U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

ACTION MEMORANDUM TO THE DEPUTY SECRETARY

From: Shailen P. Bhatt
Administrator
X62240

Through: Victoria Wassmer
Assistant Secretary for Budget and Programs and
Chief Financial Officer

Prepared by: Cheryl J. Walker
Associate Administrator for Safety
X66378

Subject: Report to Congress on Guidance for the Setting of Speed Limits

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ACTION REQUESTED

I request that you approve and authorize me to send the attached report to Congress on Guidance for the Setting of Speed Limits as required by the Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the 2021 Appropriations Act.

SUMMARY

The report summarizes the findings on how speed limits are set, from the National Cooperative Highway Research Program (NCHRP) Project 17-76, "*Guidance for the Setting of Speed Limits*." The NCHRP Project 17-76 research team investigated the factors that influence operating speed and its impacts on safety. In addition, the research team conducted a thorough review of different methods and tools that have been developed for the setting of posted speed limits. The Federal Highway Administration (FHWA) also introduces a recently initiated project to create a handbook on approaches to determining appropriate speed limits for all roads and streets to advance speed management practices in support of the Safe System Approach.

This report to Congress relates directly to the U.S. Department of Transportation's National Roadway Safety Strategy. Speed limits, how they are set and how they are obeyed, are an important component in the safety of our roads. We expect the Hill, State and local officials involved in highway safety, and advocacy groups to respond positively to the report.

The attached report summarizes the findings from NCHRP Project 17-76 with respect to the following aspects:

- States establish statutory speed limits for specific types of roads—such as freeways, rural highways, or urban streets—which are applicable even if the speed limit sign is not posted. This report focuses on the setting of posted speed limits.
- The process of selecting a posted speed limit value for a roadway segment can be influenced by many factors, including safety concerns, roadway geometry and characteristics, and human factors such as the way drivers react to the roadway.
- The predominant method used in the United States is the operating speed approach. It typically relies on the 85th percentile speed with adjustments used to account for existing roadway geometry or crash experience. Many States and some local agencies have their own laws and criteria for setting speed limits. Professionals who conduct studies to determine the appropriate posted speed limit rarely relies solely on the 85th percentile speed (i.e., they use several other factors).
- Using approaches other than the 85th percentile speed to determine the posted speed limit is gaining popularity nationwide. Several cities – such as Boston, Massachusetts; New York City, New York; and Seattle, Washington – have recently campaigned to be able to set lower citywide default speed limits. Some State legislatures have passed laws giving these cities the ability to set a 25 or 20 mph default speed limit citywide. For example, Portland, Oregon, has gained the authority to set residential streets at 20 mph. Other countries are also exploring or implementing citywide speed limits.
- The speed limit setting procedure (SLS-Procedure) uses fact-based decision rules that consider both driver speed choice and safety associated with the roadway. Employing the SLS-Procedure and the accompanying tool has the potential to help State, local, and Tribal transportation agencies make informed decisions and communicate how speed limits can be set to State/local/Tribal leadership and citizens.

BACKGROUND

The Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the Departments of Transportation, Housing and Urban Development, and Related Agencies Appropriations Act, 2021, tasked the Federal Highway Administration to summarize the findings of two NCHRP research projects and report to the House and Senate Committees on Appropriations detailing findings within those reports. Specifically, the applicable language states:

> Design speeds. - The Committee is concerned about the relationship between design speed, posted speed, and operating speed. The Committee is looking forward to the results of two upcoming projects underway by the National Cooperative Highway Research Program (NCHRP), NCHRP Project 17-76, "Guidance for the Setting of Speed Limits" and NCHRP Project 15-76, "Designing for Target Speed". Following the completion of each study, the Department should summarize the findings and report to the House and Senate Committees on Appropriations detailing findings on how speed limits are set, how they impact roadway design, and the implications for enforcement and crashes where posted speeds and design speeds deviate.

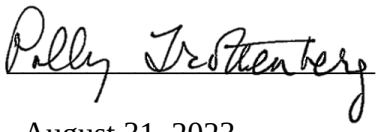
The NCHRP Project 17-76 produced two research reports: 1) *NCHRP Research Report 966: Posted Speed Limit Setting Procedure and Tool: User Guide*, which contains a procedure for setting speed limits and a user manual explaining the SLS-Procedure, and 2) *NCHRP Web-Only Document 291: Development of a Posted Speed Limit Setting Procedure and Tool*, which details the research activities and methods.

This report summarizes and documents the findings in NCHRP Project 17-76. At the time of preparing this report, NCHRP Project 15-76 has not been completed. Once it is completed, FHWA will submit a separate report to Congress summarizing the findings of NCHRP Project 15-76, including the implications for enforcement and crashes where posted speed limits and design speeds deviate.

RECOMMENDATION

I recommend that you approve the attached summary report to Congress on Guidance for the Setting of Speed Limits. With your concurrence, FHWA will transmit the report to the House and Senate Committees on Appropriations and the transportation subcommittees of the Appropriations Committees.

The Deputy Secretary

APPROVED: 

DATE: _August 31, 2023_

COMMENTS:

Attachments:

- Letters to Members of Congress
- Report to Congress

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Patty Murray
Chair
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Chair Murray:

This letter provides the report requested by the Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the Departments of Transportation, Housing and Urban Development, and Related Agencies Appropriations Act, 2021, tasking the Federal Highway Administration (FHWA) to provide findings of two projects underway by the National Cooperative Highway Research Program (NCHRP): NCHRP Project 17-76, *Guidance for the Setting of Speed Limits;* and NCHRP Project 15-76, *Designing for Target Speed*. House Report 116-452 specifically requests that following the completion of each study, "the Department should summarize the findings and report to the House and Senate Committees on Appropriations detailing findings on how speed limits are set, how they impact roadway design, and the implications for enforcement and crashes where posted speeds and design speeds deviate."

Promoting safe traffic speeds and reducing speeding-related fatalities and serious injuries is a focus of the U.S. Department of Transportation's National Roadway Safety Strategy, which officially adopts the Safe System Approach principles to guide safety actions. One of those principles is to recognize that humans are vulnerable and have a limited ability to tolerate crash impacts. The FHWA will use resources such as NCHRP Projects 17-76 and 15-76 and recently initiated work to produce a handbook providing guidance to States and localities on approaches to determining appropriate speed limits for all roads and streets to advance speed management practices in support of the Safe System Approach.

This enclosed report summarizes and documents the findings in NCHRP Project 17-76 and introduces the recently initiated project to produce a handbook on speed limits. At the time of preparing this report, NCHRP Project 15-76 has not been completed. Once it is completed, FHWA will submit a separate report to Congress summarizing the findings of NCHRP Project 15-76, including the implications for enforcement and crashes where posted speed limits and design speeds deviate.

The objectives of NCHRP Project 17-76 were (i) to identify factors that influence a driver's operating speed and (ii) to develop a speed limit setting procedure and a speed limit setting tool

that would automate the procedure used in making informed decisions related to establishing speed limits for any roadway type. The project was completed in June 2021 and produced two research reports: 1) *NCHRP Research Report 966: Posted Speed Limit Setting Procedure and Tool: User Guide*, which contains a procedure for setting speed limits and a user manual explaining the speed limit setting procedure (SLS-Procedure), and 2) *NCHRP Web-Only Document 291: Development of a Posted Speed Limit Setting Procedure and Tool*, which details the research activities and methods.

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A similar letter has been sent to the Vice Chair of the Senate Committee on Appropriations; the Chair and Ranking Member of the House Committee on Appropriations; the Chairman and Ranking Member of the Senate Subcommittee on Transportation, Housing and Urban Development, and Related Agencies; and the Chairman and Ranking Member of the House Subcommittee on Transportation, Housing and Urban Development, and Related Agencies.

Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Susan Collins
Vice Chair
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Vice Chair Collins:

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Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Kay Granger
Chair
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Chair Granger:

This letter provides the report requested by the Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the Departments of Transportation, Housing and Urban Development, and Related Agencies Appropriations Act, 2021, tasking the Federal Highway Administration (FHWA) to provide findings of two projects underway by the National Cooperative Highway Research Program (NCHRP): NCHRP Project 17-76, *Guidance for the Setting of Speed Limits;* and NCHRP Project 15-76, *Designing for Target Speed*. House Report 116-452 specifically requests that following the completion of each study, "the Department should summarize the findings and report to the House and Senate Committees on Appropriations detailing findings on how speed limits are set, how they impact roadway design, and the implications for enforcement and crashes where posted speeds and design speeds deviate."

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Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Rosa DeLauro
Ranking Member
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Ranking Member DeLauro:

This letter provides the report requested by the Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the Departments of Transportation, Housing and Urban Development, and Related Agencies Appropriations Act, 2021, tasking the Federal Highway Administration (FHWA) to provide findings of two projects underway by the National Cooperative Highway Research Program (NCHRP): NCHRP Project 17-76, *Guidance for the Setting of Speed Limits;* and NCHRP Project 15-76, *Designing for Target Speed*. House Report 116-452 specifically requests that following the completion of each study, "the Department should summarize the findings and report to the House and Senate Committees on Appropriations detailing findings on how speed limits are set, how they impact roadway design, and the implications for enforcement and crashes where posted speeds and design speeds deviate."

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Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Brian Schatz
Chairman, Subcommittee on Transportation, Housing
and Urban Development, and Related Agencies
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Chairman Schatz:

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Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Cindy Hyde-Smith
Ranking Member, Subcommittee on Transportation, Housing
and Urban Development, and Related Agencies
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Ranking Member Hyde-Smith:

This letter provides the report requested by the Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the Departments of Transportation, Housing and Urban Development, and Related Agencies Appropriations Act, 2021, tasking the Federal Highway Administration (FHWA) to provide findings of two projects underway by the National Cooperative Highway Research Program (NCHRP): NCHRP Project 17-76, *Guidance for the Setting of Speed Limits;* and NCHRP Project 15-76, *Designing for Target Speed*. House Report 116-452 specifically requests that following the completion of each study, "the Department should summarize the findings and report to the House and Senate Committees on Appropriations detailing findings on how speed limits are set, how they impact roadway design, and the implications for enforcement and crashes where posted speeds and design speeds deviate."

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- Using approaches other than the 85th percentile speed to determine the posted speed limit is gaining popularity nationwide. Several cities – such as Boston, Massachusetts; New York City, New York; and Seattle, Washington – have recently campaigned to be able to set lower citywide default speed limits. Some State legislatures have passed laws giving these cities the ability to set a 25 or 20 mph default speed limit citywide. For example, Portland, Oregon, has gained the authority to set residential streets at 20 mph. Other countries are also exploring or implementing citywide speed limits.
- The speed limit setting procedure (SLS-Procedure) uses fact-based decision rules that consider both driver speed choice and safety associated with the roadway. Employing the SLS-Procedure and the accompanying tool has the potential to help State, local, and Tribal transportation agencies make informed decisions and communicate how speed limits can be set to State/local/Tribal leadership and citizens.

A similar letter has been sent to the Chairman of the Senate Subcommittee on Transportation, Housing and Urban Development, and Related Agencies; the Chair and Vice Chair of the Senate Committee on Appropriations; the Chair and Ranking Member of the House Committee on Appropriations; and the Chairman and Ranking Member of the House Subcommittee on Transportation, Housing and Urban Development, and Related Agencies.

Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Tom Cole
Chairman, Subcommittee on Transportation, Housing
and Urban Development, and Related Agencies
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Cole:

This letter provides the report requested by the Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the Departments of Transportation, Housing and Urban Development, and Related Agencies Appropriations Act, 2021, tasking the Federal Highway Administration (FHWA) to provide findings of two projects underway by the National Cooperative Highway Research Program (NCHRP): NCHRP Project 17-76, *Guidance for the Setting of Speed Limits;* and NCHRP Project 15-76, *Designing for Target Speed*. House Report 116-452 specifically requests that following the completion of each study, "the Department should summarize the findings and report to the House and Senate Committees on Appropriations detailing findings on how speed limits are set, how they impact roadway design, and the implications for enforcement and crashes where posted speeds and design speeds deviate."

Promoting safe traffic speeds and reducing speeding-related fatalities and serious injuries is a focus of the U.S. Department of Transportation's National Roadway Safety Strategy, which officially adopts the Safe System Approach principles to guide safety actions. One of those principles is to recognize that humans are vulnerable and have a limited ability to tolerate crash impacts. The FHWA will use resources such as NCHRP Projects 17-76 and 15-76 and recently initiated work to produce a handbook providing guidance to States and localities on approaches to determining appropriate speed limits for all roads and streets to advance speed management practices in support of the Safe System Approach.

This enclosed report summarizes and documents the findings in NCHRP Project 17-76 and introduces the recently initiated project to produce a handbook on speed limits. At the time of preparing this report, NCHRP Project 15-76 has not been completed. Once it is completed, FHWA will submit a separate report to Congress summarizing the findings of NCHRP Project 15-76, including the implications for enforcement and crashes where posted speed limits and design speeds deviate.

The objectives of NCHRP Project 17-76 were (i) to identify factors that influence a driver's operating speed and (ii) to develop a speed limit setting procedure and a speed limit setting tool that would automate the procedure used in making informed decisions related to establishing speed limits for any roadway type. The project was completed in June 2021 and produced two research reports: 1) *NCHRP Research Report 966: Posted Speed Limit Setting Procedure and Tool: User Guide*, which contains a procedure for setting speed limits and a user manual explaining the speed limit setting procedure (SLS-Procedure), and 2) *NCHRP Web-Only Document 291: Development of a Posted Speed Limit Setting Procedure and Tool*, which details the research activities and methods.

The attached report summarizes the findings from NCHRP Project 17-76 with respect to the following aspects:

- States establish statutory speed limits for specific types of roads—such as freeways, rural highways, or urban streets—which are applicable even if the speed limit sign is not posted. This report focuses on the setting of posted speed limits.
- The process of selecting a posted speed limit value for a roadway segment can be influenced by many factors, including safety concerns, roadway geometry and characteristics, and human factors such as the way drivers react to the roadway.
- The predominant method used in the United States is the operating speed approach. It typically relies on the 85th percentile speed with adjustments used to account for existing roadway geometry or crash experience. Many States and some local agencies have their own laws and criteria for setting speed limits. Professionals who conduct studies to determine the appropriate posted speed limit rarely relies solely on the 85th percentile speed (i.e., they use several other factors).
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A similar letter has been sent to the Ranking Member of the House Subcommittee on Transportation, Housing and Urban Development, and Related Agencies; the Chair and Vice Chair of the Senate Committee on Appropriations; the Chair and Ranking Member of the House Committee on Appropriations; and the Chairman and Ranking Member of the Senate Subcommittee on Transportation, Housing and Urban Development, and Related Agencies.

Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

U.S. Department of Transportation
Federal Highway Administration

Office of the Administrator

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 5, 2023

The Honorable Mike Quigley
Ranking Member, Subcommittee on Transportation, Housing
and Urban Development, and Related Agencies
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Ranking Member Quigley:

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Sincerely,

Shailen P. Bhatt
Administrator

Enclosure

Report to Congress: National Cooperative Highway Research Program (NCHRP) Project 17-76 "Guidance for the Setting of Speed Limits"

U.S. Department of Transportation
Federal Highway Administration

Table of Contents

EXECUTIVE SUMMARY

There is broad consensus among global roadway safety experts that speed control is one of the most important methods for reducing fatalities and serious injuries. Speeding, whether driving in excess of the posted speed limit or driving too fast for conditions, has played a role in more than a quarter of traffic deaths – killing nearly 100,000 people in the United States – over the past decade. Moreover, as noted in this report, speed influences both the severity of crashes and the number of crashes, which underscores the need for setting safer speed limits as a critical tool for reducing fatalities and serious injuries. The U.S. Department of Transportation's (DOT) National Roadway Safety Strategy emphasizes that methods for setting speed limits should be customized to the context of the roadway. This report summarizes recent work done on speed-limit setting.

This report to Congress is prepared in response to the Joint Explanatory Statement and House of Representatives Report 116-452 accompanying the Departments of Transportation, Housing and Urban Development, and Related Agencies Appropriations Act, 2021, tasking the Federal Highway Administration (FHWA) to provide findings and results of two projects underway by the National Cooperative Highway Research Program (NCHRP): NCHRP Project 17-76, *Guidance for the Setting of Speed Limits* and NCHRP Project 15-76, *Designing for Target Speed*.

This report summarizes and documents the results of NCHRP Project 17-76, which was completed in June 2021 and produced two research reports:

1) *NCHRP Research Report 966: Posted Speed Limit Setting Procedure and Tool: User Guide*, which contains a procedure for setting speed limits and a user manual explaining the speed limit setting procedure (SLS-Procedure), and
2) *NCHRP Web-Only Document 291: Development of a Posted Speed Limit Setting Procedure and Tool*, which details the research activities and methods.

The NCHRP Project 15-76 has been delayed during the pandemic, with completion anticipated in 2023. The report to Congress summarizing the findings of NCHRP Project 15-76 will be prepared once that project is complete.

The NCHRP Project 17-76 investigated the factors that influence operating speed and safety through a review of the literature and an analysis of the relationships of speed, safety, and roadway characteristics on urban/suburban roadways. The variables identified that influence either operating speeds or crashes were grouped into five categories:

1) Traffic;
2) Traffic Control Devices (TCD);
3) Roadway Geometry;
4) Roadway Surroundings; and
5) Other.

This research also considered the breadth of approaches available for the setting of speed limits and the need to develop a methodology that could be used for any roadway type. An

investigation into the factors that influence operating speed and safety and a review of existing speed limit setting practices were used in developing the SLS-Procedure and accompanying SLS-Tool. Detailed information is provided in the *NCHRP Research Report 966: Posted Speed Limit Setting Procedure and Tool: User Guide,* and *NCHRP Web-Only Document 291: Development of a Posted Speed Limit Setting Procedure and Tool*. The goal of the SLS-Procedure and SLS-Tool is to produce an objective suggested speed limit value, based on factors specific to the roadway. Practitioners are able to use the procedure and/or tool to communicate with the public or government officials to explain the general procedures behind setting speed limits.

1. INTRODUCTION

The FHWA submits this report to the House and Senate Committees on Appropriations in response to the following committee recommendations in the House Report 116-452, Page 45:

> Design speeds. - The Committee is concerned about the relationship between design speed, posted speed, and operating speed. The Committee is looking forward to the results of two upcoming projects underway by the [NCHRP], NCHRP Project 17-76, "Guidance for the Setting of Speed Limits" and NCHRP Project 15-76, "Designing for Target Speed". Following the completion of each study, the Department should summarize the findings and report to the House and Senate Committees on Appropriations detailing findings on how speed limits are set, how they impact roadway design, and the implications for enforcement and crashes where posted speeds and design speeds deviate.

This report summarizes and documents the results of NCHRP Project 17-76. However, it does not contain results from NCHRP Project 15-76 because that project had not been completed at the time of preparing this report. The FHWA will submit another report to Congress on NCHRP Project 15-76, including the implications for enforcement and crashes where posted speed limits and design speeds deviate.

2. BACKGROUND

Speed influences both the severity of crashes – particularly in pedestrian crashes – and the number of crashes. The increase in crash severity is not linear with respect to the increase in speed. Instead, the severity of a crash tends to increase exponentially at higher speeds. It is unclear whether knowledge of the increased risks associated with higher speeds would influence drivers' speed choice. In the United States (U.S.), the predominant method for setting speed limits has been based on the 85th percentile speed, which is defined as the speed at or below which 85 percent of all vehicles are observed to travel under free-flowing conditions. However, the use of the 85th percentile method has come under scrutiny for the following reasons:

- Drivers may not see or be aware of all the conditions present along the roadway, so setting the posted speed limit based on existing driver behavior may create unsafe road conditions.

- Setting the speed limit based on existing driver behavior rather than the roadway context may not adequately consider vulnerable roadway users such as pedestrians, bicyclists, other cyclists, and persons on personal conveyance. Drivers are not always reasonable and prudent, or they may consider only what is reasonable and prudent for themselves but not for all users of the roadway. Drivers frequently select speeds at a certain increment above the posted speed limit; if this occurs, posting the speed limit based on measured operating speeds results in increases to the posted speed limit over time.
- Most of the early research justifying the use of the 85th percentile speed was conducted on rural roadways; therefore, it may not be appropriate for the urban roadway system.
- Changes to roadway design features and the context of the roadway have direct impacts on operating speeds.

Two recent publications have influenced the discussion about practices used to establish speed limits:

1) In March 2017, the National Association of City Transportation Officials (NACTO) released a policy statement.[1] One of the action items in that policy statement is to "permit local control of city speed limits." The NACTO also recommends that "state rules or laws that set speed limits at the 85th percentile speed should be repealed."

2) In July 2017, the National Transportation Safety Board (NTSB) published a report "*Reducing Speeding-Related Crashes Involving Passenger Vehicles*."[2] The NTSB report contains several recommendations to reduce speeding-related crashes, including the following two recommended changes:

- 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 USLIMITS 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)

While the highway geometric design practice has historically focused on design speed and posted speed, the concept of "target speed" is now central to many discussions related to roadways in urban, suburban, and rural towns. The target speed is simply the operating speed intended for drivers to travel on a given roadway facility. While NCHRP Project 15-76 is still underway, it is expected to give design engineers updated information about how to design roadways such that drivers naturally travel at the target speed.

3. OBJECTIVES AND SCOPE OF NCHRP PROJECT 17-76

[1] See https://nacto.org/wp-content/uploads/2017/03/NACTO-Policy-2017.pdf
[2] See https://www.ntsb.gov/safety/safety-studies/Documents/SS1701.pdf

The objectives of NCHRP Project 17-76, "Guidance for the Setting of Speed Limits," were to identify factors that influence a driver's operating speed, and develop an SLS-Procedure and SLS-Tool that automates the procedure for making informed decisions related to establishing speed limits for any roadway type. The research efforts and findings of NCHRP 17-76 are published in NCHRP Research Report 966: *Posted Speed Limit Setting Procedure and Tool: User Guide,*[3] which contains a procedure for setting speed limits and a practitioner ready user manual explaining SLS-Procedure, and NCHRP Web-Only Document 291: *Development of a Posted Speed Limit Setting Procedure and Tool*,[4] which details the research activities and methods.

This project was carried out in two phases. During Phase I, the research team collected insights into how the roadway environment influences operating speed and safety through a literature review, and identified the factors or variables used in current speed setting practices. Using those insights along with an understanding of different methods currently being considered for the setting of posted speed limits, the research team developed the SLS-Procedure in Phase II. The SLS-Procedure is based on fact-based decision rules that consider both driver speed choice and the safety associated with the roadway features. Then, Phase II involved the automation of that procedure to develop the SLS-Tool. As a part of the Phase II efforts, the research team collected data for urban and suburban roads in Austin, Texas, and Washtenaw County, Michigan, and built a database to investigate the relationships among crashes, roadway characteristics, and posted speed limits on city streets.

4. DEVELOPMENT OF RESULT: SPEED LIMIT SETTING PROCEDURE AND TOOL

4.1 SPEED LIMIT SETTING APPROACHES

The research team found that a number of approaches are used in setting speed limits. Speed limit is the maximum speed a driver is legally permitted for a given roadway segment. Several types of speed limits exist, including statutory speed limit, posted speed limit (PSL), school zone speed limit, work zone speed limit, variable speed limit, and advisory speed. States establish statutory speed limits for specific types of roads—such as freeways, rural highways, or urban streets—which are applicable even if the speed limit sign is not posted.

The primary purpose of setting speed limits is to inform and advise drivers of the appropriate and safe driving speeds under favorable conditions. Because drivers often ignore posted speed limits, simply setting a speed limit without considering the factors that affect operating speed will rarely achieve the intended operating speed (known as the target speed). In part because States and some local agencies have their own speed-limit-setting laws and criteria; various approaches and factors are used to set speed limits.

The research team conducted a literature review of current domestic and international practices on setting speed limits and summarized the following six approaches: 1) Operating Speed,

[3] See https://www.nap.edu/catalog/26216/posted-speed-limit-setting-procedure-and-tool-user-guide
[4] See https://www.nap.edu/catalog/26200/development-of-a-posted-speed-limit-setting-procedure-and-tool

2) Road Risk, 3) Expert System, 4) Injury Minimization/Safe System, 5) Citywide or Default, and 6) Slow Zones.

- **Operating Speed:** This approach uses the 85th percentile speed, with adjustments used to account for existing roadway geometry or crash experience. A review of 31 State Websites by the research team found that all 31 States use the operating speed approach. More than half of the States reviewed consider roadside development or land use, traffic condition or volume, sight distances, the maximum or minimum speed allowed in the State, as additional factors, while at least three States also consider alignment or cross-sectional factors such as horizontal/vertical curves, lane width, and pavement width.

- **Road Risk:** This approach is primarily used in Canada and New Zealand and determines the speed limit based on the risks associated with the physical design of the road and the expected traffic conditions. Essentially, the speed limits are set according to the function or classification of the roads, and then adjustments to the speed limit are made based on the relative risk introduced by road and roadside design features. Since this method may result in speed limits well below the 85th percentile speeds, additional enforcement may be needed if countermeasures to reduce operating speeds are not employed.

- **Expert System:** This approach recommends a speed limit based on a computer algorithm that uses knowledge and inference procedures that simulate the judgment and behavior derived from knowledgeable people, i.e., the "experts." The first expert system approach was developed in the late 1980s by Australia, and currently USLIMITS2, a Web-based tool developed by FHWA, is used on a limited basis as an expert system in the United States.

- **Injury Minimization/Safe System:** This approach sets speed limits based on collision types that are likely to occur, the resulting impact forces, and the human body's tolerance to withstand those forces. This approach is based on the scientific link between speed limits and serious crash prevention, placing a high priority on road safety. It is used in Australia, the Netherlands, and Sweden but is not commonly used in the United States. This may be due to lack of exposure to this method, or because the resulting low speed limits are not viewed as appropriate by some jurisdictions.
- **Citywide or Default:** This approach sets speed limits by government actions. The report discusses city efforts to set uniform speed limits for safety, such as a 20 mph speed limit on residential streets. States generally control statutory speed limits, and several U.S. cities have recently campaigned to gain the authority from their state legislatures to set lower citywide default speed limits. For example, Boston, Massachusetts; New York City, New York; and Seattle, Washington, now have the ability to set a 25 mph speed limit citywide. Portland, Oregon, has the authority to set residential streets at 20 mph. Other countries are also implementing citywide speed limits.
- **Slow Zones:** This approach is a community-based program to set lower speed limits for specifically designated corridors or areas than the speed limits on surrounding roadways of the same type. For example, New York City has implemented a "Neighborhood Slow Zones Program" to reduce crash frequency and severity and to enhance quality of life by reducing cut-through traffic and traffic noise in residential neighborhoods. Within the

Slow Zone area, speed limits are reduced from 25 mph to 20 mph, and traffic calming treatments are added with the intention of changing driver behavior.

4.2 RELATIONSHIPS AMONG ROADWAY CHARACTERISTICS, POSTED SPEED LIMIT, OPERATING SPEED, AND CRASHES

The relationships among roadway characteristics, posted speed limit, operating speed, and crashes, are very complex, and the association among those variables is known to vary widely. The research team reviewed the findings reported in the literature, and conducted a data-driven analysis to identify those relationships based on data collected for urban and suburban road segments located in Austin, Texas, and Washtenaw County, Michigan (which includes the city of Ann Arbor).

The research team identified variables that influence either operating speed or crash potential, and these variables were grouped by the research team into five categories: 1) Traffic, 2) TCD, 3) Roadway Geometry, 4) Roadway Surroundings, and 5) Other. A short synthesis on key variables follows.

4.2.1 Traffic Variables

The volume of traffic and the characteristics of that traffic – including vehicle mix and operating speed – have a clear relationship with both speed and safety. Traffic variables include:

- Average Annual Daily Traffic (AADT)

  Traffic flow measure AADT is considered the most determinant variable for the occurrence of crashes. Many safety performance functions consider only traffic flow and segment length in the model development. The relationship between traffic volume and crashes can be affected by whether the section is undivided or divided. The effect of this variable on crash frequencies differs based on the facility type. Usually, roadways with higher AADT values are associated with higher operating speeds on both urban and rural roadways. However, one study found lower operating speeds to be associated with higher AADT roadways. The researchers of that study commented that motorists may view increases in traffic volume as a motivation to slow down.

- Operating Speed

  Operating speeds reflect the speed behavior of drivers affected by roadway geometry, surroundings, traffic, and other variables. On urban roads, average speed, traffic volume, segment length, median presence, and horizontal curves have significant impacts on operating speeds, and roadways with higher average operating speeds are anticipated to have higher crash frequency. Vehicle characteristics, such as vehicle class and vehicle age, impact speed choice as well. For rural highways, one study found that the number of injury crashes increased with an increase in the segment mean speed. Another study reviewed several previous studies to identify factors, especially traffic and road-related factors, related to crashes. The research literature generally suggests that increased operating speeds would

likely lead to an increase in the overall crash rate and would also shift the severity distribution toward crashes of greater severity.

- Congestion

  Congestion has a positive direct relationship with total crashes, i.e., congestion increases the risk that a crash will occur. Also, traffic flow fluctuation on congested roadways can cause increased crashes.

- Percentage of Trucks

  The percentage of trucks has a mixed effect on operating speeds. On urban/suburban streets, crashes involving cars decrease as truck percentages increase and drivers of heavy vehicles generally choose a higher speed than drivers of passenger cars. On the other hand, the frequency of truck-involved crashes and car-truck-involved crashes increases as the truck percentage increases.

4.2.2 TCD Variables

The type of TCDs present can influence operating speeds and crashes because, when signalized intersections are present, drivers tend to select their operating speed to avoid stopping at such signalized intersections that have optimized progression along a corridor. The TCD variables are:

- Posted Speed Limit

  Several studies have found that the posted speed limit has a significant effect on free-flow speeds on urban arterials; higher average vehicle speeds are associated with higher posted speed limits. Vehicular operating speeds along tangent sections of rural two-lane highways have also been shown to be impacted by the posted speed limit, with vehicular speeds increasing as the posted speed limit increases. The magnitude of the change in operating speed when there is an increase (or decrease) in posted speed is typically only a fraction of the amount of the actual speed limit change. For undivided high-speed rural roadways, mean speeds are generally 3 to 5 mph higher for every 10-mph increase in speed limit above 55 mph, with smaller increases at higher speed limits. Increasing speed limits can lead to an increase in the overall crash rate and would also shift the severity distribution toward crashes of greater severity. One urban street study noted that “it is the higher speeds on roads with higher speed limits that cause collisions and not the speed limits (i.e., posted speed limits affect collisions through their effects on speeds).”

- Signalized Intersection

  For urban roadways, the presence of a signalized intersection is associated with higher crash frequencies and lower operating speeds.

- Passing Lane

  Passing lanes are effective in crash reduction on rural roadways. However, passing lanes are associated with higher intersection-related crash frequency on rural roadways.

4.2.3 Roadway Geometry Variables

The geometric design of the roadway and appurtenance can influence either operating speed or crashes in select cases. Roadway geometry variables include:

- Horizontal Alignment

  On rural highways, horizontal curves are identified as having the most influence on driver speed behavior and crash risk among the geometric variables. Crash frequency increases with the length and/or degree of horizontal curvature. On two-lane rural highways, design speed at horizontal curves inconsistent with a driver's desired speed could create operating speed irregularities by increasing the driver's workload, which may incur higher crash potential. However, past studies have shown mixed results regarding the safety effects of horizontal curves because the measurements used in the studies varied, including degree of curve, length of curve, deflection angle, and/or superelevation rate. While several studies found that the presence of horizontal curvature increases the likelihood of a crash occurrence, others found that sharper horizontal curves were negatively related to crash frequency since drivers tend to drive slowly on those segments.

- Vertical Alignment

  Studies showed that roadways with vertical alignment experience lower operating speeds once the vertical alignment exceeds a certain value. Typically, total crash rates increase with the degree of vertical alignment, especially in the presence of hidden horizontal curves, intersections, or driveways. Safety risks also associated with higher speed limits increased on segments with steeper vertical alignments.

- Presence of Median

  Median barriers are associated with severe crash reduction on urban arterials but have also been found to be associated with more Property-Damage-Only (PDO) crashes. Speeds are lower when either the median with a Two-Way Left Turn Lane (TWLTL) or no median was present as compared to when a raised median was present. Using data from Austin, Texas, and Washtenaw County (which includes Ann Arbor), Michigan, the NCHRP 17-76 Project team found that median type was significant for all severity level crashes, with the presence of a raised median being associated with fewer crashes than either a TWLTL or no median. On rural highways, the presence of a median on multilane, non-freeway facilities could decrease expected crash rates. A Michigan study found that the presence of a TWLTL was associated with a significant increase in total and injury crashes but was also associated with a significant decrease in fatal crashes.

- Number of Lanes

  The number of lanes is positively associated with crash frequency and operating speed. For instance, one study found that rural four-lane, undivided facilities tended to experience significantly more crashes across all severity levels compared to two-lane, undivided facilities.

- Lane Width

  Lane width is one of the significant variables affecting operating speeds and the number of crashes on rural highways. On rural highways, the width of travel lanes is related to the safety performance of both two-lane and multilane highways. Wider lanes in particular have been associated with reductions in single-vehicle run-off-the-road, head-on, and sideswipe type crashes. It is important to note that the effect of lane width on safety performance is reduced for multilane highways compared to two-lane highways. For two-lane rural highways, several studies found that operating speeds increase with wider lane width.

- Shoulder Width

  On urban freeways, increasing the outside shoulder width could reduce the total, rear-end, and fatal and injury crashes, and the presence of curb/shoulders leads to lower operating speeds on low-speed urban roads.

- Bike Lanes

  On urban/suburban streets, installation of bike lanes has positive safety effects on reducing four crash types: total crashes, injury crashes, bike crashes, and bike injury crashes.

- Intersection Angle

  On urban/suburban streets, intersection skew angle is associated with increased car, car-truck, and truck crash frequencies.

- Intersection Lighting

  On urban/suburban streets, the presence of intersection lighting appears to significantly decrease car, car-truck, and truck crash frequencies.

4.2.4 Roadway Surrounding Variables

The characteristics of the road's surroundings, including the neighboring land use, affect both operating speed and crashes. Variables associated with roadway surroundings include:

- Access Density (driveways and intersections)

  On urban/suburban streets, higher densities of driveways, unsignalized intersections, and urban interchange ramp density have a positive correlation with crash frequency. Higher density of driveways and T-intersections result in lower operating speeds, and speed variation increases as the access density increases on urban arterials.

- School Zones

  The presence of a school zone requires drivers to slow down. In studies examining different factors associated with school-zone-related crashes, the dominant factors are the type of school zones, type of schools, number of roadway lanes, and length of speed zone. Larger numbers of schools near a roadway segment have been found to be associated with a greater number of crashes. School zones are used to reduce operating speeds during select times of the day when students are moving between home and school. While operating speeds are

typically lower during an active school zone, drivers are often still not in full compliance with the speed limit.

- Parking

  The presence of on-street parking is associated with an increase in PDO crashes, but there is no statistically significant association with severe crashes. The presence of on-street parking is associated with lower operating speed.

- Liquor Stores

  The presence of licensed liquor stores is associated with higher severe and PDO crashes.

- Sidewalk Presence

  The presence of sidewalks on urban/suburban streets is generally associated with lower operating speeds, but the results varied by study. Setback sidewalks seem to result in higher operating speeds while sidewalks attached to curbs result in lower operating speeds.

- Development (surrounding land and use)

  One study of urban streets found that commercial and residential land use is positively correlated with operating speed. Type of development (land use) has a significant influence on operating speed. Generally, mixed low-density areas have the highest operating speeds, while the mixed high-to-medium density areas have the lowest operating speeds. Land use plays a role in driver perception of a safe speed. Another study found lower speed to be associated with residential development for two-lane rural highways

- Transit stops

  Transit stops and transit vehicle activities within a roadway segment are associated with higher pedestrian and bicyclist activities.

4.3 DEVELOPMENT OF SPEED LIMIT SETTING PROCEDURE AND TOOL

The NCHRP 17-76 Project developed the SLS-Procedure and an accompanying SLS-Tool, a spreadsheet which automates the procedure, based on the identified factors influencing operating speed and safety, and a review of existing speed limit setting practices. The SLS-Procedure is designed to apply a set of unique decision rules that consider both driver speed choice and safety to four collapsed Speed Limit Setting Groups[5]: Limited-Access, Undeveloped, Developed and Full-Access facilities based on roadway types and roadway contexts. The guiding principles applied to the SLS-Procedure included the following:

- Use a data-driven approach with research-based decision rules.
- Produce consistent results for a given set of conditions.
- Incorporate contemporary policies, guidelines, and practices.
- Consider drivers' speed choice and roadway safety.
- Provide transparency in the decision process.
- Consider all roadway types and roadway contexts.

[5] See https://www.nap.edu/catalog/24775/an-expanded-functional-classification-system-for-highways-and-streets

- Vary the decision rules to account for the diverse characteristics of each Speed Limit Setting Group.
- Consider agency data and human resource constraints.
- Include inputs and outputs on the same screen to demonstrate the relationship between each roadway characteristic and selection of the suggested speed limit.
- Allow for future modifications to accommodate new knowledge.
- Create efficiencies in the decision process, where possible.

For the SLS-Procedure, the research team recommended considering the measured operating speed as the starting point for selecting a posted speed limit, but with the measured operating speed being adjusted based on roadway conditions and consideration of the crash experience on the segment. Overall, the development of the suggested speed limit involves the following steps: the user identifies the roadway segment's context and type; then the user enters the existing operating speed to consider the speed drivers are selecting for the segment; next, the crash experience or potential is considered; and the result is a final suggested speed limit for the segment. Safety is considered through the observed crash data and/or risk factors. It is also considered in the decision rules when a geometric variable has been shown through other research to be associated with more crashes. The goal of the SLS-Procedure and SLS-Tool is to produce an objective suggested speed limit value, based on factors specific to the roadway. Practitioners are able to use the procedure and/or tool to communicate with the public or government officials to explain the general procedures behind setting speed limits.

5. CONCLUSIONS OF NCHRP PROJECT 17-76

Selecting a posted speed limit value for a roadway segment can be influenced by many factors, including engineering concerns, roadway characteristics, human factors such as the way drivers react to the roadway environment in terms of the speed they select, and policies including established State/local/Tribal agency laws or protocols along with political pressures.

The operating speed approach is the most common method for selecting a posted speed limit used in the U.S. It typically relies on the 85th percentile speed, with adjustments used to account for existing roadway geometry or crash experience. Many States/local agencies have their own laws/criteria for setting speed limits, many of which are quite detailed. Professionals who conduct studies to determine the appropriate posted speed limit rarely use only the 85th percentile speed (i.e., they use several other factors).

Using techniques other than the 85th percentile speed to select the posted speed limit is gaining in popularity in other countries. Several cities in the U.S. – such as Boston, Massachusetts; New York City, New York; Portland, Oregon; Seattle, Washington; and others – are using alternative speed limit setting approaches for city streets.

The SLS-Procedure uses fact-based decision rules that consider both driver speed choice and safety features associated with the roadway. Employing the SLS-Procedure and the SLS-Tool has potential to help State and/or local transportation agencies make informed decisions and communicate how speed limits are set to leadership and citizens.

6. SUGGESTED RESEARCH FROM NCHRP PROJECT 17-76

Among suggestions for additional research identified in NCHRP Project 17-76 include the following:

- Investigate current statutory speeds in all 50 States and develop a roadmap of how a uniform set of best-practice statutory speeds could be established across the country.
- Determine needed collaboration among engineering, enforcement, and judicial industries that will result in more uniform setting, enforcement, and adjudication of reasonable speed limits.
- Identify comprehensive definitions of the other factors used in setting speed limits such that they lead to more uniform application.
- Conduct outreach to the most experienced State and local personnel who have conducted engineering in setting speed limits, to help refine the speed limit setting process to be efficient and effective.
- Perform additional research on the relationships among operating speed, roadway characteristics, posted speed limit, and crashes for city streets to confirm the findings in Austin, Texas.
- Conduct similar research for roads with other speed ranges, such as freeways (generally 55 mph and greater), rural highways (subdivided into two speed groups of higher speeds and lower speeds), and local/residential streets.
- Conduct focus groups to identify other variables that could be considered within the SLS-Procedure, and investigate those variables for suitability for integration into the SLS-Tool.

7. CONCLUSION

This report was developed based on the research reports of NCHRP Project 17-76. The project team investigated how the roadway environment influences both operating speed and safety and also identified the factors used in current speed setting practices. In addition, the research team conducted a thorough review of different methods and tools that have been developed for setting posted speed limits, and developed an SLS-Procedure and an accompanying SLS-Tool. Detailed information is provided in the *NCHRP Research Report 966: Posted Speed Limit Setting Procedure and Tool: User Guide,* and *NCHRP Web-Only Document 291: Development of a Posted Speed Limit Setting Procedure and Tool*.

Reducing traffic speeds and speeding-related fatalities and serious injuries is a focus of DOT's National Roadway Safety Strategy, which officially adopts the Safe System Approach principles to guide safety actions. The FHWA aims to achieve safe mobility for all road users through the Safe System Approach and is developing guidance and resources as speed management practices shift toward applying the Safe System Approach. In addition, FHWA promotes several strategies and treatments known as the Proven Safety Countermeasures, including methods and practices for setting appropriate speed limits for all road users. The FHWA is developing materials to assist with the implementation of the Proven Safety Countermeasures. The FHWA is committed to championing the Safe System Approach and continuing to work with our stakeholders to achieve safe speeds for all road users. This approach will be comprehensive and will incorporate equity into all efforts to achieve zero roadway fatalities and injuries.

The FHWA has initiated a project to develop a handbook to provide guidance on determining appropriate speed limits for all roads and streets. The purpose of this project is to provide a single, inclusive source of informational guidance on a variety of different approaches to determining appropriate posted speed limits that are safe for all road users. The project will:

- Present the advantages and disadvantages of different current speed limit setting approaches.
- Provide guidance regarding the application of an engineering study in determining which factors need to be considered in setting appropriate non-statutory speed limits and ways to consider those factors. This effort will draw upon the advantages of different methods of speed limit setting. Practitioners can use the developed guidance to make informed decisions regarding the setting of appropriate speed limits for all road users.
- Provide technical guidance and assistance to agencies to determine appropriate speed limit setting.
- Provide resources for re-engineering roads and creating roadways that help to "self-enforce" speed limits to achieve a target speed and slow down vehicles rather than relying primarily on enforcement to achieve the posted speed limits.
- Develop training and outreach resources for speed limit setting.

The Bipartisan Infrastructure Law (BIL), also known as the Infrastructure Investment and Jobs Act (Public Law 117-58)) provides new funding resources that allow State and local governments to address speeding-related fatalities and serious injuries in their jurisdictions. The FHWA released guidance for the Highway Safety Improvement Program, which received an additional $4 billion in funding under BIL. The BIL also created a new $5-$6 billion Safe Streets and Roads for all competitive grant program for metropolitan planning organizations, local governments, and Tribal governments. In addition, BIL provides funding for safety-related activities through the National Highway Performance Program, the Surface Transportation Block Grant Program funds, and the Tribal Transportation Program Safety.

As noted in the introduction section, once the NCHRP 15-76 study is completed, FHWA will provide a summary of the report, including the implications for enforcement practices and safety where posted speed limits and design speeds deviate.