

# UNH T<sup>2</sup> Center Technical Note

## The Science of Highway Safety

*Highway Safety Manual is a valuable tool for local agencies*

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As a civil engineer (or one who works closely with civil engineers) you know that when you're designing an intersection and you have a question about sight distance, you can look in the American Association of State Highway Transportation Officials (AASHTO) *Policy on Geometric Design of Highways and Streets* for an answer (A.K.A. the AASHTO Green Book). Similarly, when you have a question about signs, pavement markings and signals for the same intersection, you know you will find all the answers in your copy of the Manual on Uniform Traffic Control Devices (MUTCD).

But where do you look when you have a question about traffic safety? For example, what is

the safest method for handling left turn movements at a four-way signalized intersection? Until recently, you would have had to sift through multiple sources of information and there was no guarantee that you would find a definitive answer. The question about left turn movements exposes a dilemma that safety professionals have grappled with for years: What constitutes safety on a road? Must a road simply adhere to established design standards to be considered safe, or does it require something more?

### Standards Are Not Enough

Dr. Ezra Hauer, Professor Emeritus in the Department of Civil Engineering at the University of Toronto and internationally-recognized highway safety expert, introduced the adjectives “nominal” and “substantive” to help shed more light on the topic of roadway safety. In a 1999 paper titled “Safety in Geometric Design Standards”, Hauer wrote, “Nominal safety is judged by compliance with standards, warrants, policies and sanctioned procedures ... Substantive safety is measured by expected crash frequency and severity” (*Hauer 19*). Nominal safety, then, refers only to whether municipalities meet the bare minimum safety standards as outlined by law. Substantive safety—which Hauer indicates is just as important as meeting the standards—refers to what is safest for a given situations.

The problem with defining safety as a function of compliance with standards, Hauer asserted, is that “Limit standards do not tell the designer what the safest design is. Rather, they specify the limit of what is permissible.” (*Hauer 2*). This means that standards, on their own, are not enough to ensure maximum roadway safety, but only minimum expectations.

Today, the Highway Safety Manual (HSM), which is available through AASHTO, is the definitive source of substantive answers to roadway safety questions. The manual was developed and refined by a diverse team of roadway safety stakeholders over the past ten years to provide a single source for safety information and tools in a form that facilitates data-based decision-making.

### Major Effort

Creation of the HSM began in May 2000, under the direction of a group of volunteers from eight different subcommittees of the Transportation Research Board (TRB) in Washington DC. Research and development for the effort was funded in large part by the National Cooperative Highway Research Program (NCHRP), and the Federal Highway Administration (FHWA) provided supplementary funding and research support.

In 2006, a decision was made to publish the HSM as an AASHTO document, at which point a joint task force was formed with representatives from the AASHTO subcommittees on Design, Traffic Engineering and Safety Management. Over the next three years, the task force examined the HSM to ensure that it would meet the needs of State Departments of Transportation as well as local agencies. During that time, members of the task force also worked to promote the HSM within their respective subcommittees.

In 2009, after nine years of intensive development and careful refinement, the AASHTO board of directors approved the HSM for distribution.

### Valuable Resource, but Not a Standard

Priscilla Tobias, Bureau Chief of Safety

Engineering for the Illinois Department of Transportation (IDOT) serves as Chair of the task force that oversees the maintenance and on-going development of the HSM. She is extremely pleased that such a powerful tool is available for road owning agencies. “This manual represents the best safety-related science of our day,” she says. “And it has been thoroughly vetted by safety experts and representatives from all groups involved with roadway safety to make sure it’s accurate and relevant for all stakeholders. This is the first time we have had such a resource.”

Tobias is careful to stress that the HSM is not a standard, like the MUTCD. She cautions, “The manual is intended as a guide; nothing about it constitutes a legal standard, nor does it mandate responsibilities. It’s simply a great tool for making informed decisions about how to allocate resources to address safety issues most effectively.”

### New Direction in Highway Safety

The key to the manual’s usefulness lies in its thorough, scientific approach to identifying, analyzing and solving safety problems. First, many methods of site selection in the HSM help road agencies zero in on the most relevant sites by eliminating from consideration sites that are at a randomly high or low fluctuation in crashes. This means that only those sites that are consistently and habitually unsafe are identified—not just sites that are at an unusual high or low point in crashes. After a site is identified, the





HSM provides a means for analyzing the safety impact of decisions at all stages of the project development process. Agencies using the HSM are thus able to see the effectiveness of each safety improvement. Finally, the HSM includes an extensive catalog of proven crash modification factors (CMFs) for a variety of geometric and operational treatment types. Using CMFs, practitioners can predict the safety impact that a potential treatment or design may have on their road system.

Highway safety expert Dr. Hauer is pleased that the manual is available. He notes that “Publication of the Highway Safety Manual indicates wide recognition of the need for approaching safety in some evidence-based manner. With procedures that examine safety quantitatively rather than subjectively, the document is an important first step in the right direction.”

### Early Adopters Lead the Way

At three volumes and nearly one thousand pages, the HSM contains a formidable amount of in-

formation, especially for those who are not experienced in the practice of analyzing and improving roadway safety. To help make such extensive information available and to encourage road-owning agencies to use it, the NCHRP is sponsoring an effort that involves showcasing different states’ experiences with the HSM. The effort, officially titled the Lead States Initiative for Implementing the Highway Safety Manual, involves state and local transportation officials in thirteen states.

The project manager for the Lead States Initiative is Charles Niessner, senior program officer at NCHRP. To kick the project off, Niessner worked with Tobias’ AASHTO task force on the HSM to solicit participants from among State Departments of Transportation (DOTs). He was encouraged by the response. “Thirty DOTs initially expressed interest,” Niessner said. “That was encouraging. We didn’t expect that kind of response from the states because launching something like this is not a simple thing – it’s a major effort.” Niessner thinks the willingness to get involved is thanks to the requirement in the trans-

portation bill of 2005 (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, or SAFETEA-LU), that required each state DOT to establish a strategic highway safety plan by October 1, 2007. Niessner continues, “Requiring strategic highway safety plans really elevated the importance of roadway safety and helped everyone move more purposefully in that direction. I think the response to our invitation shows that our State DOTs see the HSM as another great tool to help refine our collective approach to improving the safety of our roads.”

### Michigan is a Lead State

Tracie Leix, supervising engineer for the Michigan Department of Transportation (MDOT) Safety Programs Unit, is managing MDOT’s participation in the Lead States Initiative. Leix is especially excited about the HSM because she expects it will enhance her group’s already healthy relationship with local road agencies. She and her team have seen first-hand how engaging with local partners on safety projects can produce great results. In 2004, Leix’s group, at the time under the leadership of Dale Lighthizer (retired 2010), established the Local Safety Initiative to help local road agencies in Michigan implement safety improvements.

“Through the local safety initiative, we stress the importance of measuring safety and quantifying the effectiveness of improvements,” Leix explained. “The HSM will be a great tool to support these efforts as we continue to work together with our local partners to improve the safety of Michigan roads.”

To help local agencies understand and use the HSM in Michigan, Leix and a Local Agency HSM Implementation Team are working with Michigan’s Local Technical Assistance Program (LTAP) to produce training materials for various groups of stakeholders that are involved in making roadway safety decisions. “Among our local agency partners, we have metro, urban, and rural agencies. And within each agency we have people dedicated to design, development, safety, and other focus areas,” Leix said. “No

matter where someone fits in the process of improving roadway safety, certain aspects of the manual apply to them. We’re working to make sure the training is relevant to each groups’ needs.”

### Not Just for State DOTs

Tony Giancola, Executive Director of the National Association of County Engineers (NACE), is also excited about the availability and relevance of the HSM for road-owning agencies across the country. “This is a very useful tool,” he said. “It will be a big help for road agencies at state and local levels as they evaluate, design, plan for and implement safety improvements in their respective communities.”

Everyone familiar with the HSM agrees that it will be a great tool for improving roadway safety, but some are expecting more—especially those who have experience with implementing safety improvements at the local level. Wayne Schoonover, P.E., County Highway Engineer for Ionia County Road Commission in Michigan, says the HSM could help local road agencies pay for road projects. He has been an enthusiastic participant in the Michigan Department of Transportation’s (MDOT) Local Safety Initiative program since it was created in 2004. “The success we’ve had in securing federal safety funding for Ionia County road improvements is a great example of the value of a data-driven approach to safety,” Schoonover said. “If not for the quantifiable solutions that MDOT’s Local Safety Initiative group helped us define, we would not have qualified. The Highway Safety Manual can help any agency define quantifiable solutions to their safety problems, which could help them secure similar funding.”

*For more information: [www.highwaysafetymanual.org](http://www.highwaysafetymanual.org).*

#### References

- Hauer, E. *Safety in Geometric Design Standards*. Retrieved December 9, 2010, From [https://ceprofs.civil.tamu.edu/dlord/CVEN\\_635\\_Course\\_Material/Safety\\_in\\_Geometric\\_Design\\_Standards.pdf](https://ceprofs.civil.tamu.edu/dlord/CVEN_635_Course_Material/Safety_in_Geometric_Design_Standards.pdf).