distributed widely, but not in a systematic program. It is likely there are a number of copies that are "out there" but not in current use. With schools being called on for a wider variety of services and narrower set of teaching requirements, finding time to add child traffic safety modules may be quite difficult.

Effectiveness: The materials are proven to increase knowledge as observed in normal (non-crash) circumstances. In tests in Los Angeles and Milwaukee, child dart-out crashes were reduced by 20 percent overall. In Miami schools, the WalkSafe program was found to increase left-right-left searching and reduce mid-block crossings and dart-outs immediately after the intervention; however, the results from the 3-month post-test were not different from behaviors exhibited at pre-test (Hotz et al., 2004). Barton et al (2006) shows that children behaved more safely following a brief pedestrian safety training. In the United Kingdom, a combination of adult-led training and peer discussions for children age 5-8 led to improved roadside search skills (Tolmie et al., 2005).

Materials would be best if they combine child training with emphasis to teachers, parents, and other caregivers on the limits of children, particularly those younger than 10, and the need for careful supervision.

Costs: Low. NHTSA's existing materials are valuable tools in the toolbox, and they can be recommended and provided at low expense.

Time to implement: Short; after a decision is made by the school districts to offer such a program, time is needed for them to review recommended materials, select or enhance one choice, and work it into the curriculum.

2.2 Safe Routes to School

Effectiveness: Likely	Use: High	Cost: Low	Time: Short to Long

The goal of Safe Routes to School (SRTS) Programs is to increase the amount of bicycling and walking trips to and from school while simultaneously improving safety for children walking or bicycling to school. SRTS programs include educating and encouraging children to bicycle or walk to school, identifying routes that are appropriate for bicycling and walking to school, and improving the safety of those routes. SRTS is made up of training and encouragement for children, improved traffic control around schools, and engineering to improve risky elements of the traffic environment.

Safe Routes to School (SRTS) packages are available from NHTSA. They include student and instructor materials and can be implemented "off the shelf." For an overview, see NHTSA's *Safe Routes to School: Practice and Promise*, which presents the background, rationale, and steps to follow for SRTS and describes several existing programs (NHTSA, 2004). SAFETEA-LU requires each State to have its own SRTS program beginning in 2005, including infrastructure improvements, public awareness and outreach, traffic education and enforcement near schools, student sessions, training for volunteers and program managers, and a full-time State SRTS coordinator. See the USDOT Safe Routes to School Clearinghouse at www.saferoutesinfo.org for information on SRTS programs around the country.

Use: High. With the establishment of the national SRTS program, all 50 States and the District of Columbia are now operating SRTS programs in their Departments of Transportation. Local SRTS programs exist, in different forms, in nearly all States.

Effectiveness: Some materials are effective in teaching young children and their parents how to evaluate and choose the best routes for walking or bicycling to and from school. They are derived from analyses of types of crashes associated with to/from school trips, but it has not been possible to evaluate their effect on preventing crashes and injuries. Although the full program emphasizes broad education, some specific implementations have centered on site-appropriate engineering changes; results have shown behavioral improvements for pedestrians, bicyclists, and motorists (Britt, Bergman, & Moffat, 1995). Dumbaugh and Frank (2007) found that many of the safety benefits associated with SRTS countermeasures are assumed rather than known. With the establishment of the national program, there will soon be extensive evaluation of SRTS programs.

A variation on the SRTS theme, "walking school buses," uses volunteer adults, usually parents, to walk a specific route to and from school, collecting or dropping off children on the way, so that a group of children walks to school under the supervision of adults. The program has been found popular and practical in New Zealand and Italy (Collins & Kearns, 2005; Roberts, 1995). Roberts found in New Zealand that when parents walked with children to and from school, the risk of injury was only 36 percent of the risk for unaccompanied children, though the small sample sizes made the difference suggestive rather than statistically significant.

Costs: Low. Many materials are in production by NHTSA and can be procured and distributed from existing stock. The National Center for SRTS provides many freely downloadable materials for local SRTS programs.

Time to implement: Very short, once the school or district has decided to use SRTS; a wide range of materials are available from NHTSA and the National Center for Safe Routes to School. Programs funded through State DOTs typically require applications on a funding cycle and can take significantly longer to implement.

2.3 "Ice Cream Vendor" Ordinance

Effectiveness: Likely	Use: Low	Cost: Low	Time: Medium

The purpose of "Ice Cream Vendor" ordinances is to modify the behavior of drivers around ice cream trucks to reduce speeds and improve safety when children approach the trucks. The neighborhood ice cream truck is a very specific hazard for children. As children run to or from the truck, they may pay little attention to traffic. The truck may screen the children from drivers.

The ordinance requires that drivers come to a complete stop before passing an ice cream truck that is stopped to vend. Drivers may proceed when it is safe at no more than 15 mph and must yield to all nearby pedestrians. The ice cream truck must be equipped with flashing signal lamps and a stop signal arm, similar to those found on school buses, which can be activated when the truck is stopped for vending.

The regulation includes provisions for permits and inspections for ice cream trucks and similar on-street vendors. Details of the model regulation are included in Blomberg (2001); see also Hale, Blomberg, and Preusser (1978).

Use: As of 2001 some form of ice cream vendor ordinance was in place in Florida, New Jersey, New York, South Carolina, and Texas, as well as Detroit, Michigan (Blomberg, 2001).

Effectiveness: When tested in Detroit, crashes to pedestrians going to or from ice cream trucks were reduced by 77 percent (Hale et al., 1978).

Costs: The primary costs are for modifications to vendor trucks, for inspections of trucks prior to issuing vending permits, and for training police officers for enforcement.

Time to implement: Medium; following passage of an ordinance, implementation must allow enough time for truck modifications to be made and an inspection system established.

2.4 Child School Bus Training

Effectiveness: Likely	Use: High	Cost: Low	Time: Short

The purpose of school bus training for children is to teach school-age children how to safely approach, board, depart, and walk away from school buses. Approximately 800 children have died in traffic crashes in each recent year during normal school travel hours. On average, only 5 were school bus passengers and 15 were pedestrians near a school bus (TRB, 2002, p. 1). The 2005 experience fits this model: five fatalities to children in a school bus and 10 to children age 15 or younger around a school bus (NHTSA, 2006, Tables 92 and 93). There are no data for pedestrian fatalities and injuries involving school buses during hours not associated with travel to and from school (i.e., for special school-related trips). It is estimated that less than 500 pedestrians of all ages were injured in school-bus related crashes in 2005 (NHTSA, 2006, Table 93).

Basic training for children who ride school buses should be part of the normal school routine, if it is not already. Training should include behavior on the bus as well as getting on or off the bus at bus stops or school, obeying bus drivers and bus monitors, emergency evacuation procedures, and any topics unique to the school.

Jurisdictions should use a common curriculum for school bus safety training. NHTSA has developed and evaluated a safety training program for elementary children who ride the school bus (Cleven & Blomberg, 1994). Targeted behaviors include boarding and exiting from the bus and crossing the street to and from the bus. Burke, Lapidus, Zavoski, Wallace and Banco (1996) found that stenciled pavement markings, together with in-school training, led to improved behavior in waiting for and boarding the school bus (compared to training alone), for boys and girls in grades 4-6.

Use: Most school districts have some form of school bus training in place, though the content and quality of those programs varies. Schools should be eager to provide this training, both for child safety and for legal liability.

Effectiveness: School bus training to publicize and support the kinds of behaviors expected and required can be very useful. The most readily demonstrated effect of the training will be improved behavior on and around buses. The training, along with outreach publicizing it, can also communicate standards and expectations to parents and others. Any reductions in crashes and injuries are extremely difficult to demonstrate because some form of training is very widespread and the choice to adopt a stronger curriculum would be confounded with any number of other factors.

Costs: Low; the primary cost for the SHSOs would be in adapting materials for their states and producing, stocking, and distributing the materials.

Time to implement: Short. Basic materials can be obtained from NHTSA, and schools could adopt the recommended curriculum, or another of their choice, quickly.

3.1 Model Road Work Site Laws

Effectiveness: Uncertain	Use: Medium	Cost: Low	Time: Short

The purpose of implementing road work site safety laws is to advise drivers and pedestrians to proceed with additional caution when traveling through or across work zones. Road work sites are very hazardous. In 2005, 1,074 people were killed at work sites including 137 pedestrians, most often road site workers. A number of countermeasures are common for work sites, including double fines, awareness campaigns (e.g., "Slow down. My daddy/mommy works here!"), requirements for worksite signing, lighting, traffic control, and heightened enforcement.

There are two complementary model regulations for worksites. The first, from NCHRP, emphasizes marking and control of work zones including permissions and inspections, speed limit maintenance and reductions, and safe traffic control (National Committee on Uniform Traffic Laws and Ordinances [NCUTLO], 1997). It calls for site markings consistent with requirements of the *Manual on Uniform Traffic Control Devices* (MUTCD; FHWA, 2004).

The second also emphasizes worker conspicuous materials and worker and driver responsibilities. For more information on this model law, see Blomberg, 2001. The model law expands on existing Uniform Vehicle Code (UVC) provisions (NCUTLO, 2000), in particular to improve the conspicuity of workers at the site. Many States have existing work site practices that match or exceed the requirements of this model law, and anyone considering adopting this law should compare its provisions to current practice.

Use: States may not have these exact laws but may have most or all of their provisions in effect through alternative laws or regulations. No State had enacted the second model law as of 2001 (Blomberg, 2001).

Effectiveness: These model laws have not been specifically evaluated.

Costs: Low; they may require the state, municipality, or contractors to increase payments for materials, site layout, and active supervision and marking, but these would be a small part of the costs for any project.

Time to implement: Short. Once governing regulations are written, work site operators can be required to comply almost immediately.

3.2 Pedestrian Safety Zones

Effectiveness: Proven	Use: Low	Cost: High	Time: Medium

The purpose of pedestrian safety zones is to slow traffic and improve conditions for pedestrians in areas with larger numbers of at-risk pedestrians. In 2005, 981 fatalities, or 20 percent of all pedestrian fatalities, and about 5,000 injuries, 8 percent of all pedestrian injuries, occurred to pedestrians age 65 and older. About one-third of their fatalities and two-thirds of their injuries occurred at intersections, the highest values for any age group (NHTSA, 2006, Table 94).

Most countermeasures specifically intended for older adult pedestrians involve engineering changes. These can range from simple actions such as traffic signal retiming to "pedestrian zones" which can combine communications and outreach messages for pedestrians and drivers, major alterations to the pedestrian environment to slow and channel vehicle traffic, and enhanced enforcement. Pedestrian zone programs can be targeted at a full range of pedestrian crash problems within a limited geographic area.

Pedestrian safety zones were developed by Blomberg and Cleven (1998) and NHTSA (1998). Crash data were analyzed to identify areas where older pedestrian crashes occur and "zones" were drawn around the high-incidence areas. Countermeasures were developed for the kinds of crashes that were seen. They included signal retiming, providing communications and outreach for both drivers and pedestrians living near the crash zones, and enhanced enforcement. The result in Phoenix, Arizona, was a significant reduction in crashes and injuries to older pedestrians in the target areas.

Use: Low. Pedestrian zone programs have been implemented in only a handful of cities.

Effectiveness: Properly designed and implemented pedestrian zone programs have been shown effective in reducing crashes and injuries for older pedestrians (Blomberg & Cleven, 1998) and for impaired pedestrians (Blomberg & Cleven, 2000).

Costs: High. If properly done, pedestrian zone programs require up-front analysis and planning, countermeasure development and tailoring, and implementation.

Time to implement: Medium. A pedestrian zone program can take several months of concentrated activity before it can be implemented. Programs done to date have included local task forces, usually assembled for the program, to take critical leadership roles.

4.1 Impaired Pedestrians: Communications and Outreach

Effectiveness: Uncertain	Use: Low	Cost: Medium	Time: Medium

The purpose of developing specific campaigns to increase awareness of the risks associated with walking as an alcohol-impaired pedestrian is to reduce crashes involving impaired pedestrians. In 2005, 36 percent of all fatally injured pedestrians had a positive blood alcohol concentration, and 32 percent had a BAC of .08 or higher (NHTSA, 2006, Table 82). Most are young adult males (Leaf & Preusser, 1997). This observation is confirmed in more recent FARS data. For the five years of 1999-2003, of the pedestrian fatalities 18 and older, 44 percent of males and 22 percent of females had a BAC of .08 or higher, elevated BACs (.08 g/dL or higher), with the highest proportions for ages 21 through 54.

Some of the countermeasures proposed for impaired drivers in Chapter 1, such as responsible beverage service training and alternative transportation, are also appropriate for impaired pedestrians. Comprehensive programs also are appropriate.

Communications and outreach to reduce impaired-pedestrian crashes can be directed at a wide variety of audiences. A recent study obtained expert evaluations of a wide range of possible communications and outreach approaches (Leaf, Northrup, & Preusser, in press). Recommended target audiences include drivers, alcohol servers and vendors, civic and neighborhood leaders, and friends and family of likely impaired pedestrians. Likely impaired pedestrians are also a target audience, of course. However, they are viewed as a very difficult audience for communications and outreach to have a meaningful effect on their behavior. Experts think that reaching others who are in a position to prevent these crashes, or to alter the circumstances that lead up to such crashes, is the most effective way to achieve success.

Use: Low. NHTSA has successfully implemented one zone-based program in Baltimore, Maryland, but it is not currently active (Blomberg & Cleven, 2000). Most impaired-person programs focus on impaired drivers.

Effectiveness: The use of communications and outreach countermeasures alone has been shown to increase knowledge and reported behavior changes, but there have been no demonstrations of crash or injury reductions unless the communications and outreach is part of a comprehensive program such as the one in Baltimore discussed above.

Costs: The costs for such a program can range from low to high, depending on the extent of the campaign that is designed and implemented.

Time to implement: Medium. Again, the actual time to implement depends on the scope and ambition of the program. Existing communications and outreach themes should be tailored to specific localities and conditions.

4.2 Pedestrian "Sweeper" Patrols

Effectiveness: Unknown	Use: Low	Cost: Medium	Time: Short

The purpose of "sweeping" inebriated pedestrians from the streets until they no longer have high BACs is intended to reduce the exposure to traffic of these at-risk pedestrians. As shown in 4.1 (above), pedestrians with high BACs are at high risk of injury due to motor vehicle crashes. A program of removing or "sweeping" inebriated pedestrians from the streets can be effective in reducing their exposure and thus the risk.

There are some important issues that need to be resolved when setting up sweeper programs, such as how to identify at-risk pedestrians (e.g., calls from bars or direct observers, observation by police or health professionals), who picks up the targets, where they are kept until they are sober, whether friends or family need to be notified at the time of the pickup, how the pedestrians are returned home after the intervention, and how the costs of the program are borne.

Huntley (1984) focused on police "sweeper" squads and "support on call" programs involving taxis and trained escorts to get intoxicated people home. Services of these types in the Boston area were surveyed. Both types of services appeared practical and effective, though the number of people who could be reached by these services was relatively small. There was a problem related to the number of available detoxification beds in the community. The sweeper squads wanted to deliver intoxicated pedestrians to the mental health community, not to police facilities, and they stopped the sweep when the beds were filled. There were also problems with the number of taxi drivers who wanted to deal with intoxicated people and the availability of volunteer escorts.

Use: Well-publicized sweep operations, which involve picking up intoxicated people from the street and letting them "sleep it off," have been conducted in Puerto Rico and in Gallup, New Mexico. Puerto Rico's program, which included a statute, communications and outreach, and police training, led to a 7-percent drop in alcohol-related pedestrian crashes (Stewart, 1994). There appear to be no well-publicized programs operating now.

Effectiveness: Such programs typically reach only a fraction of those people who need the services. The sweeps typically deal with people who are too drunk to walk or even know that they are being "swept." These same people are at risk while they are becoming intoxicated, and, in all likelihood, will be at risk again in the near future as they become sober. As described by Huntley (1984), these individuals need intensive treatment for alcoholism; and sweeper programs may be useful in identifying potential treatment candidates.

Costs: Medium. The program incurs ongoing costs directly related to the effectiveness, i.e., the number of people swept up. Depending on how it is set up, the program may incur costs related to the sweeper patrol (or police overtime), the use of facilities, and any subsequent treatment requirements.

Time to implement: Once it is decided to offer the program, the logistics for starting it up could be handled within weeks or a few months.

Other issues:

- The legal rights of those potentially being swept need to be preserved.
- Often if the police or other formal agencies are involved, their regular procedures would require some formal charge or other processing to take place. Alternatively, a sweeper program could be without subsequent consequences to those being swept, with no formal records kept. This might eliminate certain organizations or agencies from participating.

5.1 Reduced Speed Limits

Effectiveness: Proven	Use: High	Cost: Low	Time: Medium

The purpose of reducing speed limits is to increase reaction time for both drivers and pedestrians to avoid conflicts, as well as reduce the severity of injuries that result when pedestrian crashes occur. Higher vehicle speeds produce more and more serious pedestrian crashes and casualties. Reducing speeds through lowering speed limits is a time-honored countermeasure. Evidence shows, though, that actual speeds are reduced by only a fraction of the reduction in speed limits – typically 1-2 mph speed reduction for every 5 mph speed limit reduction. For maximum effectiveness, speed limit reductions need to be accompanied by communications and outreach which inform the public and make the case for the reduction and by heightened, visible enforcement (Leaf & Preusser, 1999).

Speed limit reductions can be most effective when introduced to a limited area as part of a visible area-wide change, for example, identifying a downtown area as a special pedestrian-friendly zone through signs, new landscaping or "streetscaping", lighting, etc. If done cleverly, this can been accomplished with relatively modest engineering changes and expenses.

If speed limits are routinely ignored, then enforcing speed limits may be a more effective strategy than attempting to change them. Blomberg and Cleven (2006) report on demonstration programs in two cities in which speed limit enforcement, combined with engineering changes and extensive publicity, reduced both average speeds and the number of excessive speeders in residential neighborhoods. NHTSA is conducting a further evaluation to determine whether pedestrian crashes were reduced in these neighborhoods.

See Chapter 3, Section 1.1, for further discussion of speed limits.

Use: High, in the sense that all public roads have a speed limit and all speed limits take some account of pedestrian travel and pedestrian safety issues.

Effectiveness: Actual speed reductions improve pedestrian safety. Just changing speed limits is of limited, though positive, effectiveness. Some reasons for this include drivers not noticing the new speed limit, drivers not understanding the reason to reduce speed, or drivers continuing to keep up with the speeds maintained by other drivers. Speed limit reductions need to be made compelling to be effective.

Costs: Simply changing speed limits is low-cost, only requiring updating speed limit signs or, where few signs exist, adding some new ones. Combining speed limit changes with communications and outreach, enforcement, and decorative or engineering changes can be significantly more expensive.

Time to implement: Depending on the scope of the program, the time can be very short, or it can take several months to a year to plan and implement a complex plan.

Other issues:

- Speed limit changes exist in the context of other, unchanged speed limits. The normal expectation is that there is an overall consistent approach to speed-limit setting. Where, for safety, some speed limits need to be reduced in a manner inconsistent with other speed limits, there must be clear and visible reminders that distinct conditions exist which justify the lower limits.

5.2 Daylight Saving Time

Effectiveness: Likely	Use: High	Cost: Low	Time: Long

Daylight savings time provides more daylight during early afternoon, thus reducing the risk of pedestrian crashes during that time. Daylight saving time shifts an hour of daylight from the morning, when pedestrian traffic, crashes, and injuries are lighter, to the afternoon, when pedestrian traffic, crashes, and injuries are heavier. In daylight, pedestrians and drivers can see each other better, and fewer crashes occur. Shifting the hour of daylight by means of daylight saving time reduces afternoon crashes by many more than it adds in the morning. For example, if daylight saving time were extended for the entire year, it is estimated that about 727 pedestrian and 180 vehicle occupant fatalities would be saved each year (Ferguson, Preusser, Lund, Zador, & Ulmer, 1995).

Only three States do not follow current daylight saving time rules: Arizona, Hawaii, and most of Indiana. Those States could change their practices to follow Federal daylight saving time.

Use: As noted, daylight saving time is implemented in all but three States. Exceptions are long-standing local practice. Indiana has recently moved several counties from the Eastern to Central time zone, but in the process reaffirmed their commitment to daylight savings time exceptions.

Effectiveness: The effectiveness of existing daylight saving time in reducing pedestrian crashes has been clearly demonstrated (Ferguson et al., 1995). Stevens and Lord (2006) also show that daylight savings time results in reduced pedestrian crashes, but found a smaller effect than previous research. The effect would continue with the new daylight savings time schedule.

Costs: Minimal to the traffic safety community. Any daylight saving time change will be publicized extensively.

Time to implement: If a daylight savings time change is enacted, it can be implemented the following year.

Other issues:

- Local exceptions to daylight saving time have been in effect for many years, and the states with the exceptions have made deliberate choices to have them. Those exceptions will be difficult to overcome.
- Farming interests have been opposed to daylight saving time in any form, because of the inconvenience of matching their work schedules, largely determined by the availability of sunlight, with shifts in the rest of the world's schedules.

5.3 Conspicuity Enhancement

Effectiveness: Likely	Use: Low	Cost: Low	Time: Medium

The purpose of enhancing conspicuity for pedestrians is to increase the opportunity for drivers to see and avoid pedestrians in low light conditions. Pedestrians who are more visible are less likely to be struck. Retro-reflective materials are built into many shoes, including children's and athletic shoes. Other materials, such as arm or leg bands, gloves, vests, and caps are available from sporting goods stores and other vendors. Light sources, including strobes and other flashing lights, are also available. Many have been designed for bicyclists but are equally applicable to pedestrians. The difficulty with most of these devices is that the user must decide in advance to take and use them. Because of this extra step, and because most of the conspicuity enhancements do not look like "normal" clothing, they are very much underused. Light-colored clothing, long a recommended solution, does virtually nothing to improve conspicuity (Zegeer & Stutts, 2004).

There are a number of opportunities for improving pedestrian conspicuity. Devices designed to be semi-permanently fastened to children's clothing can be provided to parents through schools, group activities, or pediatricians. Light sticks and reflective bands can be supplied with new cars, or distributed by automobile clubs or insurance companies, for use during emergencies.

Use: Retro-reflective materials are used regularly in athletic-type shoes, occasionally in backpacks and jackets, and minimally in other clothing.

Effectiveness: Widespread use of retro-reflective materials would increase the ability of drivers to detect pedestrians in time to avoid crashes. Pedestrians wearing good retro-reflective materials, particularly materials that fill out the person's shape or outline, can be detected hundreds of feet farther than can pedestrians in normal clothing, even with low-beam illumination (Zegeer & Stutts, 2004).

Costs: Low, if supplementary materials are distributed in quantity. Supplementary materials are available commercially.

Time to implement: Medium. Promoting increased conspicuity may require development of targeted messages and a publicity strategy.

5.4 Driver Training

Effectiveness: Unknown	Use: Low	Cost: Low	Time: Medium

The purpose of pedestrian safety-related driver training is to increase the sensitivity of drivers to the presence and characteristics of pedestrians. Current training for new drivers typically includes relatively little information on other road users. Information on pedestrians can be significantly strengthened. Specifications for driver education curricula, typically a state requirement, can be adjusted to include more and specific information on the status of the pedestrian in the traffic environment, right of way requirements for driver and pedestrian, other driver and pedestrian responsibilities, categories of pedestrian crash types, and key ways drivers can avoid being involved in such crashes.

One of the best ways driver training can incorporate pedestrian and bicyclist concerns for new drivers is through "Share the Road" concepts and programs, though many focus exclusively on bicycles. One such resource is the State of New York's highly readable *Sharing the Road: New York State bicycle and pedestrian laws*, which can be found at www.dot.state.ny.us/pubtrans/share.html.

Any new information for driver education should be reflected in State publications, for example in the manual for new drivers which is handed out to learners and used as the basis for driver licensing exams.

NHTSA's current investigations of the workings and effectiveness of driver education may provide an opportunity to recommend modifications in the way driver training addresses pedestrian safety.

Use: Low. As noted, all driver education curricula include some information on other road users, but the kind of expanded information recommended here is sparse.

Effectiveness: Driver education has not been shown to reduce overall crash rates. The objective for adding more pedestrian information would be to increase knowledge, particularly of crash types and countermeasures, and to improve the new drivers' anticipation of and interactions with pedestrians – as well as improve their behavior as pedestrians.

Costs: Low. The cost would be for the development of the new segments of the standard curriculum and for getting it into the materials used by driver education instructors and schools.

Time to implement: Medium. Materials would need to be developed and integrated into the standard driver education curriculum, and adjustments made elsewhere in the curriculum to reflect likely additional time required for the new pedestrian materials.

The same timeframe would be appropriate for making changes to official State driving manuals, license exams, and related materials and procedures.

5.5 Targeted Enforcement

Effectiveness: Varies	Use: Unknown	Cost: Medium	Time: Short

The purpose of targeted enforcement is to increase compliance with appropriate traffic laws by both pedestrians and motorists. Behavioral pedestrian safety initiatives require pedestrians or drivers to change their walking or driving actions and habits. Once pedestrians and drivers are informed of the changes needed and why they are important, enforcement often is necessary to encourage compliance. Although enforcement was implied or stated for many of the earlier countermeasures, it deserves to be called out separately.

Enforcement is most effective when it is highly visible and publicized, to reinforce the message of the required behavior and to raise the expectation that failure to comply may result in legal consequences. Most enforcement is seen as aimed at drivers, with enforcement actions against pedestrians occurring only to sort out culpability in crashes. As much as possible, enforcement campaigns should balance their focus on pedestrians as well as drivers, starting with the communications and outreach efforts that announce and position the campaigns.

A coordinated program of targeted enforcement may involve a range of support activities, such as communications and outreach to notify the public of the campaign, training for the police on enforcement goals and procedures, and training for prosecutors and judges so that they understand the purposes of the campaign and are prepared for the increase in citations that the enforcement will produce.

Use: Unknown. Enforcement is largely a local option, and often is integrated into other police duties, so special enforcement efforts are difficult to isolate and track.

Effectiveness: Because targeted enforcement can be employed for a wide range of purposes in a wide range of circumstances, no overall statement of effectiveness can be made. In Queens, New York, enforcement was a key part of a campaign that included minor engineering adjustments and communications and outreach and reduced pedestrian fatalities (CDC, 1989). In Seattle, a variety of communications and outreach and enforcement combinations were tested in conjunction with a change in the law for drivers to yield to pedestrians at crosswalks; the authors concluded that enforcement was not successful in increasing driver yielding (Britt et al., 1995).

Costs: Medium. The cost of the enforcement is a direct function of the size of the effort, the number of overtime officer hours and associated supplies, ranging from vehicle operating costs to equipment such as speed measurement devices or alcohol test machines.

Time to implement: Short. Police resources can be diverted to targeted enforcement very quickly. Support equipment can take longer, as can developing a plan that coordinates law changes, environmental changes, support communications and outreach, and enforcement.

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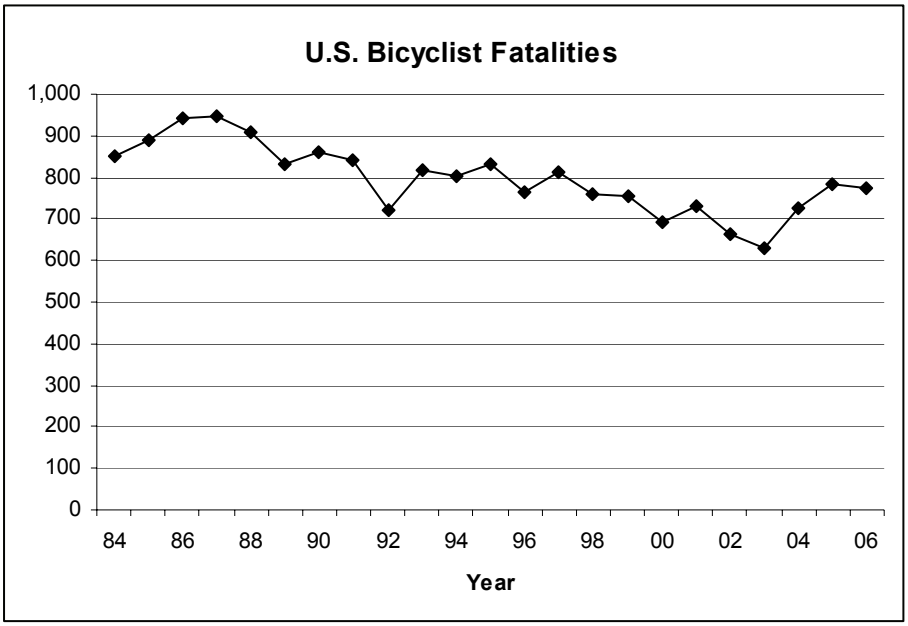
9. Bicycles

Overview

In 2006, 773 bicyclists died and about 44,000 were injured in traffic crashes in the United States. Bicyclists accounted for 2 percent of total traffic fatalities and 2 percent of total injuries (NHTSA, 2007a). Of the bicyclist casualties:

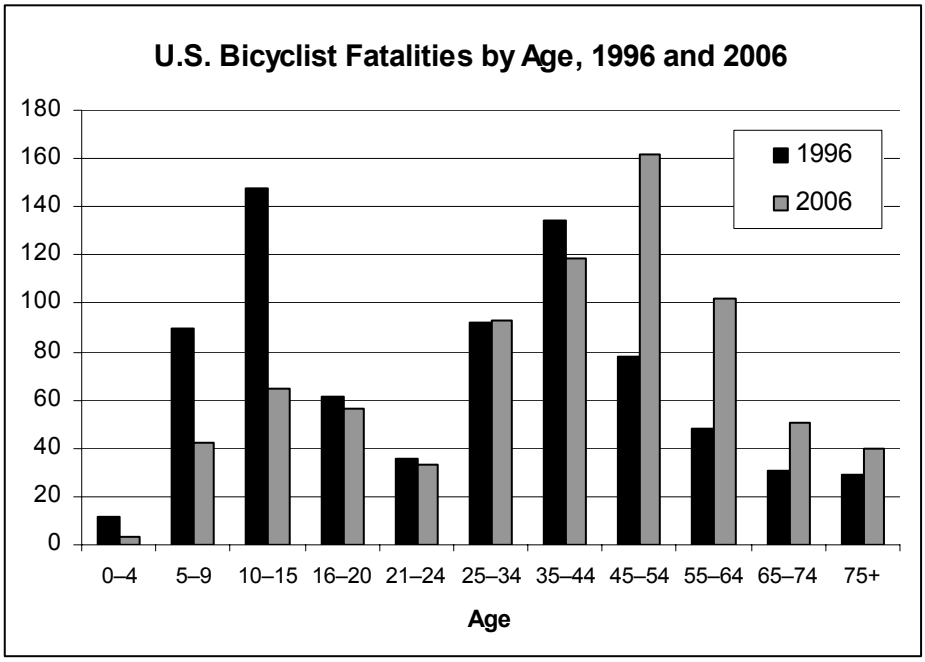
- 109 children 15 and younger were killed and about 12,000 were injured;
- 182 young adults 16 to 34 were killed and about 14,000 were injured;
- 280 mid-aged adults ages 35 to 54 were killed and about 12,000 were injured;
- 193 older adults 55 and older were killed and about 5,000 were injured;
- 88 percent of the bicyclists killed and 81 percent of those injured were male (NHTSA, 2007a).

Trends. Bicyclist fatalities dropped by 34 percent in 15 years, from 948 in 1987 to 629 in 2003, before rising to 727 in 2004 and 784 in 2005. In 2006, bicyclist fatalities decreased slightly to 773.



Source: FARS

Over the past decade, fatalities have decreased for bicyclists under 16 years old and increased for age 45 and older. The average age of bicyclists killed is now 41, up from 31 in 1996. The average age of bicyclists injured is 30, up from 23 in 1996 (NHTSA, 2007a).



Source: FARS

Exposure. According to the Department of Transportation's personal transportation surveys, the number of bicycling trips has increased from 1.7 billion in 1990 (National Personal Transportation Survey [NPTS], 1990) to 3.3 billion in 1995 (NPTS, 1995) and 2001 (National Household Travel Survey, [NHTS]; U.S. DOT, 2001), though the NPTS and NHTS surveys used somewhat different methodologies. This is approximately 10 trips per year for each U.S. inhabitant. As a fraction of all trips, bicycling has remained nearly constant, going from 0.7 percent to 0.9 percent to 0.8 percent over the three surveys.

Another estimate comes from the National Survey of Pedestrian and Bicyclist Attitudes and Behaviors (NHTSA and the Bureau of Transportation Statistics [BTS], 2003). Using telephone surveys covering summer 2002, the study estimates that about 27.3 percent of people 16 and older, or about 57 million, rode a bicycle at least once between May and August 2002, and they averaged 1.6 trips on that day.

A third source of information comes from the U.S. Census. Just for commuting, the Census reported nearly the same values in 1990 (0.4% of all commuters, or about 467,000 people) for bicycling commuting as in 2000 (0.4% or 488,000 people). Commuting, however, makes up only a small percentage of all trips.

Different crash types at different locations can be addressed by different countermeasures. The crash typing methodology is available as the Pedestrian and Bicycle Crash Analysis Tool (PBCAT) software. States and communities can use PBCAT to analyze bicycle crashes and select countermeasures. PBCAT may be downloaded from www.walkinginfo.org/facts/pbcat/index.cfm.

Bicyclist types. Bicyclists can be considered in three general categories, with the two adult categories overlapping depending on trip purposes:

- **Purposive riders**: Adults 16 and older, old enough in most States to obtain a driver's license, who are commuting, doing errands, or otherwise using the bicycle as a means to accomplish something. For these trips, bicyclists frequently use the shortest and quickest route, often involving major roads that may have relatively heavy motor vehicle traffic and less than optimal accommodations for bicyclists.
- **Recreational riders**: Adults 16 and older who ride for exercise or entertainment, or otherwise bicycle for the sake of bicycling. These bicyclists frequently seek low-traffic roads or separate bicycle-only facilities, perhaps driving in order to reach the place where they want to bicycle. They are looking for pleasant and safe places to ride and tend to avoid complex road environments with much motor vehicle traffic.
- **Children**: Children under 16 have no experience from the perspective of a driver. Depending on their age, developmental/cognitive abilities and experience, they have limited ability to detect, understand and anticipate traffic hazards and they have immature decision-making capabilities. They may be taking purposive trips, such as to or from school or to go to a sports activity, or they may be just riding around. However, they are not well equipped to take a full role as a traffic participant.

  Preschool and elementary-age beginners, who have almost no adult-level traffic awareness and who ride for play, are not able to handle unsupervised access to motor vehicle traffic. They are much different than older, early teenage riders, who lack adult traffic awareness and judgment but whose bicycle-handling skills approach or exceed those of most adult riders and who may have the ability to use specific strategies to ride safely in traffic.

Strategies to Reduce Bicycle Crashes and Injuries

Several strategies may be used to decrease bicycle crashes and injuries.

- Educate motorists and bicyclists on how they should interact with each other and what the relevant laws require. For example, add materials on sharing the road with bicyclists to the driver education curriculum and appropriate questions to the driver licensing exam.
- Pass laws to facilitate safe and efficient bicycling in traffic, to update and fill gaps in existing laws. Educate the public on any new laws.
- Increase enforcement to increase traffic law compliance by both motorists and bicyclists. Train law enforcement officers in appropriate enforcement strategies. In particular, decrease wrong-way riding, sidewalk riding, and traffic control violations by bicyclists and cutting off bicyclists, passing too closely, or blocking or driving in a designated bicycle lane by motorists.
- Increase the conspicuity of bicyclists.
- Increase the use of properly fitted bicycle helmets by all bicyclists, both children and adults.

- Increase bicycle handling skills.
- Avoid distracted riding behaviors (cell phones, headphones, etc.).
- Decrease riding while impaired.

Resources

The agencies and organizations listed below can provide information on bicycle safety issues and countermeasures and links to numerous other resources.

- National Highway Traffic Safety Administration (NHTSA): www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.810acaee50c651189ca8e410dba046a0/
- Federal Highway Administration (FHWA):
    - Bicycle and pedestrian safety program www.fhwa.dot.gov/environment/bikeped/index.htm
    - FHWA Safety: http://safety.fhwa.dot.gov/ped_bike/bike/index.htm
- Consumer Product Safety Commission (CPSC): www.cpsc.gov
- DOT Pedestrian and Bicycle Clearinghouse at the Pedestrian and Bicycle Information Center: www.pedbikeinfo.org and www.bicyclinginfo.org
- DOT National Center for Safe Routes to School: www.saferoutesinfo.org
- League of American Bicyclists: www.bikeleague.org
- National Center for Bicycling and Walking: www.bikewalk.org
- Bicycle Helmet Safety Institute [BHSI]: www.helmets.org
- SAFE KIDS Worldwide: www.safekids.org
- Safe Routes to School National Partnership: www.saferoutespartnership.org

In addition, the NCHRP Report 500 Guide for Reducing Collisions Involving Bicyclists will be released in late 2007 (Raborn & Torbic, 2007). It will include a comprehensive discussion of bicycle crash types, victims, and countermeasures emphasizing engineering solutions. When released, the Guide will be available at http://safety.transportation.org/guides.aspx.

This chapter is restricted to behavioral countermeasures. Many environmental and engineering strategies affect pedestrian safety substantially, but they are outside the direct authority of SHSOs. For information on engineering strategies, see the Pedestrian and Bicycle Information Center (www.walkinginfo.org/).

Countermeasures That Work

Countermeasures to improve bicycle safety are listed below and discussed individually in the remainder of this chapter. The table is intended to give a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. The terms used are described below. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate. See each countermeasure discussion for more information on each item.

All States are required by Congress and FHWA to have a Pedestrian and Bicyclist Coordinator in their Department of Transportation. The coordinator will be aware of active programs within the State and will have access to resources for implementing many of the countermeasures listed below.

1. Children

Countermeasure	Effectiveness	Use	Cost	Time
1.1 Bike fairs, bike rodeos	Unknown	Unknown	Low	Medium
1.2 Bicycle education in schools	Unknown	Unknown	Medium	Short
1.3 Bicycle helmet laws for children	Proven	Medium	Medium	Short
1.4 Safe Routes to School (SRTS) for bicyclists	Unknown	High	Low	Short

2. Adults

Countermeasure	Effectiveness	Use	Cost	Time
2.1 *Share the Road* awareness programs	Unknown	Unknown	Medium	Medium
2.2 Bicycle safety in driver education	Unknown	Low	Low	Medium
2.3 Bicycle helmet laws for adults	Likely	Low	Medium	Short

3. All bicyclists

Countermeasure	Effectiveness	Use	Cost	Time
3.1 Rider conspicuity	Likely	Medium	Low	Medium
3.2 Active bicycle lighting	Likely	Low	Medium	Medium
3.3 Targeted enforcement	Unknown	Low	Medium	Medium
3.4 Promote bicycle helmet use with education	Likely	Medium	High	Medium

Effectiveness:

Proven: demonstrated by several high-quality evaluations with consistent results
Likely: balance of evidence from high-quality evaluations or other sources
Uncertain: limited and perhaps ambiguous evidence
Unknown: no high-quality evaluation evidence
Varies: different methods of implementing this countermeasure produce different results

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise. See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Use:

High: more than two-thirds of the States, or a substantial majority of communities
Medium: between one-third and two-thirds of States or communities
Low: less than one-third of the States or communities
Unknown: data not available

Cost to implement:

High: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources
Medium: requires some additional staff time, equipment, facilities, and/or publicity
Low: can be implemented with current staff, perhaps with training; limited costs for equipment, facilities, and publicity

These estimates do not include the costs of enacting legislation or establishing policies.

Time to implement:

Long: more than one year
Medium: more than three months but less than one year
Short: three months or less

These estimates do not include the time required to enact legislation or establish policies.

1.1 Bike Fairs, Bike Rodeos

Effectiveness: Unknown	Use: Unknown	Cost: Low	Time: Medium

The purpose of bike fairs and bike rodeos is to teach children about traffic laws that apply to them and how to ride defensively in a number of traffic conditions. Young children are just learning about traffic. They have little experience with which to anticipate and interpret potential traffic hazards, and limited abilities to reason and react. Their brains are still developing and they lack the maturity and judgment needed to negotiate traffic safely and limit risk-taking behaviors. They also are less skilled at riding than adults. Their bicycles often are smaller and less stable, and most children aren't able to maintain the same speeds that adults can. Bike fairs and rodeos can't correct the physical shortcomings, but they teach better riding behavior.

A bike fair or rodeo is an event which provides children an opportunity to learn and practice bicycling skills. A rodeo typically has several stations for specific skills and also includes bicycle and helmet inspections.

There are a number of bicycle safety courses and models for fairs and rodeos. Examples include Washington Area Bicyclist Association (undated), Chapin (2005), Minnesota Safety Council (undated), and Williams and Burden (1994). In addition, the League of American Bicyclists has numerous League Certified Instructors across the country that can teach a course very similar to Bike Rodeos.

Use: Bicycle safety fairs and rodeos are local events. They are often run by the police, school personnel, or health educators. There may be permanent "neighborhood" layouts where the rodeos are conducted, and the events may be scheduled as part of the elementary and middle school curriculum. Although their use is unknown, they are increasingly implemented as part of Safe Routes to School projects.

Effectiveness: While rodeos can result in increases in knowledge and skills, an extensive review of the research literature does not reveal any studies that document crash and injury reduction. One program of comprehensive education for preschool children and their parents, including a skills and safety rodeo, led to a doubling of helmet use (Britt, Silver, and Rivara, 1998).

Costs: A one-time rodeo can be operated with volunteers at minimal cost. A permanent rodeo facility could cost thousands of dollars.

Time to implement: A one-time rodeo can be organized in a few months. Implementing a permanent rodeo program with a facility may take up to a year or longer.

1.2 Bicycle Education in Schools

Effectiveness: Unknown	Use: Unknown	Cost: Medium	Time: Short

The purpose of bicycle education offered in schools is to teach children traffic laws and how to ride on streets with traffic present. As part of the regular curriculum, the courses can reach every student. Most courses should include the importance of wearing a properly fitted helmet, a helmet demonstration, and the importance of wearing a helmet every ride. In addition, the course could include pedestrian safety training, making it part of a comprehensive traffic safety program, with components assembled from separate NHTSA, or comparable, programs. Many bicycle safety programs target children in grades K-8, though some are aimed at younger children.

For a careful review of training programs, many aimed at school children, see Rivara and Metrik (1998). A current listing of many training programs can be found in the FHWA Bicycle Safety Education Resource Center, www.bicyclinginfo.org/ee/education.htm. See also the *Good Practices Guide for Bicycle Safety Education* (FHWA, 2005).

Use: The use of such programs, which may be at the option of local school districts, is unknown. In-school education and training, however, is a frequent part of local Safe Routes to School programs.

Effectiveness: Programs such as these can increase knowledge of laws and proper behaviors, but their effectiveness in persistent behavior change and crash reductions has not been demonstrated.

Costs: Existing materials can be used to set up the courses within the school environment, perhaps with temporary road and intersection layouts that can be used in the gym or outside parking lot, so the cost to the schools is moderate. If the sessions are used within the existing curriculum, then there would be no extra costs associated with the presentations.

Time to implement: Short, for existing materials; medium, to develop and disseminate a training curriculum with materials.

1.3 Bicycle Helmet Laws for Children

Effectiveness: Proven	Use: Medium	Cost: Medium	Time: Short

The purpose of bicycle helmet laws for children is to reduce the number of severe and fatal head injuries to children involved in bicycle crashes. Bicycle helmets, when used properly, reduce head injuries and fatalities. Attewell, Glase, and McFadden (2001) examined all research studies published between 1987 and 1998. They found that helmets reduced overall head injuries by about 60 percent and reduced fatalities by about 73 percent. The recent Cochrane review and meta-analysis (Thompson, Rivara & Thompson, 2006) confirms these findings.

A helmet use law is a significant tool in increasing helmet use. Its effectiveness is enhanced when combined with a supportive publicity and education campaign. See, for example, Rivara, Thompson, Patterson and Thompson (1998), Kanny, Schieber, Pryor, and Kresnow (2001), and Rodgers (2002).

Use: As of August 2007, 22 States, the District of Columbia, and at least 149 municipal localities have child helmet laws (Bicycle Helmet Safety Institute [BHSI], 2007). Most laws cover all bicyclists under the age of 16. Only 13 States have no State or local laws.

Effectiveness: Grant and Rutner (2004) analyzed FARS data and concluded that State helmet-use laws for children reduce child bicycle fatalities by about 15 percent in the long run.

Costs: A helmet law should be supported with appropriate communications and outreach to parents, children, schools, pediatric health care providers, and law enforcement. NHTSA has a wide range of materials that can be used to publicize proper helmet use. While helmets that meet safety requirements can be purchased for as little as $8, States may wish to provide free or discounted helmets to some children. The practical effect of bicycle helmet laws is to encourage parents to require their children to use helmets. Law enforcement officers rarely issue citations, so law enforcement costs are minimal.

Time to implement: Short, for existing materials; medium, to develop custom communications and outreach or to start a helmet distribution or subsidy program.

1.4 Safe Routes to School (SRTS) for Bicyclists

Effectiveness: Unknown	Use: High	Cost: Low	Time: Short to Long

The goal of Safe Routes to School (SRTS) Programs is to increase the amount of bicycling and walking trips to and from school while simultaneously improving safety for children walking or bicycling to school. SRTS programs include educating and encouraging children to bicycle or walk to school, identifying routes that are appropriate for bicycling and walking to school, and improving the safety of those routes. SRTS is made up of training and encouragement for children, education of adults and the community, improved traffic control around schools, and engineering to improve risky elements of the traffic environment.

SRTS packages are available from NHTSA. They include student and instructor materials and can be implemented "off the shelf." For an overview, see NHTSA's Safe Routes to School: Practice and Promise, which presents the background, rationale, and steps to follow for SRTS and describes several existing programs (NHTSA, 2004). Beginning in 2005, SAFETEA-LU requires each state to have its own SRTS program including infrastructure improvements, public awareness and outreach, traffic education and enforcement near schools, student sessions, training for volunteers and program managers, and a full-time coordinator for the State's entire SRTS program. As of July 2007, every State had established their SRTS program, and more than half were actively involved in funding local SRTS activities. A link to a list of current State coordinators can be found on the FHWA's Safe Routes to School overview Web page, http://safety.fhwa.dot.gov/saferoutes/index.htm. The USDOT's National Center for Safe Routes to School (www.saferoutesinfo.org) provides not only information, but also guidance and support for community, state and national SRTS efforts.

Use: High. With the establishment of the national SRTS program, all 50 states and the District of Columbia are now operating SRTS programs in their Departments of Transportation. Local SRTS programs exist in different forms in nearly all states.

Effectiveness: Many SRTS materials are effective in teaching young children and their parents how to evaluate and choose the best routes for walking or bicycling to and from school. They are derived from analyses of types of crashes associated with trips to and from school, but it has not been possible to directly evaluate their effect on crashes and injuries. Although the full program emphasizes broad education, some specific implementations have centered on site-appropriate engineering changes; results have shown behavioral improvements for pedestrians, bicyclists, and motorists (NHTSA, 2004). Dumbaugh and Frank (2007) found that many of the safety benefits associated with SRTS countermeasures are assumed rather than known. With the establishment of the national program, there will soon be extensive evaluation of SRTS programs.

Costs: Low. Many materials are in production by NHTSA and can be procured and distributed from existing stock. The National Center for SRTS provides many freely downloadable materials for local SRTS programs.

Time to implement: Very short, once the school or district has decided to use SRTS; a wide range of materials are available from NHTSA and the National Center for Safe Routes to School.

Programs funded through State DOTs typically require applications on a funding cycle and can take significantly longer to implement.

2.1 *Share the Road* Awareness Programs

Effectiveness: Unknown	Use: Unknown	Cost: Medium	Time: Medium

The purpose of "Share the Road" programs is to increase drivers' awareness of bicyclists, as well as improve both bicyclist and driver compliance with relevant traffic laws. *The National Strategies for Advancing Bicycle Safety* was developed from a July 2000 conference of bicycle advocates, injury prevention specialists, and government representatives (NHTSA, 2001). The result was five goals, each with a series of strategies and action steps. The first goal, Motorists Will Share the Road, called for the creation of a "coordinated 'Share the Road' public education campaign that can be adapted at the State and local levels."

The end product, still in development by NHTSA, is available for States and communities to use. For an example of communication and outreach materials, see www.bicyclinginfo.org/ee/ed_motorist.htm.

Use: Unknown.

Effectiveness: The materials can be effective in increasing knowledge and appropriate attitudes, but there is no systematic evidence of changes in driving behavior or reductions in crashes.

Costs: Medium, including the costs to develop new materials or tailor current ones. The materials can be delivered as training for specific target audiences, such as new drivers or all high school students, or drivers as they renew their licenses, or general communications and outreach intended for mass media delivery.

Time to implement: Medium. The first step in implementing this countermeasure would be to select the message, audience, and objectives, followed by identifying appropriate source materials and making whatever changes are needed to meet the specific requirements. Subsequent delivery could be implemented quickly.

2.2 Bicycle Safety in Driver Education

Effectiveness: Unknown	Use: Low	Cost: Low	Time: Medium

The purpose of addressing bicycle safety as part of driver education is to increase the sensitivity of drivers to the presence and characteristics of bicyclists. Though driver education and State driver manuals address sharing the road with bicyclists, they spend relatively little time on the topic. Materials exist which could be used to increase the emphasis on driving around bicyclists. For example, the League of American Bicyclists has two relevant products, *Bike Ed: Motorist Education* and *Effective Cycling: Motorist Education* (www.bikeleague.org). The former is intended to train driver education instructors on how to expand the topic in their driver education classes. The latter is a three-hour module which can be inserted into the standard driver education curriculum. It covers topics such as positioning of cyclists on the roadway, traffic and hand signals, right-of-way principles, and left- and right-turn problems.

One standard approach would be to implement a Share the Road module (see 2.1, above), covering interactions with both bicyclists and pedestrians, into the driver education curriculum, as Maine does currently (for bicyclists). For complete coverage, the same message would need to be included in State-provided materials for new drivers and covered by new questions added to the knowledge license exam.

Use: All driver education curricula have some coverage of bicycles on the road. However, enhanced modules in the spirit of this countermeasure likely are quite rare.

Effectiveness: Unknown for crash and injury reduction.

Costs: Low. Materials such as those listed above are available from the League of American Bicyclists. The cost to add them to the existing driver education curriculum would be low. Changes to State manuals and other materials could be done within the normal material update budget.

Time to implement: A matter of months, once the scope and content of the added information was determined. Driver education curricula can be updated quickly. Changes to State driver manuals or licensing exams would wait for their normal update cycle, though as an interim measure the State could provide the information in the form of a separate supplement.

2.3 Bicycle Helmet Laws for Adults

Effectiveness: Likely	Use: Low	Cost: Medium	Time: Short

As with helmet laws for children, the purpose of bicycle helmet laws for adults is to reduce the number of severe and fatal injuries resulting from bicycle crashes. Bicycle helmets, when used properly, reduce head injuries and fatalities. Attewell et al. (2001) examined all research studies published between 1987 and 1998. They found that helmets reduced overall head injuries by about 60 percent and reduced fatalities by about 73 percent. The recent Cochrane review and meta-analysis (Thompson et al., 2006) confirms these findings.

Currently, no States require adult bicyclists to wear helmets. About 40 smaller governments, mostly in the State of Washington, require helmet use for all ages (BHSI, 2007).

Use: Very low.

Effectiveness: Likely to be effective. Ginsberg and Silverberg (1994) analyzed a prospective helmet law in Israel, finding a 3:1 benefit-to-cost ratio. Puder, Visintainer, Spitzer, and Casal (1999) found a helmet law for all ages produced higher helmet wearing than laws for children only; consistently, teens were least likely to wear helmets.

Costs: Moderate costs could be incurred for informing and educating the public and providing training for enforcement personnel.

Time to implement: Medium, with the need to adapt materials from those urging helmet use for children, or develop entirely new materials, and train police.

3.1 Rider Conspicuity

Effectiveness: Likely	Use: Medium	Cost: Low	Time: Medium

Improving bicyclist conspicuity is intended to make bicyclists more visible to motorists and allow motorists more opportunity to see and avoid collisions with bicyclists. A common contributing factor for crashes involving bicyclists in the roadway is the failure of the driver to notice the bicyclist. New bicycles must be sold with reflectors meeting the U.S. Consumer Product Safety Commission (CPSC) requirements (though owners are free to remove them after the purchase). The reflectors significantly improve a bicycle's visibility when lit by vehicle lights.

Additional materials attached to bicyclists can increase their conspicuity day or night. For daytime, bright clothing, including vests, caps, and ankle and wrist straps, can make the bicyclist much more noticeable. At night, the same items can have retro-reflective materials incorporated in them, so that headlights can make the bicyclist visible and identifiable from much greater distances. Retro-reflective bicycle tires are also available, but may be costly.

Use: Use of bicycle reflectors is high. Use of retro-reflective clothing is rare. Most, if not all, athletic shoes contain some retro-reflective material. Some athletic clothing has retro-reflective material. Bicycle helmets have retro-reflective elements. Some bicyclists may be seen wearing additional retro-reflective materials, such as vests, arm bands, or rear-mounted reflective triangles ("fanny bumpers").

There is much room for improvement. An aggressive education campaign may make riders more aware of the need for, and benefits of, retro-reflective materials and more likely to choose and use retro-reflective clothing or other enhancements. Such a campaign may encourage clothing and bicycling equipment manufacturers to develop and market a range of bicycling clothing with retro-reflective materials strategically embedded.

Effectiveness: Retro-reflective vests can greatly increase the detection distance for pedestrians or, by extension, bicyclists at night. Even low beam headlights can illuminate figures hundreds of feet away, much farther than figures wearing normal clothing (NCHRP, 2004, Strategy B5; Raborn & Torbic, 2007). Bright colored or white clothing is not detected much more readily than dark clothing (Jacobs, Leaf, & Shaw, 1980). The trick is getting bicyclists to wear retro-reflective materials routinely when bicycling at night. To the extent that all of their normal bicycling gear is retro-reflective, the likelihood of it being used increases.

Costs: The cost of separate vests, wrist or ankle straps, etc. is relatively modest. Adding retro-reflective fibers or patches to jackets or caps that bicyclists would wear anyway should be almost cost-free to the bicyclists. Much of the gear currently being made for bicycling can have retro-reflective materials.

Time to implement: Materials for an education campaign by bicycle safety can be created quickly. The time necessary for bicyclists to get the materials and integrate them into their normal routines will be much longer, with gradual adoption and use building over a year or more.

3.2 Active Bicycle Lighting

Effectiveness: Likely	Use: Low	Cost: Medium	Time: Medium

The purpose of encouraging active bicycle lighting use is to increase the ability of motorists to detect and avoid bicyclists in low light conditions. In most States and jurisdictions, bicycles ridden after dark are required by law to have active white front lights and red rear lights (i.e., devices that emit their own light, not just reflect light from automobile headlights or other external sources). However, most bicycles do not have such lighting (Osberg, Stiles, & Asare, 1998). Active bicycle lighting can be critical for the detection of bicyclists coming at an angle toward the path of a motor vehicle, because the bicyclist is outside the vehicle's headlight beam until the last moment.

The laws for bicycle lighting typically specify lights on the bicycle. Though standard headlights and taillights are continuously lit, bicycle lights that flash are more readily detected. Lights also may be strapped to the bicyclist's ankles, wrists, or elbows, where the motion of the rider makes them more detectable. More extreme lighting is also available. For example, bright neon tubes are designed to be mounted on the bicycle frame, where they cast a bright, broad pattern of light onto the roadway, creating the illusion of a vehicle much wider than a bicycle. See, for example, www.fossilfool.com/down-low-glow.htm.

The goal is to encourage bicyclists to use active lighting. Most active lights are not permanently mounted on bicycles, so they are often not available when needed. Improvements in the lights themselves can help. Batteries last much longer with new LCD lighting, increasing convenience and safety. It is possible to obtain widespread use of lighting. Osberg et al. (1998) found nearly half of bicyclists in Paris used active lighting, compared to just 14 percent of Boston bicyclists, reflecting differences in laws, public health priorities, and perceived risk.

The SHSO can provide communications and outreach on active bicycle lighting and by supporting police training leading to enforcement of the existing requirements. All of these steps can be important to increasing the use of lights.

Use: Active lights appear to be used only occasionally by bicyclists who ride after dark.

Effectiveness: Active lights can increase the distance at which bicyclists can be detected. A CPSC study showed that flashing taillights can be detected at significantly greater distances than bicycles with CPSC regulation reflectors (CPSC, 1999). Standard lighting patterns, designed specifically for bicycling, could also improve the ability of motorists to correctly identify the source as a bicyclist.

Costs: Moderate costs are involved. Bicyclists will incur some costs to properly equip themselves and their bicycles with lights, and these costs can be substantial for something like the neon tubes described above. The State will also incur costs, for communications and outreach and for police training.

Time to implement: Medium. Though lights are available now, at least several months can be taken up by designing, producing, and implementing the communications and outreach and police training.

3.3 Targeted Enforcement

Effectiveness: Varies	Use: Unknown	Cost: Medium	Time: Medium

The purpose of targeted enforcement is to increase compliance with appropriate traffic laws by both bicyclists and motorists. Enforcing laws concerning bicyclists requires focus on both motorists and bicyclists. While bicyclists often fail to follow the rules of the road as they are written for motor vehicles, motorists often fail to treat bicyclists as legitimate vehicles on the roads.

Bicyclists often take inappropriate paths, such as wrong-way riding, riding on sidewalks, and making left turns by creatively weaving through lanes and traffic. They also frequently ignore stop signs and red lights. Motorists may cut bicyclists off by overtaking and then turning through the bicyclist's path without allowing enough room, or by making a left turn in front of an oncoming bicyclist. Motorists also may pass without allowing enough space between the car and the bicycle or drive in or otherwise block a designated bicycle lane. All of these actions, and others, are enforceable offenses.

Enforcing bicycle-related laws for motorists falls within the normal scope of traffic law enforcement for police, though they may not be particularly alert to these specific violations. Enforcing laws for bicyclists can be a frustrating, unpopular activity for police. The public seems tolerant of a wide variety of non-legal bicyclist behavior, so that there may be little public support for the enforcement. Also, targets for potential enforcement are often children. In those cases, police may appropriately use stops as an opportunity to explain the correct behaviors as an extension of community policing principles.

The SHSO can help ensure correct riding through a communications and outreach campaign and through training police to know the laws, the safety benefits of obeying the laws, and how to enforce bike laws. Specific training for police can be found at the Pedestrian and Bicycle Information Center, www.bicyclinginfo.org/ee/enforce_officer03.htm. Training includes a bicycle safety roll-call video, a two-hour self-paced CDROM training, a two-day training for officers on community outreach, and a two-day course in bicycle safety and enforcement. These products can satisfy the needs of departments regardless of how they choose to emphasize bicycle safety. Additional training for prosecutors and judges is important as well so that there is appropriate follow-up for citations throughout the judicial system.

Use: Unknown. It is likely that targeted enforcement of bicycle-related violations is rarely used.

Effectiveness: Gilchrist, Schieber, Leadbetter, and Davidson (2000) describe an enforcement program in Georgia which impounded the bicycles of unhelmeted children and produced long-term increases in helmet wearing. This specific example seems unlikely to be broadly popular. Increasing community awareness and police enforcement efforts, however, through the training courses and approaches noted above, could yield benefits that go beyond bicycle safety, to include improved community relations and more positive interactions between police and younger members of the community.

Costs: Medium. Training currently exists for the police. Roll-call videos can be implemented at essentially no cost to the departments. The longer courses take officers away from their regular

duties or require overtime commitment. SHSOs may be able to provide funding for departments to participate in such training. Training for prosecutors and judges would likely need to be developed, as would a supporting communications and outreach programs for the public, motorists and bicyclists.

Time to implement: For existing police training, with ongoing presentation schedules, implementation time can be quite short. For the full effort described above, a longer time frame would be needed.

3.4 Promote Bicycle Helmet Use with Education

Effectiveness: Proven	Use: Medium	Cost: High	Time: Medium

The purpose of bicycle helmet promotions is to increase proper use of helmets and thereby decrease the number of severe and fatal injuries to bicyclists involved in crashes. Bicycle helmet promotions are frequent, but are usually aimed only at child bicyclists, often through youth health organizations and schools. Promotions can include sponsoring organizations and often involve police and schools to deliver helmets and teach their proper use. Promotions can be conducted through single events or extended campaigns to promote helmet distribution and use. Expanding helmet promotions to include adults will require an expansion in focus, and perhaps more sponsors. However, adding adult-oriented riding tips can increase the appeal of the program. NHTSA recently released a video titled "Bicycle Safety Tips for Adults," which is available on NHTSA's Web site (NHTSA, 2007b).

Bicycle helmet promotions must include instruction on properly fitting helmets and the importance of wearing helmets on every trip. Everyone could benefit from utilizing resources that demonste how helmets work to reduce injury.

Use: Most States have conducted some bicycle helmet promotion for children within the last few years, although only a few have ongoing or regular programs.

Effectiveness: Bicycle helmets are proven to reduce injuries and fatalities (see Sections 1.3 and 2.3). Of course, a bicyclist must have a helmet (that fits) before he or she can wear it. Helmet promotions are successful in getting more helmets into the hands of bicyclists. Rouzier and Alto (1995) describe a comprehensive program of presentations, media coverage, messages from doctors to patients, as well as low-cost helmet availability, which significantly increased helmet purchases and use for all ages. Though owning a helmet doesn't guarantee its use, a large percentage of helmets distributed through a promotion do end up on the heads of bicyclists.

Costs: The cost for underwriting large numbers of helmets can be quite high, including supporting communications and outreach materials. Adequate helmets can be purchased for as little as $8 each, within reach of most adult bicyclists. Making those helmets or more expensive ones available at reduced cost, through subsidies or merchant-manufacturer participation, could greatly increase the possible impact of the program by making it available to all at-risk segments of the population.

Time to implement: The time to recruit sponsors, develop support materials, and publicize the event can add up to several months or more.

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