SYNTHESIS OF SPEED ZONING PRACTICES

Research, Development, and Technology

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U.S. Department of Transportation
Federal Highway Administration

Report No.
FHWA/RD-85/096

Technical Report
July 1985

FOREWORD

This synthesis examines State and local speed laws, regulations, and current practices for establishing speed limits. Problems with current methods used to set speed limits are identified along with research needs. The report will be of interest to State and local highway officials involved in speed zoning.

Appreciation is given to Archie Burnham and Jim Barnett of the AASHTO Subcommittee on Traffic Engineering for furnishing the survey data used in this report. Thanks also go to the State and local highway officials who completed the AASHTO survey and furnished copies of their speed laws and zoning practices.

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NOTICE

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/RD-85/096	PB88-248992/AS	

4. Title and Subtitle	5. Report Date
Synthesis of Speed Zoning Practices	July 1985
	6. Performing Organization Code
	8. Performing Organization Report No.

7. Author(s)	
M. R. Parker, Jr.	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Martin R. Parker & Associates, Inc. 44236 Suffolk Court Canton, Michigan 48187-2129	31A4-034
	11. Contract or Grant No. DTFH61-83-C-00128
	13. Type of Report and Period Covered Technical Report October 1983 - July 1985

12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code
Federal Highway Adminstration Office of Safety and Traffic Operations Research and Development Washington, D.C. 20590	

15. Supplementary Notes

FHWA Contracting Officer's Technical Representative: Davey L. Warren (HSR-30)

16. Abstract

This research was conducted to examine State and local speed laws, regulations, and current practices for setting speed limits. The information for the study was obtained from a review of the literature and a mail survey of State and local highway officials conducted by a Task Force of the AASHTO Subcommittee on Traffic Engineering.

Throughout years of experimentation and observation, little consensus has been reached concerning criteria that should be used to establish speed limits. While the 85th percentile speed is considered as a major factor in all States and most localities, the deviations from the 85th percentile that are used to establish the speed limit can result in an arbitrary limit. The diversities in State and local laws, the lack of national guidelines, and the variety of methods currently in use suggest that non-uniform speed zones are commonplace.

There is an immediate need to validate the applicability of existing methods and/or to develop new objective criteria that will lead to establishing realistic speed zones. There is also a need to examine the potential benefits of establishing minimum speed limits. Objective methods for setting speed limits in work zones should be explored. State and local officials also identified the need to determine the effects of raising or lowering speed limits on speed and accidents.

17. Key Words	18. Distribution Statement
Prima Facie limits, Absolute limits, Maximum limits, Minimum limits, 85th percentile speed, Accident risk, Data collection practices	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	62	A04 $14.95

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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INTRODUCTION

Speed zoning is a traffic engineering tool that has been employed for a number of years to influence motorist behavior. A wide variety of regulations and methods have been used to post numerical limits, however, after years of practice, serious problems persist. The need to develop a widely accepted method for establishing realistic zones based on sound scientific principles is important to achieving the potential benefits of uniform speed regulations.

A review of the early speed laws in the United States and Europe suggests that the regulations were established for the protection of the public.[1] The rationale for government regulation of speed is based on the fact that a driver's speed may cause damage or injury to others. Speed laws are enacted to regulate the unreasonable behavior of an individual.

While public safety is frequently mentioned as the primary basis for establishing speed zones, a number of States and localities also use efficiency traffic flow as justification. Generally, speed zoning is defined as the establishment of safe and reasonable speed limits. There is considerable controversy as to what constitutes a safe and reasonable speed. It has been noted that the only safe speed is zero as accidents occur at all speeds.[2] It is more difficult to define the term "reasonable speed" as a reasonable speed for one person may be unreasonable for another person.

Safety and traffic efficiency have not always been the major objectives for establishing maximum speed limits. From September 30, 1942 until the fall of 1945, a nationwide speed limit of 35 mph (56 km/h) was enacted to conserve rubber and gasoline.[3] In March 1974, the nationwide maximum speed limit of 55 mph (89 km/h) was enacted as a temporary fuel conservation measure.[4] The 55 mph (89 km/h) limit was permanently established by Congress in January 1975 because of the apparent safety benefits.

Speed limits based on achieving maximum safety benefits, i.e., speeds near zero, are not perceived as reasonable to the majority of motorists and would increase energy consumption. Limits set to optimize energy consumption, i.e., between 30 and 35 mph (48 and 56 km/h), do not maximize safety and are not perceived as reasonable. Reasonable limits may not maximize safety or energy objectives. These conflicting objectives make the establishment of numerical speed limits difficult and controversial. Clearly, the objectives of speed limits must be defined before guidelines can be developed to promote uniform speed zoning practices.

Based on years of experimentation and observation the following fundamental concepts have been used as guidelines in establishing realistic speed zones.

- The majority of motorists drive at a speed they consider reasonable, convenient, and safe for existing conditions. Posted limits which are set higher or lower than dictated by roadway and traffic conditions are ignored by the majority of motorist.[5]

- A speed limit should be set so that the majority of motorists observe it voluntarily and enforcement can be directed to the minority.[6]

- The normally careful and competent actions of a reasonable person should be considered legal.[7]

- A speed limit should seem too fast to at least 85 percent of the drivers or it is not a maximum limit.[8]

- Any speed limit is reasonable only for the roadway and traffic conditions for which it was set. Limits based on prevailing speeds of free-flowing vehicles obtained during good weather will be unreasonably high for extreme weather and traffic conditions.[6]

- Accident severity increases with increasing speeds because in a collision, the amount of kinetic energy dissipated is proportional to the square of the velocity. Accidents, however, appear to depend less on speed and more on the variation in speeds. Vehicles traveling one standard deviation above the mean speed of traffic have the lowest accident involvement rate. The likelihood of an accident occurring is significantly greater for motorists traveling at speeds slower and faster than the mean speed of traffic.[9-12]

- A realistic speed limit must be related to actual risk. The lowest accident involvement rate occurs when vehicles are traveling one standard deviation above the mean speed which is approximately equivalent to the 85th percentile speed.[13]

Realistic speed zones established on the basis of these guidelines are reported to have the following benefits.[7]

- Provides a factual scientific basis for determining limits which are otherwise arbitrarily set often in response to emotional and political issues.

- Invites public compliance by conforming to the behavior of the majority of motorists and provides a clear reminder to violators.

- Gives enforcement officials a good guide as to what is a reasonable and prudent speed and permits concentration of enforcement against real traffic violators.

- Assists traffic courts by providing a realistic guide as to what constitutes a reasonable and prudent speed and reduces arbitrary enforcement and conviction tolerances.

- Insures that speed zones satisfy the requirements and intent of State and/or local laws and ordinances.

- Encourages motorists to drive at or near the same speed resulting in smoother flow and a reduction in accident risk.

For many years organizations, including the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and governmental agencies have collected and analyzed information for the purpose of developing uniform speed zoning practices.[14,15] In spite of these extensive efforts, there is no generally accepted method in use.

The absence of a widely accepted quantitative method for establishing speed zones leads to non-uniform limits among jurisdictions for similar conditions in both rural and urban areas. Non-uniform speed regulations create motorist disrespect and places law enforcement officials and the courts in the position of arbitrary selecting violators. The competency of highway officials who install unrealistic speed limits is subject to public scrutiny. Without a factual basis for establishing limits, legislators and concerned citizens are motivated to take an active role and influence speed zoning decisions.

Although years of experience and research have produced a foundation upon which to develop realistic speed limits and speed zoning practices, uniformity appears to be more ideal than real. Recent data show widespread non-compliance with posted speed limits on major roads and local streets.[16] The relative subjectivity of existing practices and arbitrary level of many posted limits suggests that a re-examination of regulations and practices is needed.

This report provides a synthesis of State and local speed zoning laws and regulations, enforcement practices, and a summary of current methods used to establish speed limits. Specific speed zoning problems were identified to provide direction for future work.

METHOD

The information used in this report was obtained from a literature review and a mail survey of State and local highway officials conducted by a task force of the AASHTO Subcommittee on Traffic Engineering. The analysis of the data and interpretation of the results was conducted by the author.

An extensive worldwide search for publications was conducted using the facilities of the Highway Research Information Service and the International Road Federation.[17] Over 300 foreign and domestic publications including articles from journals, magazines, research reports, and university and government documents were obtained and reviewed. Respondents to the AASHTO survey also provided other published and unpublished documents.

A survey of current speed zoning practices was conducted by the AASHTO Task Force on Speed Zoning and Control during the Summer of 1984. The task force was organized to examine regulations, practices, and problems related to speed zoning. The survey was designed to obtain regulatory, policy, and procedural documents as well as the respondents' views on speed zoning issues.

Surveys were sent to highway officials in the 50 States, the District of Columbia, Puerto Rico, and a sample of local agencies. The urban and rural counties, cities, and other localities surveyed are randomly selected geographic areas which are representative of the degree of urbanization, geographic region, population, and road mileage in the United States that comprise the Primary Sampling Units of the National Accident Sampling System.[18]

A summary of the survey distribution and response rates is shown in Table 1. The compiled responses of the State officials are shown in Appendix A. A follow up letter and telephone contacts were made to ensure a 100 percent return rate by the States. Follow up contacts were also conducted with the localities, however, only 57 percent of the agencies returned the survey. Reasons for not responding include the fact that the States have the primary responsibility for speed zoning in many rural areas and on major roads in urban counties, and personnel in some cities did not have the time to respond to the nine page survey.

It should be noted that some of the issues discussed in this report represent a summary of the respondents views and not necessarily a summary of actual departmental or agency policies. The summaries of speed zoning regulations, driver penalties, and methods used to set speed limits were taken from published departmental records and statutes and are assumed to represent actual policies and practices.

Table 1. Survey distribution and response rate.

Category	Number of Contacts	Number of Responses	Percent of Responses
States, District of Columbia, and Puerto Rico	52	52	100
Localities Population Group			
Less than 50,000	25	12	48
50,000 to 99,999	20	12	60
100,000 to 500,000	22	15	62
Over 500,000	10	5	50

SPEED LAWS AND REGULATIONS

A review of the history of speed regulations indicates that most of the legislation has been directed at restricting maximum speeds, although the need for minimum speed laws was identified in the 1920's.[1] The need for uniform speed laws in all States and jurisdictions was recognized and incorporated in the 1926 Uniform Vehicle Code.[19] Revisions to the Code and State laws were made periodically to accommodate changes in observed speeds created by improvements in vehicle capabilities and highway design, and in response to general practices and Federal policies. The Uniform Vehicle Code recommends statutory limits and authorizes the State highway commission to raise or lower the limits based on an engineering and traffic investigation. Although variations in State laws exist, most State statutes conform with the basic intent of the Uniform Vehicle Code.

Agencies Empowered to Set Speed Limits

Based on the results of the AASHTO task force data, the State highway and/or transportation department or commission is empowered to set or alter speed limits in 40 States. Michigan and Alabama laws require the cooperation of the State police. The Alabama statute also requires the approval of the Governor. In Oregon, the State Speed Control Board has the authority to alter speed limits while in Massachusetts the responsibility rests with the Registry of Motor Vehicles. In the remaining 10 States, both State and local agencies are empowered to set speed limits in their jurisdiction. In six States, the local agency sets speed limits with the approval of the State agency. One exception is Florida where local officials do not have to obtain State approval to zone local roads, however, the speed limits must be established in accordance with criteria promulgated by the Department of Transportation.

Of the 44 local officials who responded to the AASHTO survey, the State highway agency is empowered to set speed limits in 6 jurisdictions. Both State and local agencies have the responsibility in 12 localities, and the local agency must obtain State agency approval in 6 other jurisdictions. In approximately 40 percent of the remaining localities, the local agency is empowered to set speed limits. Most of these localities consist of the more highly populated urban counties and cities. A variety of local administrators including the county board of commissioners, the traffic administrator, and the mayor and city council have specific authority for speed zoning in these metropolitan areas.

While State laws and local ordinances empowered specific agency administrators with speed zoning authority, the responsibility for conducting the studies is delegated to traffic engineering departments. In practice most States and localities base their decisions to raise or lower speed limits on the results of engineering and traffic investigations. State statutes, however, do not specifically require engineering and traffic investigations in Connecticut, Hawaii, Maine, Massachusetts, New York, and South

Dakota.[20] State laws in Connecticut, Hawaii, Louisiana, Massachusetts, and Missouri permit localities to establish speed limits but do not specifically require engineering and traffic investigations.

Existing Statutory Limits

The following three principal types of speed laws have evolved over the years.

- Basic Speed Rule Every State has a basic speed law which specifies that regardless of any other speed limit that may be applicable at the time and place, the driver shall operate at a speed that is reasonable and prudent for existing conditions, taking into account actual and potential hazards encountered.

- Prima Facie Limits Any vehicle speed in excess of the established numerical limit is prima facie evidence that the driver is not operating at a reasonable and prudent speed. The law permits the driver the right to provide proof that the speed was not improper under existing conditions. Prima facie limits recognize the fact that no specific speed is particularly safe or unsafe at all times.

- Absolute limits Absolute or fixed speed limits are always illegal to exceed regardless of whether the driver's speed was safe or reasonable and prudent for conditions.

Current State statutory maximum speed limits by type are summarized in Table 2. A tabulation of the limits by type reveals that 60 percent of the States have absolute limits; only 10 percent have prima facie; and the remaining 30 percent use both absolute and prima facie limits. Nearly 40 years ago, 40 percent of the States had absolute limits; 54 percent had prima facie; and 6 percent employed both types.[21] In 1956, the Uniform Vehicle Code was revised and recommended absolute limits instead of the prima facie rule. In a survey conducted by Witheford in 1970, 60 percent of the States were using absolute limits; 20 percent had prima facie limits; and 20 percent used both types.[22] These data indicate that the use of absolute limits has remained stable during the past 15 years, however, there has been a small decrease in States with prima facie limits and a proportional increase in States using both absolute and prima facie limits.

Statutory limits in localities, as summarized from the AASHTO survey data, are shown in Table 3. Absolute limits are used in 25 percent of the localities while another 25 percent use prima facie limits. Thirty percent of the localities use both types and the remaining 20 percent did not specify a type. Compared to the results of the 1970 Witheford survey, there has been a dramatic increase in the use of both types of limits, i.e., from 8 percent to 30 percent, and a decrease in the use of absolute limits (from 34 to 25 percent) and prima facie limits (from 38 to 25 percent).

Table 2. State statutory maximum speed limits.

State	Residential	Business District	Urban Freeway	Rural Freeway	Rural Multilane	Rural Two-Lane	School Zone	Work Zone	Comments
Alabama	30 AB	30 AB	55 AB	55 AB	55 AB	55 AB	25 PF		
Alaska	25 PF	20 PF	55 AB	55 AB	55 AB	55 AB	20 AB		
Arizona	25 PF	25 PF	55 AB	55 AB	55 AB	55 AB	15 PF		
Arkansas			55 AB	55 AB	55 AB	55 AB	25 AB		
California	55 AB	55 AB	55 AB	55 AB	55 AB	55 AB	25 PF		25 PF can be used on local highways
Colorado	30 PF	25 PF	55 AB	55 AB	55 AB	55 AB	Not<20 PF	Not<20 PF	
Connecticut	PF	PF	55 AB	55 AB	55 AB	55 AB	PF	PF	
Delaware	25 AB	25 AB	55 AB	55 AB	55 AB	50 AB	20 AB		
Dist. of Columbia	25 PF	25 PF	45 AB				15 AB		
Florida	30 AB	30 AB	55 AB	55 AB	55 AB	55 AB			
Georgia	30 AB	30 AB	55 AB	55 AB	55 AB	55 AB	55 AB	40 AB	
Hawaii	25 PF	25 PF					25 PF		Limits vary by county
Idaho	35 AB	35 AB	55 AB	55 AB	55 AB	55 AB	35 AB		
Illinois	30 AB	30 AB	55 AB	55 AB	55 AB	55 AB	20 AB	55 AB	
Indiana	30 AB	30 AB	55 AB	55 AB	55 AB	55 AB	55 AB	55 AB	
Iowa	25 AB	20 AB	55 AB	55 AB	55 AB	55 AB	25 AB		
Kansas	30 AB	20 AB	55 AB	55 AB	55 AB	55 AB	55 AB	55 AB	Minimum 20 PF in school zones
Kentucky	35 AB	35 AB	55 AB	55 AB	55 AB	55 AB	55 AB	55 AB	School zones can be lower using flasher assembly
Louisiana			55 AB	55 AB	55 AB	55 AB			
Maine	25 AB	25 AB	55 AB	55 AB	55 AB	55 AB	15 AB		
Maryland	30 AB	30 AB	55 AB	55 AB	55 AB	55 AB			55 mph can be used in residential and business areas
Massachusetts	30 PF	30 PF	55 PF	55 PF	50 PF	40 PF	20 PF		
Michigan	25 PF	25 PF	55 AB	55 AB	55 AB	55 AB	55 AB	45 AB	School zone limits may be 25 mph PF
Minnesota	30 AB	30 AB	55 AB	55 AB	55 AB	55 AB	Not<15 AB		
Mississippi	55 AB	55 AB	55 AB	55 AB	55 AB	55 AB	15 AB	55 AB	
Missouri	45 AB	45 AB	55 AB	55 AB	55 AB	55 AB	AB	40 PF	Urban school zones set by local government
Montana	25 PF	25 PF	55 AB	55 AB	55 AB	55 AB	55 AB	35 PF	
Nebraska	25 AB	20 AB	55 AB	55 AB	55 AB	55 AB			
Nevada			55 AB	55 AB	55 AB	55 AB		55 AB	
New Hampshire	30 PF	30 PF	55 PF	55 PF	55 PF	55 PF	20 PF		
New Jersey	25 PF	25 PF	55 PF	55 PF	50 PF	50 PF	25 PF		
New Mexico	35 PF		50 PF	55 AB	55 AB	55 AB	15 PF	Varies	
New York	55 AB	55 AB	55 AB	55 AB	55 AB	55 AB	Not<15 AB	55 AB	
North Carolina	35 AB	35 AB	55 AB	55 AB	55 AB	55 AB	Not<25 AB		
North Dakota	20 AB	25 AB	55 AB	55 AB	55 AB	55 AB	20 AB	Varies	
Ohio	25 PF	25 PF	55 AB	55 AB	55 AB	55 AB	20 PF		
Oklahoma	55 AB	55 AB	55 AB	55 AB	55 AB	55 AB	25 AB	Not<35 AB	
Oregon	25 PF	20 PF	55 AB	55 AB	55 AB	55 AB	20 PF		
Pennsylvania	35 AB	35 AB	55 AB	55 AB	55 AB	55 AB	15 AB	Not<25 AB	
Puerto Rico	25 AB	25 AB		55 AB	45 AB	45 AB	25 AB		
Rhode Island	25 PF	25 PF	50 PF	50 PF	50 PF	50 PF	20 AB		
South Carolina	30 AB	30 AB	30 AB	55 AB	55 AB	55 AB			
South Dakota	25 AB	25 AB	55 AB	55 AB	55 AB	55 AB	15 AB		
Tennessee			55 AB	55 AB	55 AB	55 AB	15 AB		
Texas	30 PF	30 PF	55 PF	55 PF	55 PF	55 PF			
Utah	25 PF	25 PF	55 PF	55 PF	55 AB	55 AB	20 PF	55 AB	
Vermont	50 PF	50 PF	55 AB	55 AB	50 PF	50 PF	50 PF	50 PF	
Virginia	25 AB	25 AB	55 AB	55 AB	55 AB	55 AB	25 AB	Varies	
Washington	25 AB	25 AB	55 AB	55 AB	55 AB	55 AB	20 AB	55 AB	
West Virginia	25 AB	25 AB	55 AB	55 AB	55 AB	55 AB	15 AB		
Wisconsin	25 AB	25 AB	35 AB	55 AB	55 AB	55 AB	15 AB		
Wyoming	30 AB	20 AB	50 AB	55 AB	55 AB	55 AB	20 AB		

Note: 1 mph = 1.6 km/h
AB = Absolute limit
PF = Prima Facie limit

Table 3. Statutory maximum speed limits in selected localities.

State	Residential	Business District	Urban Freeway	Rural Freeway	Rural Multilane	Rural Two-Lane	School Zone	Work Zone
Tuscaloosa, AL	25	25	50	55	55	55	35	Varies
Tucson, AZ	25	25	55	55	50	50	15	
Yuma Co., AZ	25					50	15	
Eureka, CA	25 AB	25 AB	55 AB	55 AB	55 PF	55 PF	25 AB	25
Los Angeles, CA	25 PF	25 PF	55 AB	55 AB			25 PF	
Sacramento, CA	25 PF	25 PF	55 PF	55 PF	55 PF	55 PF	25 PF	55 PF
San Bernardino, CA	25 PF	25 PF	55 AB	55 AB	55 AB	55 AB	25 AB	25 AB
Ventura Co., CA	25 PF	25 PF	55 AB	55 AB	55 AB	55 AB	25 PF	25 PF
Jefferson Co., CO	30 PF	25 PF	55 AB	55 AB	55 AB	55 AB		
Brevard Co., FL	30 AB	30	50	50	50	50	25 AB	
Broward Co., FL	30 AB	30 AB					20 AB	25 AB
Dade Co., FL	30	Varies	55	55	Varies	Varies	15	Varies
Chicago, IL	30 AB	30 AB	55 AB				20 AB	
Joliet, IL	30 AB				50	35 PF	20 PF	
Kankakee Co., IL	30	30				55 AB	20 AB	
Lake Co., IL	30 PF	30 PF	55 PF	55 PF	55 PF	55 PF	20 AB	
Prince Georges Co., MD	30 AB	30 AB	55 AB	55 AB	50 AB	50 AB		
Berrien Co., MI	25 PF	25 PF			55 AB	55 AB	Varies	
Huron Co., MI	25 PF	PF	55 AB	55 AB	55 AB	55 AB	PF	PF
Washtenaw Co., MI	25 PF	25 PF	55 AB	55 AB	55 AB	55 PF	55 PF	45 PF
Wayne Co., MI	25 PF		55 PF	55 PF	55 PF	55 PF		
St. Louis, MO	25 PF	25 PF						Judgment
Omaha, NE	25 AB	25	55	55	55	55	25	
Albuquerque, NM	25	25					15	
Buffalo, NY	30	30					30	Varies
Kingston, NY						55 AB		Varies
Schenectady Co., NY			55 AB	55 AB	55 AB	55 AB	15	20
Raleigh, NC			55 AB	55 AB	55 AB	55 AB	AB	45 AB
Salisbury, NC	35 AB	20 AB	45 AB	55 AB	55 AB	55 AB	25 AB	
Akron, OH	25 PF	25 PF	55 AB				20 PF	
Summit Co., OH	25 PF	25 PF	50 PF	55 PF	55 PF	55 PF	20 PF	Varies
Hamilton, OH	25 PF	25 PF	50				20 PF	
Stark Co., OH	50 PF	50 PF	50 PF	50 PF	50 PF	50 PF	50 PF	PF
Scranton, PA	25	25	55		55	55	15	15
South Kingston, RI	25 PF	25 PF	50 PF	50 PF	50 PF	35 PF	20 PF	35 PF
Darlington Co., SC	30 PF	25 PF	55 PF	55 PF	55 PF	55 PF	35 PF	Varies
Spartanburg, SC	35 PF	35 PF	55 PF	55 PF	55 PF	55 PF		
Shelby Co., TN	30 PF		55 PF	55 PF	55 PF	45 PF	15 PF	Varies
Dallas, TX	30 AB	30 AB	50 AB			40 PF	20 PF	30 PF
Garland, TX	30 PF	55 PF	55 PF	55 PF	55 PF	55 PF	20 PF	55 PF
Wytheville, VA	25 AB	35 AB	55 AB	55 AB	55 AB	55 AB	25 AB	35 AB
Skagit Co., WA	25 PF			50 AB		50 AB	20 AB	
Waukesha, WI			55	55	55	55	15	

Note: 1 mph = 1.6 km/h
AB = Absolute limit
PF = Prima Facie limit

The advantages and disadvantages of absolute and prima facie limits have been discussed in several reports, however, no substantive information, i.e., nationwide case studies, opinions of traffic court judges, etc., could be found in the literature to support or refute either speed rule.[15,20] One major advantage of prima facie limits over absolute limits is that prima facie limits provide greater flexibility in meeting the need for a speed limit that changes due to weather, road, and traffic conditions. With prima facie limits, drivers can raise or lower their speed according to conditions. Absolute limits eliminate the opportunity for motorists to present evidence that their speed was reasonable and prudent for local conditions. Thus, with absolute limits enforcement officials only have to show that the driver was traveling in excess of the posted limit. Unfortunately, when an absolute limit is not realistic, violators may be selected from the majority of motorists instead of the minority of high-accident risk motorists. One advantage of using prima facie limits may be that the courts would encourage highway agencies to post realistic limits in order to identify the minority of violators that create hazard to other drivers.

With a few exceptions, the 55 mph (89 km/h) limit is the maximum limit on rural freeways and multilane highways. Maximum limits in residential areas and business districts vary from 20 to 55 mph (32 to 89 km/h) in the States and from 25 to 50 mph (40 to 80 km/h) in localities. The most frequently used limit in these areas was 25 mph (40 km/h). As statutory limits are not specified in all jurisdictions for school and work zones, these limits along with other special cases including minimum, advisory, and differentiated limits are discussed in the current practices section of this report.

A comparison of maximum speed limits in the United States and other countries is shown in Table 4. With the exception of New Zealand with an upper limit of 50 mph (80 km/h), maximum limits in the other countries are significantly higher than limits in the United States for rural interstate type roadways and for most other rural facilities. Maximum limits in urban areas are comparable among the selected countries.

The 55 mph national maximum speed limit has greatly decreased the disparity in maximum speed limits among the jurisdictions. For example, on rural freeways prior to 1974, the maximum statutory limits ranged from 60 to 75 mph (97 to 121 km/h) with 70 mph (113 km/h) listed as the most common value.[23] The majority of other main rural roads were posted at 60 mph (97 km/h). Statutory limits in residential and business districts have not substantially changed during the past 15 years.[22]

While nationwide adoption of the 55 mph (89 km/h) speed limit reduced the variance in statutory limits among jurisdictions, the question remains as to whether the change improved the uniformity of the speed zones, i.e., are similar situations treated in the same way? The problem with adopting any fixed statutory limit is that the limit may not be reasonable and safe for existing conditions. Any statutory limit is an arbitrary limit which should be altered, i.e., raised or lowered, for particular conditions. Statutory limits merely establish a foundation upon which realistic speed limits can be determined through engineering studies. When the statutory

limit is adopted as a maximum limit, the uniformity and credibility of speed zones decreases. For example, it is not unusual to find an 80 mph (129 km/h) design speed on limited access highways and two-lane roads with a 50 mph (80 km/h) design speed both posted at 55 mph (89 km/h).

Proposed Legislation

Due to eroding compliance, decreasing public support, and increasing average speeds on roadways posted at 55 mph (89 km/h), the question of whether the limit should be retained or rescinded was recently addressed.[4,24] If revisions are made in the statutory maximum limits in the future, the question of what, if any, maximum value is appropriate must be addressed. As previously mentioned, maximum speed limits prior to 1974 ranged from 60 to 75 mph (97 to 121 km/h) with 70 mph (113 km/h) used most frequently on interstate highways. Statutory limits in excess of 55 mph (89 km/h) were only temporarily suspended in 26 States. Thus, in the absence of other legislation in these States, the pre-1974 limits could easily be reinvoked.

In the AASHTO survey of State and local highway officials, over 75 percent of the respondents favored raising the 55 mph (89 km/h) limit. Although the values ranged from 60 to 75 mph (97 to 121 km/h), the average limit suggested by the respondents was 65 mph (105 km/h) on rural freeways and 60 mph (97 km/h) on non-freeways. The mean value suggested by respondents from the northeastern States and localities for freeways was slightly lower than the mean values suggested in other regions, i.e., 63.8 mph (105 km/h) compared to the nationwide average of 65 mph (105 km/h). No other regional differences existed in the responses. If the respondents' opinions represent the general attitude of State and local officials responsible for speed zoning, then it appears that most jurisdictions would not return to the higher pre-1974 speed limits.

The question of a maximum statutory limit, however, should not be decided by opinion, but should be based on scientific evidence. The difficulty in selecting an upper limit has been addressed by the European Conference of Ministers of Transport on several occasions.[25, 26] The ministers recommended speed limits in the range of 110 to 130 km/h (70 to 80 mph) for freeways and a limit of less than 100 km/h (60 mph) for general roads.[26] As shown in Table 4, the maximum limits for most European countries fall within these recommended limits.

One other consideration that should be addressed before changes are made in existing speed laws is the complexity of regulations. The Uniform Vehicle Code recommends five statutory limits.[19] In a review of State speed limit laws, English, et al., found that 16 States have 10 or more statutory limits.[20] It is doubtful whether motorists are aware of such a variety of limits. Because statutory limits serve as a foundation upon which realistic speed limits can be determined for specific conditions through engineering studies, legislators should strive to simplify existing statutes. As suggested by English, et al., perhaps one statutory limit for urban areas and one limit for rural areas is sufficient.[20]

Table 4. Maximum speed limits in selected countries.

Country	Road Classification	Current Maximum Limit km/h	mph
Australia	Rural freeways	110	68
	Other rural roads	100	62
	Some urban arterials	80	50
	Urban roads	60	37
Ontario, Canada	Freeways	97	60
	Special cases	89	55
	Other roads	80	50
Denmark	Motorways	110	68
	Non-urban roads	90	56
	Urban roads	60	37
Finland	Motorways	120	75
	Major highways	100	62
	General roads	80	50
France	Rural interstate	130	81
	Dual highways	110	68
	Other rural roads	90	56
	Urban roads	60	37
The Netherlands	Motorways	100	62
	Other rural roads	80	50
	Major urban roads	70	44
	Urban roads	50	31
New Zealand	Rural roads	100	62
South Africa	Freeways	120	75
	Other roads	100	62
Sweden	Rural Motorways	110	68
	Other dual lane	90	56
	Urban arterials	70	44
	General urban roads	50	31
	Special urban conditions	30	19
United Kingdom	Motorways and dual roads	113	70
	Rural two-lane roads	97	60
	Urban streets	48-80	30-50
United States	Interstate and principal roads (National maximum limit)	89	55
	Urban areas	40-89	25-55
West Germany	Autobahns	Free speed, i.e., no limit unless posted	
	Rural roads	100	62
	Urban roads	50	31

According to the results of the AASHTO data, only minor legislation has been recently proposed to change existing State statutes and local ordinances. In Illinois a bill is pending to establish a 20 mph (32 km/h) speed limit near senior citizen housing centers. In Washington, D.C. a proposal has been introduced to increase the school speed limits from 15 to 25 mph (24 to 40 km/h). A 30 mph (48 km/h) prima facie limit is being considered for residential collector streets in Sacramento, California.

ENFORCEMENT PRACTICES

A comprehensive review of the effects of enforcement on traffic speeds and safety was recently completed by Jones, et al.[27] Throughout the literature, the importance of enforcement is stressed as one of the essential elements of proper speed zoning. The respondents to the AASHTO survey provided the following views on enforcement.

State and local highway officials felt that the main objective of enforcement was to apprehend dangerous and reckless drivers. Encouraging compliance and safer driving were rated as secondary objectives. Police officials in Witheford's survey felt that the primary goal of enforcement was to encourage safer driving and to increase voluntary compliance with posted speed limits. The importance of this finding is that enforcement officials see their role as a preventive measure, while the majority of highway engineers view enforcement as a punitive measure. The enforcement view of their role as a measure to improve safety may partially explain why police officials permit tolerances for exceeding certain speed limits.

The highway officials also provided estimates of the enforcement tolerances used in their jurisdictions. Nearly 40 percent of the State and local officials indicated that tolerances of at least 5 mph (8 km/h) over the posted speed limit were used by police officials. Approximately 60 percent of the officials felt that tolerances ranging from 6 to 15 mph (10 to 24 km/h) were used. Only two localities reported that tolerances were not used by police officials.

Based on the results of the Witheford survey of police officials, the use of 1 to 5 mph (2 to 8 km/h) tolerances in the States has decreased from 67 percent in 1970 to 40 percent in 1984. Tolerances greater than 5 mph (8 km/h) increased from 33 to 60 percent. Comparable data are not available for localities. The increase in the use of larger enforcement tolerances since 1970 may be an indication that enforcement officials view the 55 mph (km/h) limit as unrealistic and unenforceable and adjust their tolerances to accommodate their perception of what is realistic. Also, because the 55 mph (89 km/h) limit may have encouraged the posting of unrealistic limits on non-55 mph (89 km/h) roadways, enforcement officials may be applying larger tolerances to these highways.

State and local officials suggested that the main reason tolerances were granted was due to the fact that rigid enforcement was not upheld in the courts and reasonable allowances were necessary to ensure convictions. Tolerances may also be widely used because many speed limits are arbitrary

and unreasonable. Speedometer error was cited as a primary reason for permitting tolerances by 87 percent of the State respondents and 61 percent of the local officials. Only 23 percent of the State and 11 percent of the local officials attributed enforcement tolerances to unreasonable speed limits.

The AASHTO survey revealed that approximately 31 percent of the State highway officials felt that enforcement activity should be increased. In contrast, over 64 percent of the local officials suggested an increase in enforcement. One possible explanation for the suggested increase in enforcement in localities may be an increase in pressure at the local level due to the disrespect of the 55 mph (89 km/h) and the carry over effect on local streets. Another hypothesis is that localities do not have the resources to undertake desirable levels of enforcement. In the 1970 Witheford survey, 61 percent of the city police officials felt that enforcement should be increased.[22] One of the major reasons cited for increasing enforcement was poor compliance with existing limits.

Very little information has been published concerning State and local penalties imposed upon drivers who are convicted of exceeding speed limits. Based upon the information supplied by officials responding to the AASHTO survey, a summary of the State and local penalties was compiled and the results are shown in Tables 5 and 6. Examination of these data reveal several trends. First, there is a wide range of penalties imposed among the jurisdictions for the same infractions. Secondly, in most jurisdictions greater penalties are imposed for persons convicted of exceeding the posted limits by more than 20 mph (32 km/h).

The effect of the penalties on driver speed is unknown. Also, the actual penalties imposed upon drivers convicted of speeding is unknown, but some evidence indicates that the average penalty is considerably below the maximum.[4] It has been reported that 14 States revised the statutes to impose modest fines for exceeding the 55 mph (89 km/h) limit.[20] The committee that conducted a recent study of the 55 mph (89 km/h) limit reported that it did not find a relationship between State statutes for driver penalties and compliance.[4]

Based on the limited data available, there appears to have been an increase in the tolerances used by enforcement officials during the past 15 years. One reason stated for large tolerances is that reasonable allowances were necessary to ensure conviction. The need for tolerances, however, may be due to unrealistic speed limits. The impact of enforcement practices on speed zoning policies is difficult to assess because no quantitative data are available. The larger tolerances provide an indication that enforcement officials and the traffic courts have decided that many existing limits are unrealistically low and are arbitrarily making judgments as to what the posted speed limit should be. Whether these judgments are applied to all highways or just to high-speed freeways is unknown. Experience over the years suggests that speed limits should be set to aid police in identifying unreasonable behavior. One exception is when speed limits are set unrealistically low to generate revenue through fines. There is little value in posting limits that require enforcement officials to arbitrarily differentiate between reasonable and unreasonable behavior.

Table 5. State penalties for exceeding speed limits.

State	Penalties for Exceeding Speed Limits
Colorado	1 to 19 mph above limit, $5 to $100 maximum fine; 20 mph or more, $10 to $300 maximum fine and/or 10-90 days maximum in jail.
Connecticut	1 to 5 mph above limit, $17 fine; 6 to 10 mph above limit, $33 fine; 11 to 15 mph above limit, $50 fine; 16 to 20 mph above limit, $66 fine; over 20 mph above limit, $99 fine.
District of Columbia	1 to 10 mph above limit, $10 fine; 11-15 mph above limit, $15 fine; 16 to 20 mph above limit, $20 fine; over 20 mph above limit, $25 fine.
Florida	1 to 10 mph above limit, $25 fine; 11 to 20 mph above limit, $50 fine; 25 mph and more above limit, $75 fine plus mandatory court hearing.
Hawaii	1st offense, not more than $100 fine; 2nd offense within one year, not more than $200 fine; 3rd offense within one year, not more than $500 fine.
Illinois	1 to 20 mph above limit, $50 fine and bond certificate or suspension of drivers license; 21 to 30 mph above limit, $70 fine or suspension of drivers license; over 30 mph above limit, $100 fine or suspension of drivers license.
Indiana	1 to 15 mph above limit, class C infraction $500 maximum fine; 16 mph or more above limit, possible reckless driving, class B misdemeanor $1000 fine and/or 180 days in jail maximum.
Iowa	Simple misdemeanor, $100 maximum fine and/or 30 days in jail.
Kansas	11 to 15 mph above limit is considered a moving violation. Suspension of license for three or more moving violations committed on separate occasions.
Kentucky	1 to 5 mph above limit, $5 fine; 6 to 10 mph above limit, $25 fine; 11 to 15 mph above limit, $35 fine; 16 to 20 mph above limit, $45 fine; 21 to 25 mph above limit, $60 fine; 26 mph or more above limit, $100 fine.
Michigan	1 to 10 mph above limit, $100 fine maximum and 2 points; 11 to 15 mph above limit, $100 and 3 points; 16 to 20 mph above limit, $100 fine and 4 points maximum.
Minnesota	$100 maximum fine if no two similar offenses occur within a 12 month period.
Montana	$5 fine for exceeding 55 mph; $20 fine plus $1 each mph over other limits.
Nebraska	1st offense maximum $100 fine; 2nd offense within a two-year period minimum $100 fine, maximum $300 fine; 3rd offense within a two-year period minimum $200 fine, maximum $500 fine.
Nevada	$2 each mph over limit, however in a 55 mph zone from 56 to 70 mph the fine is $5 plus $10 administration fee.
New Hampshire	11 to 15 mph above limit, $33; 16 to 20 mph above limit, $44; 20 mph or more above limit, $66 to $110 maximum fine.
New Jersey	1 to 15 mph above limit, 2 points plus fines; 16 to 20 mph above limit, 4 points plus fines; 20 mph or more above limit, 5 points plus $200 maximum fine.
New York	$50 maximum fine.
North Carolina	1 to 15 mph above limit, 3 points; 16 mph or more above limit, loss of license for 30 days.
North Dakota	1 to 5 mph above limit, $5 fine; 6-15 mph, $1 each mph over 55 mph; 16 to 20 mph above limit, $15 fine plus $2 each mph over 70 mph; over 20 mph above limit, $25 fine plus $3 each mph over 75 mph.
Oklahoma	1 to 10 mph above limit, $52 fine; 11 to 15 mph above limit, $62 fine; 16 to 20 mph above limit, $72 fine; 21 to 25 mph above limit, $92 fine; 25 mph or more above limit, $122 fine.
Oregon	$100 maximum fine.
Pennsylvania	1 to 5 mph above limit, $35 fine; All speeds over 5 mph above limit have a fine of $35 plus $2 each mph over 5 mph over limit; 6 to 10 mph above limit, fine plus 2 points; 11 to 15 mph above limit, fine plus 3 points; 16 to 25 mph above limit, fine plus 4 points; 26 to 30 mph above limit, fine plus 5 points; 31 or more mph above limit, fine plus 5 points and Departmental Hearing with sanctions provided by statute.
Puerto Rico	$7 to $15 fine plus 3 points minimum based on mph above limit.
Rhode Island	1 to 5 mph above limit, $20 fine; 6 to 10 mph above limit, $30 fine; 11 to 15 mph above limit, $40 fine.
South Carolina	1 to 10 mph above limit, $5 to $25 fine and/or not more than 7 days in jail; 11 mph or more above limit, $10 to $50 fine and/or not more than 20 days in jail.
South Dakota	1 to 5 mph above limit, $20 fine; 6 to 10 mph above limit, $40 fine; 11 to 15 mph above limit, $55 fine; 16 to 20 mph above limit, $85 fine; 76 to 80 mph, $100 maximum fine; over 80 mph requires court appearance.
Tennessee	1st offense: $10 to $25 fine; 2nd offense $25 to $100 fine.
Utah	Statute for a misdemeanor is $299 fine maximum. Courts throughout Utah set their own penalties generally between $15 to $20 fine for 1 to 5 mph over limit and $2 to $4 for each additional mph.
Vermont	$2 per mph over speed limit, by statute 3 points assessed against driving record up to 20 mph over limit, 6 points for 20 mph or more over limit.
Virginia	1 to 19 mph above limit, $2 for each mph over posted limit plus $18 court cost; 20 mph or more above limit is considered reckless driving and the penalties are determined by the court.
Washington	Maximum fine is $250 and/or 90 days in jail.
West Virginia	1st conviction, maximum $100 fine and/or 10 days in jail; 3rd conviction, $500 maximum fine and/or 6 months in jail.
Wisconsin	Automatic 15 day suspension of license for conviction of exceeding the speed limit by 25 mph. Fines range from $20 to $200 maximum. Points range from 3 for the 1st conviction for exceeding limit by 10 mph to 14 for 5th or more conviction for exceeding limit by 20 mph or more.
Wyoming	$1 each mph above posted limit plus $5 court cost up to 74 mph; 75 to 100 mph ranges from $30 to $150 maximum fine.

Note: 1 mph = 1.6 km/h

Table 6. Local penalties for exceeding speed limits.

Locality	Penalties for Exceeding Speed Limit
Tuscaloosa, AL	1 to 20 mph above limit, $53.50 fine; over 20 mph above limit, $63.50 fine.
Tucson, AZ	1 to 10 mph above limit, $45 fine plus points; 11-15 mph $50 fine plus points; 16 to 20 mph $65 fine plus points; 20 mph or more, $500 fine, 30 days in jail, 1 year probation.
Jefferson Co., CO	1 to 5 mph above limit, warning citation issued; 6 to 10 mph above limit, 3 points plus fines; 11 to 15 mph above limit, 4 points plus fines; 16 mph or more above limit, 5 points plus fines.
Brevard Co., FL	1 to 15 mph above limit, $35 fine; 16 mph or more above limit, mandatory court appearance - Judge determines penalties.
Dade Co., FL	Judge determines penalties.
Chicago, IL	1 to 10 mph above limit, none; Fines range from $50 to $200. No set formula. Amount fined is up to magistrate.
Kankakee Co., IL	1 to 20 mph above limit, $50 fine; 20 to 29 mph above limit, $70 fine; 30 mph or more above limit, $100 fine.
Prince Georges Co., MD	1 to 10 mph above limit, 1 point; 11 to 30 mph above limit, 2 points; 30 mph or more above limit, $5 points.
St Louis, MO	1 to 15 mph above limit, $27 fine; 16 mph or more above limit, determined by Judge.
Salisbury, NC	1 to 10 mph above limit, $5 fine plus court cost; 11 to 15 mph above limit, $10 fine plus court cost; 16 mph or more above posted limit, loss of license.
Hamilton, OH	1 to 10 mph above limit, $30 fine; 11 to 15 mph above limit, $40 fine; 20 mph or more above limit, $50 fine.
South Kingston, RI	1 to 5 mph above limit, $20 fine; 6 to 10 mph above limit, $30 fine; 11 to 15 mph above limit, $40 fine; 16 mph or more above limit, $40 or more in fines.
Garland, TX	Misdemeanor, $200 maximum fine.

Note: 1 mph = 1.6 km/h

METHODS FOR ESTABLISHING MAXIMUM SPEED LIMITS

After careful analysis of the data, the author has found that two methods are used to establish maximum speed limits. These methods are arbitrary or subjective methods and engineering or objective-based methods. Arbitrary methods employ decisions based on opinion or the desires of a few individuals. In contrast, engineering methods include all techniques where the choice of a speed limit is based on the analysis of data collected at a site. Engineering methods have the advantage of replication, i.e., the same results can be produced under the same conditions, whereas arbitrary methods produce haphazard, unpredictable and often biased results.

Arbitrary methods are used by most agencies to some extent. In some cases, political and public pressure is used to set an arbitrary limit even when an engineering and traffic investigation has been conducted. The effects of posting speed limits based on arbitrary methods include unrealistic zones which do not meet the safety and operational needs of traffic, non-uniform speed zones, and unenforceable limits.

Concepts and Theories

It is essential that traffic engineers have a sound factual basis for setting and changing speed limits. The method must be theoretically and conceptually valid for a wide range of conditions and highway types, and must be generally accepted by the profession.

Several concepts and theories for establishing speed limits have evolved during the past 40 years. Some of the methods have been used in practice while others have only been discussed in a conceptual framework. Prior to describing the actual zoning practices used in the States and localities, a brief description of the major concepts is presented in this section. The concepts are grouped into the following categories.

- Skewness theory
- Economic approaches
- 10 mph pace
- ITE guidelines
- 85th percentile speed

Skewness Theory

This unique theory was developed by Taylor who proposed using the skewness of the speed distribution as a parameter for establishing speed

limits.[28] Taylor examined the effect of speed zoning at 51 sites on rural two-lane highways in Ohio and found that accident rates were higher in areas where the speed distribution was non-normal. Accident rates were lower at sites with normal speed distributions. The Tennessee Department of Highways applied Taylor's theory as criteria for determining the effectiveness of speed zones but did not develop or evaluate warrants using skewness as a factor.[29]

The basis for Taylor's theory is that there is a relationship between the speed distribution and accident rates on rural highways. A 1969 American Association of State Highway Officials Resolution supported this theory, stating that in order to optimize safety, it is desirable to secure a speed distribution with a skewness index approaching unity.[14] Joscelyn, et al., provided a critique of Taylor's theory and questioned the validity of the assumed relationship between normality, skewness, and accidents.[13] Joscelyn argued that the skewness index provides a measure of symmetry rather than normality and provided evidence that speed distributions may be bimodal, such as in the vicinity of intersections. It was suggested that further work be performed in the area of speed differences, including the effects of left and right skewness, before the theory could be accepted.

Economic Approaches

Economic approaches for establishing speed limits place factors such as accidents, travel time, fuel consumption, etc., on an economic basis and permit selection of speed limits which reflect the overall cost of driving to the motorist or to society. These theories are conceptually appealing because a wide variety of options can be explored, e.g., increasing enforcement to improve traffic flow.

Oppenlander devised an approach to setting speed limits that considered operation costs, time costs, accident costs, and service (comfort and convenience) costs.[30] His theory involved combining these components into a total cost function with respect to vehicular speed as shown in Figure 1. The minimum value of the total cost function was described as the optimum speed limit for ideal traffic, roadway and environmental conditions. The optimum speed may be adjusted to reflect prevailing conditions. Oppenlander suggested establishing minimum and maximum limits based on statistical relationships of the speed distribution using the adjusted speed as the mean value of the distribution. One primary problem with this approach is how to determine the speed at which costs of transportation are minimal. Also, the relative importance placed on the different factors is highly subjective and may not result in a single value.

Jondrow, et al.,[31] and Crouch[32] have also developed economic theories to set speed limits. While Oppenlander's approach is directed toward minimizing societal costs, Jondrow, et al., and Crouch also consider the driver's optimum speed as shown in Figure 2. The calculated optimum speed limit is a function of the individual drivers optimum speed which is adjusted to take into account damage that his or her extra speed may do to others.

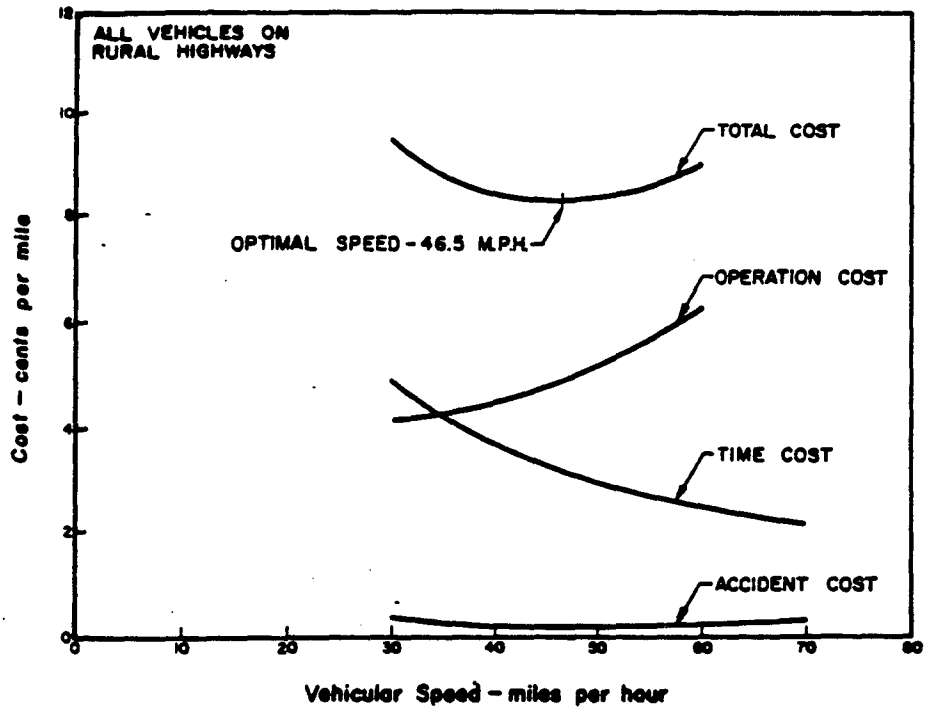

Figure 1. Oppenlander's cost function for all vehicles on two-lane rural highways during daytime periods.

Source: Reference [30]

Value of Time ($/h)	Value of Life ($/life)	Speed (mph) Private Optimum	Social Optimum
10	174 256	85.0	83.8
15	1 716 697	85.0	78.0
20	3 259 137	85.0	75.6

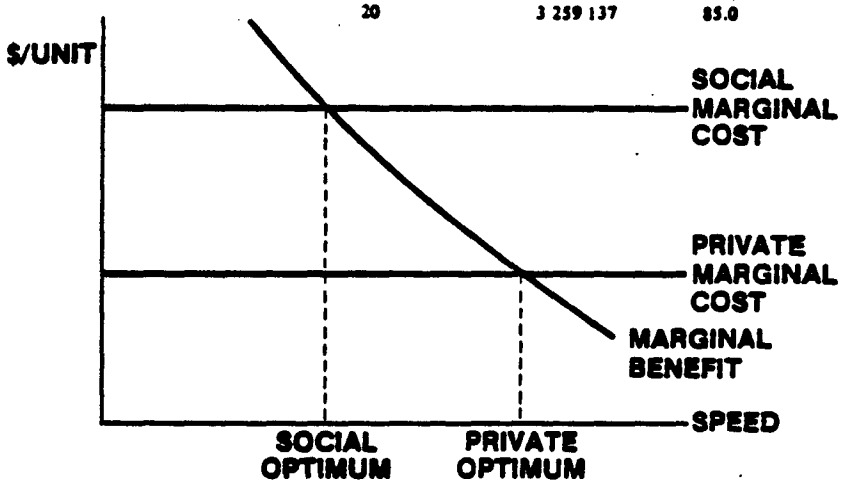

Figure 2. Social and private optimum speed limits.

Source: Reference [31]

The minimum cost approaches for establishing speed limits proposed by Oppenlander, Jondrow, et al., and Crouch are of considerable interest, however, there are inherent problems with each. For example, accurate, reliable, nonsubjective costs for time, life, and comfort and convenience do not exist at the present for the Oppenlander model. The wide variance of values which may be used for these factors would greatly effect the resultant speed limit values obtained. The approach outlined by Jondrow, et al., requires a major data collection effort to obtain the speed in absence of a speed limit and the ratio of external to internal costs. Because this model is conceptually appealing, further research is warranted to obtain these data and derive optimum speed limits for a variety of roadway types.

10 MPH Pace

The pace is defined as the 10 mph (16 km/h) speed range which contains the largest percentage of vehicles. A normal speed distribution contains approximately 70 percent of the vehicles within the pace with approximately 15 percent of the vehicles below the lower limit of the pace and 15 percent of the vehicles above the upper limit of the pace.

The use of the pace to establish maximum speed limits does not appear to be based on the objectives of providing a reasonable and safe limit for the majority of drivers. Carter, for example, suggested that the posted speed limit be no lower than the lower limit of the pace.[33] Wilson also provided a guideline for setting speed limits using the pace by suggesting that the speed limit be posted somewhere between the lower limit of the pace and the 85th percentile speed.[34] These suggested uses of the pace allows for a range of at least 10 mph (16 km/h) in selecting a numerical limit. This practice provides considerable latitude in establishing a limit and could lead to non-uniform zones. Others have also proposed the use of the pace as a factor in the speed limit selection process along with other factors such as 85th percentile speed.[14,15,35] The use of the pace in conjunction with other measures may have merit and should be examined when criteria for speed zoning are developed.

ITE Speed Zoning Guidelines

In 1961 the Institute of Traffic Engineers published a report on speed zoning which contained guidelines for establishing speed zones based on a variety of factors including prevailing speed, accident experience, various elements of physical roadway features, traffic characteristics and traffic control.[15] A two-part check sheet, shown in Table 7, was presented in the report as a guideline for setting speed limits.

It is not known to what extent, if any, the check sheet was used in practice. It is suspected that the guide received very limited application as only a few of the factors identified in the report were actually used in developing the check sheet. The degree to which the other factors such as

Table 7. ITE check sheet for establishing speed zones.

(PART I)

Highway Conditions (3 or more must be satisfied)				Preliminary Estimate of Maximum Speed Limit
Design Speed	Minimum length of proposed zone equals or exceeds*	Average distance between intersections equals or exceeds	Number of roadside businesses (with access) does not exceed	
MPH	MILES	FEET	PER MILE	
20	0.2	No Minimum	No Maximum	20
30	0.2	No Minimum	No Maximum	30
40	0.3	125	8	40
50	0.5	250	6	50
60	0.5	500	4	60
70	—	1000	1	70

*Consideration is to be given to the number of isolated sharp curves which require posting with Advisory Speed signs. If sharp curves occur at intervals of less than these figures, the speed limit may be determined by the curves.

(PART II)

Speed Pattern (2 or more must be satisfied)			Maximum Proposed Speed Limit
"85 percentile speed" between	Both limits of "Pace" between	Average test run speed equals or exceeds	
MPH	MPH	MPH	
under 22.5	under 25	17.5	20
22.5 - 27.5	11 - 29	22.5	25
27.5 - 32.5	16 - 34	27.5	30
32.5 - 37.5	21 - 39	32.5	35
37.5 - 42.5	26 - 44	37.5	40
42.5 - 47.5	31 - 49	42.5	45
47.5 - 52.5	36 - 54	47.5	50
52.5 - 57.5	41 - 59	52.5	55
57.5 - 62.5	46 - 64	57.5	60
62.5 - 67.5	51 - 66	62.5	65
67.5 - or over	over 55	67.5	70

Note: 1 mph = 1.6 km/h
1 foot = 0.30 m

Source: Reference [15]

accidents and physical features should be considered is not mentioned in the report. Also, the procedure only considers roadside development when the design speed is 40 mph (64 km/h) or more. This omission means that most urban speed limits would be established without consideration of roadside development.

85th Percentile Speed

The 85th percentile speed is the speed at or below which 85 percent of the vehicles are moving. Traffic engineers have long recognized that the cumulative speed distribution curve is fairly uniform until it reaches the 85 percent point.[33] Inspection of a typical cumulative speed distribution curve shown in Figure 3 reveals that beyond the 85th percentile value, the curve begins to flatten significantly. The region beyond the 85th percentile point contains fewer vehicles which are traveling at much higher speeds than the majority of traffic. In their search for a method to establish reasonable speed limits, traffic engineers began using the 85th percentile speed. Widespread use of the 85th percentile speed was based on experience,

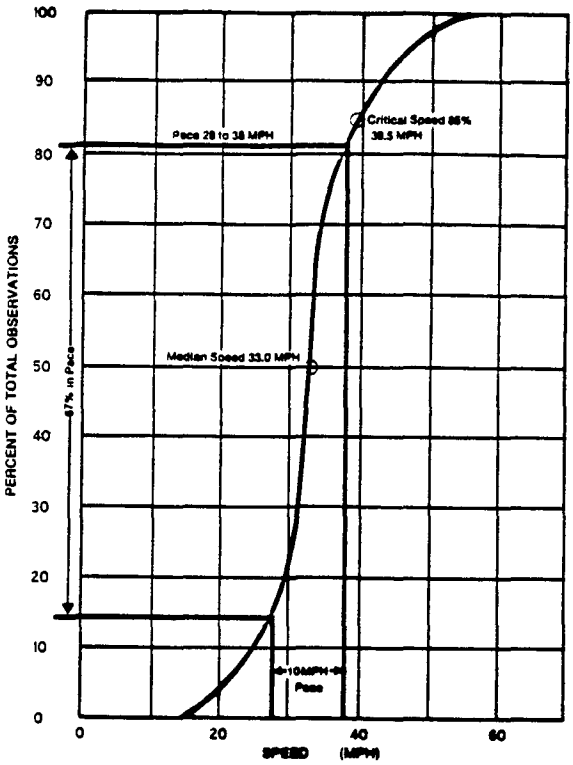

Figure 3. Typical cumulative speed distribution curve.

Source: Reference [7]

however, little research was conducted at that time to substantiate the effects of the method on traffic speeds and safety.

Kessler was one of the first to state that the 85th percentile speed may be related to accident risk.[36] In 1959 he wrote "the 85-percentile speed is based upon the theory that the majority of motorists traveling upon a city street or highway are competent drivers and possess the ability to determine and judge the speed at which they operate safely; further, that motorists are responsible and prudent persons who do not want to become involved in an accident and desire to reach their destination in the shortest possible time".[36]

Studies conducted by Solomon[9] and Cirillo[10] indicate that the 85th percentile speed is in the speed range where the accident involvement rate is lowest. The relationship between the accident involvement rate and the deviation from average speed is shown in Figure 4. On most roadways, the 85th percentile speed is one standard deviation or approximately 6 to 8 mph (10 to 13 km/h) above the average speed. A study conducted by West and Dunn provided further evidence that the 85th percentile speed had the lowest accident involvement.[11] As shown in Figure 5, Joscelyn, et al., analyzed speed and accident data on Indiana highways and found that accident risk begins to increase significantly beyond the 85th percentile speed.[13] These data indicate that the 85th percentile speed is not only reasonable for the majority of drivers, but also the safest. The findings support the

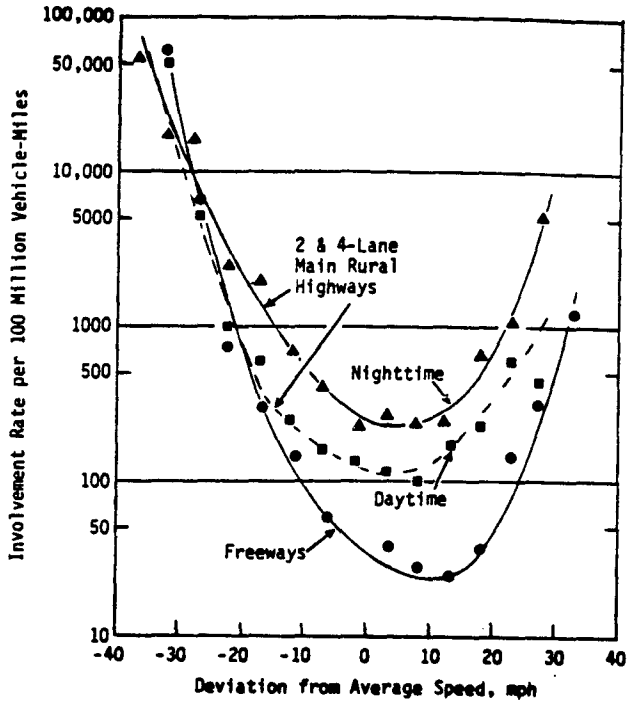

Figure 4. Relationship between accident involvement rate and deviation from mean speed.

Source: Reference [37]

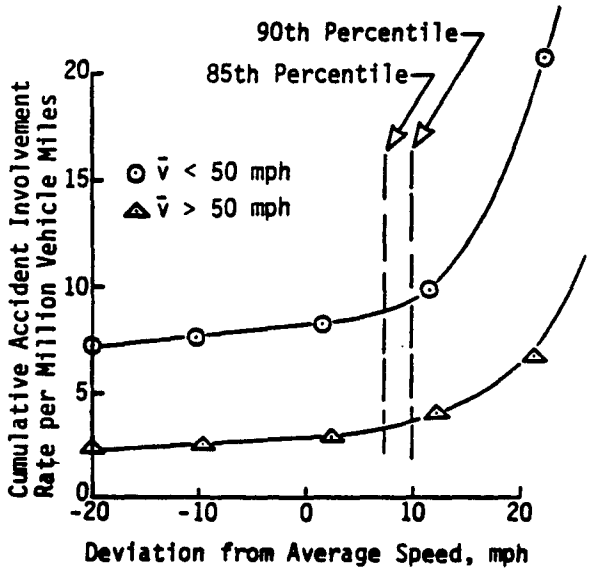

Figure 5. Relationship between 85th percentile speed, accident involvement rate, and deviation from mean speed for two levels of traffic speed.

Source: Reference [37]

theory that the majority of motorists travel at a reasonable and safe speed and that their perception of accident risk is valid.

The major reasons for using the 85th percentile speed to establish maximum speed limits are summarized below.

- Widespread use and acceptance of the method by traffic professionals.
- The probability of accident occurrence is low for vehicles traveling below the 85th percentile speed.
- The 85th percentile speed reflects a safe speed for existing conditions as perceived by the majority of motorists and is largely self-enforcing.
- When using the method, other factors such as accident rates, geometric features, etc., do not have to be considered separately or in combination with other data since they are reflected in the driver's choice of speed which is altered to adjust for these conditions.
- Speed samples are easy to obtain and analyze for most roadways.
- Using the 85th percentile speed, enough violators are present so no revenue loss will occur to jurisdictions as a result of enforcement.

Perhaps one of the major problems with the 85th percentile method is that it is not well understood by highway personnel or the public. While numerous references are made to the method in traffic engineering texts, there are only a few documents that provide supporting safety relationships that justify setting limits at the 85th percentile speed of traffic.[13, 37] The use of the method in practice, as well as other problems, are presented in the next section of this report.

CURRENT PRACTICES

The implementation of regulatory measures is guided by personal experience and knowledge, as well as by governmental statutes and departmental policies. In this section, the factors that influence the way speed limits are established are briefly examined. A summary of the procedures used to set maximum and other speed limits is also presented, along with practices in selected foreign countries.

Factors That Influence Speed Zoning Practices

A wide variety of factors influence how speed limits are set including the perceived objectives of establishing limits, the effects of other interest groups, and personal views based on experience. These issues were examined in the AASHTO survey of State and local officials and the results are discussed in the following paragraphs.

The importance of setting objectives for establishing speed zones cannot be overstated. Procedures for setting speed limits to conserve energy during national emergencies are significantly different than methods used to establish limits based on the perceived accident risk of the majority of drivers. State and local highway officials that responded to the AASHTO survey felt that the most important objective of speed limits was to inform motorists of a safe speed as shown below.

Main objective of speed limits	Percent
Inform motorists of a safe speed	48
Separate occasional violator from reasonable majority	18
Reduce accidents	18
Optimize travel and accident costs	7
Provide uniform flow	4
Slow traffic down	1
Keep accident level below predetermined level	0
Conserve energy	0
Increase service life of road	0

While most State statutes place the responsibility of establishing speed zones with the highway agency, many other agencies and interested citizens are affected by speed zoning decisions. Respondents to the AASHTO survey felt that in addition to the highway agency, motorists should have the most influence in speed zoning decisions as shown below.

Group that should most influence posted speed	Percent
Highway Department	65
City/county Government	21
Motorists	11
Law enforcement	2
State legislature	1
Residents adjacent to highway	0
Judiciary	0
Federal Government	0

These responses reinforce the view that the majority of motorists should be involved in the decision-making process and that speed limits should be primarily self-enforcing.

Views on value of speed limits	Percent		
	Agree	Neutral	Disagree
Speed limits are very helpful for motorists....	67	28	4
Motorists are capable of deciding what speed is safe for road and traffic conditions.....	55	19	26
Without speed limits the roads would be dangerous to drive on.....	39	32	28
Many speed limits are not appropriate for road and traffic conditions.....	49	21	28
On the whole, I am not in favor of speed limits	1	11	86
Most of the time motorists drive at a speed that road and traffic conditions will permit regardless of the posted speed limit.....	83	9	5
The majority of speed limits in my jurisdiction are set at about the right level.....	85	10	2
The majority of speed limits in other jurisdictions are set at about the right level...	48	40	10

The respondents to the AASHTO survey were asked to state their personal views on speed limits and the results are tabulated above. The traffic engineers seem somewhat ambivalent towards speed limits. While they generally regard speed limits as providing helpful guidance to drivers, they believe many speed limits are not realistic especially in other juristictions. Traffic engineers tend to support the view that most drivers can be relied on to drive at a reasonable and safe speed. So it is not surprising that most criteria for setting speed limits are based to some extent on field studies of actual driving speeds.

The majority of highway officials felt that existing speed limits should not be change on residential streets, in business districts and on suburban arterial highways. This again reflects the viewpoint that most of the speed limits - except for freeways and other rural high speed roads - are set at about the right level.

The respondents in no way thought they had all the answers to the speed limit problem. At least two-thirds of the traffic engineers responded that further research was needed on the following, listed in order of importance:

1. The effects of altering speed limits on speed and accidents
2. Objective and quantifiable criteria for setting speed limits
3. Driver attitudes and knowledge about speed limits
4. Criteria for setting speed limits in work zones
5. An analysis of optimum highway speed limits

Practices Used to Establish Maximum Speed Limits

A review of the literature revealed that there is little consensus of opinion on guidelines or criteria that should be used to set speed limits.[38, 39] While the use of the 85th percentile speed is frequently mentioned as a major factor in most speed zoning publications, no widely accepted method for setting maximum speed limits was found.

National Guidelines

An examination of national standards reveals that very little guidance is given to State and local officials on how speed limits should be determined. For example, the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) provides the following statement.[40]

> "In order to determine the proper numerical value for a speed zone on the basis of an engineering and traffic investigation the following factors should be considered:
>
> 1. Road surface characteristics, shoulder condition, grade, alignment, and sight distance
> 2. The 85-percentile speed and pace speed
> 3. Roadside development and culture, and roadside friction
> 4. Safe speed for curves or hazardous locations within the zone
> 5. Parking practices and pedestrian activity
> 6. Reported accident experience for a recent 12-month period."[40, pg. 2B-5]

The problems with attempting to establish speed limits using these guidelines are obvious. The traffic engineer is directed to consider a variety of factors, but no quantitative or qualitative method is suggested as to how these factors should be used to determine the speed limit. As no emphasis is placed on any one factor, one could consider accident experience and decide to post a low limit. Using the same information, another engineer may consider the 85th percentile speed and post a much higher limit. If uniformity in setting speed limits is a realistic goal, then the MUTCD should, at a minimum, provide objective guidelines.

Guidelines developed by a technical committee of the Institute of Traffic Engineers in 1961 were discussed in the preceding section of this report. The guidelines are reprinted in the latest edition of the Transportation and Traffic Engineering Handbook.[41] The problems with the procedure include the absence of information on how relevant factors such as physical features, accident experience, and traffic characteristics and control should be used to determine the speed limit. Also, while some of

the factors are placed in a quantitative format, no reports or research could be found which examined the validity of the method.

Currently, the Institute of Transportation Engineers has a policy on speed zoning and on speed limits.[42] The policy on speed zoning advocates the establishment of speed zones be based on established traffic engineering principles and realistic route and traffic characteristics, and not on artificial criteria or other considerations. The policy on maximum speed limits encourages studies to determine appropriate maximum limits. The policies reflect the need to use a scientific, factual basis for establishing limits and to implement realistic maximum limits on high-speed highways.

In 1969 the AASHTO Subcommittee on Speed Zoning recommended that the 85th percentile speed be given primary consideration in setting speed limits below 50 mph (80 km/h) and the 90th percentile speed be used for setting limits 50 mph (80 km/h) or above.[14] The 1984 AASHTO policy on geometric design does not provide a specific recommendation, but suggests that the posted maximum speed is about the 85th percentile speed.[43] The use of the 85th or 90th percentile speed is a scientific method based on safety, traffic, and other factors which affect prevailing speed.

Practices in Selected Foreign Countries

A review of the literature and correspondence with highway officials in a number of foreign countries revealed that the 85th percentile speed is frequently given consideration in setting speed limits, however, other factors, i.e., accident experience, roadside development, etc., are also evaluated in a subjective manner. Objective criteria are reported as being used in two countries.

As shown in Figure 6, speed limit criteria in the United Kingdom consist of obtaining the 85th percentile speed, injury accident rate, roadway location, and highway type. After these data are obtained, the appropriate speed limit is selected by following the steps outlined in the flow diagram.

The quantitative method recently developed and implemented in South Africa is illustrated in Figure 7. The procedure involves obtaining data for nine factors including 50th percentile speed, accident rate, sight distance, etc. Tables are provided which permit the selection of a speed limit for each factor level, e.g., 40 km/h for restricted sight distance ranging to 90 km/h for unrestricted sight distance. After the speed limit for the different factors have been encircled in Figure 7, the lowest speed encircled is selected. The 85th percentile speed is used by some agencies instead of the 50th percentile.

Information concerning the validity of either method was not available.

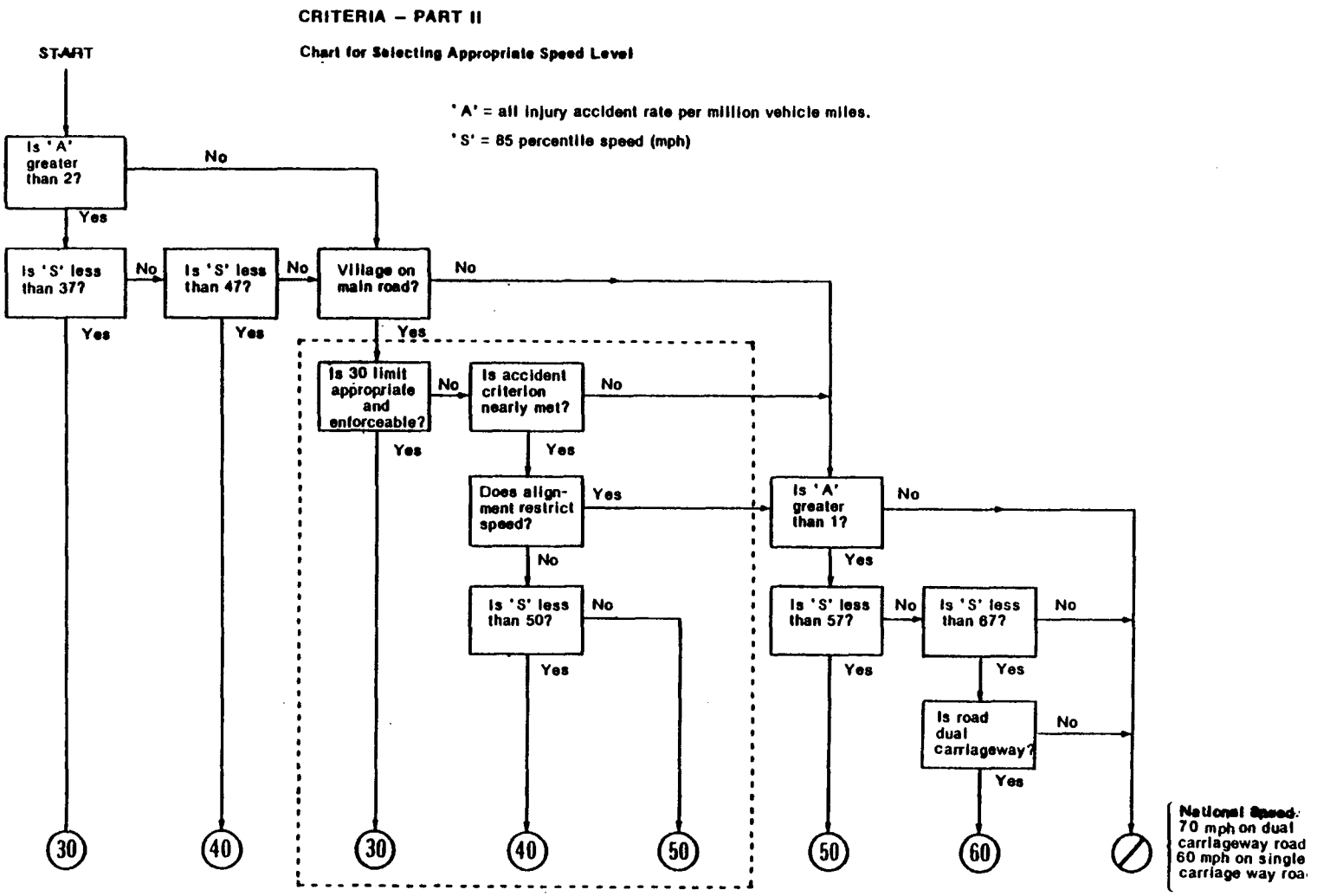

Figure 6. Procedure for setting speed limits in the United Kingdom.

Source: Reference [44]

RECORDING FORM FOR SPEED LIMITS AS SELECTED ACCORDING TO THE CRITERIA UNDER THE DIFFERENT FACTORS GIVEN IN APPENDIX A

	Factor	Appropriate speed limit									
1.	50th Percentile speed of traffic	40	50	60	70	80	90	100	110	120	NA
2.	Accident rate	40	50	60	70	80	90	100			NA
3.	Stopping sight distance	40	50	60	70	80	90				NA
4.	Pedestrians and cyclists	40	50	60	70	80					NA
5.	Parking and loading manoeuvres		50	60	70	80					NA
6.	Access to bounding properties			60	70						NA
7.	Intersections			60	70	80					NA
8.	Width of road without central median		50			80					NA
9.	Clear roadside area			60	70	80					NA

NOTE: 1) Consider the criteria under the different factors described in Appendix A and encircle the most appropriate speed limit above for each applicable factor.

Where the conditions along the road section are outside the scope of the criteria and can not be applied, encircle the letters NA to indicate that the criteria are "not applicable".

2) Set the speed limit at the lowest figure encircled above or at the second lowest figure if the lowest figure is considered unnecessarily restrictive.

Figure 7. Procedure for setting speed limits in South Africa.

Source: Reference [45]

Practices in the United States

Most State statutes require that speed limit changes be based on the results of an engineering and traffic investigation. While the MUTCD and other national publications suggest a list of factors to be considered in setting speed limits, no guidelines are given for conducting the investigation. Throughout years of experience, the States have developed a wide variety of methods for establishing maximum speed limits.

Nearly 95 percent of the State officials and 60 percent of the local officials contacted in the AASHTO survey reported that they used objective criteria in establishing maximum speed limits. Most of the respondents said that engineering studies were conducted unless the maximum limit was specified by State statute. Engineering judgment was seldom used as the primary method of selecting a maximum limit. All States and 86 percent of the localities reported using the 85th percentile speed in setting speed limits. The major factors considered in an engineering study, listed in order of their importance, is given below.

- 85th percentile speed
- Type and amount of roadside development
- Accident experience
- 10 mph pace
- Horizontal and vertical alinement
- Design speed
- Average test run speed

Approximately one-half of the State officials submitted written procedures for conducting engineering studies. A summary of the methods is shown in Table 8. Only five of the local officials provided data, and in each case their procedure did not differ from the one used by the State.

While some of the methods described in Table 8 appear to be quite subjective, several States have developed unique objective procedures for establishing speed limits. Although roadway and other data are collected, nine States primarily use the 85th percentile speed to establish the speed limit. Illinois and Missouri engineers use the prevailing speed, defined as the 85th percentile speed, upper limit of the pace, or average test run speed, as the foundation for establishing the limit, but permit reductions in the limit based on accidents, access control, pedestrian activity, and parking.[51, 57]

The Nevada Department of Transportation has recently adopted the methodology for speed zoning that was developed by the Traffic Institute at Northwestern University.[58, 66] The procedure consists of a minimum study

Table 8. State procedures for setting speed limits.

State	Major Factors Considered	Description of Method	Reference Source
Alaska	85th percentile speed	Post limit at or within 5 mph increment above 85th percentile speed.	[46]
Arizona	Length of section Alinement Roadway width Surface condition Signt distance Traffic volume Accident experience 85th percentile speed	Conduct analysis of factors. Any factor may affect the selection of a speed limit. Generally, the limit should be as near as practical to the 85th percentile speed.	[47]
California	Prevailing speeds Unexpected conditions Accident records	Set limit at or slightly below 85th percentile speed except when roadside development, traffic conflicts, and unusual conditions warrant a lower limit. If accident records show abnormally high percentage of accidents with excessive speeds, the proposed limit should be reduced. Judgment should be used in this case.	[48]
Connecticut	Roadway features Traffic volumes Operating speeds Accident experience	Speed limit determined by analysis of all factors which should result in a limit close to the 85th percentile speed.	[49]
Florida	85th percentile speed Pace Average test run speed Traffic accidents	Limit should not differ from 85th percentile speed or upper limit of 10 mph pace by more than 3 mph or less than 8 mph. A limit of 4 to 8 mph less must be supported by a supplemental investigation which reveals roadside features not obvious to the normal prudent driver; other traffic controls have been tried but found ineffective; and signal timing is not acceptable with 50 mph limits or higher and advisory speeds on signal ahead signs have not been successful. Accident experience should be considered but a realistic speed limit is conducive to lowering accident potential.	[50]
Illinois	Prevailing speed Accident rate Access control Pedestrian activity Parking	Speed limit should not differ from the prevailing speed (85th percentile, upper limit of pace, or average test run speed) by more than 3 mph unless justified by supplementary investigations. The study may include any or all of the following conditions. 1. If the accident rate is 50 percent higher than the statewide rate for the same highway classification, the speed may be reduced by 5 percent. If the accident rate is more than twice the statewide rate, the speed may be reduced by 10 percent. 2. The effect of driveways and other entrances will be determined by using an access conflict number. Based on the number, the prevailing speed may be reduced by the percentages indicated below. Access Conflicts Per Mile: 0-40 — Prevailing Speed Reduction Percent: 0 41-60 — 5 61 or more — 10 3. The prevailing speed may be reduced by 5 percent where no sidewalks are provided and the total pedestrian traffic exceeds 10 per hour for any three hours within any 8-hour period. 4. Where parking is permitted adjacent to the traffic lanes, the prevailing speed may be reduced by 5 percent. After applying the percentage corrections, in no case shall the resulting speed limit differ from the prevailing speed by more than 9 mph or 20 percent of the prevailing speed, whichever is less.	[51]
Indiana	85th percentile Accident experience	Speed limits should normally be established at the first 5 mph increment at or above the 85th percent speed unless hidden hazards revealed by accident experience and the study location exist. The limit should not normally be set more than 7 mph below or 5 mph above the 85th percentile speed.	[52]
Kentucky	Roadside development 85th percentile speed Physical conditions Accident records	Generally, the appropriate numerical limit will approximate the prevailing 85th percentile speed.	[53]
Louisiana	Surface characteristics 85th and 50th percentile Pace Roadside development Parking Pedestrian activity	The 85th percentile speed is the principal factor that should be used as a guide in establishing the limit. The limit should not be set below the upper limit of the pace.	[54]
Michigan	85th percentile speed Pace	Unless there are hidden hazards of an exceptional nature, a speed limit should be set within 5 to 7 mph of the 85th percentile speed.	[55]
Minnesota	85th percentile speed Pace Accident records	If the roadway has satisfactory accident experience and no situations which might cause confusion or surprise, speed limits should be established at the 85th percentile speed or upper limit of the pace, whichever is higher. The limit may be set 5 mph under the upper limit of the pace when there is a bad accident record involving accidents of a type that would be eliminated or reduced by enforcement of a lower limit.	[56]

Table 9. Summary of State studies of the effects of raising and lowering speed limits.

State	Date of Study	Number of Sites	Existing Speed Limit	Average 85th Percentile Speed			Remarks
				Before	After Posting Lower Limit	After Posting Higher Limit	
Massachusetts	Oct. 1966	19 Two-lane	30-45	47.5	48.3	48.0	After posting 10 mph lower and higher limits than existing zones, no difference in 85th percentile speeds were found.
		6 Dual-lane	50-55	60.7	60.3	61.0	
Michigan	1982	4	25	37.6		36.0	Speed limit increased to 35 mph. Violations decreased from 90.4 to 19.3 percent.
		4	55	56.8	54.8		Speed limit lowered to 50 mph. Violations increased from 26.6 to 44.4 percent.
		4	55	57.8	56.0		Speed limit lowered to 50 mph. Violations increased from 29.3 to 53.8 percent.
		5	45	49.2	47.0		Speed limit lowered to 35 mph. Violations increased from 43.7 to 93.2 percent.
Minnesota	Jan. 1979	12 Two-lane	45	NA	43.6		Speed limit lowered to 30 mph.
		4 Four-lane	40	42.0	40.3		Speed limit lowered to 30 mph.
Washington	1981-82	3	25	34.7		34.3	Speed limit raised to 30 mph.
		1	50	57.0		59.0	Speed limit raised to 55 mph.
		1	50	43.0	42.0		Speed limit lowered to 35 mph.
		3	40	45.0	43.7		Speed limit lowered to 35 mph.

Note: 1 mph = 1.6 km/h
NA = Not Available

Table 10. State speed data collection practices.

State	Site Selection	Minimum Sample Size	Vehicle Selection	Equipment Used
Alaska	Minimum of 3 sites per zone with additional sites at intervals if road elements change. Use procedures in ITE TRAFFIC AND TRANSPORTATION ENGINEERING HANDBOOK.	100 vehicles total for both directions. If more than 2 hours are needed to obtain 100 vehicles, use automated speed recording equipment.	Select only free-flowing vehicles whose speeds are not appreciably affected by other traffic or slowing and stopping traffic.	Automated speed recording devices
Arizona		If ADT is under 750, 50 vehicles or a maximum of 2 hours. If ADT is over 750, 100 vehicles or a maximum of 2 hours.		
California	Select section with representative operating speeds. If speeds vary, conduct additional surveys.	100 vehicles or for low volume conditions, collect data for 3 hours but not less than 25 vehicles.	Specific types of vehicles may be recorded.	Radar Flash Box Stopwatch
Connecticut		Collect sampling of operating speeds.	Low volume conditions when vehicles move freely.	Radar
Florida	In rural areas, sites should be at 0.5-mile intervals or more. In urban areas use one-block intervals.	100 vehicles in each direction or 2 hour maximum. If sample is less than 25 vehicles, conduct 3 test runs in each direction.	Select free-flow vehicles where a driver has relative freedom to choose a speed without interference from other traffic. Do not classify vehicles by type unless required by the study.	Radar Enoscope Pneumatic tubes are not acceptable as they influence a driver's speed.
Illinois	Select site at center of zone. In rural zones of 1 mile or more and urban zones of 0.5 mile, use two or more locations.	100 cars but do not include trucks over 4 tons. On low volume roads, collect data for 3 hours.	Collect speeds of free-flowing traffic.	Radar
Indiana	Select location where an accurate representative speed sample can be obtained.	100 vehicles or 2 hours per site.	Use free-flowing traffic conditions. Include all traffic with a separate tabulation by direction.	
Louisiana	Select a strategic point on the road.	100 vehicles or 2 hours in both directions.	Breakdown vehicles into automobiles, light commercial, heavy commercial, and busses.	Radar Stopwatch
Minnesota		150 vehicles in each direction or 3 hours.	Record only through traffic and not slowing or turning vehicles.	Radar Floating car
Missouri	Select site at center of zone. In rural zones of 1 mile or more and urban zones of 0.5 mile, use two	100 cars but no trucks over 4 tons. On low volume roads, collect data for 3 hours.	Collect speeds of free-flowing traffic.	Radar
Nebraska		150 vehicles or 4 hour minimum at each station.	Select free-flowing vehicles at least 6 seconds or 400 feet apart. Record vehicles as cars, trucks, and busses.	Radar
North Carolina	Select sites to insure radar unit is inconspicuous.	At least 50 vehicles, preferably 100 to 150. Refer to HRB Bulletin 281 for determining sample size.	Randomly select free-flowing vehicles with a 6 to 9 second headway where the driver is not trying to overtake or pass the vehicle ahead. Record total vehicles only by direction, i.e., not cars, trucks, etc.	Radar Stopwatch
Ohio			Breakdown vehicles by passenger cars and commercial vehicles.	Radar Test car
Pennsylvania	In urban areas, select sites at 0.5 mile intervals. In rural areas with consistent roadway features, use 2 mile intervals. Use tangent sites not influenced by stop signs, curves, etc.	100 vehicles but 50 vehicles on low volume roads are acceptable.	Randomly select vehicles.	Radar
Texas	In urban areas, sites should not exceed 0.25 mile intervals. Greater distance can be used in rural areas. For low volume roads, conduct one check in middle of the section and at each end.	125 vehicles in each direction or 2 hours maximum.	Select cars in which driver is choosing his own speed. Record busses and trucks but do not include these vehicles in calculating the 85th percentile speed.	Mirror boxes Radar
Virginia	Conduct one check every 0.5 miles. Select sites representative of area being studied through an on-site investigation.		Collect free-flow vehicle speeds without the influence of unusual traffic flow. Record speeds of automobiles, trucks, and busses.	Radar

Note: 1 mile = 1.6 km

Practices Used to Establish Other Speed Limits

In addition to establishing maximum speed limits, practices for setting minimum, advisory, school, work zone, transition, and differentiated limits were examined. A summary of these practices is presented below.

Minimum Speed Limits

Respondents to the AASHTO survey indicated that 40 percent of the States and 70 percent of the localities do not post minimum speed limits. The types of roadways where minimum speed limits are posted include freeways and other limited access facilities. Minimum limits are statutory in most of the States. When engineering studies are conducted, engineering judgment, the 15th percentile speed and the lower limit of the pace are used to select the minimum speed limit.

Minimum speed limits appear to have considerable potential to reduce accident risk to slower motorists and increase capacity, however, little research has been devoted to this area.

Advisory Limits

Advisory limits are posted on horizontal curves, exit ramps at interchanges, construction and maintenance work zones, and at some intersections where conditions dictate that speeds temporarily be reduced below the maximum limit. Over 60 percent of the highway officials indicated that they did not have a written policy for posting advisory speeds. Nearly 90 percent of the respondents reported using the ball bank indicator to determine the maximum safe speed for horizontal curves. A review of the written procedures submitted by the States indicates that there is a variety of ball bank indicator values used to set specific limits. These differences encourage non-uniformity in posting advisory speeds for similar curve conditions. This problem was also identified by ITE Committee 4I-M in 1978.[70]

Uniform procedures should be developed to establish advisory speeds. Incorporation of ball bank readings in the MUTCD may be a first step to encouraging uniform practices.

School Zones

In 28 States school zone speed limits are statutory.[20] As shown in Tables 2 and 3, the limits vary from 15 to 55 mph (24 to 89 km/h) with the average value of 25 mph (40 km/h). Only two States provided guidelines for establishing school speeds. In New York the limit cannot be less than 15

mph (24 km/h), but is usually set 10 mph (16 km/h) below the statutory speed limit or the 85th percentile speed of traffic. In Texas, the school zone limit should not be more than 15 mph (24 km/h) below the statutory limit or the 85th percentile of traffic.

Work Zones

Engineering judgment is the primary factor employed to establish speed limits in construction and maintenance work areas. Engineering studies are conducted in some States, however, in a few States work zone limits are statutory. In Pennsylvania, the results of an engineering and traffic investigation can be used to establish a limit not less than 25 mph (40 km/h) and up to 15 mph (24 km/h) below the normal speed of traffic.

Because of the arbitrary nature of existing practices, guidelines should be developed for establishing speed limits in work zones.

Transition Zones

Data furnished by the State highway officials revealed that the major guideline used in establishing transition zones is based on the Uniform Vehicle Code recommendation that no more than six alterations per mile be used with not more than 10 mph (16 km/h) differences between zones. Several States have established minimum lengths for transition zones, but there is considerable variance in lengths, e.g., from 0.2 mile (0.3 km) to 0.5 mile (0.8 km).

Differentiated Limits

The use of differentiated limits for roadway, vehicle, and environmental conditions has always been controversial.[13, 20] Widespread use of differential limits declined significantly with implementation of the 55 mph (89 km/h) speed limit. Illinois is one of the few States that restricts the speed of large trucks to 50 mph (80 km/h).

At the present time, there does not appear to be a need to develop criteria for establishing differentiated speed limits. If speed limits are increased in the future, however, the controversy over the safety of differentiated limits will be refueled.

CONCLUSIONS

This synthesis of State and local speed laws, regulations, and speed zoning practices was conducted to identify problem areas and provide direction for future research. The information for the report was obtained from a review of the literature and a mail survey of State and local highway officials conducted by a Task Force of the AASHTO Subcommittee on Traffic Engineering. The ultimate goal of this effort is to develop guidelines that will lead to the establishment of realistic speed zones.

Except during national emergencies, speed limits have been established to provide safe, convenient, and reasonable speeds for the majority of motorists. Throughout years of experimentation and observation, little consensus has been reached concerning criteria that should be used to establish speed limits. While the 85th percentile speed is considered as a factor in all States and most localities, the deviations from the 85th percentile used to establish the speed limit can result in an arbitrary limit.

The diversities in State and local laws, the lack of national guidelines, and the variety of methods currently in use suggest that non-uniform speed zones are commonplace. There is an immediate need to validate the applicability of existing methods and/or to develop new methods that will lead to realistic zoning. There is also a need to examine the potential benefits of establishing minimum speed limits. Ball bank reading should be made standard to improve the uniformity of advisory speeds on horizontal curves. Objective methods for setting speed limits in work zones should be explored. Highway officials also suggested that a study to determine the effects of raising or lowering speed limits on speed and accidents be given top priority.

Several important issues relating to how and why speed limits are set were expressed by the State and local highway officials. First, the need for considering the majority of drivers in the decision-making process is recognized as necessary to establish an enforceable limit. There are indications that either the reported relationships among speed limits, speed, and accidents are not well understood or perhaps not accepted by practicing engineers. If there is a lack of knowledge or confidence in the research conducted to date, then these obstacles must be overcome before any objective method of setting speed limits will be accepted and implemented. When these guidelines are developed and validated, the method should be clearly described for distribution to the public. The justification and use of the method, along with uniform data collection procedures, should be sent to all State and local officials who are involved in speed zoning.

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APPENDIX A - AASHTO MAIL QUESTIONNAIRE

SURVEY OF SPEED ZONING PRACTICES

Jurisdiction 50 States, Puerto Rico and District of Columbia

General

1. WHICH AGENCY IS EMPOWERED TO SET OR CHANGE SPEED LIMITS IN YOUR JURISDICTION? (Circle appropriate letter)

41 a. State Highway and/or Transportation Department or Commission

2 b. State Police or state enforcement agency

0 c. Local administrative agency

0 d. Local enforcement agency

11 e. Both state and local agencies

6 f. Local agency with state agency approval

4 g. Other. Please specify. Division of Motor Vehicles, Approval of the Governor, etc.

2. LISTED BELOW ARE A FEW POSSIBLE OBJECTIVES OF SPEED LIMITS. WHICH TWO OBJECTIVES DO YOU BELIEVE ARE MOST IMPORTANT? (Put letter in appropriate box)

[B] MOST IMPORTANT

[ ] SECOND MOST IMPORTANT

B, A, F

a. Separate occasional violator from the reasonable majority of motorists

b. Inform motorists of a safe speed

c. Keep accident risk below predetermined level

d. Optimize travel and accident costs

e. Reduce accidents

f. Provide uniform flow of traffic to increase capacity

g. Conserve energy

h. Increase service life of roadway

i. Slow traffic down

j. Other. Please specify. Increase capacity and safety

3. LISTED BELOW ARE EIGHT GROUPS WHICH COULD INFLUENCE THE CHOICE OF A SPEED LIMIT ON A GIVEN SECTION OF ROAD. IN YOUR OPINION, WHAT DEGREE OF INFLUENCE SHOULD EACH GROUP HAVE ON SPEED LIMITS POSTED ON HIGHWAYS IN YOUR JURISDICTION? (Circle appropriate number for each group)

Group	Influence group should have: Much	Some	Little	None
a. Federal Government	1 1	6 2	18 3	28 4
b. State Legislature	5 1	12 2	21 3	15 4
c. City/County Government	10 1	24 2	13 3	4 4
d. Highway Department	52 1	0 2	0 3	0 4
e. Judiciary	2 1	8 2	13 3	28 4
f. Law Enforcement	7 1	34 2	8 3	3 4
g. Motorists	16 1	17 2	13 3	4 4
h. Residents adjacent to the highway	0 1	14 2	31 3	8 4

4. OF THE GROUPS LISTED ABOVE, WHICH TWO DO YOU FEEL SHOULD HAVE THE MOST INFLUENCE ON THE SELECTION OF SPEED LIMITS? (Put letter in appropriate box)

[D] MOST INFLUENCE

[C] SECOND MOST INFLUENCE

5. OF THE EIGHT ITEMS LISTED BELOW, WHICH THREE FACTORS MOST INFLUENCES THE CHOICE OF A SPEED LIMIT ON HIGHWAYS IN YOUR JURISDICTION? (Put letter in appropriate box)

[B] MOST INFLUENCE
[A] SECOND MOST INFLUENCE
[C,D] THIRD MOST INFLUENCE

a. Engineering judgement
b. Engineering and traffic investigation
c. Political considerations
d. Pressures from local residents
e. Enforcement practices
f. Driver complaints
g. Judicial practices
h. Other. Please specify. Type of area, roadside development, roadway geometrics

6. HOW WOULD YOU DESCRIBE YOUR EXISTING CRITERIA, POLICY, OR PROCEDURE FOR SETTING SPEED LIMITS FOR EACH ZONE LISTED BELOW? (Circle the number that best describes your criteria for each zone)

Zone				
Maximum	Minimum	Advisory	Work	Current Criteria
1 1	21 1	3 1	3 1	.....No criteria exist
0 2	1 2	3 2	15 2	.....Criteria subjective and arbitrarily applied
2 3	9 3	2 3	10 3	.....Criteria subjective but uniformly applied and accepted by drivers
0 4	5 4	1 4	0 4	.....Criteria objective but seldom used because _____
27 5	7 5	29 5	23 5	.....Criteria objective but do not reflect all factors; some decisions based on judgement
22 6	5 6	18 6	3 6	.....Criteria objective, uniformly applied, and accepted by drivers

7. PLEASE ENCLOSE A COPY OF YOUR CRITERIA, POLICY, OR PROCEDURES FOR SETTING EACH SPEED LIMIT CONDITION LISTED BELOW.

Condition	Copy Enclosed? Yes	No.	Criteria are:
a. Maximum limits.....23	1	2 23	85th percentile speed, NMSL
b. Minimum limits.....11	1	2 31	State statute
c. Advisory limits.....15	1	2 29	Ball-bank indicator, engr. judgement
d. School zones.....19	1	2 29	State statute
e. Work zones.....13	1	2 26	Engineering judgement
f. Transition between high and low speed zones.....16	1	2 18	10 - 15 mph intermediate zone increments
g. Special zones. Please describe. _____ 5	1	2 10	Construction, special events

8. TO WHAT EXTENT ARE THE RESULTS OF AN ENGINEERING AND TRAFFIC INVESTIGATION USED TO SET OR ALTER SPEED LIMITS IN YOUR JURISDICTION FOR THE FOLLOWING CONDITIONS? (Circle appropriate number of each condition)

	Extent engineering study used:				
Condition	Always	Most Always	Sometimes	Seldom	Never
a. Maximum limits..... 31	1	17 2	2 3	1 4	2 5
b. Minimum limits..... 9	1	6 2	4 3	8 4	16 5
c. School zones..... 14	1	14 2	8 3	5 4	9 5
d. Work zones..... 5	1	12 2	21 3	13 4	1 5
e. Residential streets..... 16	1	10 2	14 3	7 4	3 5
f. Business district..... 17	1	12 2	15 3	2 4	3 5
g. Advisory speeds..... 16	1	26 2	7 3	2 4	2 5

Maximum Limits

9. INDICATE THE METHOD THAT BEST DESCRIBES HOW MAXIMUM SPEED LIMITS ARE SET FOR EACH HIGHWAY SITUATION LISTED BELOW. (Circle appropriate number for each highway situation. See definitions of each method listed below)

Highway Situation	Primary Method* Used Is: Statute	Judgement	Engr. Study	Petition	Political
a. Rural two-lane	26 1	1 2	28 3	0 4	0 5
b. Rural freeway and multilane	32 1	0 2	23 3	0 4	0 5
c. Isolated signalized intersection	5 1	9 2	38 3	0 4	0 5
d. Residential street	25 1	5 2	23 3	2 4	1 5
e. Business district	23 1	4 2	27 3	0 4	0 5
f. Small town	12 1	4 2	39 3	0 4	0 5
g. Urban freeway	13 1	0 2	30 3	0 4	0 5
h. Urban multilane	12 1	0 2	41 3	0 4	0 5
i. Urban two-lane	12 1	2 2	41 3	0 4	0 5
j. School zone	29 1	7 2	20 3	0 4	0 5
k. Work zone	2 1	34 2	18 3	0 4	0 5

*Definitions

STATUTE means state law or legislative decision
JUDGEMENT means subjective decision of the engineer
ENGR. STUDY means study based on prevailing speeds of traffic
PETITION means citizen request
POLITICAL means pressure from elected officials

10. WHEN ENGINEERING AND TRAFFIC INVESTIGATIONS ARE CONDUCTED, WHICH OF THE FOLLOWING FACTORS ARE USED TO SET OR ALTER MAXIMUM SPEED LIMITS IN YOUR JURISDICTION? (Circle each factor that is used)

2 a. 90th percentile speed
52 b. 85th percentile speed
35 c. Pace
32 d. Design speed of the facility
37 e. Length of zone and posted limits on adjacent zones
44 f. Type and amount of roadside development
21 g. Pedestrian volumes
13 h. Number of signalized intersections on roadways
9 i. Percentage of commercial vehicles
17 j. Traffic volume
31 k. Pavement and shoulder widths
35 l. Horizontal and vertical alinement
16 m. High percentage of drivers exceeding existing limit
27 n. Average test run speed
41 o. Accident experience
17 p. Presence of parking and loading zones
6 q. Other. Please specify. 50th percentile speed, sight distances, unexpected condition.

11. OF THE FACTORS LISTED ABOVE, WHICH THREE DO YOU BELIEVE ARE THE MOST IMPORTANT IN SETTING OR ALTERING MAXIMUM LIMITS? (Put letter in appropriate box)

[B] MOST IMPORTANT
[C,O] SECOND MOST IMPORTANT
[F] THIRD MOST IMPORTANT

12. WHEN THE 85th PERCENTILE SPEED IS USED AS A FACTOR IN SETTING MAXIMUM SPEED LIMITS IN YOUR JURISDICTION, WHAT TOLERANCE IS GENERALLY USED IN SELECTING THE POSTED SPEED LIMIT? (Circle appropriate letter)

3 a. 5 MPH above the 85th percentile speed (Alaska, New Mexico, Ohio)

32 b. 5 MPH above or below the 85th percentile speed

17 c. Other. Please specify tolerance. Range between 2 and 10 mph above or below 85th percentile speed, upper limit of pace speed

13. PLEASE DESCRIBE ANY PROBLEMS YOU HAVE EXPERIENCED IN USING THE 85TH PERCENTILE SPEED AS A GUIDELINE IN SETTING MAXIMUM SPEED LIMITS ON HIGHWAYS IN YOUR JURISDICTION.

Acceptance of procedure by politicans and local citizens
85th percentile speed must be used with other parameters
Difficulty concealing vehicle and radar during data collection
85th percentile speed is too high for some suburban and small town conditions

Minimum Limits

14. ARE MINIMUM SPEED LIMITS USED ON HIGHWAYS IN YOUR JURISDICTION?

21 a. No.

b. Yes. Please circle the types of highways where minimum speed limits are posted.

24 1. Urban freeway

16 2. Rural freeway

1 3. Urban multilane

1 4. Rural multilane

1 5. Rural two-lane

10 6. Other. Please specify. Limited access highways, long bridges and tunnels

15. WHAT CRITERIA OR POLICY DO YOU USE TO SET MINIMUM SPEED LIMITS?

5 a. 15th percentile speed

33 b. Other. Please specify. Statutory limits, engr. judgement, lower limit of pace

Advisory Limits

16. WHERE ARE ADVISORY SPEED LIMITS USED IN YOUR JURISDICTION? (Circle each condition that applies)

50 a. Horizontal curves

51 b. Exit ramps

21 c. Intersections

50 d. Work zone

14 e. Other. Please specify. Trucks on long steep grades, special road conditions, ie, fog, bumps, etc, areas with limited sight dist

17. DO YOU HAVE WRITTEN CRITERIA OR A POLICY FOR POSTING ADVISORY SPEEDS?

32 a. No.

19 b. Yes. Please enclose a copy of your criteria.

18. WHAT FACTORS DO YOU USE TO SET ADVISORY SPEED LIMITS ON HORIZONTAL CURVES? (Circle each factor that applies)

16 a. Design speed

49 b. Ball bank indicator

10 c. Sight distance

3 d. 85th percentile speed of traffic entering the curve

12 e. Other. Please specify. Curve data from plans, driver complaints, engineering judgement

Differential Limits

19. DOES YOUR JURISDICTION HAVE DIFFERENTIAL SPEED LIMITS FOR THE FOLLOWING CONDITIONS?

Condition	Differential Limit?		If yes, specify limits
a. Trucks.....	37 No	10 Yes	Downgrades
b. Oversize vehicles.....	38 No	9 Yes	By permit
c. Overweight vehicles.....	38 No	9 Yes	By permit
d. School buses.....	39 No	10 Yes	35 - 50 mph
e. Day/Night.....	45 No	5 Yes	Prior to 55 NMSL
f. Other. Please Specify.....	18 No	8 Yes	

Speed Measurement

20. DOES YOUR ORGANIZATION HAVE A DOCUMENTED PROCEDURE FOR CONDUCTING SPEED ZONING STUDIES WHICH INCLUDES GUIDELINES FOR SITE SELECTION, VEHICLE SELECTION, AND MINIMUM SAMPLE SIZE?

30 a. No.

22 b. Yes. Please enclose a copy of your procedure

21. HOW OFTEN IS THE POSTED SPEED LIMIT ON ANY GIVEN SECTION OF HIGHWAY EVALUATED BY YOUR ORGANIZATION? (Circle appropriate letter)

43 a. On request only

1 b. Annually

0 c. Once every two years

6 d. Once every three years

2 e. Other — No specified frequency; Variable up to 5 years

22. WHAT TYPE OF SPEED DATA COLLECTION EQUIPMENT DOES YOUR AGENCY USE FOR SPEED ZONING STUDIES? (Circle letter that best describes your equipment)

2 a. Stopwatch timing

8 b. Moving vehicle

51 c. Radar

8 d. Automated speed classifier with road tubes

8 e. Automated speed classifier with loops

23. WHEN COLLECTING SPEED DATA FOR SETTING SPEED LIMITS, DOES YOUR AGENCY TYPICALLY MEASURE ALL VEHICLE OR FREE-FLOW VEHICLE SPEED? (Circle appropriate letter)

3 a. All vehicles (Alabama, Hawaii, North Dakota)

43 b. Free-flow vehicles only

6 c. Mixture of free-flow and non-free-flow vehicles (Georgia, Indiana, New Mexico, Puerto Rico, Utah, Virginia).

Laws and Regulations

24. WHAT ARE THE STATUTORY MAXIMUM SPEED LIMITS FOR STREETS AND HIGHWAYS IN YOUR JURISDICTION? (Please circle whether the speed limits are prima facia or absolute)

Maximum Speed Limit		Prima Facia	Absolute
Residential Street	25-30 MPH.....	21 P	24 A
Business District	20-25-30 MPH.....	20 P	24 A
Urban Freeway	55 MPH.....	11 P	37 A
Rural Freeway	55 MPH.....	10 P	38 A
Rural Multilane	55 MPH.....	10 P	38 A
Rural Two-Lane	55 MPH.....	10 P	37 A
School Zone	20-25 MPH.....	17 P	26 A
Work Zone	45-55 MPH.....	9 P	13 A

25. WHAT MAXIMUM PENALTIES ARE SET BY STATUTE FOR DRIVERS WHO ARE CONVICTED OF VIOLATING SPEED LIMITS BY THE AMOUNTS INDICATED BELOW?

Amount Over Speed Limit	Penalty
1 - 5 MPH.....	Fines,
6 - 10 MPH.....	points,
11 - 15 MPH.....	jail
16 - 20 MPH.....	
over 20 MPH.....	

26. ARE THERE ANY PROPOSED LEGISLATIVE OR POLICY CHANGES PERTAINING TO SPEED LIMITS IN YOUR JURISDICTION?

45 a. No.

5 b. Yes. Please describe proposed changes. 20 mph in senior housing areas, increase speed zone limit to 35 mph, decentralize existing authority

Enforcement

27. BASED ON YOUR KNOWLEDGE OF SPEED LIMIT ENFORCEMENT PRACTICES IN YOUR JURISDICTION, WHAT TOLERANCE ABOVE THE POSTED LIMITS IS GENERALLY GRANTED ON HIGHWAYS IN YOUR JURISDICTION? (Circle appropriate tolerance)

0 a. None

21 b. 1 - 5 MPH

23 c. 6 - 10 MPH

3 d. 11 - 15 MPH

7 e. Other. Please specify tolerance. High tolerance due to 55 mph on freeways is not consistent with proper speed zoning practices

28. IN YOUR OPINION, WHY ARE ENFORCEMENT TOLERANCES ALLOWED? (Circle all reasons that apply)

12 a. Unreasonable speed limits

45 b. Speedometer error

32 c. Speed measurement device error

28 d. Other. Please specify reason. Rigid enforcement is not upheld in the courts

29. BASED ON THE REASONS LISTED ABOVE, WHAT DO YOU BELIEVE IS THE MAIN REASON TOLERANCES ARE ALLOWED? (Put letter in box)

[B,D] Main reason tolerances are allowed

30. DO YOU THINK PRESENT SPEED LIMIT ENFORCEMENT ACTIVITY IN YOUR JURISDICTION SHOULD BE INCREASED, DECREASED, OR REMAIN AT THE CURRENT LEVEL? (Circle appropriate letter)

16 a. Enforcement needs to be increased

2 b. Enforcement should be reduced to free personnel for other police activities

33 c. Enforcement is about right at the present level

31. IN YOUR OPINION, WHAT ARE THE TWO OBJECTIVES OF SPEED LIMIT ENFORCEMENT IN YOUR JURISDICTION? (Put letter in appropriate box)

[A] MAIN OBJECTIVE

[C] SECONDARY OBJECTIVE

a. Apprehend dangerous and reckless drivers

b. Generate revenues through fines

c. Increase driver compliance with speed limits

d. Conserve energy

e. Encourage safer driving

f. Other. Please specify. To prevent loss of Federal Aid Funds

Views on Speed Limits

32. PLEASE INDICATE YOUR VIEW OF THE FOLLOWING STATEMENTS CONCERNING SPEED AND SPEED LIMITS. (Circle number for each statement)

	My view is: Agree	Neutral	Disagree
a. Speed limits are very helpful for the motorist	35 1	14 2	3 3
b. Motorists are capable of deciding what speed is safe for road and traffic conditions	34 1	10 2	9 3
c. Without speed limits the roads would be dangerous to drive on	19 1	20 2	13 3
d. Many speed limits are not appropriate for road and traffic conditions	26 1	10 2	16 3
e. On the whole, I am not in favor of speed limits	0 1	4 2	48 3
f. Most of the time motorists drive at a speed that road and traffic conditions will permit regardless of the posted speed limit	46 1	4 2	1 3
g. The majority of speed limits in my jurisdiction are set at about the right level	46 1	5 2	0 3
h. The majority of speed limits in other jurisdictions are set at about the right level	29 1	18 2	4 3

33. WHAT PERCENTAGE OF THE SPEED LIMITS IN YOUR JURISDICTION DO YOU BELIEVE ARE SET AT ABOUT THE RIGHT LEVEL? (Circle appropriate letter)

42 a. More than 80 percent

7 b. 66 to 80 percent

3 c. 50 to 65 percent

0 d. Less than 50 percent

34. WHAT PERCENTAGE OF THE SPEED LIMITS IN OTHER JURISDICTIONS DO YOU BELIEVE ARE SET AT ABOUT THE RIGHT LEVEL? (Circle appropriate letter)

26 a. More than 80 percent

12 b. 66 to 80 percent

9 c. 50 to 65 percent

2 d. Less than 50 percent

35. FOR EACH FACILITY LISTED BELOW, CIRCLE THE NUMBER WHICH REFLECTS YOUR OPINION OF HOW EXISTING SPEED LIMITS SHOULD BE CHANGED.

Facility	Existing speed limit should be: Increased	Not Changed	Decreased
Residential Street	2 1	48 2	1 3
Business District	1 1	50 2	0 3
Suburban Arterial	6 1	45 2	0 3
Urban Freeway	17 1	36 2	0 3
Rural Freeway	34 1	18 2	0 3
Rural Multilane	19 1	34 2	0 3
Rural Two-Lane	10 1	42 2	1 3

36. WHICH OF THE FOLLOWING RESPONSES BEST DESCRIBES HOW YOU FEEL ABOUT THE 55 MPH NATIONAL MAXIMUM SPEED LIMIT? (Circle appropriate letter)

12 a. Satisfied. Oppose any change. (Go to Question 38.)

25 b. Favor raising the limit on freeways only

12 c. Favor raising the limit on freeways and non-freeways

4 d. Other. Please describe. Freeways and some rural multilane routes, isolated rural two-lane highways

37. TO WHAT LEVEL WOULD YOU LIKE TO SEE THE MAXIMUM 55 MPH SPEED LIMIT CHANGED?

	Average	Range
Freeways	65 MPH	60 to 75
Non-Freeways	60 MPH	55 to 70

Speed Zoning Issues

38. BRIEFLY DESCRIBE THE MOST IMPORTANT SPEED ZONING-RELATED PROBLEMS IN YOUR JURISDICTION.

41 Citizen understanding of speed zoning practices
Local official acceptance of engineering study results
Unrealistic school zone limits
Lack of personnel to conduct studies
High judicial tolerance

39. DOES YOUR ORGANIZATION HAVE ANY PLANNED, ONGOING, OR RECENTLY COMPLETED STUDIES INVOLVING THE DEVELOPMENT OF PROCEDURES OR CRITERIA FOR ESTABLISHING SPEED LIMITS?

46 a. No.

5 b. Yes. Please enclose a copy of the report or briefly describe the study.

40. DOES YOUR ORGANIZATION HAVE ANY ONGOING OR RECENTLY COMPLETED STUDIES EVALUATING THE EFFECTS OF INCREASING OR DECREASING SPEED LIMITS?

44 a. No.

6 b. Yes. Please enclose a copy of the report or briefly describe the study.
Before and after speed samples taken in Montana indicate no change in speeds due to signing changes

41. DO YOU BELIEVE THAT STATE OR FEDERAL RESEARCHERS SHOULD BE WORKING IN THE AREAS LISTED BELOW? (Circle appropriate response for each area)

Research Area	Response		
a. Effects of altering speed limits on speed and accidents	41	Yes	No 9
b. Driver attitudes and knowledge about speed limits	35	Yes	No 14
c. Effects of traveling from high speed zone to lower speed zone	29	Yes	No 24
d. Work zone speed limits	38	Yes	No 11
e. Determining optimum highway speed limits	34	Yes	No 15
f. Separate speed zoning for residential streets	11	Yes	No 36
g. Factors affecting travel speed	25	Yes	No 25
h. Portable sensors for automated speed monitoring	21	Yes	No 25
i. Develop objective and quantifiable speed zone criteria	42	Yes	No 7
j. Changeable speed limits based on real time monitoring of traffic	14	Yes	No 33

42. WHICH OF THE THREE RESEARCH AREAS LISTED ABOVE DO YOU BELIEVE ARE MOST IMPORTANT? (Put letter in appropriate box)

[A] MOST IMPORTANT

[A,D] SECOND MOST IMPORTANT

[I] THIRD MOST IMPORTANT

43. LIST OTHER TOPICS YOU FEEL SHOULD BE STUDIED.

Unrealistic limits in construction zones
Judicial system training of speed zoning concepts
Methods and criteria for setting school zone limits

44. ADDITIONAL COMMENTS OR OBSERVATIONS.

Thank you for your cooperation and assistance. The information you have provided will be tabulated along with data from other jurisdictions. If you would like a summary of the results, please put your name and address on the back of the return envelope and we will send you a copy.

FEDERALLY COORDINATED PROGRAM (FCP) OF HIGHWAY RESEARCH, DEVELOPMENT, AND TECHNOLOGY

The Offices of Research, Development, and Technology (RD&T) of the Federal Highway Administration (FHWA) are responsible for a broad research, development, and technology transfer program. This program is accomplished using numerous methods of funding and management. The efforts include work done in-house by RD&T staff, contracts using administrative funds, and a Federal-aid program conducted by or through State highway or transportation agencies, which include the Highway Planning and Research (HP&R) program, the National Cooperative Highway Research Program (NCHRP) managed by the Transportation Research Board, and the one-half of one percent training program conducted by the National Highway Institute.

The FCP is a carefully selected group of projects, separated into broad categories, formulated to use research, development, and technology transfer resources to obtain solutions to urgent national highway problems.

The diagonal double stripe on the cover of this report represents a highway. It is color-coded to identify the FCP category to which the report's subject pertains. A red stripe indicates category 1, dark blue for category 2, light blue for category 3, brown for category 4, gray for category 5, and green for category 9.

FCP Category Descriptions

1. **Highway Design and Operation for Safety**
   Safety RD&T addresses problems associated with the responsibilities of the FHWA under the Highway Safety Act. It includes investigation of appropriate design standards, roadside hardware, traffic control devices, and collection or analysis of physical and scientific data for the formulation of improved safety regulations to better protect all motorists, bicycles, and pedestrians.

2. **Traffic Control and Management**
   Traffic RD&T is concerned with increasing the operational efficiency of existing highways by advancing technology and balancing the demand-capacity relationship through traffic management techniques such as bus and carpool preferential treatment, coordinated signal timing, motorist information, and rerouting of traffic.

3. **Highway Operations**
   This category addresses preserving the Nation's highways, natural resources, and community attributes. It includes activities in physical maintenance, traffic services for maintenance zoning, management of human resources and equipment, and identification of highway elements that affect the quality of the human environment. The goals of projects within this category are to maximize operational efficiency and safety to the traveling public while conserving resources and reducing adverse highway and traffic impacts through protections and enhancement of environmental features.

4. **Pavement Design, Construction, and Management**
   Pavement RD&T is concerned with pavement design and rehabilititation methods and procedures, construction technology, recycled highway materials, improved pavement binders, and improved pavement management. The goals will emphasize improvements to highway performance over the network's life cycle, thus extending maintenance-free operation and maximizing benefits. Specific areas of effort will include material characterizations, pavement damage predictions, methods to minimize local pavement defects, quality control specifications, long-term pavement monitoring, and life cycle cost analyses.

5. **Structural Design and Hydraulics**
   Structural RD&T is concerned with furthering the latest technological advances in structural and hydraulic designs, fabrication processes, and construction techniques to provide safe, efficient highway structures at reasonable costs. This category deals with bridge superstructures, earth structures, foundations, culverts, river mechanics, and hydraulics. In addition, it includes material aspects of structures (metal and concrete) along with their protection from corrosive or degrading environments.

9. **RD&T Management and Coordination**
   Activities in this category include fundamental work for new concepts and system characterization before the investigation reaches a point where it is incorporated within other categories of the FCP. Concepts on the feasibility of new technology for highway safety are included in this category. RD&T reports not within other FCP projects will be published as Category 9 projects.