Speed Management Toolkit

FHWA Safety Program

U.S. Department of Transportation
Federal Highway Administration

Safe Roads for a Safer Future
Investment in roadway safety saves lives

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Contents

Tables

Introduction to the Speed Management Toolkit

This package of speed management resources was developed from the most relevant and up-to-date existing speed management guides, informational resources, and research evidence. There are three main types of content.

- The first section, an Annotated Bibliography provides a descriptive list of key speed management resources. The Bibliography also indicates the primary target audiences who may find the resources most useful. Resources were reviewed as part of the project to identify best speed management practices, and to develop the model speed management Action Plan template.
- The second section describes crash- and speed-reducing countermeasures and the effects that might be expected for implementing the listed treatments. The countermeasures included, with potential crash effects or Crash Modification Factors (CMFs), are derived from high quality evaluations. Several sources were consulted to develop the list of countermeasures with strong evidence of crash or speed-reducing effects. Key among these sources were the *Highway Safety Manual*, the Crash Modification Factors Clearinghouse, and FHWA proven safety countermeasures information. Although only measures that have a high quality of evaluation evidence were included in these lists, other measures may also have crash-reducing effects, but the evidence is not as conclusive. New knowledge emerges continually, so practitioners are encouraged to consult the Crash Modification Factors Clearinghouse and other sources for the most up-to-date information. These CMF effect estimates may be used in cost : benefit assessments to help prioritize among alternate countermeasures as described in the Action Plan template.
- The third section provides tip sheets for communications experts and others involved in supporting the speed management program and countermeasures through education and awareness efforts. The tip sheets provide guidance on developing a locally-tailored communications program. Creating and sustaining an effective speed management program requires the commitment and support of diverse stakeholders, including users of the roadways and effective communications can help build such support. In addition, safety benefits of specific countermeasures, such as enforcement or new or unfamiliar engineering treatments, may be enhanced with an effective communications programs.

Annotated Bibliography of Key Speed Management Resources

Table 1. Speed Management Resources - Annotated Bibliography.

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Highway Safety Manual, 1st edition. American Association of State Highway and Transportation Officials: Washington, D.C., 2010. Available at: highwaysafetymanual.org.	*"The first edition of the* [Highway Safety Manual] *HSM provides the best factual information and tools in a useful form to facilitate roadway planning, design, operations, and maintenance decisions based on precise consideration of their safety consequences. The primary focus of the HSM is the introduction and development of analytical tools for predicting the impact of transportation project and program decisions on road safety.* *AASHTO's Highway Safety Manual webpage serves as the official HSM website where you can find the most up to date information and new developments on the HSM."*	-Engineers -Program Managers
Crash Modification Factors Clearinghouse. Interactive website resource. U.S. Department of Transportation, Federal Highway Administration web page. Available at: http://www.cmfclearinghouse.org/.	*"This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the University of North Carolina Highway Safety Research Center.* This site is continually updated with the latest information on safety or crash effects of countermeasures. "*A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. The Crash Modification Factors Clearinghouse houses a Web-based database of CMFs along with supporting documentation to help transportation engineers identify the most appropriate countermeasure for their safety needs. Using this site, you can search to find CMFs"* to treat identified problems.	-Engineers -Program Managers

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
CMFs in Practice. U.S. DOT, Federal Highway Administration web page Available at: http://safety.fhwa.dot.gov/tools/crf/resources/cmfs/.	*"Crash modification factors (CMFs) support a number of safety-related activities in the project development process. The CMFs in Practice Series includes five separate guides that identify opportunities to consider and quantify safety in specific activities, including roadway safety management processes, road safety audits, design decisions and exceptions, development and analysis of alternatives and value engineering. The series also includes reference documents that provide background information on crash modification factors and safety performance functions."*	-Engineers
Speed Concepts: Informational Guide. Washington, D.C.: Office of Safety, Federal Highway Administration, 2009. Available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa10001/ .	*"The objectives of this guide are to:* *-Define common speed-related terminology so that the guide's contents can be clearly conveyed.* *- Explain the differences between designated design speed, inferred design speed, operating speed, and posted speed limits.* *- Illustrate perceptions and research conclusions related to the effects of speed.* *-Document speed-based technical processes.* *- Summarize State and local government agency roles and actions related to traffic speed.* *- Highlight speed management and mitigation measures."*	-Engineers -Enforcement -Others
Automated Enforcement for Speeding and Red Light Running. NCHRP Report 729, Washington, D.C.: Transportation Research Board, 2012. Available at: http://www.trb.org/main/blurbs/167757.aspx.	*"TRB's* [Transportation Research Board] *National Cooperative Highway Research Program (NCHRP) Report 729: Automated Enforcement for Speeding and Red Light Running includes guidelines designed to help transportation agencies start-up and operate automated enforcement programs to improve highway safety by reducing speeding and red light running."*	-Enforcement -Program Managers

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Engineering Countermeasures for Reducing Speeds: A Desktop Reference of Potential Effectiveness in Reducing Speed. FHWA Office of Safety website tool, 2014. Available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/2014/reducing_speed.cfm.	*"This chart summarizes studies about engineering countermeasures used to manage speeds. Studies where an increase in speed were reported are also shown since this information is also relevant in selection of countermeasures."*	-Engineers -Others
Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Crashes. FHWA Office of Safety website tool, 2014. Available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/2014/eng_ctm_crsh_14.pdf	*"This chart summarizes studies about the effectiveness of engineering countermeasures. Studies where an increase in crashes were reported are also shown since this information is also relevant in selection of countermeasures."*	-Engineers -Others

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Traffic Calming: State of the Practice. Prepared for the U.S. Department of Transportation, Federal Highway Administration, by Institute of Transportation Engineers, 1999. Available at: http://www.ite.org/traffic/tcstate.asp - tcsop.	*"Traffic Calming: State of the Practice is an Informational Report of the Institute of Transportation Engineers (ITE) and the Federal Highway Administration (FHWA). The information in this document has been obtained from the research and experiences of transportation engineering and planning professionals. The report was prepared by ITE on behalf of FHWA for informational purposes only and does not include recommendations on the best course of action or the preferred application of the data."*	-Engineers
FHWA Guidance Memorandum on Consideration and Implementation of Proven Safety Countermeasures. Date: July 10, 2008 Available at: http://safety.fhwa.dot.gov/policy/memo071008/.	Considerations and Implementation of Proven Safety Countermeasures.	-All
FHWA. Speed Management Safety. Available at: http://safety.fhwa.dot.gov/speedmgt/.	FHWA Speed Management webpages and resources.	-Engineers

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
***Methods and Practices for Setting Speed Limits: An Informational Report*.** Washington, D.C.: Federal Highway Administration, Report no. FHWA-SA-12-004. Available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa12004/.	*"This informational report describes four primary practices and methodologies that are used in establishing speed limits (engineering approach, expert systems, optimization, and injury minimization). It also reviews the basic legalities of speed limits and presents several case studies for setting speed limits on a variety of roads."*	-Engineers -Program Managers -Policy-Makers
Community Speed Reduction and Public Health. Informational resources and case studies. Available at: http://hria.org/resources/reports/community-speed-reduction/2013-resources-speed-reduction.html.	*"Motor vehicle crashes are the leading cause of unintentional injury deaths in the United States each year. In 2011, vehicle speed played a role in nearly one in three crash deaths, about ninety percent of which took place on non-Interstate roads. High speeds are especially dangerous for pedestrians and cyclists, who are disproportionately threatened by even small increases in traffic speed, when collisions occur. Poor road design, lack of enforcement, and speed limits that are set too high can encourage high speeds. Community-wide speed reduction strategies intervene in the built environment to slow down motor vehicles and are systematically applied within a defined geographic area."* - See more at: http://hria.org/resources/reports/community-speed-reduction/2013-resources-speed-reduction.html - sthash.EqjnT2WZ.dpuf.	-Public Health / Injury Prevention -Policymakers

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Interactive Highway Safety Design Model (IHSDM). Website with description and link to the IHSDM modeling tool. Available at: http://www.fhwa.dot.gov/research/tfhrc/projects/safety/comprehensive/ihsdm/.	*"IHSDM development is coordinated with two related initiatives: the Highway Safety Manual, developed by the Transportation Research Board and published by AASHTO; and the SafetyAnalyst, developed by FHWA and now available as AASHTOWare.* *The Interactive Highway Safety Design Model (IHSDM) is a suite of software analysis tools for evaluating safety and operational effects of geometric design decisions on highways. IHSDM is a decision-support tool. It provides estimates of a highway design's expected safety and operational performance and checks existing or proposed highway designs against relevant design policy values. IHSDM results support decision making in the highway design process. Intended users include highway project managers, designers, and traffic and safety reviewers in State and local highway agencies and engineering consulting firms.* *IHSDM currently includes six evaluation modules (Crash Prediction, Design Consistency, Intersection Review, Policy Review, Traffic Analysis, and Driver/Vehicle)."*	-Engineers
Managing Speed: Review of current practice for setting and enforcing speed limits. Transportation Research Board, Special Report 254, National Research Council. Washington, D.C., National Academy Press, 1998. Available: http://www.trb.org/Main/Blurbs/152251.aspx.	*"Managing Speed: Review of Current Practices for Setting and Enforcing Speed Limits reviews practices for setting and enforcing speed limits on all types of roads and provides guidance to state and local governments on appropriate methods of setting speed limits and related enforcement strategies. Following an executive summary, the report is presented in six chapters and five appendices."*	-Engineers -Program Managers -Enforcement

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Adding Power to Our Voices: A Framing Guide for Communicating about Injury. National Center for Injury Prevention and Control: Atlanta, GA: US Department of health and Human Services, Centers for Disease Control and Prevention; 2008 (revised March 2010). Available: http://www.cdc.gov/injury/framing.	*"This guide is designed to help organizations involved in injury and violence prevention and response speak with a consistent voice. The framing guide is built on the belief that the collective voice of many injury and violence professionals across several disciplines is much louder than that of an individual or single organization.* *This guide incorporates framing theory, message development techniques and vehicles for explaining important public health statistics. The information and tools provided in this Guide can be used to build messages that can be included in press releases, speeches, annual reports, and research articles, to help health professionals better communicate with their audiences."*	-Communications Specialists
Roundabouts: An informational guide, Second edition. NCHRP Report 672, Transportation Research Board: Washington, D.C., 2010. Available: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_672.pdf.	*"This report updates the FHWA's Roundabouts: An Informational Guide based on experience gained in the United States since that guide was published in 2000. The report addresses the planning, design, construction, maintenance, and operation of roundabouts. It also includes information that will be useful in explaining to the public the trade-offs associated with roundabouts."*	-Engineers

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Guidance for Implementation of the AASHTO Strategic Highway Safety Plan. Volume 21: Safety Data and Analysis in Developing Emphasis Area Plans. Washington, DC: NCHRP, Transportation Research Board, 2008. Available: onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_500v21.pdf.	*"This guide specifically addresses highway safety data, an emphasis area under the management category in AASHTO's SHAP, and was developed to aid highway safety analysts in using the other implementation guides to make decisions about how to appropriately allocate safety funds to get the best results. Section I introduces a three-stage process for identifying a target emphasis area, setting an appropriate injury (and fatality) reduction goal, and defining the treatments that will allow the jurisdiction to reach that goal." Section II describes the types of data necessary; Section III lays out the details of the three-stage process; and the remaining sections provide a detailed description of the specific applications of the process and procedures for roadway segments, junctions, special road users, illegal driver actions, unsafe driver actions, work zones, and EMS services."*	-Program Managers -Data Analysts
Guidance for Implementation of the AASHTO Strategic Highway Safety Plan. Volume 23: A Guide for Reducing Speeding-Related Crashes. Washington, DC: NCHRP, Transportation Research Board, 2009. Available: onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_500v23.pdf.	Note: This guide, one of a series of 23 such guides in the NCHRP Report 500 series, describes essential processes and a speed management program planning framework, as well as specific strategies and countermeasures, to assist with meeting Strategic Highway Safety Plan objectives. *"One of the hallmarks of the AASHTO Strategic Highway Safety Plan process is to approach safety problems in a comprehensive manner. The range of strategies available in the guides cover various aspects of the road user, the highway, the vehicle, the environment, and the management system. The guides strongly encourage the user to develop a program to tackle a particular emphasis area from each of these perspectives in a coordinated manner."*	-All Road Safety Practitioners -Program Managers

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Countermeasures that Work, 7th ed. Department of Transportation, National Highway Traffic Safety Administration, 2013. Available at: www.nhtsa.gov/staticfiles/nti/pdf/811727.pdf.	*"The National Highway Traffic Safety Administration has released the latest edition of its report that explores major highway safety strategies and countermeasures that are relevant to State Highway Safety Offices; summarizes their use, effectiveness, costs, and implementation time; and provides references to safety research summaries and individual studies."*	-Enforcement -Educators -Communications Specialists
Uniform Guidelines for State Highway Safety Programs. Highway Safety Program Guidelines No. 19. National Highway Traffic Safety Administration, 2006. Available: http://www.nhtsa.gov/nhtsa/whatsup/tea21/tea21programs/402guide.html#g19.	The Speed Control Guidelines (no. 19) is one of 21 sets of uniform program guidelines for state highway safety programs developed for TEA21. *"Introduction: Each State, in cooperation with its political subdivisions, should have, as part of a comprehensive highway safety program, an effective speed control program that encourages its citizens to voluntarily comply with speed limits. The program should stress systematic and rational establishment of speed limits, a law enforcement commitment to controlling speed on all public roads, a commitment to utilize both traditional methods and state-of-the art equipment in setting and enforcing speed limits, and a strong public information and education program aimed at increasing driver compliance with speed limits."*	-Program Managers -Enforcement -Communications Specialists

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Effectiveness of Behavioral Highway Safety Countermeasures, NCHRP Report 622. Washington, DC: Transportation Research Board, 2008. Available: http://www.nap.edu/openbook.php?record_id=14195.	*"The goal of this project is to assist states in selecting programs, projects, and activities that have the greatest potential for the reduction of highway death and injury. The specific objectives are as follows: Produce a manual for application of behavioral highway safety countermeasures and develop a frame-work and guidance for estimating the costs and benefits of emerging, experimental, untried, or unproven behavioral highway safety countermeasures."*	-Enforcement -Communications Specialists -Program Managers

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Road Safety Audit resources on FHWA website: http://safety.fhwa.dot.gov/rsa/. ***FHWA Road Safety Audit Guidelines.*** Available: http://safety.fhwa.dot.gov/rsa/guidelines/. ***Pedestrian Road Safety Audit Guidelines and Prompt Lists.*** Highway Administration. Available: http://safety.fhwa.dot.gov/ped_bike/tools_solve/ped_rsa/. ***Bicycle Road Safety Audit Guidelines and Prompt Lists.*** Available: http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa12018/.	*"A Road Safety Audit (RSA) is the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users. The FHWA works with State and local jurisdictions and Tribal Governments to integrate RSAs into the project development process for new roads and intersections, and also encourages RSAs on existing roads and intersections…* *The aim of an RSA is to answer the following questions:* *-What elements of the road may present a safety concern: to what extent, to which road users, and under what circumstances?* *-What opportunities exist to eliminate or mitigate identified safety concerns?* *Public agencies with a desire to improve the overall safety performance of roadways under their jurisdiction should be excited about the concept of RSAs. Road safety audits can be used in any phase of project development from planning and preliminary engineering, design and construction. RSAs can also be used on any sized project from minor intersection and roadway retrofits to mega-projects."* Note: The pedestrian and bicycle road safety audit guidelines provide supplemental information focusing on safety and roadway issues particularly affecting those users.	-Engineers -Planners -Law Enforcement -Other Road Safety Stakeholders

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Safety Analyst. AASHTOware. Network screening analysis tool. Available: http://www.safetyanalyst.org/.	*"Synopsis: SafetyAnalyst incorporates state-of-the-art safety management approaches into computerized analytical tools for guiding the decision-making process to identify safety improvement needs and develop a system wide program of site-specific improvement projects. SafetyAnalyst has a strong basis in cost-effectiveness analysis; thus, SafetyAnalyst has an important role in ensuring that highway agencies get the greatest possible safety benefit from each dollar spent in the name of safety. SafetyAnalyst was developed as a cooperative effort by FHWA and participating state and local agencies. AASHTO manages distribution, technical support, maintenance, and enhancement of SafetyAnalyst as a licensed AASHTOWare product."*	-Engineers
Speed Management: Road Safety Manual for Decision-makers and Practitioners. Geneva: Global Road Safety Partnership, 2008. Available at: http://www.who.int/roadsafety/projects/manuals/speed_manual/en/.	*"This speed management manual proposes simple, effective and low-cost solutions to excessive and inappropriate speed that can be implemented on a national or local level. It targets governments, non-governmental organizations and road safety practitioners, particularly those in low- and middle-income countries. The manual is based on a modular structure that provides evidence, examples, case studies and practical steps on how to manage vehicle speed."*	-All Safety Stakeholders -Program Managers -Policymakers
U.S. DOT, NHTSA Branding website. Accessible at: http://www.trafficsafetymarketing.gov/TOOLS/Branding.	General traffic safety marketing guidance.	-Communications Specialists

Speed Management Resources - Annotated Bibliography		
Resource	**Description**	**Primary Audience**
Speed Enforcement Camera Systems: Operational Guidelines. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration and Federal Highway Administration, 2008. Available at: http://ntl.bts.gov/lib/30000/30100/30166/810916.pdf.	*"The ASE guidelines are intended to serve program managers, administrators, law enforcement, traffic engineers, program evaluators, and other individuals responsible for the strategic vision and daily operations of the program. The guidelines are written from a U.S. perspective and emphasize U.S. contexts and best practices. However, they are also drawn from the experiences of exemplary programs internationally. Though international differences in law, history, and culture might influence best practices for ASE, the majority of these guidelines are relevant to ASE programs worldwide."*	-Enforcement -Engineering -Program Managers
USLimits2. FHWA. A Tool to Aid Practitioners in Determining Appropriate Speed Limit Recommendations. Tool available at: http://safety.fhwa.dot.gov/uslimits/	*"USLIMITS is a web based tool designed to help practitioners set reasonable, safe, and consistent speed limits for specific segments of roads. USLIMITS is applicable to all types of roads ranging from rural local roads and residential streets to urban freeways.* *User-friendly, logical, and objective, USLIMITS2 is of particular benefit to local communities and agencies without ready access to engineers experienced in conducting speed studies for setting appropriate speed limits. For experienced engineers, USLIMITS2 can provide an objective second opinion and increase confidence in speed limit setting decisions."* A related report documenting research for USLimits, 1st ed.: *Expert System for Recommending Speed Limits in Speed Zones: Final Report.* National Cooperative Highway Research Program, Transportation Research Board. Available at: onlinepubs.trb.org/onlinepubs/trbnet/acl/NCHRP%200367_FinalReport.pdf.	-Engineers -Others responsible for setting speed limits

Speed Management Countermeasures

Countermeasures included in this Resource are ones with well-documented safety or speed-reducing effects. The countermeasures with expected crash modifying effects (Crash Modifying Factors or CMFs) that were included in the Highway Safety Manual (AASHTO, 2010) or that are derived from high quality studies that have since been added to the CMF Clearinghouse are included. (See more information on these resources in the bibliography.) In addition, some measures with speed-reducing or calming effects but (as of the time this document was prepared) unproven crash-reducing effects, are also included, since measures known to reduce speeds are also expected to reduce fatal and injury crashes. In particular, geometric measures that by their design limit travel speeds are expected to lower speeds where vehicles are traveling above those design speeds. More information on using these estimates of speed reduction to determine expected crash benefits is provided below.

Table 2 provides an overview of the countermeasures identified to reduce crashes, and/or control travel speed by design. Other types of treatments that have been reported to reduce travel speeds in multiple studies at multiple locations are also included for consideration. Other measures may also reduce travel speeds and crashes in some situations, but the evidence is less conclusive.

Below Table 2, the listed countermeasures are grouped into additional tables containing more details about the expected crash or speed effects of these treatments**.** Separate tables are provided for measures with expected crash reductions (crash modification effects) and measures with expected speed reductions as follows:

- Road Design and Traffic Calming countermeasures.
  - Potential crash effects (Table 3).
  - Potential speed reduction effects (Table 4).
- Pavement Treatments, Markings, and Signs.
  - Potential crash effects (Table 5).
  - Potential speed reduction effects (Table 6).
- Traffic Speed Management and Operations measures.
  - Potential crash effects (Table 7).
- Enforcement and Publicity measures.
  - Potential crash effects (Table 8).

Two other tables are included (Table 9 and Table 10) that show what the crash effects might be for countermeasures that reduce travel speeds (Tables 4 and 6, and FHWA's Engineering Countermeasures for Reducing Speeds), but measured crash effects are unavailable.

Table 2 shows the area and location types where the countermeasure is most typically applied. The two right-most columns under "Documented Effects" indicate whether research has found crash-reducing or speed-reducing effects of the treatment, or both.

Table 2. Matrix of Speeding-related Crash Countermeasures.

Matrix of Speeding-related Crash Countermeasures								
	Area Type			Location Type			Documented Effects	
Countermeasure Name	Urban	Suburban	Rural	Intersection	Section/ corridor	Curve	Crash Reducing	[1]Speed Reducing
Design and Traffic Calming								
Area-wide Traffic Calming	X	X	X	X	X		X	X
Chicanes	X	X	X		X			X
Full Closure	X	X						X
Gateway Treatment	X	X	X					X
Half Closure	X	X						X
Lateral Shift	X	X	X		X			X
Mini Traffic Circle	X	X	X	X			X	X
Realigned Skewed Intersection	X	X	X	X			X	X
Reduce Lane Width on Intersection Approaches using longitudinal rumble strips and painted median			X	X			X	X
Road Diet	X	X			X		X	X
Roundabout	X	X	X	X	Pos.[2]		X	X
Speed Cushions	X	X	X	X				X
Speed Humps	X	X	X	X				X

[1] Crash-based evidence may be unavailable for some measures with documented speed-reducing effects. Estimates of speed reduction may be used in conjunction with Highway Safety Manual estimates of crash modification effects for changes in average operating speed to generate crash modification estimates for speed-reducing treatments.

[2] May also improve flow and average mobility along a corridor.

Matrix of Speeding-related Crash Countermeasures								
	Area Type			Location Type			Documented Effects	
Countermeasure Name	Urban	Suburban	Rural	Intersection	Section/ corridor	Curve	Crash Reducing	[1]Speed Reducing
Design and Traffic Calming								
Speed Tables	X	X	X	X				X
Traffic Calming (varied)	X	X	X	X	X		X	X
Pavement Treatments, Markings, Signs, and Signals								
Enhanced Curve Delineation			X			X	X	
Optical Speed bars / Converging Chevrons	X	X	X	X	X	X		Possibly
Transverse (in lane) Rumble Strips for Speed Calming	Pos.[3]	Pos.	X	X		X	X	
Speed Management and Traffic Operations Measures								
Lower Speed Limits on Expressway	X	X	X		X		X	
Protected-only Left Turn Signal Phasing (high-speed intersections)				X			X	
Signal Coordination along a Corridor	X	X		X	X		X	
Variable Speed Limits on Expressway [4]	X				X		X	X
Enforcement and Publicity								
Automated Section Speed Enforcement								
Mobile Speed Camera Enforcement	X	X					X	X
Fixed Speed Camera Enforcement	X	X					X	X
Publicity of Automated Speed Enforcement Cameras	X	X					X	
Speed Display / Feedback Devices	X	X	X		X		X	X [5]

[3] May be used in urban / suburban areas, but there are noise considerations in developed areas.
[4] In testing phase in U.S. but promising speed and crash reductions have been documented when limits are lowered.
[5] Effective where and while in place. Effects enhanced with visible law enforcement presence. May not be effective in some areas.

Users should consider that combinations of multiple countermeasures might be appropriate and generate larger crash reductions than any one measure. Other types of countermeasures may provide mitigation or reduce crash types that frequently involve speeding, but are not included in this Resource. Such measures as improving pavement friction, providing shoulder and centerline rumble strips, and providing roadside barriers may reduce some types of crashes that are potentially associated with speeding, but are unlikely to reduce travel speeds.

Using the Tables of Crash Modification Factor (CMF) Estimates

In each of the tables with crash modification estimates below, the expected effects on crashes of the listed countermeasures are shown in the "CMFs" column. CMFs (or crash modification factors) show the expected effects (with standard errors when available) of the different treatments compared to if no treatment were applied. These estimates may be used to help perform cost : benefit analysis of alternate potential countermeasures as described in the Action Plan Template document and other sources. Countermeasures with CMFs less than 1 are expected to have a crash-reducing effect. For example, a CMF of 0.7 is expected to yield a crash rate of 0.7 times the expected crash rate if no treatment is applied, or a 30 percent crash reduction, controlling for traffic volume and other trends. Statistically significant CMFs are shown with asterisks.

A few non-significant CMF effects are included that indicate potential safety improvement, but uncertainty of the estimate means the CMF may be no different than 1 (within 90 or 95% confidence limits). The standard error estimates provide an indication of the variability and reliability of the estimate. Small standard errors (s.e.) that are much less than the estimated CMF indicate more robust and reliable estimates. Some non-significant effects or negative treatment effects were also included in the tables for more complete disclosure about the overall potential effects of a treatment. Treatments may sometimes have beneficial effects on certain crash types or severities but no effect or negative effects on other types or severities. The potential user should understand these potential trade-offs to understand how best to apply the treatment.

The CMF star ratings provide another indication of the quality or reliability of the estimate, as provided by the expert reviewers for the CMF Clearinghouse. A five point star-rating system (highest quality) was developed using five measures of study quality.[6] An "HSM" in the CMF star rating column indicates that the estimate is from the Highway Safety Manual.

The area and location types, and types of crashes covered by the CMF estimate, are those that were included in the study and may not be generalizable to other conditions. Other disaggregate effect measures may also be available from some studies. The sources of the estimates are provided in footnoted references. If specific estimates are unavailable for the circumstances for which treatment is needed, the estimate for the most similar circumstances may be used, but additional uncertainty or caution may be warranted. In addition, locally-calibrated CMFs should be used, if available, as estimates derived from other States/areas may need adjustment to reflect differences in expected outcomes.

The CMF estimates (or locally-calibrated CMFs) may be used to help determine the expected economic benefits or cost-effectiveness of each treatment. As per the Action Plan, each corridor or location must undergo further diagnosis to determine the most appropriate treatment or combination of treatments among alternates available.

Using the Tables of Potential Speed Reduction Effects

Traffic calming measures with speed limiting designs (primarily measures that require a vertical or horizontal shift in the travel way) are included in Table 4. Other traffic calming measures that have been reported to reduce travel speeds in multiple studies at multiple locations are also included in Table 4 and Table 6.

The speed reduction estimates in Table 4 (Traffic Calming Measures) and Table 6 (Pavement Treatments, Markings and Signs) are reproduced from the 2009 version of *Engineering Countermeasures for Reducing Speeds.* Note that this resource was updated in 2014, and the updated resource is available on FHWA's speed management web pages. This and a companion resource on the crash effects of speed-related countermeasures are both referenced in Table 1. More information about the reported changes in speed

[6] CMF Clearinghouse. The star quality ratings are based assessments of study design, sample size, standard error, potential bias, and data source. For more information see the Clearinghouse website at http://www.cmfclearinghouse.org/sqr.cfm

and references to the original studies are available in the *Engineering Countermeasures* resource. Note that different studies may have measured speeds using different methods. For example, not all may have measured change in free-flow operating speeds, so caution or review of the original studies is suggested. The resources (both 2009 and 2014) also include additional countermeasures reported in some instances to reduce travel speeds, but effects may not be consistent. Similar to CMF estimates with larger standard errors, larger standard deviations suggest that speed results obtained may vary to a greater degree compared to measures with lower standard deviations. Again, combinations of treatments may be needed to achieve desired crash/speed reductions.

In the case of measures for which there are estimates of speed change, but as yet no measured crash effects, *estimates of potential crash effects* can be obtained by using expected crash effects for changes in *average travel speed*. As mentioned earlier, CMFs from Table 9 and Table 10, which were adapted from the Highway Safety Manual, may be used to estimate fatal and injury crash effects for countermeasures that reduce average travel speed.

Table 3 follows with crash effect estimates for design and traffic calming treatments.

Table 3. Potential Crash Effects (CMFs) for Design and Traffic Calming Treatments.

CMFs for Design and Traffic Calming Treatments								
Countermeasure	*Description*	*Area Type*	*Road / Intersection Type*	*Traffic Volume*	*Crash Type*	*Crash Injury Severity*	*CMF [7] (std. error)*	*CMF Star Rating*
Traffic Calming [8]	Area/corridor-wide traffic calming	Urban	All	Up to 30,000	All	Serious, Minor Injury	0.89** (0.05)	5
Traffic Calming [8]	Area/corridor-wide traffic calming	Urban	Local	Not specified	All	Serious, Minor Injury	0.82 (0.12)	3
Traffic Calming [8]	Area/corridor-wide traffic calming	Urban	Major, Minor Collector (2+ lanes)	5000 - 30,000	All	Serious, Minor Injury	0.94 (0.06)	3
Realign Skewed Intersection [9]	Realign skewed angle(s) of intersection approach(es)	Rural	Unsignalized, 3-leg intersection of 2-lane highways (minor road stop-controlled)	Not specified	All	All	CMF = e(0.0040 x *SKEW* angle) [10]	Equa-tions cannot be rated

[7] In this and each subsequent table of CMFs, ** (two asterisks) next to the CMF estimate indicates effects significant at the 0.05 level (95% confidence interval).
In this and each subsequent table of CMFs, * (one asterisk) next to the CMF estimate indicates effects significant at the 0.10 level (90% confidence interval). No stars indicates that the effects reported were not statistically significant, or significance could not be determined.

[8] Source: Elvik, R. and Vaa, T., (2004). *Handbook of Road Safety Measures.* Oxford, United Kingdom: Elsevier.

[9] Sources: AASHTO (2010). *Highway Safety Manual, 1st ed*. Washington, DC: American Association of State Highway and Transportation Officials. [There are mistakes in equations for multilane roads in the HSM; also see: Lord et al., *Methodology for Estimating the Safety Performance of Multilane Rural Highways.* National Cooperative Highway Research Program 17-29 Project, Washington, DC: NCHRP, for the original equations.]

[10] The base condition for this CMF is an intersection without any skew (i.e., all the intersection angles are 90 degrees). If converting from a skewed intersection to an intersection without skew (all right angles), the inverse of the CMF (i.e., 1/CMF) should be used. If converting from an intersection with more skew to

CMFs for Design and Traffic Calming Treatments								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF [7] (std. error)***	***CMF Star Rating***
Realign Skewed Intersection [9]	Realign skewed angle(s) of intersection approach(es)	Rural	Unsignalized 4-leg intersection of 2-lane highways (minor road stop-controlled)	Not specified	All	All	CMF = e(0.0054 x *SKEW* angle) [10]	Cannot be rated
Realign Skewed Intersection [9]	Realign skewed angle(s) of intersection approach(es)	Rural	Unsignalized 3-leg intersection of multi-lane highways (minor road stop-controlled)	Not specified	All	All	CMF = 0.016 x *SKEW*/(098 + 0.016 x *SKEW* angle) + 1.0 [10]	Cannot be rated
Realign Skewed Intersection [9]	Realign skewed angle(s) of intersection approach(es)	Rural	Unsignalized 4-leg intersection of multi-lane highways (minor road stop-controlled)	Not specified	All	All	CMF = (0.053 x *SKEW)*/ (1.43 + 0.053 x *SKEW angle*) + 1.0 [10]	Cannot be rated

one with less skew, use the difference between the CMFs for the estimated crash effects of the different skew angles. For more information see the Highway Safety Manual or http://safety.fhwa.dot.gov/intersection/resources/intsafestratbro/ub16_intersection_skew.pdf.

CMFs for Design and Traffic Calming Treatments								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF [7] (std. error)***	***CMF Star Rating***
Reduce Lane Width - Intersection Approach [11]	Reduce lane width using longitudinal rumble strips on both edge lines and painted median	Rural	Major (high speed) road approach of 2-lane, 2-way roadways with 2-way STOP-control, 3-leg, 4-leg.	Not specified	All	All	0.69 (n/a)	2 [12]
Reduce Lane Width - Intersection Approach [11]	Reduce lane width using longitudinal rumble strips on both edge lines and painted median	Rural	Major (high speed) road approach of 2-lane, 2-way roadways with 2-way STOP-control, 3-leg, 4-leg.	Not specified	All	Fatal, Serious, Minor Injury	0.8 (n/a)	2

[11] Source: Hughes, W., Jagannathan, R., and Gross, F. (2008). *Two Low Cost Safety Concepts for Two Way Stop Controlled, Rural Intersections on High Speed Two Lane, Two Way Roadways,* (Report No. FHWA-HRT-08-063), Washington, DC: Federal Highway Administration. Available at: http://www.fhwa.dot.gov/publications/research/safety/10047/index.cfm.

[12] Note increase in rear-end crashes. Although the CMF estimate receives only a fair rating (2 stars) due to a small sample size, a preliminary study observed that operating speeds at the treatment sites decreased by an average of 4.5 mph for all vehicles, and by 4.8 mph for trucks. These speed reductions support crash reduction effectiveness.

CMFs for Design and Traffic Calming Treatments								
Countermeasure	*Description*	*Area Type*	*Road / Intersection Type*	*Traffic Volume*	*Crash Type*	*Crash Injury Severity*	*CMF [7] (std. error)*	*CMF Star Rating*
Reduce Lane Width - Intersection Approach [11]	Reduce lane width using longitudinal rumble strips on both edge lines and painted median	Rural	Major (high speed) road approach of 2-lane, 2-way roadways with 2-way STOP-control, 3-leg, 4-leg.	Not specified	Angle	All	0.58 (n/a)	2
Reduce Lane Width - Intersection Approach [11]	Reduce lane width using longitudinal rumble strips on both edge lines and painted median	Rural	Major (high speed) road approach of 2-lane, 2-way roadways with 2-way STOP-control, 3-leg, 4-leg.	Not specified	Rear-end	All	1.54 (n/a)	2

CMFs for Design and Traffic Calming Treatments								
Countermeasure	*Description*	*Area Type*	*Road / Intersection Type*	*Traffic Volume*	*Crash Type*	*Crash Injury Severity*	*CMF [7] (std. error)*	*CMF Star Rating*
Road Diet [13]	Convert 4-lane undivided road to 2-lanes plus turning lane)	Urban & Suburban	Minor Arterial and Highway routes	4,000 - 17,000	All	All	0.71** (0.02)	5
Road Diet [13]	Convert 4-lane undivided road to 2-lanes plus turning lane)	Large Suburban area	Minor Arterial	6000 to 17,000	All	All	0.81** (.03)	4
Road Diet [13]	Convert 4-lane undivided road to 2-lanes plus turning lane)	Small Urban	Highway routes	4000 to 14,000	All	All	0.53** (0.01)	4
Roundabout [14, 15]	Convert two-way stop-controlled intersection to roundabout	All	All (1- or 2-lane)	Not specified	All	All	0.56** (0.04)	5

[13] Source: NCHRP, (2008). *Crash Reduction Factors for Traffic Engineering and ITS Improvements*, *NCHRP Report 617,* Washington, D.C.: National Cooperative Highway Research Program, Transportation Research Board. Available at: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_617.pdf.

[14] Source: NCHRP (2007). *Applying Roundabouts in the United States, NCHRP Report 572,* Washington, D.C.: National Cooperative Highway Research Program, Transportation Research Board.

[15] With the exception of all-way stop control conversions (where no significant change in crashes), roundabouts have provided significant safety benefits in urban, suburban and rural environments for both signal-control and stop-controlled conversions (NCHRP 572). Injury /more severe crashes are especially

CMFs for Design and Traffic Calming Treatments								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF [7] (std. error)***	***CMF Star Rating***
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	All	All (1- or 2-lane)	Not specified	All	Injury	0.18** (0.03)	5
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Rural	1-lane	Not specified	All	All	0.29** (0.04)	5
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Rural	1-lane	Not specified	All	Injury	0.13** (0.03)	5

reduced. Safety benefits are highest for single-lane roundabouts. Consider pedestrian (including sight-impaired) and bicyclist needs at entry/crossings and especially exits where yielding by motorists was lower. Two-lane entry legs are also more difficult for pedestrians to cross than one-lane entry legs. See http://safety.fhwa.dot.gov/intersection/resources/fhwasa10005/brief_14.cfm

CMFs for Design and Traffic Calming Treatments								
Countermeasure	*Description*	*Area Type*	*Road / Intersection Type*	*Traffic Volume*	*Crash Type*	*Crash Injury Severity*	*CMF [7] (std. error)*	*CMF Star Rating*
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Suburban	All (1- or2-lane)	Not specified	All	All	0.68** (0.07)	4
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Suburban	All (1- or2-lane)	Not specified	All	Injury	0.29** (0.08)	4
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Suburban	1-lane	Not specified	All	All	0.22** (0.06)	4
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Suburban	1-lane	Not specified	All	Injury	0.22** (0.10)	4
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Suburban	2-lane	Not specified	All	All	0.81** (0.09)	3

CMFs for Design and Traffic Calming Treatments								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF [7] (std. error)***	***CMF Star Rating***
Roundabout [14]	Convert two-way stop-controlled intersection to roundabout	Suburban	2-lane	Not specified	All	Injury	0.32** (0.12)	4
Roundabout [16]	Convert two-way stop-controlled intersection to roundabout	Urban	All (1- or 2-lane)	Not specified	All	All	0.71** (0.09)	4
Roundabout [16]	Convert two-way stop-controlled intersection to roundabout	Urban	All (1- or 2-lane)	Not specified	All	Injury	0.19** (0.08)	4

[16] Source: NCHRP (2007). *Applying Roundabouts in the United States, NCHRP Report 572,* Washington, D.C.: National Cooperative Highway Research Program, Transportation Research Board.

CMFs for Design and Traffic Calming Treatments								
Countermeasure	*Description*	*Area Type*	*Road / Intersection Type*	*Traffic Volume*	*Crash Type*	*Crash Injury Severity*	*CMF [7] (std. error)*	*CMF Star Rating*
Roundabout [16]	Convert two-way stop-controlled intersection to roundabout	Urban	1-lane	Not specified	All	All	0.61** (0.10)	4
Roundabout [16]	Convert two-way stop-controlled intersection to roundabout	Urban	1-lane	Not specified	All	Injury	0.22** (0.10)	4
Roundabout [16]	Convert two-way stop-controlled intersection to roundabout	Urban	2-lane	Not specified	All	All	0.88 (0.17)	3
Roundabout [16]	Convert two-way stop-controlled intersection to roundabout	Urban	2-lane	Not specified	All	Injury	too few to estimate	

CMFs for Design and Traffic Calming Treatments								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF [7] (std. error)***	***CMF Star Rating***
Roundabout [17]	Convert signalized intersection to roundabout	Urban / Suburban	1-lane	5,322-43,123 total intersection	All	All	0.735** (0.086)	3
Roundabout [17]	Convert signalized intersection to roundabout	Urban / Suburban	1-lane	5,322-43,123 total intersection	All	Fatal, Serious, Minor Injury	0.451** (0.115)	3
Roundabout [17]	Convert signalized intersection to roundabout	Suburban	1-2-lane	5,322-43,123 total intersection	All	All	0.576** (0.053)	4
Roundabout [17]	Convert signalized intersection to roundabout	Suburban	1-2-lane	5,322-43,123 total intersection	All	Fatal, Serious, Minor Injury	0.259** (0.066)	4

[17] Source: Srinivasan, R., Baek, J., Smith, S., Sundstrom, C., Carter, D., Lyon, C., Persaud, B., Gross, F., Eccles, K., Hamidi, A., and Lefler, N. (2011). *Evaluation of Safety Strategies at Signalized Intersections, NCHRP Report 705*, Washington, DC.: Transportation Research Board.

CMFs for Design and Traffic Calming Treatments								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF [7] (std. error)***	***CMF Star Rating***
Roundabout [18]	Convert signalized intersection to roundabout	Urban	1-2-lane	5,322-43,123 total intersection	All	All	1.150 (0.093)	3
Roundabout [18]	Convert signalized intersection to roundabout	Urban	1-2-lane	5,322-43,123 total intersection	All	Fatal, Serious, Minor Injury	0.445** (0.100)	4
Roundabout [18]	Convert signalized intersection to roundabout	Suburban and Urban	1-2-lane; 3 leg intersection	5,322-43,123 total intersection	All	All	1.066 (0.163)	3
Roundabout [18]	Convert signalized intersection to roundabout	Suburban and Urban	1-2-lanes; 3 leg intersection	5,322-43,123 total intersection	All	Fatal, Serious, Minor Injury	0.370** (0.172)	3
Roundabout [18]	Convert signalized intersection to roundabout	Suburban and Urban	1-2-lane; 4 leg intersection	5,322-43,123 total intersection	All	All	0.759** (0.052)	4

[18] Source: Srinivasan, R., Baek, J., Smith, S., Sundstrom, C., Carter, D., Lyon, C., Persaud, B., Gross, F., Eccles, K., Hamidi, A., and Lefler, N. (2011). *Evaluation of Safety Strategies at Signalized Intersections, NCHRP Report 705*, Washington, DC.: Transportation Research Board.

CMFs for Design and Traffic Calming Treatments								
Countermeasure	*Description*	*Area Type*	*Road / Intersection Type*	*Traffic Volume*	*Crash Type*	*Crash Injury Severity*	*CMF [7] (std. error)*	*CMF Star Rating*
Roundabout [18]	Convert signalized intersection to roundabout	Urban / Suburban	1-2-lane; 4 leg intersection	5,322-43,123 total intersection	All	Injury and Fatal	0.338** (0.061)	3
Roundabout [18]	Convert signalized intersection to roundabout	Urban / Suburban	2-lane; 3-4 leg	5,322-43,123 total intersection	All	All	0.809** (0.061)	4
Roundabout [18]	Convert signalized intersection to roundabout	Urban / Suburban	2-lane; 3-4 leg	5,322-43,123 total intersection	All	Fatal, Serious, Minor Injury	0.288** (0.065)	4
Speed Humps [19]	Rounded, raised area (3 - 4" high spanning 12 - 14 feet in length)	Urban / Suburban	Local 2-lane roads	Not specified	All	Serious, Minor Injury	0.6** (0.16)	4

Table 4 shows potential speed reductions, based on prior studies, which might be obtained with traffic calming measures. There may be significant variability in the speed reduction effect percentages actually obtained, as shown by higher standard deviations in the average results. Results may vary by site, or by prior speeds or other conditions. More information is available in the source document and original studies. Estimates of speed effects can be used to estimate crash effects by consulting Tables 9 and 10.

[19] Source: Elvik, R. and Vaa, T. (2004). *Handbook of Road Safety Measures*. Oxford, United Kingdom: Elsevier.

Table 4. Potential Speed Reductions for Design and Traffic Calming Measures.[20]

Potential Speed Reductions for Design and Traffic Calming Measures					
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***85th Percentile Speed Reduction (std. deviation)***
Chicanes	Curb extensions that alternate from one side of the street to the other, forming S-shaped curves.	Urban	Not specified	1,380 - 3,200	16% (4%)
Chicanes	Curb extensions that alternate from one side of the street to the other, forming S-shaped curves.	Not specified	Not specified	1,380 - 1,965	29% (8%)
Full Closure	Physical street closure resulting in a dead end	Urban	Not specified (typically local/residential)	Not specified	17% (3%)
Gateway Treatment	Combined use of signs, monuments, landscaping, and potentially other traffic calming treatments at entrance to a neighborhood or community.	Rural (transition area	Main	Not specified	5% (4%)

[20] Source for speed reduction estimates in this table: Engineering Countermeasures for Reducing Speeds (2009): A Desktop Reference of Potential Effectiveness was used as the primary source for the speed change estimates, which were reported for 85th percentile (not average) speeds. This guide provides references to the original studies. FHWA Office of Safety website. Available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/ . An updated version is available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/2014/reducing_speed.cfm .

Potential Speed Reductions for Design and Traffic Calming Measures					
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***85th Percentile Speed Reduction (std. deviation)***
Gateway Treatment	Combined use of signs, monuments, landscaping, and potentially other traffic calming treatments at entrance to a neighborhood or community.	Urban	Not specified	Not specified	7% (n/a)
Half Closure	Physical blockage of one direction of traffic for a short distance on a two-way street	Urban	Not specified (typically local/residential)	Not specified	20% (12%)
Lateral Shift	Shifting of travel lanes from one side of road to other and back over distance	Urban	Local	Not specified	8% (n/a)
Lateral Shift	Shifting of travel lanes from one side of road to other and back, over a distance	Rural	At city limits	Not specified	25% (9%)
Mini Traffic Circle [21]	Circular, raised islands placed in middle of an intersection	Urban	Not specified	240 - 10,910	11% (9%)
Speed Humps [22]	Rounded raised area across the road, typically 12 - 14' long; 3 - 4" high	Urban	Local	48 - 11,544	22% (9%)

[21] See BikeSafe case study on Seattle's experience with implementing over 800 mini traffic circles. Available at: http://www.pedbikesafe.org/BIKESAFE/case_studies/casestudy.cfm?CS_NUM=503

[22] Also see Table 3 in this document for CMF estimate for speed humps.

Potential Speed Reductions for Design and Traffic Calming Measures					
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***85th Percentile Speed Reduction (std. deviation)***
Speed Humps [22]	Rounded raised area across the road, typically 12 - 14' long; 3 - 4" high	Not specified	Local	400 - 4,362	20% (6%)
Speed Humps [22]	Rounded raised area across the road, typically 12 - 14' long; 3 - 4" high	Urban	Local	574 - 1,506	15% (3%)
Speed Tables	Long speed hump, typically 22', flat in mid-portion with ramps on ends	Urban	Not specified	198 - 14,500	16% (9%)
Speed Tables	Long speed hump, typically 22', flat in mid-portion with ramps on ends	Rural (Small town))	Not specified	1,480	14% (3%)
Speed Tables	Long speed hump, typically 22', flat in mid-portion with ramps on ends	Not specified	Residential	198 - 2,102	24% (n/a)
Speed Cushion	Speed hump typically 6 - 7' wide that allows most emergency vehicles to straddle the hump	Urban	Not specified	3,323	20% (n/a)
Speed Cushion	Speed hump typically 6 - 7' wide that allows most emergency vehicles to straddle the hump	Urban	Not specified	1,042 - 1,556	16 to 19% (n/a)

Table 5 shows potential crash effects for various pavement treatments, markings, and signs.

Table 5. Potential Crash Effects for Pavement Treatments, Markings and Signs.

CMFs for Pavement Treatments, Markings, and Signs								
Countermeasure	*Description*	*Area Type*	*Road / Intersection Type*	*Traffic Volume*	*Crash Types*	*Crash Injury Severity*	*CMF (std. error)*	*CMF Star Rating*
Enhanced Curve Delineation [23]	Install new fluorescent curve signs or upgrade existing curve signs to fluorescent sheeting	Rural	2-lane, undiv.	260-20,500	Non-intersection	All	0.82** [24] (0.077)	4
Enhanced Curve Delineation [23]	Install new fluorescent curve signs or upgrade existing curve signs to fluorescent sheeting	Rural	2-lane, undiv.	900 - 20,500	Non-intersection	Fatal and Injury	0.75** [24] (0.127)	4
Enhanced Curve Delineation [23]	Install chevron signs on horizontal curves	Rural	2-lane, undiv.	260 - 14,790	Non-intersection	Nighttime	0.75** [24] (0.095)	4

[23] Source: Srinivasan, R., Baek, J., Carter, D., Persaud, B., Lyon, C., Eccles, K., Gross, F., Lefler, N. (2009). *Safety Evaluation of Improved Curve Delineation.* (Report No. FHWA-HRT-09-045), Washington, DC: Federal Highway Administration.

[24] The reductions were more prominent at locations with higher traffic volumes and sharper curves (curve radius less than 492 ft) and in locations with more hazardous roadsides (roadside hazard rating (RHR) of 5 or higher) compared to locations with less hazardous roadsides (RHR of 4 or lower). In addition, curves where more signs were either added or replaced (with a more retroreflective material) within the curve experienced larger reductions in crashes. An economic analysis revealed that improving curve delineation with signing improvements is a very cost-effective treatment with the benefit-cost ratio exceeding 8:1. More CMFs are available for other crash types.

CMFs for Pavement Treatments, Markings, and Signs								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Types***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Enhance Curve Delineation [25]	Install a combination of chevron signs, curve warning signs, and/or sequential flashing beacons	Not specified	Principal arterial, & other freeways and expressways	7,400 - 13,975	All	All	0.606** [26] (0.07)	4

[25] Source: Montella, A. (2009). Safety Evaluation of Curve Delineation Improvements. An Empirical Bayes Observational Before-After Study. Presented at the 88th Annual Meeting of the Transportation Research Board, Compendium of Papers CD-ROM. Washington, DC.

[26] CMFs also available for other crash types and conditions. The CMFs range from 0 .58 - 0 .59 for run-off road, and wet-road to .81 for all crash types - fatal and injury severities.

CMFs for Pavement Treatments, Markings, and Signs								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Types***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Transverse (in lane) Rumble Strips for speed calming (intersection approaches) [27]	Install transverse rumble strips (TRS) (also called in-lane rumble strips) on stop-controlled intersection approaches	Rural	3 & 4 leg minor road, stop-controlled	Major road: 3265 avg.; Minor road: 801 avg.	All	Injury and Fatal (KA)	0.608** (0.140)	4
Transverse (in lane) Rumble Strips for speed calming (intersection approaches) [27]	Install transverse rumble strips (TRS) (also called in-lane rumble strips) on stop-controlled intersection approaches	Rural	3 & 4 leg minor road, stop-controlled	Major road: 3265 avg.; Minor road: 801 avg.	All	Injury and Fatal (KAB)	0.785** (0.107)	4
Transverse (in lane) Rumble Strips for speed calming (intersection approaches) [27]	Install transverse rumble strips (TRS) (also called in-lane rumble strips) on stop-controlled intersection approaches	Rural	3 & 4 leg minor road, stop-controlled	Major road: 3265 avg.; Minor road: 801 avg.	All	Injury and Fatal (KABC)	0.987 (0.109)	4

[27] Source: Srinivasan, R., Baek, J., and Council, F. (2010). Safety Evaluation of Transverse Rumble Strips on Approaches to Stop-Controlled Intersections in Rural Areas, *Journal of Transportation Safety and Security*, Vol. 2(3), September 2010.

CMFs for Pavement Treatments, Markings, and Signs								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Types***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Transverse (in lane) Rumble Strips for speed calming (intersection approaches)[27]	Install transverse rumble strips (TRS) (also called in-lane rumble strips) on stop-controlled intersection approaches	Rural	3 & 4 leg minor road, stop-controlled	Major road: 3265 avg.; Minor road: 801 avg.	All	Property Damage Only (PDO)	1.191 (0.102)	4
Transverse (in lane) Rumble Strips for speed calming[28]	Install transverse rumble strips as traffic calming device	Suburban / Urban	Local, 2-lane	Not specified	All	All	0.66** (0.11)	4
Transverse (in lane) Rumble Strips for speed calming[28]	Install transverse rumble strips as traffic calming device	Suburban / Urban	Local, 2-lane	Not specified	All	Serious, Minor Injury	0.64** (0.12)	4
Transverse (in lane) Rumble Strips for speed calming[28]	Install transverse rumble strips as traffic calming device	Suburban / Urban	Local, 2-lane	Not specified	All	Property Damage Only (PDO)	0.73 (0.41)	2

[28] Source: Elvik, R. and Vaa, T. (2004). *Handbook of Road Safety Measures,* Oxford, United Kingdom: Elsevier.

Table 6 provides estimates of speed reductions for a few other pavement treatments, markings and signs for which crash estimates may not be available. Note that some of the estimates are smaller than the measure of variability (standard deviation); percentage effects on speed may vary substantially by location or other factors, including prior speeds.

Table 6. Potential Speed Reductions for Pavement Treatments, Markings and Signs.[29]

Potential Speed Effects for Pavement Treatments, Markings, and Signs					
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***85th Percentile Speed Reduction (Std. deviation)***
Converging Chevrons	Type of transverse pavement markings forming chevron shape to create the illusion of traveling faster as well as the impression of narrower lanes	Rural	Main Roads	2,300	7% (6)
Converging Chevrons	Type of transverse pavement markings forming chevron shape to create the illusion of traveling faster as well as the impression of narrower lanes	Rural	Double-S curves	Not specified	4 (n/a)
Converging Chevrons	Type of transverse pavement markings forming chevron shape to create the illusion of traveling faster as well as the impression of narrower lanes	Urban	Collectors	Not specified	5% (n/a)

[29] Source for speed reduction estimates in this table: Engineering Countermeasures for Reducing Speeds (2009): A Desktop Reference of Potential Effectiveness was used as the primary source for the speed change estimates. This guide provides references to the original studies. FHWA Office of Safety website. Available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/.

Potential Speed Effects for Pavement Treatments, Markings, and Signs					
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***85th Percentile Speed Reduction (Std. deviation)***
Converging Chevrons	Type of transverse pavement markings forming chevron shape to create the illusion of traveling faster as well as the impression of narrower lanes	Urban	Freeway Connectors	18,000	1% (n/a)
Converging Chevrons	Type of transverse pavement markings forming chevron shape to create the illusion of traveling faster as well as the impression of narrower lanes	Urban	Exit Ramps	Not specified	24% (n/a)
Optical Speed Bars	Series of white rectangular markings typically 1 foot wide placed just inside both edges of the lane and spaced progressively closer to create the illusion of traveling faster as well as the impression of narrower lane.	Rural	Main Roads (two studies)	Not specified, 1000	2% (n/a)
Optical Speed Bars	Series of white rectangular markings typically 1 foot wide placed just inside both edges of the lane and spaced progressively closer to create the illusion of traveling faster as well as the impression of narrower lane.	Rural	Curve	Not specified	2% (8%)
Optical Speed Bars	Series of white rectangular markings typically 1 foot wide placed just inside both edges of the lane and spaced progressively closer to create the illusion of traveling faster as well as the impression of narrower lane.	Rural	2-lane; Tourist Area	Not specified	7% (n/a)

Potential Speed Effects for Pavement Treatments, Markings, and Signs					
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***85th Percentile Speed Reduction (Std. deviation)***
Optical Speed Bars	Series of white rectangular markings typically 1 foot wide placed just inside both edges of the lane and spaced progressively closer to create the illusion of traveling faster as well as the impression of narrower lane.	Rural	Freeway Curves	63,072	2% (n/a)

Table 7 presents traffic management or operational measures with documented potential to reduce speeding-related crashes. Numerous other operations measures may also lower speeding-related and severe crashes, although they may not be intended primarily for those purposes, or there is less evidence of their effectiveness for speeding-related crash problems at this time. For example, other signal timing measures may help to separate conflicting traffic and person movements that could result in decreasing speeding-related crashes at signalized intersections, including crashes involving pedestrians, cyclists or transit users. The design of intersections also affects traffic speed and safety for all users, with wider intersections having potential to increase speeds and increase risk to pedestrians.[30]

[30] Chandler, B.E., Myers, M.C., Atkinson, J.E., Bryer, T.E. et al. (2013). *Signalized Intersections Informational Guide, Second Ed.* Report No. FHWA-SA-13-027. Washington, DC: Federal Highway Administration. Available at: http://safety.fhwa.dot.gov/intersection/signalized/13027/fhwasa13027.pdf.

Another potential countermeasure is to use coordinated traffic signal progression along a corridor, a measure primarily intended to help manage the flow of traffic, but which may also help to manage the speed of traffic along certain corridors.[30, 31] Signal progression is estimated to reduce all collisions along a corridor from 10 to 20 percent.[30]

Table 7.Potential Crash Effects for Traffic Speed Management and Operations Measures.

CMFs for Traffic Speed Management and Traffic Operations Measures								
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***Crash Types***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Variable Speed Limits[32]	Install Variable Speed Limit signs (from 40 to 60 mph)	Urban	Principal Arterial Interstate (1 study site)	Not specified	All	All	0.92 (n/a)	4
Decrease Speed Limit on Expressway[33]	Lower posted speed limit on expressway from 100 to 80 km/hr (Korea)	Not specified	Principal Arterial Other Freeways and Expressways (divided by median)	3,100 to 50,300	All	All	0.855* (0.079)	4
Decrease Speed Limit on Expressway[33]	Lower posted speed limit on expressway from 100 to 80 km/hr (Korea)	Not specified	Principal Arterial Other Freeways and Expressways (divided by median)	3,100 to 50,300	Speed-related	All	0.912 (0.161)	4

[31] Koonce, P., Rodegerdts, L., Lee, K., Quayle, S., Beaird, S., Braud, C., Bonneson, J., Tarnoff, P., and Urbanik, T. (2008). *Traffic Signal Timing Manual.* (Report No. FHWA-HOP-08-024), Washington, DC: Federal Highway Administration. Available at: http://ops.fhwa.dot.gov/publications/fhwahop08024/fhwa_hop_08_024.pdf.

[32] Source: Bham, G. H., Long, S., Baik, H., Ryan, T., Gentry, L., Lall, K., Arezoumandi, M., Liu, D., Li, T., and Schaeffer, B. (2010). *Evaluation of Variable Speed Limits on I-270/I-255 in St. Louis.* (Report No. RI08-025), Rolla, MO: Missouri University of Science and Technology.

[33] Source: Park, E.S., Park, J., Lomax, T.J. (2010). A fully Bayesian multivariate approach to before–after safety evaluation. *Accident Analysis & Prevention 42*, 1118-1127.

CMFs for Traffic Speed Management and Traffic Operations Measures								
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***Crash Types***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Decrease Speed Limit on Expressway[33]	Lower posted speed limit on expressway from 100 to 80 km/hr (Korea)	Not specified	Principal Arterial Other Freeways and Expressways (divided by median)	3,100 to 50,300	All	Fatal, serious injury	1.036 (0.172)	4
Decrease Speed Limit on Expressway[33]	Lower posted speed limit on expressway from 100 to 80 km/hr (Korea)	Not specified	Principal Arterial Other Freeways and Expressways (divided by median)	3,100 to 50,300	All	Minor injury	0.792** (0.086)	4
Change Signal Phasing [34]	Change from permissive to protected signal phasing	Not stated	Signalized, 3-, 4-, > 4-legs	Not specified	All	All	0.94 (n/a)	HSM
Change Signal Phasing [35]	Convert from permitted-protected to protected on major approach	Urban	Signalized, high speed	Not specified	Angle	All	0.01** (0.02)	5
Change Signal Phasing [35]	Convert from permitted-protected to protected on major approach	Urban	Signalized, high speed	Not specified	All	All	0.58* (0.19)	3

[34] AASHTO (2010). Highway Safety Manual, 1st ed.

[35] Source: Davis, G.A. and Aul, N. (2007). *Safety Effects of Left-Turn Phasing Schemes at High-Speed Intersections*, (Report No. MN/RC-2007-03), Minnesota Department of Transportation. [CMFs also available for left turn and total intersection crashes from NCHRP Report 705: Evaluation of Safety Strategies and Signalized Intersections.

CMFs for Traffic Speed Management and Traffic Operations Measures								
Countermeasure	***Description***	***Area Type***	***Road Type***	***Traffic Volume***	***Crash Types***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Change Signal Phasing [35]	Convert from permitted-protected to protected on minor approach	Urban	Signalized, high speed	Not specified	Angle	All	0.01** (0.02)	5
Change Signal Phasing [35]	Convert from permitted-protected to protected on minor approach	Urban	Signalized, high speed	Not specified	All	All	0.99 (0.34)	1
Change Signal Phasing [35]	Convert from permitted to protected on minor approach	Urban	Signalized, high speed	Not specified	Angle	All	0.01** (0.01)	5
Change Signal Phasing [35]	Convert from permitted to protected on minor approach	Urban	Signalized, high speed	Not specified	All	All	0.83 (0.44)	1

Table 8 show enforcement and publicity measures that have crash modification factor estimates. While many other types of speed enforcement are thought to reduce speeding and related crashes, recent high quality evidence of the extent of effects is lacking.

Table 8. Potential Crash Effects for Enforcement and Publicity Countermeasures.

CMFs for Enforcement and Publicity Countermeasures								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Automated Speed enforcement[36]	Implement automated speed enforcement cameras	All	All	Not specified	All	Fatal, Serious, Minor Injury	0.83** (.01)	5
Enforcement with Mobile Speed Cameras[37]	Implement mobile automated camera enforcement following publicity phase	Urban	Not specified	Not specified	All	All	0.84** (0.07)	4
Enforcement with Mobile Speed Cameras[37]	Implement mobile automated camera enforcement following publicity phase	Urban	Not specified	Not specified	All	Fatal, Serious, Minor injury	0.85 (0.11)	3
Enforcement with Mobile Speed Cameras[37]	Implement mobile automated camera enforcement following publicity phase	Urban	Not stated	Not specified	All	Property damage only (PDO)	0.82 (0.11)	3

[36] Source: AASHTO (2010). Highway Safety Manual, 1st Ed. Washington, D.C.: American Association of State Highway and Transportation Officials. [From various studies.]

[37] Source: Moon, J.P. and J. E. Hummer. (2010). Estimating the Longer-Term Safety Effects of Speed Enforcement Cameras in Charlotte, NC. TRB 89th Annual Meeting Compendium of Papers CD-ROM.

CMFs for Enforcement and Publicity Countermeasures								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Enforcement with Fixed Speed Cameras[38, 39]	Implementation of fixed speed camera enforcement	Urban	Principal Arterial (Beltway)	Not specified	All (non-peak hours)	All	0.46** (0.07)	4
Enforcement with Fixed Speed Cameras[38,39]	Implementation of fixed speed camera enforcement	Urban	Principal Arterial (Beltway)	Not specified	Single vehicle (non-peak hours)	All	0.37** (0.09)	4
Enforcement with Fixed Speed Cameras[38,39]	Implementation of fixed speed camera enforcement	Urban	Principal Arterial (Beltway)	Not specified	All (non-peak hours)	Serious, Minor injury	0.52** (0.14)	3

[38] Source: Shin, K., Washington, S., van Schalkwyk, I., (2009). Evaluation of the Scottsdale Loop 101 automated speed enforcement demonstration program. *Accident Analysis & Prevention 41,* 393-403.
A number of other disaggregate CMF estimates are also available from this study.

[39] Target crashes were defined as those occurring during non-peak hours (6 to 9 am and 4 to 7 pm weekdays), as little exceeding limits was measured during peak hours.

CMFs for Enforcement and Publicity Countermeasures								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Automated Section Speed Enforcement[40]	Implement automated section speed enforcement system (enforces average speed over a distance)	Not specified	Principal Arterial, Other Freeways and Expressways (median divided; speed limit 130 km/h (81 mph)	23,000 - 42,000 ADT	All	All	0.69**[41] (0.04)	4
Automated Section Speed Enforcement[40]	Implement automated section speed enforcement system (enforces average speed over a distance)	Not specified	Principal Arterial, Other Freeways and Expressways (median divided; speed limit 130 km/h (81 mph)	23,000 - 42,000 ADT	All	Fatal, Serious Injury	0.44** (0.07)	4

[40] Source: Montella, A., Persuad, B., D'Apuzzo, M., Imbriani, L. (2012). Safety Evaluation of an Automated Section Speed Enforcement System. Presented at the 91st Annual Meeting of the Transportation Research Board, Paper No. 12-0226, Washington, DC.
Other CMFs also available. Study from Italy.

[41] CMFs at 12 months (0.66, 0.07 s.e.); at 18 months (0.68, 0.07 s.e.); and at 24 months (0.69, 0.07).

CMFs for Enforcement and Publicity Countermeasures								
Countermeasure	***Description***	***Area Type***	***Road / Intersection Type***	***Traffic Volume***	***Crash Type***	***Crash Injury Severity***	***CMF (std. error)***	***CMF Star Rating***
Automated Section Speed Enforcement[40]	Implement automated section speed enforcement system (enforces average speed over a distance)	Not stated	Principal Arterial, Other Freeways and Expressways (median divided; speed limit 130 km/h (81 mph)	23,000 - 42,000 ADT	Curves	All	0.57** (0.08)	4
Earned Publicity Associated with Mobile Camera Enforcement[37]	Publicity Associated with Mobile Camera Enforcement	Urban	Not specified	Not specified	All	All	0.92 (0.06)	3
Earned Publicity Associated with Mobile Camera Enforcement[37]	Publicity Associated with Mobile Camera Enforcement	Urban	Not specified	Not specified	All	Fatal, Serious, Minor injury	0.9 (0.12)	3
Speed Display/Feedback Device[42]	Individual driver speed display/feedback	Not specified	Not specified	Not specified	All	All	0.54** (0.17)	

[42] Source: Elvik, R. and Vaa, T., *Handbook of Road Safety Measures*. (2004). Oxford, United Kingdom: Elsevier. (Multiple original studies.)

As mentioned earlier, CMFs from Table 9 and Table 10 may be used to estimate crash effects for countermeasures that reduce average travel speed, but for which estimates of crash effects are unavailable.

Table 9. Potential Injury Crash Effects (CMFs) of Changes in Average Operating Speed for a Road Section. [Based on Table 3E-2. Crash Modification Factors for Changes in Average Operating Speed, *Highway Safety Manual*, AASHTO, 2010, p. 3-57. Used by Permission.] [43]

CMFs - Injury Crashes						
Change in avg. speed (mph)	***Baseline Average Speed 30 mph***	***Baseline Average Speed 40 mph***	***Baseline Average Speed 50 mph***	***Baseline Average Speed 60 mph***	***Baseline Average Speed 70 mph***	***Baseline Average Speed 80 mph***
-5	0.57	0.66	0.71	0.75	0.78	0.81
-4	0.64	0.72	0.77	0.8	0.83	0.85
-3	0.73	0.79	0.83	0.85	0.87	0.88
-2	0.81	0.86	0.88	0.9	0.91	0.92
-1	0.9	0.93	0.94	0.95	0.96	0.96
0	1	1	1	1	1	1
1	1.1	1.07	1.06	1.05	1.04	1.04
2	1.2	1.15	1.12	1.1	1.09	1.08
3	1.31	1.22	1.18	1.15	1.13	1.12
4	1.43	1.3	1.24	1.2	1.18	1.16
5	1.54	1.38	1.3	1.26	1.22	1.2

Table 10. Potential Fatal Crash Effects (CMFs) of Changes in Average Operating Speed for a Road Section. [Based on Table 3E-2. Crash Modification Factors for Changes in Average Operating Speed, Highway Safety Manual, AASHTO, 2010, p. 3-57. Used by Permission.] [43]

CMFs - Fatal Crashes						
Change in avg. speed (mph)	***Baseline Average Speed 30 mph***	***Baseline Average Speed 40 mph***	***Baseline Average Speed 50 mph***	***Baseline Average Speed 60 mph***	***Baseline Average Speed 70 mph***	***Baseline Average Speed 80 mph***
-5	0.22	0.36	0.48	0.58	0.67	0.75
-4	0.36	0.48	0.58	0.66	0.73	0.8
-3	0.51	0.61	0.68	0.74	0.8	0.85
-2	0.66	0.73	0.79	0.83	0.86	0.9
-1	0.83	0.86	0.89	0.91	0.93	0.95
0	1	1	1	1	1	1
1	1.18	1.14	1.11	1.09	1.07	1.05
2	1.38	1.28	1.22	1.18	1.14	1.1
3	1.59	1.43	1.34	1.27	1.21	1.16
4	1.81	1.59	1.46	1.36	1.28	1.21
5	2.04	1.75	1.58	1.46	1.36	1.27

[43] *"NOTE: Although data used to develop these CMFs are international, the results apply to North American conditions."* (AASHTO, 2010. Highway Safety Manual, 1st ed. Washington, DC: American Association of Highway and Transportation Officials.)

Keys to Successful Speed Management Programs Tip Sheets

Two resources were developed to help local agencies, in particular, build an effective communications program and leverage resources to increase support of and effectiveness of the speed management program. Many of the ideas in the tip sheets may also be useful for regional or statewide speed management communications programs or partnership-building.

The two tip sheets, on the following pages, are as follows:

- Build a Coalition of Supporters and Partners.
- Keys to Communication Success.

Build a Coalition

of Supporters and Partners

Tip Sheet

GETTING BUY IN

Create early buy-in from the community:

- **Reach out to leading individuals (see potential partner list below) to ask for their perspective and campaign support** (and track your contact with and input from each on a spreadsheet for easy reference).
- **"Frame the problem" to address their specific concerns** (teen accidents, high-speeding areas, child or school areas safety, pedestrian and bicycle safety, the social, monetary, environmental impact, or public health threat of speed-related accidents and fatalities, for instance).
- **Customize campaign messages** with their input, which also helps create buy-in.

MAKING CONTACT

Prepare for your contact with key people:

- **Do your homework.** (Who are the largest employers? What community or neighborhood organizations are concerned about traffic safety and injury? Who will be most receptive to your message? What sort of messages do they send with their ads or community outreach?)

- **Create a "call script"** to tighten your approach and be sure you have covered important selling points.
- **Start with the people most likely to be receptive** (hospital staff members already understand and value safety so they are likely partners, for instance).

Increase your contact success:

- **Ask to speak with a specific person** in a potential partner's organization – perhaps the "safety or security director" (manufacturing plants, large companies), "community programs or outreach director" (community organizations), "communications or public relations director" (corporations), or "advertising or community relations director" (newspapers or TV). Search online for staff directories to see if you can ask for that person by name.
- **Mention other partners** to new contacts to increase your credibility.

Contact key people at organizations that have a direct vested interest in the outcome (a hospital), **tremendous grassroots outreach** (a utility company), **or a large audience** (major retailers/employers), particularly if their target demographic matches yours. To start, identify local:

- Hospitals
- Businesses, including major employers and retailers
- Churches
- Utility companies
- Community organizations
- Colleges, universities, private schools
- Safety organizations
- Automobile and health insurers
- Health care providers
- Chambers of commerce
- Military bases
- Newspapers and television stations

GAINING SUPPORT

Suggest ways partners can participate such as:

- **Buying advertising** on radio, television, billboards, or in print (a business can sponsor morning traffic reports on behalf of the campaign, for instance).
- **Flagging existing or planned advertising** with campaign messages or reminders.
- **Sponsoring promotional materials** (co-brand campaign and your partner's name/logo on appropriate items such as coffee wrappers and car decals).
- **Hosting campaign speakers** (at little or no cost to the sponsor) **or events**.
- **Distributing campaign materials** to employees or members (at little or no cost).
- **Posting information and a link to the campaign website** on the partner Intranet or website (at little or no cost).

SUSTAINING SUPPORT

Reciprocate partner support:

- **Post partner efforts/contributions** on the campaign website and social media.
- **Send press releases** to praise partner efforts/contributions.
- **Share media opportunities/spotlight** with partners at every opportunity.

Refresh the partner network:

- **Ask partners who else they would like to see** in the network**.**
- **Continually seek new partners** to ensure a steady level of outreach over a longer period of time and gain creative input from fresh perspectives.

Keys to Communication Success

Tip Sheet

FUNDAMENTALS

Be clear about what you are trying to accomplish.

- **Describe specific, desired outcomes.** Quantify what will be viewed as "success."
- **Figure out whom you need to reach** to achieve the outcomes**.**
- **Consider how you will best influence their action** toward the outcome you desire**.**
- **Track and measure** your results**.**

Build a coalition of supporters and partners.

(See "Build a Coalition" Tip Sheet)

Localize campaign as much as possible.

- **The most effective campaigns support enforcement (or engineering) activities.** (e.g. "This is why we are … enforcing close to the limit, in Town, on rural roads, etc.)
- **Appropriate "look" (local geography/climate/ feel) is important to gaining acceptance for messages**. Penetrating resistance to information overload begins with messages that feel relevant, personal, and local.
- **Appropriate "voice" is important to gaining acceptance, particularly with young audiences,** Leverage peer-to-peer communication with young audiences by holding a poster, social media, or video contest with local media arts students or other stakeholders (e.g., environmental science programs, medical students, etc.), judged by local industry leaders with technical assistance from appropriate professionals. Use winning materials to promote the campaign.
- **Customize messages with input from community members** (see "Building Support Tip Sheet").

Use Several Types of Media.

- **Offer a unified message across a mixture of media** to reach the target audience from several directions. The words may change but a simple, consistent message should underlie each communication.
- **Reach teens and young adults through their use of technology** and try to leverage respected peers or other figures to "deliver" the message.
- **Reach adults through radio ads or Public Service Announcements (PSAs)** during drive time (rush hours).
- **Reach audiences through face-to-face communication** as well as media**.** Even social media is based on the fact that human beings are hard-wired for personal connection.
- **Consider bilingual messaging** where appropriate.
- **Create a simple campaign website and/or social media site** to allow audience members who align with you to share information through their networks. Several options exist for free websites that can be created in one to two hours by a person with no technical experience.
- **Develop an interactive component to your campaign, possibly through your website**. Consider a simple incentive for interaction like an online "Safe Driver Pledge" that serves as an entry form to a weekly/monthly drawing for cash/prizes. The site can suggest "Tweeting" or recommending the site to friends so they can take the pledge and enter to win. Prizes can be provided by local sponsors or partners, boosting their visibility in the campaign.
- **Create an interactive display** at a health fair, street fair, farmer's market, community, or company event. Simple games that engage families may help children influence parents to pay attention to driving speed.

Build a platform.

- **Commit to a plan** with roles, responsibilities, a timeline, and a calendar of activities, creating an infrastructure for coordination and growth of the effort.
- **Inform (and annually update) local leaders**, including lawmakers, officials, policy chiefs, school board officers, college/university administrations, military base communicators, civic leaders, and peer groups who have a stake in the outcome. Enlist their involvement, in accordance with your plan.

TACTICS

Repeat the message.

- **Deliver the same message to your target audience several times**. Studies show that slight variation in message (who says it, the exact words) may help repeated messages penetrate more effectively. Despite debate, there does not appear to be a magic number for the frequency of repetition, but many sources cite three to seven repetitions as the number of times a person must hear a message to *begin* to feel likely to act on it.
- **Search for credible sources** who are writing or talking about speed and safety issues within your community. They may be willing to carry your message through a new communication or a follow-up to a previous one.
- **Provide message delivery devices** to partners and local officials or other stakeholders (monthly messages to include with bills, paychecks, or advertisements; a paragraph or two for a local leader to insert into a speech; a sample pledge and usage guidelines; compelling and consistent print and web-ready content). Consider developing a sample agreement for a spokesperson to make it easy to enlist such help.

Leverage local human resources.

- **Hire campaign interns** from local colleges in subject areas related to your effort (and pay them with small scholarships or inexpensive, but desirable, items such as gift cards, phones or cameras).
- **Recruit high school student volunteers** who want to earn community service hours by helping you.
- **Appoint campaign liaisons** within the business community – and ask them to enlist members of their networks.

Leverage pre-existing events by sending a campaign representative to:

- **Partner sites**, perhaps to speak at a regularly scheduled luncheon.
- **Career days** at high schools to talk about employment-related driving and hand out informative pamphlets.
- **University classes** to give students a background briefing on the campaign and hand out information or show a DVD with information they will find useful.
- **Neighborhoods**, via health, safety, craft, art, holiday or other gatherings, and create relevant "hooks" to your campaign (i.e., coloring books or "paint your family car" stations for kids at a craft fair). Provide informative campaign materials.
- **Sporting events** – **or engage the cooperation of a local sports figure** to help deliver your message at a focal point in the event.

Think creatively about budget.

- **Leverage local partners to help carry your message** to their networks. Their credibility with their own audience may exceed yours.
- **Evaluate media realities** (budget and effectiveness of paid vs. earned media, for instance).
- Recognize that **"earning" media today does not always mean editorials and traditional "news"** pieces. It could involve social media, emails, promotional items, or contests that may or may not be covered by news media but will help deliver your message through a credible third party.
- Remember that **earned media also includes delivering messages through partner publications** or any vehicle partners use to communicate effectively with their own audiences.

Be creative in planning press-worthy events.

- **Make events camera-friendly** (action-oriented and demonstrating points rather than describing them).
- **Provide professional quality video footage** (known as "b roll") that reporters can use to illustrate your subject matter as they speak about your campaign.
- **Be sure to deliver new information.** After all, this is the "news" media.
- **Enlist local individuals to tell the story through their own relevant experiences.** There is a reason reporters call their pieces "stories."

SUSTAINABILITY

Update your initial plan annually, for the duration of the campaign, including lessons learned.

Embed ownership among stakeholders for a specific period of time (i.e., ask for a commitment to the issue beyond the campaign).

Continue to seek new partners who may have new ideas and can replace those whose involvement is waning.

Be generous with praise for your partners.

For More Information:

Visit http://safety.fhwa.dot.gov/

FHWA, Office of Safety

Guan Xu
gxu@dot.gov

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