

Current Attitudes among Transportation Professionals with Respect to the Setting of Posted Speed Limits

Kay Fitzpatrick¹, Randy McCourt², and Subasish Das¹

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Abstract

A recent survey conducted by the National Committee on Uniform Traffic Control Devices Task Force explored current and potential approaches to the setting of posted speed limits. The survey was distributed in the spring of 2018 and gathered 740 responses. The survey found that many states and local agencies have their own laws or criteria for the setting of speed limits (many are very detailed). Professionals who perform posted speed limit studies rarely only use the 85th percentile speed. It is clear from the survey that analysts who establish speed zones utilize many factors beyond the 85th percentile in their studies, including the context, that is, where the street is and what function it serves. The use of the 85th percentile for rural roads or interstate/freeways is different from urban streets (on urban streets, the 85th percentile plays a less significant role). The industry knowledge and use of USLIMITS2 are very limited. USLIMITS2 is a web-based tool designed to help practitioners set speed limits and is maintained by the Federal Highway Administration. Setting of reasonable speed zones requires consideration of many factors that are currently not well defined in the *Manual on Uniform Traffic Control Devices* (MUTCD). These factors are best defined as part of national guidance/research or local policy documents and do not need to be defined in the MUTCD as they can involve state/local interpretation.

The topic of how to best select a reasonable speed limit for a given roadway segment has been discussed and debated for years, and the debate continues. Many different approaches are available and within the United States, the operating speed approach based on the 85th percentile speed is typically used. In the operating speed approach, the selection of the speed limit value uses the measured the 85th percentile speed for the roadway segment along with adjustment factors that consider a number of conditions. This concept is predicated on the idea that most prudent drivers factor in roadway design and context and select their speed accordingly.

Although statutory speed limits form the basis for many posted speeds limits, non-statutory speed limits are established by engineering studies. There is little uniformity in the United States regarding statutory speeds. However, the *Manual on Uniform Traffic Control Devices* (MUTCD) (1) does provide some uniformity in setting of non-statutory speed limits. A guiding principle of the MUTCD is that through uniformity, consistent driver expectations can improve safety.

Within Section 2B.13 of the MUTCD are several paragraphs related to the selection of the posted speed limit value including Paragraph 1 (standard), Paragraph

12 (guidance), and Paragraph 16 (option). Other paragraphs within Section 2B.13 focus on statutory speed limits, need for engineering study, requiring limits to be multiples of 5 mph, placement of signs, use of warning signs with speed limit signs, where to conduct speed studies, special speed limits, changeable message signs, and school zones. Relative to setting speed limits the key paragraphs in Section 2B.13 are:

01 Speed zones (other than statutory speed limits) shall only be established on the basis of an engineering study that has been performed in accordance with traffic engineering practices. The engineering study shall include an analysis of the current speed distribution of free-flowing vehicles.

12 When a speed limit within a speed zone is posted, it should be within 5 mph of the 85th-percentile speed of free-flowing traffic.

¹Texas A&M Transportation Institute, College Station, TX

²DKS Associates, Portland, OR

Corresponding Author:

Address correspondence to Kay Fitzpatrick: K-Fitzpatrick@tamu.edu

16 Other factors that may be considered when establishing or reevaluating speed limits are the following:

- Road characteristics, shoulder condition, grade, alignment, and sight distance,
- The pace,
- Roadside development and environment,
- Parking practices and pedestrian activity
- Reported crash experience for at least a 12-month period.

It should be noted that setting speed limits using the 85th percentile as a consideration first appeared in the MUTCD in the 1971 edition (2) and was advanced to language similar to Paragraph 12 above in the 2000 edition (3). Though the MUTCD indicates that the posted speed limits be set near the 85th percentile speed, in reality the speed limit is often set lower (4). Several studies have documented that the 85th percentile operating speeds exceed the posted speed limits; and, in many cases, the 50th percentile operating speed is either near or exceeds that posted speed limit as well (5).

Recently the speed limit debate has increased with two publications. In March 2017, the National Association of City Transportation Officials (NACTO) released a policy statement (6). One of the action items in that statement would “permit local control of city speed limits.” They recommend “state rules or laws that set speed limits at the 85th percentile speed should be repealed.”

In July 2017, the National Transportation Safety Board (NTSB) published a report on speeding (*Reducing Speeding-Related Crashes Involving Passenger Vehicles*) (7). That document included several recommendations for reducing speed-related crashes including two recommendations directed to the Federal Highway Administration for changes to the MUTCD [(7) p. 57]:

- Revise Section 2B.13 of the *Manual on Uniform Traffic Control Devices* so that the factors currently listed as optional for all engineering studies are required, require that an expert system such as USLIMITS2 be used as a validation tool, and remove the guidance that speed limits in speed zones should be within 5 mph of the 85th percentile speed (H-17-27).
- Revise Section 2B.13 of the *Manual on Uniform Traffic Control Devices* to, at a minimum, incorporate the safe system approach for urban roads to strengthen protection for vulnerable road users (H-17-28).

To address the NTSB recommendations, the National Committee on Uniform Traffic Control Devices (NCUTCD), Regulatory and Warning Signs (RW) Technical Committee established a Task Force to explore current and potential approaches to the setting of posted speed limits. The Task Force started the process by creating a survey to gather an understanding of how practitioners actually applied current practices in setting speed limits and elicited their opinions on the topic.

Objective

The objective of this paper is to document the findings from the survey on posted speed limits conducted by the NCUTCD Task Force. In addition, the authors summarize and interpret discussions and observations on the speed limit setting process made during several meetings held in 2018. This paper also includes comments on potential actions suggested from the results of the survey, and from discussions on the results of the survey. Note that the opinions and conclusions expressed or implied in this paper are those of the authors and may not be shared by all who have participated in the multiple discussions held.

Survey Distribution

The Task Force developed and distributed the survey in the spring of 2018. Significant interest exists in the setting of posted speed limits from many sources within the NCUTCD-sponsoring organizations and outside. The survey reached members of the following groups: NCUTCD, Institute of Transportation Engineers, American Association of State Highway and Transportation Officials/Committee on Traffic Engineering (AASHTO/CTE), American Public Works Association, National Association of County Engineers, American Society of Civil Engineers, NACTO, Association of Pedestrian and Bicycle Professionals, and Transportation Research Board. Responses were sought from a wide spectrum of transportation analysts. Although most of the people within these organizations were engaged in work that sets speed limits, several respondents may have dealt with discussions of speed limits but not the actual engineering studies to establish a speed limit. The survey included questions that identified respondents' experience with setting speed limits and their years of experience so the findings could be subdivided by experience.

The survey included 13 questions with the initial questions focusing on the individual's background and the remaining questions focusing on how they conduct speed studies or what they think a speed study should consider. A total of 740 participants completed the survey.

Table 1. Number and Percent of Respondents for Knowledge on MUTCD or State Supplement by Number of Studies Conducted (1 to 5, 6 to 20, 21 to 50, or 51+) When They Indicated They had Done at Least One Speed Study

Knowledge on MUTCD or state supplements	1 to 5 num ^a	1 to 5 per ^b	6 to 20 num ^a	6 to 20 per ^b	21 to 50 num ^a	21 to 50 per ^b	51+ num ^a	51+ per ^b	Total num ^a	Total per ^b
Don't use	2	2%	0	0%	1	1%	1	1%	4	1%
Infrequent user (maybe once every year or two)	21	18%	5	3%	3	3%	6	3%	35	6%
Occasional user (a few months out of the year)	45	38%	50	33%	15	15%	23	12%	133	23%
Regular user (multiple times a month)	50	42%	97	64%	81	80%	164	84%	392	69%
Did not answer question	0	0%	0	0%	1	1%	1	1%	2	0%
Grand total	118	100%	152	100%	101	100%	195	100%	566	100%

^aNumber of respondents by number of speed zone studies conducted.

^bPercentage of respondents by number of speed zone studies conducted.

Findings

Most of the respondents were either consultants (199), employed by a city (68 for large cities and 122 for small or midsize cities with less than 250,000 population), or employed by a county/regional agency (118). Within the pool of respondents, the survey captured an approximately similar distribution between decades of experience, with the smallest proportion being for those with less than 10 years of experience:

- 0 to 9 years of experience: 142 (19%).
- 10 to 19 years of experience: 225 (30%).
- 20 to 29 years of experience: 194 (26%).
- More than 30 years of experience: 179 (24%).

A large number of the respondents had not conducted a speed zone/limit study (24%) and a slightly larger number of the respondents had conducted greater than 50 speed studies. The majority of the respondents had conducted more than six speed limit studies (60%). The distribution was:

- No speed studies: 174 (24%).
- 1 to 5 speed studies: 118 (16%).
- 6 to 20 speed studies: 152 (20%).
- 21 to 50 speed studies: 101 (14%).
- More than 50 speed studies: 195 (26%).

For those respondents who had conducted a speed study, most are regular users (multiple times a month) of the MUTCD or a state supplement. Table 1 provides the number of respondents to the question “How would you assess your knowledge of the MUTCD and/or state supplements?” subdivided by the number of speed zone studies they had conducted. The vast majority were occasional to frequent users of the MUTCD (80% for those with less than five speed zone studies conducted to 96% for six or more studies).

The next question asked the respondents to select all references within the list provided that they rely upon to guide their analysis in setting a speed zone. For those that had conducted at least one speed study (566 respondents), the following observations were made:

- The MUTCD is the reference most relied upon (415 respondents, 73%); however, 27% (151) of the respondents did not select that document.
- 77 (14%) selected State Guidelines and nothing else.
- 19 (3%) selected Local Guidelines and nothing else.
- 6 (1%) selected USLIMITS2 and nothing else.
- 30 (5%) did not select any of the available choices (MUTCD, State, Local, or USLIMITS2).
- The remaining 19 respondents who did not select the MUTCD as one of the documents that they

use, selected a combination of the other available documents (e.g., both state and local guides).

- For those that selected “other” the most common document referenced was the California MUTCD.

One of the questions specifically asked whether the participants had utilized USLIMITS2 for setting a speed limit. For those who had conducted at least one speed study, 80% (450) had not used USLIMITS2 whereas 20% (116) had used the expert system. Most of those who had used USLIMITS2 had carried out the most speed studies; 52 of the 116 respondents who indicated they had used USLIMITS2 had each conducted over 51 speed studies. The employer type for those 116 respondents included state agency/department of transportation (DOT) (45 respondents), consultants (19 respondents), small/midsize city agency (18 respondents), and large city agency (10 respondents), with the remaining being in county/regional agency, academic, or other categories.

A series of questions inquired about the criteria that practitioners use in speed studies. Two questions used the following list of criteria:

- Access management (number of driveways).
- Bicycle activity.
- Context locality.
- Context land use.
- Crash history.
- Distracted driving data.
- Driver demographics.
- Driver under the influence.
- Facility classification.
- Road geometry (curve).
- Road geometry (lane width cross section).
- Road geometry (grade).
- Road geometry (sight distance).
- Prior speeding zone.
- Intersection spacing.
- Parking.
- Pedestrian activity.
- Percent of vehicles above posted speed limit.
- Policy.
- Political.
- Roadway lane departure data.
- Seat belt usage.
- Vehicle speed.
- Statutory requirements.
- Traffic signal control.
- Traffic volume.
- Transit activity.
- Violation history.

In Question 7, the respondents were to indicate for each criterion (listed above) if they would:

- Always utilize it.
- Routinely use it.
- Use only if required.
- Use if it seemed appropriate for the context.
- Might use if I knew more about it.
- Never use it.

The top five criteria for all respondents that selected “always utilize it” included (in order of preference): speed of vehicles, crash history, context locality, statutory requirements, and geometry (curve). The same five criteria were at the top of the ranking, but in a slightly different order, when the answers “always utilize it” and “routinely use it” were combined: crash history, speed of vehicles, context locality, geometry (curve), and statutory requirements.

A visual review of the results was performed between those with a lot of experience and those without experience. The strongest difference observable was that those with no speed study experience compared with those who had conducted more than five speed studies indicated that the following three criteria are considered or need to be considered more often:

- Distracted driving data.
- Driver demographics.
- Driving under the influence history.

In Question 8, the respondents were limited to selecting only five criteria believed to be the most important factors when setting a speed limit. The authors reviewed the overall findings along with subdividing the data by number of studies conducted and by years of experience. The criteria were ranked based upon the number of respondents who selected the criteria. The responses for those who had not completed a speed study were removed. Figure 1 illustrates the change in priorities in slope graph format by years of experience. For example, crash history was positioned at Rank 1 for respondents with 10 years or less experience. This ranking shifted to 4 and 3 for respondents with 11–20 years of experience and 20 years or more experience, respectively. Statutory requirements was the most important criterion for those with over 20 years of experience whereas it was 7th for those with 10 years or less experience. The context (location) was ranked 2nd for those with 10 years or less experience whereas it was 5th for those with the most years of experience.

Using percent of respondents who selected a specific criterion rather than the slope graph approach shown in Figure 1, the authors identified changes in priorities by years of experience. The criteria that were more important for those with 10 years or less experience as compared to those with more than 20 years of experience were:

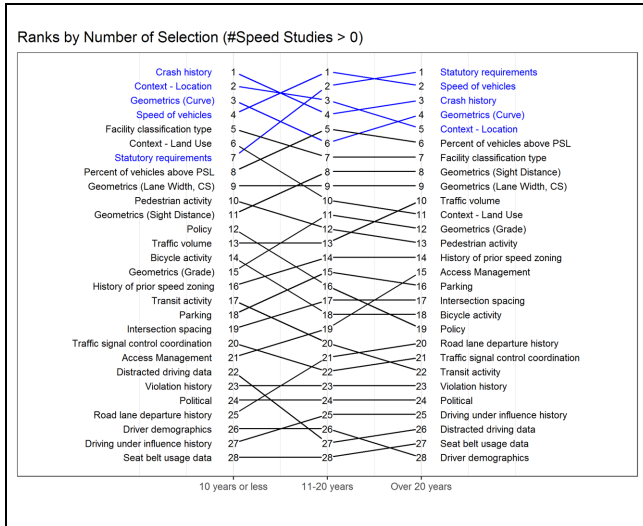


Figure 1. Rank of criteria believed to be the most important factors when setting a speed limit by years of experience when the participant had conducted at least one speed study.

- Bicycle activity.
- Pedestrian activity.
- Policy.
- Context (locality).
- Context (land use).

For example, 36% of the participants with 10 years or less experience selected bicycle activity as one of the five most important criteria whereas only 14% of the respondents with over 20 years of experience selected it as one of their five most important criteria.

The criteria that were more important for those with more than 20 years of experience as compared to those with 10 years of experience or less were:

- Speed of vehicle.
- Statutory requirements.
- Geometrics (sight distance).
- Percent of vehicles over the posted speed limit.
- Access management.

Question 9 asked the respondents to indicate the two most relied upon speed measures from this list:

- Average speed.
- Design speed.
- Operating speed.
- Pace speed.
- Percent of vehicles 10 mph over posted speed.
- Percent of vehicles 5 mph over posted speed.
- Percent of vehicles in the pace.
- Percentile (85th) speed.
- Prevailing speed.
- Running speed.

Most of the respondents who had conducted at least one speed study, selected the 85th percentile speed (83%). The next speed measure with the most responses was design speed (24%). When subdivided by the number of studies conducted, the importance of the 85th percentile changes (see Figure 2, blue, or the darker shade, representing those who selected that speed measure

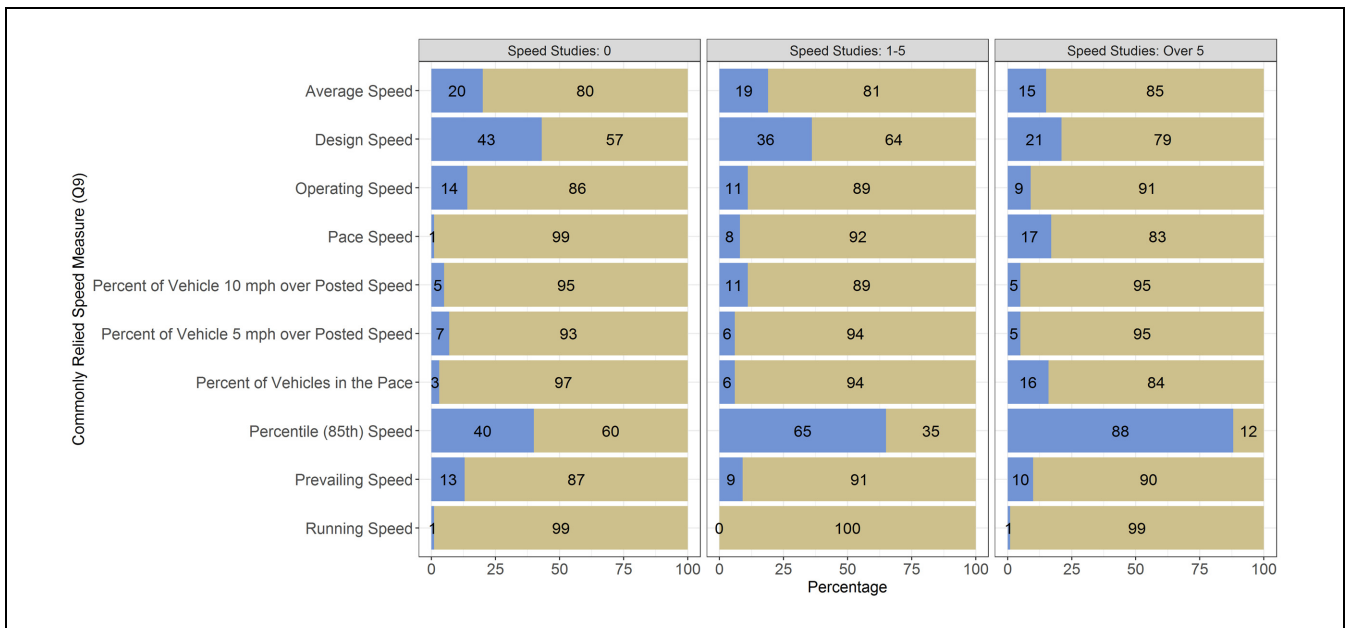


Figure 2. Most relied upon speed measure by number of speed studies.

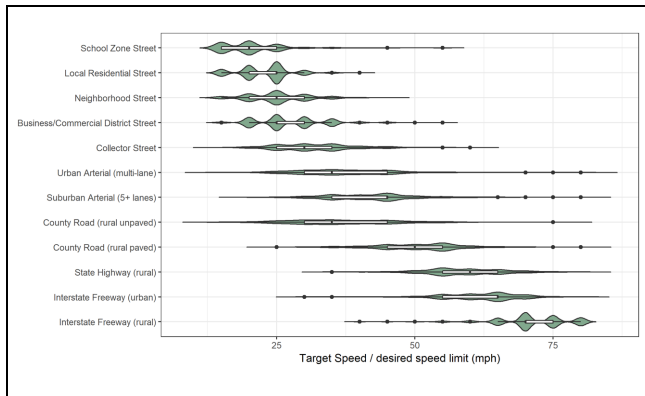


Figure 3. Violin plot showing the target speed/desired speed limit for each facility type for which the height of the violin is a reflection of the number of responses for that speed value.

based upon experience doing studies). For those who had conducted more than five studies, 88% selected the 85th percentile, those who had conducted between 1 and 5 studies, only 65% selected the 85th percentile, and for those that had not conducted a speed study, only 40% selected the 85th percentile as the most relied upon speed measure. Those that had not conducted a speed study believed that design speed (43%) or average speed (20%) should be the more relied upon speed measures. Although pace speed and percent vehicles in the pace are the third and fourth highest responses of those who had conducted more than five studies, they were among the least selected speed measures of the inexperienced participants (1%).

Question 10 asked the respondents to indicate how they set the speed when setting speed limits. The distribution of responses after those who had not conducted a speed survey were removed follows:

- Round to nearest 5 mph of the 85th percentile: 224 respondents (40%).

- Other (please specify): 115 respondents (20%).
- Round down to nearest 5 mph of the 85th percentile: 99 (17%).
- Round up to nearest 5 mph of the the 85th percentile: 89 respondents (16%).
- Use either top of pace or the 85th percentile: 23 respondents (4%).
- Average speed rounded up to nearest 5 mph: 12 respondents (2%).
- Did not respond: 4 respondents (1%).

A large proportion (20%) selected other. A review of the responses revealed that respondents frequently use roadway context as part of the process or use multiple approaches to setting speed such as considering factors as required by law in addition to the 85th percentile speed.

Question 11 provides similar options as Question 10, and asked the participant how they would set a speed limit (rather than how they were currently setting speed limits). A large proportion selected “my method” (349 or the 770 respondents, 47%). The word used most often within the “my method” responses was context.

In Question 12, the respondents were asked to provide, in their opinion and using their best judgment, the target speed (desired speed limit) for several facility types. Figure 3 provides an illustration of the findings whereas Table 2 provides the average and standard deviation speed by roadway type. As shown in Figure 3 and Table 2, the higher functional classification roads are associated with higher suggested target speeds. The roads with the greatest range of suggested target speeds include county roads (rural unpaved), urban arterial (multi-lane), and suburban arterial (5+ lanes).

The survey concluded with the opportunity for the participants to provide a textual comment, with over half doing so (388 of 740 respondents, 52%). The comments varied widely in relation to topic with about half being

Table 2. Target Speeds by Facility Type

Functional class/type	Average speed (mph)	Standard deviation (mph)	Median speed (mph)	Number of responses
Interstate freeway (rural)	71	6.2	70	711
Interstate freeway (urban)	62	7.0	60	711
State highway (rural)	59	7.5	60	705
County road (rural)	51	8.0	50	701
County road (rural unpaved)	37	9.6	35	680
Suburban arterial (5+ lanes)	42	8.5	45	706
Urban arterial (multi-lane)	38	9.0	35	709
Collector street	32	7.0	30	709
Business/commercial district street	27	6.5	25	714
Neighborhood Street	25	5.4	25	719
Local residential street	23	4.7	25	719
School zone street	20	5.3	20	703

easy to group and the other half being generally unique. An example of a comment difficult to group was a recommendation that posted speed limit signs for higher speeds (e.g., 65 mph) should have larger font. Only one other comment dealt with signing and it was on “When Children Are Present.”

For those comments that could be reasonably assigned to broad groups, the group with the most comments (about 28% or 110 respondents) was on the 85th percentile speed and included comments that were both for and against, with many suggesting moving away from the 85th percentile speed or reducing the reliance on that approach. Following is a comment made by one of the participants to provide an example of this opinion:

It's becoming clear that our policy of blind adherence to 85th percentile is not in line with our mandate to uphold public safety as paramount. The method only considers one user type of the road even if there are other ways the road is being used to transport people and goods. Other methods considering context, use of the road, safety goals, and safety research should be available so engineers can make informed, appropriate decisions to uphold public safety.

About 18% of the 388 comments received discussed the need to consider context (e.g., residential, business district) or to have factors (e.g., lane width) that could be considered in the speed limit setting process. Vulnerable road users (e.g., pedestrians, bicyclists) were discussed within 13% of the comments. USLIMITS2 was mentioned by 11 participants (3%) with some expressing caution or concerns with the software and others supporting USLIMITS2 as an option. About 6% commented on the need for guidelines or how guidelines should be structured. An example of a comment regarding potential guidelines is that the process should be “easier to explain to the general public and elected officials.” Enforcement was discussed by 4% of those providing a comment.

Summary of Key Survey Findings

Background

Initial questions in the survey gathered information on the background of the participants. Following are key findings from those questions:

- Although consultants were the most represented group in the survey (~27%), state agency/DOT (~18%), smaller cities (~17%), county/regional agency (~16%) and larger cities (~9%) were also well represented.
- Survey respondents averaged 20 years of professional experience (nearly 15,000 collective years of experience).

- Participants had a wide range of experience with speed limit studies, somewhat equally spread over the five survey categories of 0, 1–5, 6–20, 21–50, or 50+.
- About 93% of the respondents who had conducted speed studies had regularly (69%) or occasionally (23%) used the MUTCD or a state supplement.

Resources

The survey questions that focused on the resources used had the following key findings:

- A majority of respondents depend upon the MUTCD or state/local guides/requirements in setting a speed zone.
- Few respondents had used USLIMITS2 (only 16%).

Criteria

Several questions investigated the criteria used or the criteria that should be considered within a speed study. The following are key findings:

- The top criteria that are always used in setting speed limits (over 50% responses) were:
 - For practitioners who had done >5 studies: speed of vehicles, statutory requirements, crash history, context (location), geometrics (curve), facility classification type.
 - For practitioners who had done 0 studies: context (location), context (land use), pedestrian activity, crash history.
 - For all survey respondents: speed of vehicles (61%), statutory requirements (59%), crash history (59%), context/location – urban, business district, residential, suburban, rural (58%), geometrics of the roadway – horizontal/vertical curvature (53%).
- When asked what the five most important factors were when they set a speed limit, over 50% responses stated:
 - For practitioners who had done >5 studies: speed of vehicles, crash history, context (location).
 - For practitioners who had done 0 studies: pedestrian activity, context (location), bicycle activity.
 - For all survey respondents: context/location – urban, business district, residential, suburban, rural (57%).

- When asked what the one or two most relied upon speed measures for their work were, the top responses were:
 - For practitioners who had done >5 studies: 85th percentile speed (88%), design speed (21%), pace speed (17%).
 - For practitioners who had done 0 studies: design speed (43%), 85th percentile speed (40%), average speed (20%).
 - For all survey respondents: 85th percentile speed (75%), design speed (29%).
- Related to setting speed limits and rounding, the most frequent response was to round to the nearest 5 mph of the 85th percentile; but when given the option to choose how they “would” do it, they offered nearly 350 comments.
- Table 2 and Figure 3 highlight the response to target/desired speed by facility type.
 - It is reasonable to add several factors to Paragraph 16, such as road context, bicyclists, lane width, median type, number of driveways, or any combination.

Discussion

While reviewing and discussing the findings with NCUTCD, several questions were identified that needed additional consideration. Those questions along with potential directions follow:

- To what extent should the MUTCD define procedures/criteria for posted speed limit engineering studies?
 - There is support on both sides of the question as to whether the MUTCD should be focused on simply traffic control device criteria (e.g., sign size, color, or shape) or both traffic control device criteria and the criteria for setting of speed limits. After review of the survey results and discussion with the NCUTCD Council, the direction was to keep the MUTCD material regarding setting speed limits broad allowing states/locals to define the procedures in more detail.
- Given the implicit understanding of what the 85th percentile means, is there a need to better define the five items in Section 2B.13, Paragraph 16 to build a more uniform level of understanding (e.g., what defines crash experience comparable with our understanding of the 85th percentile)?
 - Greater definition should be left to national research and state/local procedures rather than expanding upon them in the MUTCD.
- Why are bicyclists not noted in Paragraph 16? Should any criteria be added to Paragraph 16?
 - In reviewing the MUTCD history, this list was added in 1971.
- Is a specific reference to USLIMITS2 appropriate?
 - Given the survey finding that 84% of the respondents had not utilized USLIMITS2, the question as to “why” should be answered before changes to the MUTCD are considered. Adding USLIMITS2 would substantially further the MUTCD role of defining the process or procedure of setting speed limits. This level of detail would be inconsistent with the MUTCD establishing broad criteria of setting speed limits and could affect state/local agencies who have detailed procedures.
- Should the rounding approach to speed data be defined?
 - This is a detail of setting a speed limit that would not be appropriate for the MUTCD. It should be part of state/local agency policy documents.
- What will enforcement and/or the judicial system accept if not the 85th percentile (Paragraph 12)? Could speed limits for high crash corridors be set below the 85th percentile (note California’s recent approval) and is this a MUTCD role or a state/local role in defining the speed limit process?
 - This should be left to guideline documents and national research rather than the MUTCD.
- Given the commonality of responses to target speed for various facility types from the survey, should a reference be provided that would guide practitioners to further study when setting speeds above/below certain levels nationally (for example the 50th percentile response levels of the survey, Table 2)?
 - This is a detail of setting speed limits and would be better in guidelines (or statutory change/requirements) rather than the MUTCD.
- A criterion suggested for setting speed limits that is relatively new is “context – location.” Some may consider “road characteristics” or “environment” – terms currently in the MUTCD – to be similar in

Table 3. NCHRP Report 855 Suggested Target Speed for Context/Roadway (8)

Context roadway	Rural	Rural town	Suburban	Urban	Urban core
Freeways	Not addressed in 855 since “designs are based on federally developed standards with little flexibility.”				Assumed to be High
Principal arterial	High	Low/Med	Med/High	Low/Med	Low
Minor arterial	High	Low/Med	Med	Low/Med	Low
Collector	Med	Low	Med	Low	Low
Local	Med	Low	Low	Low	Low
Suggested target speeds: Low (<30 mph), Med (30 to 45 mph), High (>45 mph)					

concept. National Cooperative Highway Research Program (NCHRP) Report 855 (8) recommends an expanded functional classification system with five roadway types (freeways, principal arterial, minor arterial, collector, and local) and five contexts (rural, rural town, suburban, urban, and urban core). These contexts “have been determined to not only represent unique land use environments, but also identify distinctions that require wholly different geometric design practices in relation to desired operating speeds, mobility/access demands and user groups” (8). Should the MUTCD recognize these different roadway type/context combinations especially if different speed limit setting practices are suggested for the different roadway type/context combinations?

- This is a detail of setting speed limits and would be better as a subject of guidelines (or statutory change/requirements) rather than the MUTCD.

Table 3 shows the suggested target speeds from NCHRP Report 855.

Conclusions

Discussions among those conducting the survey along with other professionals generated the following observations:

- Many states/local agencies have their own laws/criteria for setting of speed limits (many are very detailed).
- Professionals who perform posted speed limit studies rarely only use the 85th percentile speed (i.e., they use several other factors).
- Practitioners consider pace as an important factor when evaluating speed data. It was the third highest response after the 85th percentile and design speed when combining both responses involving pace (speed and percent).
- An expansion of statutory requirements for speed limits could be considered (beyond a single or a few speed categories), which could bring greater uniformity to speed limits in the United States. Tables 2 and 3 could provide a starting framework for that discussion. The outcome of this would be a reduced need for engineering studies as the expanded statutory framework would address reasonable speed limits in more cases.
- The use of the 85th percentile for rural roads or interstate/freeways is different than urban streets (on urban streets, 85th percentile plays a less significant role). It is clear from the survey that analysts who establish speed zones utilize many factors beyond the 85th percentile in their studies, including the context, that is, where the street is and what function it serves.
- The development of a national speed management guide for states and local agencies is encouraged to aid in establishing uniform procedures for the setting of speed zones. The NCHRP Project 17-76 is tasked with developing such a guide.
- Use of speed distribution in setting of speed zones is important and is one of the factors in setting speed zones.
- In the opinion of the authors, a comparison of the most important factors by level of experience demonstrated that priorities may be changing. Context (location) is more important for those practitioners early in their career as compared to those toward the end of their career. Those with less than 10 years of experience noted that the following criteria are more important: bicycle activity, pedestrian activity, policy, context (locality), and context (land use). Awareness of these criteria has emerged over the past two decades.
- The MUTCD could re-enforce that “other” factors in addition to speed should be considered in setting speed zones (include in Paragraph 16).

- The inclusion of bicycle activity as a factor in Paragraph 16 is important and should be added to the list.
- There is a requirement to clarify “other factors” to include lane widths, medians, driveways, land use, and past study data.
- Past studies provide valuable insights into understanding if or how speed distribution may have changed over time (e.g., potential for speed creep).
- To clarify the use of the 85th percentile speed (Paragraph 12), limit the specificity of setting speed zones within 5 mph of the 85th percentile to use on freeways, expressways, and highways outside urban areas where other factors play less of a role.
- The industry knowledge and use of USLIMITS2 are very limited. Before prescriptively requiring it as a methodology in the MUTCD for setting speed zones (it was originally developed in 2006), more information is needed about why more analysts do not use it currently. The NTSB referenced two processes that are more detailed: USLIMITS2, and Safe Systems. USLIMITS2 and Safe Systems are both detailed procedures that may be better placed in national guidelines for consideration of states/local jurisdictions in setting their speed limit policy rather than the MUTCD.
- Setting of reasonable speed zones requires consideration of many factors that are not well defined in the MUTCD. These factors are best defined as part of national guidance/research documents and do not need to be defined in the MUTCD as they can involve state/local interpretation.
- Consideration of target speeds (reflecting on survey findings in Table 2 and NCHRP Report 855 in Table 3) should be considered further (potentially as part of a uniform, best practice statutory speed framework), but not part of MUTCD.

With those observations, potential revisions to the MUTCD could include:

- Changing the MUTCD to reinforce the stated understanding that other factors have a role in setting speed limits (in addition to the 85th percentile). Refine the factors in Paragraph 16 and group the paragraphs that speak to setting of speed limits.
- Retaining reference to the 85th percentile as a factor that should be considered, particularly for freeways, expressways, and rural areas.
- Keeping the MUTCD broad. Although it could be reorganized to better present the material for setting speed limits (by minor reorganization), it should not be expanded with greater detail. The detail should be provided by national research, state/local procedures and promoted by FHWA.
- Not referencing specific processes, such as USLIMITS2, but promoting this level of detail in state/local procedures and investigating in more depth the reasons why after more than 20 years a small fraction of practitioners utilize this expert system.

Setting of speed limits is a policy that affects nearly every American. There are groups who argue this topic from many perspectives probably more than any other aspect of the MUTCD. Although comments have been voiced that speed limits are set by old, narrow, unsafe parameters, the survey of practitioners who perform speed studies for the most part indicate the opposite. Many factors are considered. Setting reasonable speed limits that are enforced properly and adjudicated consistently can produce a safer experience for all travelers. This survey of practitioners and detailed discussion of NTSB findings has led to proposed changes/clarifications to the MUTCD developed by the NCUTCD for FHWA consideration. This is a step toward the goal of more uniform, reasonable speed limit setting.

Areas for Further Research

Though some research is already underway related to setting of speed limits, there are elements of research that could be updated and would contribute significantly to best practice in setting speed limits:

- Updating the Solomon research from 1964 to address the 21st century relationship between safety and speed (and speed variance). This research should be subdivided by high (50–70 mph), mid (35–45 mph) and low (15–25 mph) speed facilities.
- Updating research of the relationship of vehicle speed to fatalities and serious injury in crashes involving pedestrians, bicyclists, and other vehicles, previously documented in 1999 (9).
- Investigation of the industry use of USLIMITS2 and why there is not greater use of expert systems.
- Investigation of current statutory speeds in all 50 states and development of a road map of how a uniform set of “best practice” statutory speeds could be established across the country.
- Collaboration between judicial, enforcement, and engineering industries toward more uniform setting, enforcement, and adjudication of reasonable speed limits.

- Expand understanding of the relationship between speed pace and crashes and how to use speed pace as a means to achieve more uniform speeds in setting speed limits.
- Greater definition of the other factors used in setting speed limits such that they lead to more uniform application, similar to the use of the 85th percentile speed.
- Outreach to the most experienced state/local personnel who have conducted engineering studies that have set speed limits to refine process to be efficient and effective.

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Author Contributions

The authors confirm contribution to the paper as follows: study conception and design: RM, KF; data collection: RM; analysis and interpretation of results: KF, RMM, SD; manuscript preparation: KF, RM, SD. All authors reviewed the results and approved the final version of the manuscript.

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