

STUDY OF OPTIMAL TRAVEL SPEED LIMITS FOR SHARED TRAFFIC

FINAL REPORT

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Submitted by

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16. Abstract <p>This report summarizes the results of the work performed under the project <i>Study of Optimal Travel Speed Limits for Shared Traffic</i>. The objectives of the research were to determine if a 25-mph speed limit addresses safety needs of bicyclists and pedestrians sharing roadway with vehicles, to recommend a method to assess and set speed limits for shared use of public right of way by motor vehicle, bicycle and pedestrian traffic, and to recommend optimum speed limits for shared use bicycle/motor vehicle traffic in terms of different perspectives for low volumes, low speeds, and road geometry.</p> <p>One approach to enhance the safety of bicyclists and pedestrians is to ensure safe operating speeds on residential and commercial roadways by identifying appropriate speed limits for shared roadways or roadways that accommodate motor vehicles, pedestrians and bicycles. Although guidelines are provided on the geometric design of shared-use roadways, little research has been performed on the appropriate speed limit for these roadways to ensure safety to all users of the roadway. In New Jersey, current regulations require the use of the low statutory speed of 25 mph in residential and business districts. No research has been performed, however, to determine whether this speed is appropriate on roadways in these districts where pedestrians and bicycles share the travelway with motor vehicles. This research examines current criteria and procedures used for setting speed limits and develops an approach to determine appropriate speed limits for shared use of public rights of way.</p>					
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Summary

The goal of this project is to identify safe operating speeds on residential and commercial roadways by identify proper speed limits for shared roadways or roadways that accommodate motor vehicles, pedestrians and bicycles. To achieve this purpose, the research team examined current criteria and procedure used for setting speed limits and developed an approach to determine appropriate speed limits for shared use of public rights of way by motor vehicle, bicycle and pedestrian traffic.

First, a literature reviewed was performed covering the relationship between vehicle travel speeds and the frequencies and severities of pedestrian injuries, the benefits of reduced speed limits in terms of decreased frequencies and severities of pedestrian injuries, the state-of-the-art practices of speed zoning, methods used in enforcing speed limits, and engineering approaches, other than lowering speed limits, that help reduce vehicle travel speeds.

Then, the criteria and regulations used for setting speed limits in New Jersey and elsewhere were identified and documented. These criteria were obtained from a variety of sources, including New Jersey Legislation as well as previous speed zoning surveys conducted by the Institute of Transportation Engineers (ITE), and the Federal Highway Administration (FHWA). Some additional information about speed zoning in other States and foreign countries were also obtained from web sources. These sources, in general, provided information about statutory speed limits. The review sought to identify speed zoning practices for local and residential roadways.

Next, information on the characteristics of roadways posted with the less than 25-mi/h speed limit was sought after. To this end, NJDOT's Traffic Engineering Division was contacted; locations identified in the State crash database as having a posted speed limit of 25 mi/h or less was reviewed; and literature on 20-mi/h speed zones that have been implemented in Great Britain was reviewed. Also, crash data were evaluated to determine the nature of crashes involving pedestrians and bicycles on New Jersey roadways.

A statistical model was then developed to relate pedestrian/bicyclist injury severities with speed limits and other roadway factors. Appropriate speed limits could

subsequently be computed from the model for a roadway with given characteristics to target set pedestrian/bicyclist injury severity levels. The crash data for our model development purpose were from NJDOT's crash database on crashes involving pedestrians and bicycles in the years 1997 to 2000. An ordinal logistic regression was performed to detect the relationship between injury severities and other roadway characteristics. The regression was implemented using the commercial statistics software SAS.

The microscopic simulation tool CORSIM was used to study impacts of various speed limits on roadways' operational performances including total travel times, average vehicle delays, percent stops, fuel consumptions, and vehicle emissions. Only the combined use of the statistical model and this operational module would lead to well balanced roadway speed limits.

Using our developed models, safety speed limits were proposed for seven roadways based on their geometric and traffic conditions. The roadways used in the analysis included county road CR501 in Hudson County, Broad Street in the city of Newark, CR551 in Camden and Gloucester Counties, CR603 in Essex County, RT322 in Gloucester County, CR607 in Ocean County, and RT30 in Atlantic County.

Finally, conclusions were reached for the study and recommendations were made out of the study results.

CHAPTER I

INTRODUCTION

Overview

The congressionally mandated *National Bicycling and Walking Study* has set goals to: (1) double the percentage of all trips made by bicycling or walking; and (2) reduce the current number of bicycling and walking injuries and fatalities by 10 percent. One approach to enhance the safety of bicyclists and pedestrians is to ensure safe operating speeds on residential and commercial roadways by identifying appropriate speed limits for shared roadways or roadways that accommodate motor vehicles, pedestrians and bicycles. Motor vehicles, pedestrians and bicycles share the same right-of-way in conditions where sidewalks or bicycle paths are not provided. These conditions occur in rural areas where sidewalks, in general, are not provided, or in urban areas with insufficient width or no anticipated pedestrian traffic. ⁽¹⁾ In lightly travelled rural roadways and suburban streets with an average annual daily traffic (AADT) less than 1200 vehicles per day, neither sidewalks nor shoulders may be required. This condition forces pedestrians even closer to the active travelway.

Background

Although guidelines are provided on the geometric design of shared-use roadways, little research has been performed on the appropriate speed limit for these roadways to ensure safety to all users of the roadway. In New Jersey, current regulations require the use of the low statutory speed of 25 mi/h in residential and business districts. No research has been performed, however, to determine whether this speed is appropriate on roadways in those districts where pedestrians and bicycles share the travelway with motor vehicles. Research has shown substantial reduction in the severity of injuries and number of fatalities when the vehicle is traveling at less than 25 mi/h. This research examines current criteria and procedures used for setting speed limits and develops an approach to determine appropriate speed limits for shared use of public rights of way by motor vehicle, bicycle and pedestrian traffic.

Objectives

The objectives of work performed under Task Order No. NCTIP-043, Study of Optimal Speed Limits for Shared Traffic, include to:

- Determine if the 25-mi/h speed limit addresses safety needs of bicyclists and pedestrians sharing roadway with vehicles.
- Recommend a method to assess and set speed limits for shared use of public right of way by motor vehicle, bicycle and pedestrian traffic.
- Recommend optimum speed limits for shared use bicycle/motor vehicle traffic in terms of different perspectives for low volumes, low speeds, and road geometry.

The tasks performed to achieve these objectives include:

- Phase I. Literature Search.
- Task 1. Review the current criteria used for setting speed limits in New Jersey.
- Task 2. Compare speed limit criteria for New Jersey with other State DOTs, Federal DOT and foreign countries.
- Task 3. Review attributes for roads posted with less than 25-mi/h speed limit.
- Task 4. Assess data supporting need to evaluate appropriate speed limits for shared traffic.
- Task 5. Identify the speed factors in determining the optimal speed limits for shared road (besides the pedestrian and bicyclist crashes), such as travel time, vehicle operating costs, road crashes, road geometry, the residential perspective, traffic noise and air pollution.
- Task 6. Establish criteria and procedures for setting optimum speed limits for at least four types (groups) of roads with factors identified in Task 1.
- Task 7. Identify locations (roads/streets) where the proposed new optimum speed limit can be implemented in New Jersey. These sites should be selected to provide optimal future evaluation. Provide recommendations for next phase/study for future implementation.
- Task 8. Prepare quarterly reports, a Tech Brief and a final report, with appropriate tables, graphs and charts in hard copy version, pdf file format, Word97, and on CD-ROM in accordance with NJDOT reporting requirements.

Organization

This report is organized into eight chapters. Chapter I provides an introduction to the research, stating the research objectives and the tasks performed to accomplish these objectives. Chapter II provides a literature review describing the relationship between speed controls and pedestrian and bicycle safety. Chapter III reviews current criteria used for setting speed limits in New Jersey providing a comparison with other State Departments of Transportation (DOTs) as well as what is used in foreign countries. Chapter IV provides the work performed to identify attributes of roadways posted less than 25 mi/h. Chapter V discusses the methodological side of the statistical analysis of pedestrian/bicycle crash data. The analysis reveals factors that impact pedestrian/bicyclist crash severities. Chapter VI describes the methodology and procedure developed for determining optimal speed limits on shared roadways. The theoretical background, data source, and model results are provided. Chapter VII provides information on potential locations where optimal speed limits are proposed for field testing. Finally, Chapter VIII provides a summary and conclusion of the research.

CHAPTER II

LITERATURE REVIEW

Overview

In Phase I of the research, a literature review is performed covering (1) the relationship between vehicle travel speeds and the frequencies and severities of pedestrian injuries; (2) the benefits of reduced speed limits in terms of decreased frequencies and severities of pedestrian injuries; (3) the state-of-the-art practices of speed zoning; (4) methods used in enforcing speed limits; and (5) engineering approaches, other than lowering speed limits, that help reduce vehicle travel speeds.

Vehicle Travel Speeds and Pedestrian Injury

Every year, approximately 80,000 people are injured in the United States; of these, about 8,000 of them die. ⁽²⁾ Existing literature points to the fact that higher vehicle travel speeds increase the likelihood of crashes. Also, with higher vehicle speeds, each crash is more likely to be severe and even fatal for involved pedestrians.

Leaf and Preusser ⁽³⁾ conducted a comprehensive literature review and empirical study on vehicle travel speeds and resulting pedestrian injury. Their empirical study was based on data from three databases: the General Estimate System (GES) database, the State of Florida Single-vehicle Crashes database, and the Fatality Analysis Reporting System (FARS). The study conclusively showed that the correlation between pre-crash vehicle travel speeds and injury severities and fatalities is significantly positive, the correlation between posted speed limits and the latter factors is apparently positive, though not as significant as the first correlation, and among all environmental factors that may contribute to the crashes, the posted speed limits have the dominant impact. They therefore concluded that higher vehicle speeds are strongly associated with both a greater likelihood of pedestrian crash occurrence, as indicated already in the above, and with more serious resultant pedestrian injury.

In the UK Department of Environment, Transport, and the Regions (DETR) Traffic Advisory Leaflet 7/93 ⁽⁴⁾, it was estimated that only 5 percent of pedestrians would die when struck by a vehicle traveling at 20 mi/h or less, as opposed to fatality

rates of 40, 80, and nearly 100 percent for striking speeds of 30, 40, and 50 mi/h or more, respectively. As for overall crashes and fatalities, it was estimated by European experts that reducing average speeds by 5 km/h (3 mi/h) could eliminate 11,000 fatal crashes and 180,000 injury-involved crashes every year in the European Union countries. ⁽⁵⁾

By examining NHTSA's Pedestrian Injury Causation Study (PICS) data, containing police-reported pedestrian crash cases in five U.S. cities between September 1977 and March 1980, Pitt et al. ⁽⁶⁾ found a strong link between vehicle travel speeds and pedestrian injury severities. Being confined to about 1,000 urban crashes with pedestrians younger than 20 years of age, they concluded that, compared to vehicle travel speeds of 10-19 mi/h, the risk of serious injury or death was 2.1 for speeds of 20-29 mi/h, 7.2 for speeds of 30-39 mi/h, and 30.7 for speeds of 40 mi/h or more. They also found a similar, albeit weaker, relationship between injury severity and posted speed limits. In addition, research on child pedestrian injuries confirmed the above findings. Using New Zealand data, Roberts et al. ⁽⁷⁾ found an odds ratio of 3.22 for injuries on 40-49 km/h (25-30 mi/h) roads vs. roads with lower limits; and in the Seattle area, vs. roads with speed limits below 40 km/h (25 mi/h), Mueller et al. ⁽⁸⁾ found odds ratios of 3.2 for child pedestrian injuries in 45-55 km/h (28-34 mi/h) roads and 6.0 for roads with limits above 64 km/h (40 mi/h).

It is supported by other research that pedestrians are usually not seriously injured when hit by a car moving at a speed of 19 mi/h or less at the time of impact; injuries are usually serious if vehicle speeds are between 19 and 34 mi/h; and injuries are likely to be fatal if vehicle speeds are above 34 mi/h ^(9,10). Proctor ⁽¹¹⁾ depicted the speed-fatality relationship in more detail as follows: The probability of a pedestrian fatality is 5 percent when vehicle speed is at 20 mi/h, rising to 37 percent at 30mi/h and to 83 percent at 45 mi/h.

Benefits of Reduced Speed Limits

McMahon et al. ⁽¹²⁾ used the case-control methodology in conjunction with conditional and binary logistic models to determine the effects of physical design attributes and other socioeconomic data on the likelihood of sites being crash sites. Among the

various attributes, they identified higher speed limit as the single most significant physical design factor that is associated with higher likelihood of a site being a crash site. A study by the Insurance Institute for Highway Safety ⁽¹³⁾ drew the same conclusion that pedestrians involved in crashes are more likely to be killed when the involved vehicles travel at higher speeds.

Jensen ⁽¹⁴⁾ reported the dramatic reduction in crash occurrences and injury severities due to the introduction and lowering of speed limits in Denmark. When general speed limits were introduced in Denmark in 1974, average vehicle travel speeds decreased by 6 km/h (4 mi/h) and speed standard deviations decreased by 3 km/h (1.9 mi/h). As a result, occurrences of pedestrian crashes of all severities dropped by 25 percent. After the 1985 reduction of urban speed limit from 60 km/h (37 mi/h) to 50 km/h (31 mi/h), average vehicle travel speeds dropped by 2-3 km/h (1.2-1.9 mi/h). Consequently, pedestrian fatalities decreased by 31 percent, serious injuries by 4 percent, and slight injuries by 9 percent. He also showed that the percentage of fatalities among injuries occurred on roads with certain posted speed limits increased dramatically in the posted speed limits: no fatalities for 20 km/h (12 mi/h), 5 percent fatalities for 50 km/h (31 mi/h), 20 percent fatalities for 80 km/h (50 mi/h), and 35 percent fatalities for 110 km/h (68 mi/h).

There was an urban speed limit reduction in France in November 1990, from 60 km/h (37 mi/h) to 50 km/h (31 mi/h). Page ⁽¹⁵⁾ reported that injury crashes in urban areas decreased 14.5 percent from the two years before the speed reduction to the two years after immediately after; in rural areas, where the speed limits did not change, the decrease was 9.1 percent. Also, fatalities decreased 12.3 percent in urban areas and 10.2 percent in rural areas. A city-wide 30 km/h (19 mi/h) limit on residential streets was implemented in Graz, Austria in September 1992. Along with other programs including traffic regulation, extensive and varied public information and awareness campaigns, and supervision, this reduction of speed limits led to a 12 percent decrease in minor injuries, a 24 percent decrease in serious injuries, and a 17 percent overall pedestrian injuries. Other benefits included a \$6,000,000, or 26 percent drop, in economic loss due to injuries and decrease in noise levels. ⁽¹⁶⁾

Recent NHTSA report ⁽¹⁷⁾ cited the wide recognition that increased speed limits contribute the most to the increase in pedestrian injury severity. In particular, it reported from Florida data in the years between 1993 and 1996 that the pedestrian fatality per crash varies substantially as a function of posted speed limits. For roadways with posted speed limits of 20 mi/h or less, this number is about 1.1 percent, while for roadways with posted speed limits between 31 and 35 mi/h, the number rises dramatically to 22.4 percent.

Davis ⁽¹⁸⁾ evaluated the impact of reducing speed limits in urban residential areas from 30 mi/h to 25 mi/h for the State of Minnesota. The speed limit reduction was being considered as a means of improving pedestrian safety. The approach taken was to develop a model relating pedestrian injury severity to vehicle impact speed and then to fit the model to actual vehicle-pedestrian crash data. Given this model, the impact of various speeds on residential roadways could then be determined. Both logit and probit models were used to fit vehicle impact speeds using three categories of injury severity with models separately developed for children and adults. The study found that the impact speed at which the change of fatal injury is 50 percent occurs between 70 and 75 km/h (44-47 mi/h). For impact speeds below 40 km/h (25 mi/h) pedestrian injuries were found to be slight. For impact speeds above 40 km/h (25 mi/h), serious injuries become more frequent. For impact speeds above 75 km/h (47 mi/h), fatal injuries were determined to be most likely. The study concluded that a 40 km/h (25 mi/h) speed limit would provide a good speed limit for vehicles on local residential streets.

Fieldwick and Brown ⁽¹⁹⁾ conducted a regression study on the fatality and casualty data in 21 developed countries vs. the respective urban and rural posted speed limits. They found that both fatality and casualty numbers were highly correlated with the speed limits, more so with the urban limits than with the rural ones. Their regression model predicted a 25 percent fatality and casualty drop if urban speed limits were reduced from 60 km/h (38 mi/h) to 50 km/h (31 mi/h). Were this done in combination with a decrease of rural speed limits from 100 km/h (63 mi/h) to 90 km/h (56 mi/h), a one-third decline in fatality and casualty numbers could be reached.

Other works on the connection between vehicle speeds and pedestrian injury risks include Anderson et al. ⁽²⁰⁾, which studied the likely effect of reduced vehicle

speeds on pedestrian fatalities in Adelaide, Australia; Jacobsen et al. ⁽²¹⁾, which verified that speed is the most promising variable for change among a set of potential variables in reducing injury risks of children; Mueller, Rivara, and Bergman ⁽²²⁾, which used multiple logistic regression to study both urban and rural pedestrian-vehicle collision data; and Sullivan and Flannagan ⁽²³⁾, which found higher speed limits to be the most important factor in raising pedestrian safety risks in darkness.

State-of-Art Speed Zoning Practices

Speed zoning is the establishment of reasonable and safe speed limits on roadways based on engineering study. A speed zone is a section of street or highway where a speed limit different from the statutory speed limit has been established. In the U.S., speed zoning is generally based on the principle of setting speed limits as near as practicable to the 85th percentile free flowing speed, i.e., the speed at or below which 85 percent of drivers are traveling.

The 85th percentile speed is usually obtained through collecting and analyzing spot speed samples. However, the data collecting procedure tends to be costly and time-consuming. Therefore, people have been using alternative methods to estimate this speed. Najjar, Stokes, and Russell ⁽²⁴⁾ set to describe the relationship between the 85th percentile speed and various roadway characteristics such as shoulder widths and AADT by using the back-propagation artificial neural networks (ANNs) approach. Working on the data from rural highways in the State of Kansas, they found that their ANNs method could predict the speeds much more accurately than the best regression model, and the predictions were very close to the actual observed 85th percentile speeds. The cost saving for the State of Kansa resulting from using their method as opposed to the one involving spot sampling could amount to \$400,000.

Enforcement of Speed Limits

The most obvious and effective way to lower vehicle travel speeds is to impose lower speed limits. However, imposed speed limits need costly police enforcement, which has its limitations. Speed enforcement is effective on the drivers only when it is believed likely to occur, is meaningfully costly to the offenders, is associated with driving

in general rather than any specific time of day or roadways, and is not associated with any specific cues. ⁽³⁾

A two-week national police strike occurred in Finland that resulted in a widely known, complete absence of enforcement of speed limits. During the strike, mean vehicle travel speeds increased slightly, yet the percentage of speeding more than 10 km/h (6 mi/h) above the speed limit increased by 50 to 100 percent, translating into a 20 percent increase in the traveling speed standard deviation. Due to the dramatic nature of how increased vehicle travel speeds result in more severe injuries, this increase in standard deviation will potentially lead to more severe crashes. ⁽²⁵⁾

The effects of police enforcement of speed limits are very “localized”. Council ⁽²⁶⁾ examined the effects of stationary and moving marked police units on the speeds of oncoming vehicles on two-lane roads with speed limits of 55 and 60 mi/h. He found that vehicle travel speeds decreased by 5-6 mi/h alongside the stationary vehicle but did not change visibly alongside the moving vehicle. Speeds of vehicles 1.25 miles after passing the stationary car dropped only slightly, while speeds of vehicles 1.25 miles after passing the moving car were even up slightly. Dart and Hunter ⁽²⁷⁾ studied vehicle travel speeds at “treatment” points, two miles upstream and two miles downstream, on a two-lane rural roadway. Average speeds alongside a partially concealed radar-equipped marked police car, a manned parked police car, and an “enforcement scene” of a police car with flashers activated parked behind an “arrestee’s” vehicle, all dropped by 5-6 mi/h. However, mean speeds increased to recover half the speed decrease by 1000 feet beyond the treatment, and fully recovered two miles downstream. These findings naturally lead to the conclusion that to enforce speed limits over a wide stretch of roads regularly, a tremendous amount of police manpower and equipment resource has to be invested into the activity.

On the other hand, irregular enforcement can still be effective if the drivers are made to believe that the enforcement is independent of space and time. Edwards and Brackett ⁽²⁸⁾ tested a two-phase approach: start with a two-week intensive enforcement to slow drivers down, then follow with a four-week schedule of minimum police presence that is adequate to maintain the slower speeds. They placed enforcement vehicles randomly along a 17-mile stretch. This strategy reduced average and extreme speeds

for up to 14 miles during the course of the study. Holland and Conner⁽²⁹⁾ tested an intensive enforcement campaign on a busy commuter dual carriageway in the UK. Police speed check warning signs were put on for three weeks and visible enforcement was carried out in the middle week. Speeds declined significantly during these weeks, most dramatically when police were visibly active. The residual effect of the campaign lasted till six weeks afterward. Vaa⁽³⁰⁾ reported a study of police enforcement on a 35-km (22 mi/h) stretch of two-lane road with speed limits of 60-80 km/h (38-50 mi/h) in Norway. The police adopted an enforcement strategy that is irregular in both timing and enforcement locations with intensity of 40 hours/week for six weeks. This resulted in a 5 km/h (3 mi/h) speed decrease in all time periods, and the effect lasted for up to eight weeks.

Other cost-effective means exist for enforcing speed limits. Photo radar can be used to take photos of vehicles traveling above a threshold value, usually at 5-10 mi/h above the speed limit. The photos are then used to identify the speeding vehicle and mail tickets to the registered owner. No on-site personnel are needed on-site with the devices. These devices are being used in places like New York, Los Angeles, San Francisco, and other smaller cities. Blackburn and Gilbert⁽³¹⁾ did a study on the impacts of photo radar and other automated speed enforcement (ASE) systems implemented in the United States, Australia, Canada, and other European countries. They found that the devices can reduce speeds, crashes, and injuries, but the extent of benefits heavily depends on the details of implementations.

Elvik⁽³²⁾ studied crash reductions along 64 road segments with photo radar in Norway. The installations of the photo radar resulted in a 20 percent reduction in injury crashes and a 12 percent drop in property-damage-only crashes. The author observed that the use of photo radar was warranted if crash rates were higher than for similar roads, or there were at least 0.5 injury crashes per km per year. Repard⁽³³⁾ reported on the installation of photo radar in National City, California. The devices produced 14,000 speeding tickets in 20 months and reduced crashes to less than 50 per month from about 70 per month. Price and Hunter-Zaworski⁽³⁴⁾ studied a two-year demonstration project with photo radar in school zones and residential neighborhoods in Portland,

Oregon. The study showed significant declines in mean vehicle travel speeds and in percentage of drivers going more than 10 mi/h above the speed limits on test streets.

Police surveillance without enforcement can be effective in enforcing speed limits. Hashimoto ⁽³⁵⁾ reported the placement of uniformed police on the corners of a dangerous intersection where they did not intervene with the traffic. This deployment reduced behaviors that placed drivers at risk of crashes. Speed display boards have also been used to counter speeding, though they seem to have effects only when they are “on”. Casey and Lund ⁽³⁶⁾ showed that the deployment of trailer-mounted speed boards labeled “police” reduced vehicle speeds by 10 percent next to the boards and 7 percent one-half mile downstream, but effects rapidly disappeared as the boards were removed. Webster ⁽³⁷⁾ studied vehicle-activated speed reminder signs in the UK, Europe, and the U.S. The signs reduced vehicle speeds by a few mi/h and downstream effects were discernible. When the signs were used at the entrances of villages in the UK, speed reductions were sustained till the middle of the village. Testing speed warning signs in the UK, Eagle and Winter ⁽³⁸⁾ found that vehicle speeds declined during a 12-week test period, and the effects disappeared when the signs were withdrawn.

Engineering Approaches to Lowering Vehicle Travel Speeds

Even though imposing and enforcing lower speed limits on roadways is the most effective way to reduce pedestrian safety risks, there exist other means to slow down vehicles on roadways. Giese, Davis, and Sykes ⁽³⁹⁾ studied the three alternatives that have the potential to slow down vehicles on residential streets: physical speed constraints, passive speed deterrents, and psychological speed deterrents. Through a regression study on 49 residential streets in the Minneapolis/St. Paul area, they concluded that, besides imposed speed limits, architectural and engineering designs of the roadway can play significant roles in slowing down vehicles.

Huang and Cynecki ⁽⁴⁰⁾ examined the effect of traffic calming treatments on pedestrian and motorist behaviors. They found that overall vehicle speeds were lower at treatment sites, the percentage of pedestrians for whom motorists yielded increased at sites where raised crosswalks and overhead flashers were used in combination, the average pedestrian waiting time did not increase due to the treatments, and refuge

islands served to induce pedestrians into marked crosswalks. They concluded that several traffic calming measures have the potential for improving the pedestrian environment.

In their comprehensive literature review, Leaf and Preusser⁽⁴¹⁾ also pointed out traffic calming as an effective means, in addition to speed limits, to battle high vehicle speeds. The calming measures they mentioned include road humps, roundabouts, other horizontal traffic deflections such as chicanes, and increased use of stop signs. They also recommended the implementations of comprehensive community-based speed reduction programs that combine public information and education, enforcement, and roadway engineering.

A report by the Road Information Program⁽⁴²⁾ listed 10 steps other than lowering speed limits that can be used to improve motorist, pedestrian, and bicyclist safety. These steps include, among others, road improvements, better winter maintenance of roads, installation of pedestrian signals and marked crosswalks, installation of bicyclist lanes, and more sidewalks. In Konheim⁽⁴³⁾, the use of intelligent transportation systems (ITS) technology was also recognized as an effective way to reduce vehicle speeds.

Fitzpatrick et al.⁽⁴⁴⁾ studied design factors that affect vehicle speeds on four-lane suburban arterials. The factors considered fell into one of three categories: geometric, roadside, and traffic control device variables. Regression analysis was used to determine the relationship of the 85th percentile speed to these variables for horizontal curves and straight sections. For horizontal curves, the variables found to be significant in influencing operating speeds include curve radius, deflection angle, the presence of a median, access density, roadside development and posted speed. For straight roadway sections, such variables include distance to the downstream control, lane width and posted speed.

Through statistical analyses, many researchers have identified the roadway curvature (the horizontal curve), as might be measured by the curve radius or degree of curve (degree/30m, degree/100ft), as a very influential factor in determining vehicle travel speeds on low-grade (low vertical gradation) roads. Studies done by McLean^(45,46), Lamm et al.⁽⁴⁷⁾, Glennon et al.⁽⁴⁸⁾, Islam and Seneviratne⁽⁴⁹⁾, and Krammes et al.⁽⁵⁰⁾ can all confirm this point.

Tarris et al. ⁽⁵¹⁾ compared different statistical approaches to modeling the geometric and driver effects on vehicle travel speeds along low-speed urban streets. They used three methods to conduct the study: linear regression on mean speed data through data aggregation, linear regression on individual speed data, and panel analysis which takes into account the correlation among speed data produced by the same individual at different locations. The study showed that predictions made by regression model based on individual speed data, though more widely spread, are more reliable. Besides identifying roadway curvature as the most influential factor in determining vehicle speeds, it also showed significant degrees of dependence of vehicle speeds on individual drivers.

Zaidel et al. ⁽⁵²⁾ showed the effectiveness of road humps in reducing vehicle speeds. He also pointed out obstacles to the wide implementation of the devices as: they are perceived as obstructions and degradations to the smooth paved surface of roadways; their earlier designs were ineffective and hazardous; and there is worry that they may become overused. The authors singled out public opinion as the major concern, and therefore obtaining public support is the key to successful implementations. The U.S. started to install speed humps fairly recently. Currently, they are being used in communities in Washington State and Maryland. ^(53,54)

Chicanes are also useful in reducing vehicle speeds. Sayer et al. ⁽⁵⁵⁾ studied 49 chicane schemes involving 142 chicanes. Both mean and 85th percentile speeds through the chicanes dropped by 12 mi/h, and the speeds between chicanes dropped by 7-8 mi/h. Traffic flows dropped 15 percent at single-lane chicanes and 7 percent at two-lane chicanes. Overall, there was a 54 percent decrease in crashes after the chicanes were installed.

Roundabouts are intersections at which traffic entering the area has to yield traffic already in the intersection and is forced into a circular pattern, and vehicles travel around the circle until finding their desired exit point. Schoon and van Minnen ⁽⁵⁶⁾ examined the injury data for 181 installations of roundabouts in the Netherlands. They found that fatal crashes decreased 76 percent and fatalities decreased 72 percent two years after the conversion to roundabouts, compared with five years before. The decline in pedestrian injury was more dramatic: there was a 73 percent drop in

pedestrian crashes and a 89 percent drop in pedestrian casualties. In the U.S., Mundell and Grigsby ⁽⁵⁷⁾ examined a program of installing roundabouts at intersections in residential neighborhoods in Seattle, Washington. They found that, for the 119 roundabouts constructed in 1991-1994, number of crashes dropped from 187 in the year before construction to 11 in the year after. Roundabouts constructed in Colorado, Maryland, and Florida achieved similar results. ^(58, 59, 60, 61)

Other approaches for reducing vehicle speeds and enhancing pedestrian safety include purposefully designed narrow streets with on-street parking ^(62,63), alleys for access to parking and as utility corridors, short curb corner radii at intersections ⁽⁶⁴⁾, limiting vehicle access to certain areas ⁽⁶⁵⁾; the use of rumble strips ^(66,67,68); and other traffic calming techniques. ^(69, 70, 71, 72, 73)

CHAPTER III

SPEED SETTING CRITERIA

Overview

In Task 1 of this project, the criteria and regulations used for setting speed limits in New Jersey and elsewhere are identified and documented. These criteria were obtained from a variety of sources, including New Jersey Legislation as well as previous speed zoning surveys conducted by the Institute of Transportation Engineers (ITE), and the Federal Highway Administration (FHWA). In Task 2 of the project, some additional information about speed zoning in other States and foreign countries were also obtained from web sources. These sources, in general, provide information about statutory speed limits. The review sought to identify speed zoning practices for local and residential roadways, as these are the types of roadways of interest in this study.

Speed Limit Definitions

Before describing various criteria used for setting speed limits, definitions of various types of speed limits and terminology used when discussing speed limits are provided.

Prima Facie Speed Limit

The prima facie speed limit is the speed limit above which drivers are presumed to be driving unlawfully. Approximately one-third of States use a prima facie speed limit with the remaining States using absolute speed limits, which are the alternative to the prima facie speed limit. ⁽⁷⁴⁾

Statutory Speed Limit

The statutory speed limit is the speed limit set forth by State statute and is specified for specific categories of streets and highways. State laws may or may not require that these limits be posted.

Posted Speed Limit

State laws usually allow either State or local authorities to set highway speed limits above or below the statutory speed limits. The determination of this speed is generally based on an engineering study to determine the safe speed limit for that part of the highway. Posted speed limits are conveyed to motorist using a regulatory sign.

Absolute Speed Limit

Absolute speed limits specify a numerical value, above which a driver is in violation of the law. Exceeding this speed limit results in violation regardless of the condition or the roadway or hazard involved.

New Jersey Speed Limit Criteria

Speed limits in New Jersey are based on the *New Jersey Permanent Statutes* Title 39 Motor Vehicles and Traffic Regulations. Title 39:4-98 states that except where a lower speed is specified, the prima facie rate of speed by which a vehicle can be driven should not exceed:

- a) Twenty-five miles per hour, when passing through a school zone during recess, when the presence of children is clearly visible from the roadway, or while children are going to or leaving school, during opening or closing hours.
- b) 1. Twenty-five miles per hour in any business or residential district.
2. Thirty-five miles per hour in any suburban business or residential district.
- c) Fifty miles per hour in all other locations, except as otherwise provided in the "Sixty-Five MI/H Speed Limit Implementation Act".

These speeds are subject to change when it is determined, based on an engineering and traffic investigation, that these speeds are greater or less than what is reasonable or safe under the conditions found at the location under question. The statutes state that speed limits must be approved by the Commissioner of Transportation after an investigation. Speed limits can vary from the Title 39 legislation if it appears to be in the interest of safety and expedition of traffic on public highways, and if it conforms to current standards prescribed by the *Manual of Uniform Traffic Control Devices (MUTCD)*.⁽⁷⁵⁾

The MUTCD guidance on speed limits can be found in Section 2B.11 of the MUTCD. These guidelines surround the placement of the regulatory speed limit sign R2-1. The MUTCD calls for speeds to be posted at the 85th-percentile speed of free flowing traffic, rounded up to the nearest 5 mi/h (10 km/h) increment. Other factors that could also be considered when establishing the speed limit include: road characteristics; shoulder condition; grade; alignment; sight distance; the pace speed; roadside development and environment; parking practices and pedestrian activity; and reported crash experience for at least a 12-month period.

The 85th-percentile speed, although being only one element of this procedure, is relied on by many agencies, including the New Jersey Department of Transportation (NJDOT), as a representative speed for use in establishing speed limits. The 85th percentile speed is defined as the speed not exceeded by 85 percent of drivers. Using the 85th-percentile speed as the primary factor in setting speed limits, however, assumes that motorists can decide the appropriate speed at which to travel and also assumes that the 85th percentile speed is a reasonable safe speed for the roadway. ^(76,77) Studies have shown that in some cases, the 85th percentile speed can exceed the design speed of the roadway. However, despite these limitations of the use of the 85th percentile speed, there is a general consensus among researchers and agencies implementing speed limits that this approach provides reasonable speed limits reflective of roadway conditions.

In New Jersey, the engineering study performed to determine the most appropriate speed limit includes the following items:

1. Radar checks, if possible, for 100 vehicles in each direction for each particular zone along with a sketch showing the location of the unmarked car and direction of the radar beam.
2. Data showing the 85th percentile speed of the above checks.
3. Crash data for the latest available year.
4. A description of the roadway characteristics including width, curbing, sidewalks, shoulders, adjacent land use, parking restrictions, school locations and areas of pedestrian activity.

5. Ball banking data, if possible, for all curves along the roadway to determine the advisory speed to be utilized with warning signs.
6. Certified Ordinance (County roadway) (Municipal roadway) with the speed limit listed in zones (beginning and ending limits within each zone) and with School Zone speed limits included if applicable. [Promulgated pursuant to N.J.S.A. 39:4-8(b)].
7. A statement of the reasons the above data was unable to be submitted.
8. A statement of the reasons for the engineer's decision.

Appendix I provides a sample Reference Sheet used to record the field investigation portion of an engineering study. Also included in the Appendix is a sample Radar Speed Check sheet used to record results from the speed test.

Special Report 254

In response to the repeal of the National Maximum Speed Limit (NMSL) of 55 mi/h in 1995, which then allowed States with the responsibility of setting appropriate speed limits on major highways, the Transportation Research Board reviewed existing methods of setting and enforcing speed limits. The results of that review, including guidance on appropriate speed limits and related enforcement policies, were documented in *Special Report 254: Managing Speed – Review of Current Practice for Setting and Enforcing Speed Limits.*⁽⁷⁸⁾ The study involved:

- Reviewing existing research on: various methods of setting speed limits; the role of speed in safety; the role of road design and function in setting and enforcing speed limits; the effectiveness of speed limits; and social benefits and costs of speed limits.
- Considering the effects of new and emerging technologies for speed management and speed enforcement.
- Providing judgment concerning appropriate changes to current speed setting practice.

Speed limits are legislated by State statutes based on the functional classification of the roadway and by the geographic location of the roadway. Geographic locations of roadways include urban or rural locations. Where statutory limits do not fit because of

roadway or traffic conditions, speed zones are established with varying maximum speed limits used on these roadways. Speed limits are intended to regulate driving speeds so as to achieve an appropriate balance between travel time and risk for a road class or specific highway section. More importantly, speed limits attempt to increase roadway safety by setting speed limits that avoid crashes and mitigate crash outcomes. Speeds are directly related to injury severity through the change in velocity (ΔV) that occurs in the crash. Speed is also related to the probability of being in a crash.

Speed limits are regulated for three reasons: (1) drivers impose significant risks on others; (2) drivers are sometimes incapable of correctly assessing safe and appropriate speeds; and (3) drivers sometimes underestimate the effects of speed on crash probability and severity. Although the relationship between speed limits and safety is recognized, this relationship is complex with a variety of factors. Figure 1 attempts to demonstrate the relationship between speed limits, crash probability and severity. Based on this complex relationship, *Special Report 254* identifies factors affecting determination of appropriate speed limits as following into two categories: (1) road function and use; and (2) vehicle and driver characteristics. Roadways are designed based on a design speed. This design speed influences critical design features such as superelevation of horizontal curves and length of vertical curves. Although the roadway is designed to this design speed, the operating speed of vehicles on the roadway may exceed the design speed. The American Association of State Highway Officials

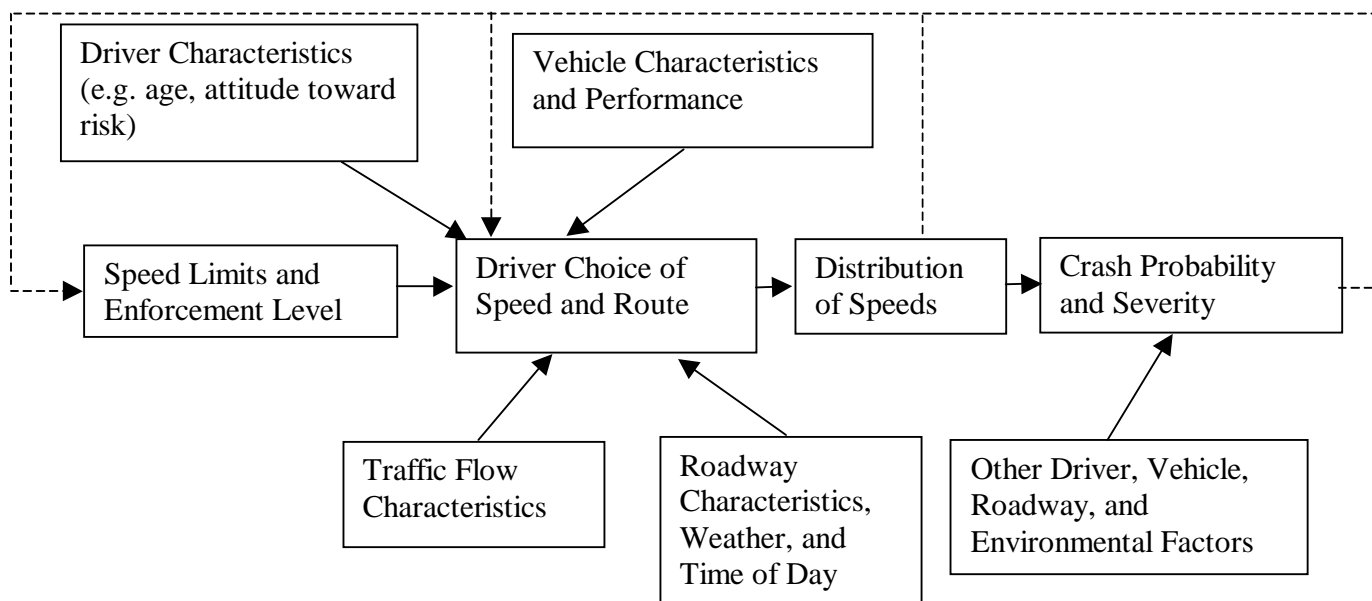


Figure 1. Relationship Between Safety and Speed Limits (Source, TRB 1998).

recommends that the design speed of local streets serving residential areas be between 20 and 30 mi/h. The design speed of local roadways is a function of several factors including development and street grid patterns and number of intersections.

The use of the roadways also influences the appropriate speed limit for a roadway. On rural Interstates and freeways, where mobility is the primary function, higher speed limits are used. Where access is the primary function of the roadway, such as the case for residential local roadways, lower speed limits are used.

Special Report 254 identified an approach for setting speed limits. For many States, speed limits are legislated by roadway classification. Where these statutory speed limits are not considered appropriate, speed zones are established with a lower or higher speed than the statutory speed limit. Legislative speed limits should be made with input from traffic engineers, law enforcement officials, judges, public health officials, and the general public. These speed limits should be reviewed periodically and revised when necessary. Within speed zones, speed limits should be based on an engineering

study. Speed limits within speed zones should be reviewed periodically to determine whether conditions have changed sufficiently to warrant an adjustment in the speed.

ITE Speed Zoning Survey

The Institute of Transportation Engineer's (ITE) Engineering Council Technical committee TENC-97-12 performed a survey of all 50 States to identify the speed zoning practices used by agencies across the United States. The survey focused on roadways under State jurisdiction. The committee sought not only to determine speed zoning guidelines used, but also to determine the type of adjustments made to speed zones, the individual variations to the guidelines and the differences between the speed zoning guidelines and speed zoning implementation. ⁽⁷⁹⁾

Forty States responded providing information from the Uniform Vehicle Code, State Law, written guidelines and/or other related documents used by States in setting speed zones. A total of 124 surveys were returned with 58 percent of the surveys from transportation officials at the city level, 24 percent at the county level and 17 percent at the State level.

Deviations from State Guidelines

The survey found that almost two-thirds of respondents followed their State practices for establishing speed zones and did not differ from these practices. When asked under what conditions are deviations from the State guidelines allowed, 33 percent of respondents indicated that "Politics" warranted deviation from the State guidelines. "Crashes" and "Residential Areas" were the next highest conditions under which agencies deviated from State guidelines when setting speed limits. If there are deviations from State guidelines, in 88 percent of the time the posted speed limits are lower than recommended from the State guidelines.

Factors Considered for Setting Speed Limits

The survey asked respondents to rate how often 18 factors for recommending a speed limit are considered. Figure 2 indicates the response for this question. As the figure demonstrates, the 85th percentile speeds is the predominant factor used in setting speed

limits. This factor was used by 99 percent of respondents. "Roadway Geometry" and "Crash Experience" were also considered as significant factors in the determination of the speed limit. Fifty to 75 percent of respondents indicated the following factors to be of importance in determining the speed limit of a roadway: pedestrian activity; roadway functional classification; traffic volumes; pavement width; lane width; unexpected conditions; design speed; public input; presence of parking; and presence of shoulders. The mean speed, 10 mi/h pace speed, presence of curb and gutter and average test run speed were not considered as often as being important in determining the speed limit of the roadway.

Other factors identified by respondents as being important in determining the speed limit included: access density; school zones; political conditions; blanket speed limits set by States; input from law enforcement agencies; sight distance; length of speed zone; existing speed limit and percent of vehicles greater than speed limit; 50th percentile speed and mode; and typical vehicle type.

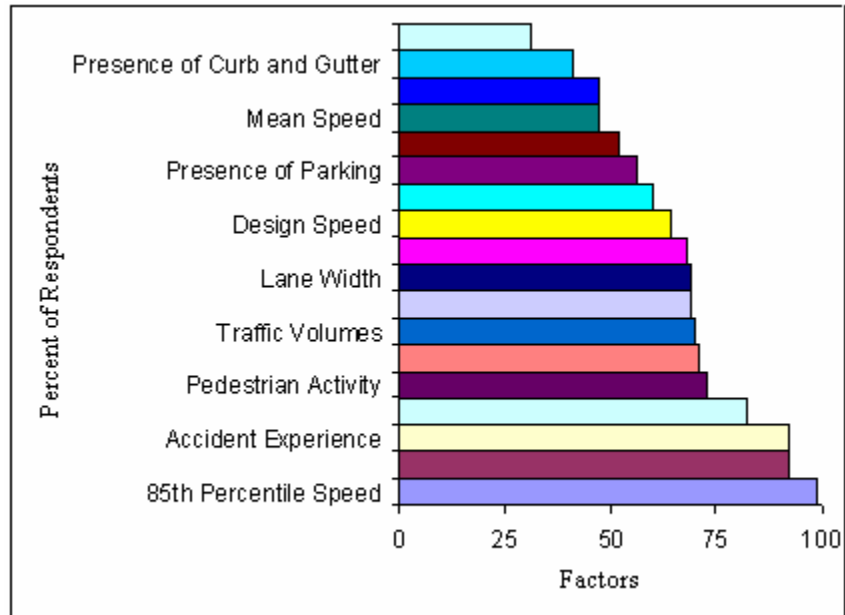


Figure 2. Factors "Always or Usually Considered" when Setting Speed Limits.

Engineering Study

The survey asked for respondents to summarize the procedures followed in the engineering study used for determining posted speed limits. Thirty-four guidelines were received with speed data collection, roadway geometry, crash history and field investigation, the four elements used the most in engineering studies. When collecting speed data, most agencies sought to gather a minimum of 100 vehicles per direction at each location on high-volume streets. At low volume roadways, the number of speeds obtained was lowered and a time limit of about 2 hours of data were gathered. When collecting data on the geometry of the roadway, other types of data were also collected, including roadside development, sight distance, especially at horizontal and vertical curves, design speed, and the functional classification of the roadway. Crash data were collected and crash rates calculated and compared to similar roadways with the same functional classification. Some agencies also included the use of test speed runs in their engineering study. This was used to validate the recommended speed limit.

FHWA Study Tour

A scanning tour was conducted with a team from the United States to the Netherlands, Germany, Sweden, and Australia in 1995. ⁽⁸⁰⁾ The tour was intended to gain information about the practices and policies concerning speed management and enforcement in other countries.

The Netherlands

Speed limits on roadways in the Netherlands are established by national law. For light vehicles, speed limits on motorways are set at 120 km/h (75 mi/h). Trucks have a maximum speed limit of 80 km/h (50 mi/h), however, speed limiters are mandatory on trucks over 12 metric tons, with a maximum speed of 90 km/h (56 mi/h). For lower design motorways or where there is heavy traffic flows, the speed limit is 100 km/h (63 mi/h). Speed limits also differ by the geographic location of the roadway. In rural locations, the general speed limit is 80 km/h (50 mi/h), and in urban locations, the speed limit is 50 km/h (31 mi/h). For urban areas, speed limits can be raised to 70 km/h (44 mi/h) for multilane roadways. When the roadway is within a residential area, the speed limit is 30 km/h (19 mi/h), although in general, speed limits are usually not posted on the roadway. Deviations from these national speed limits can be permitted, however, the speeds are generally lowered and require that crash statistics and other data provide compelling evidence of the need to lower the speed limit.

Research was performed on 80 km/h (50 mi/h) roadways which had excessive crash experiences. The study found that motorists did not obey the speed limit because they did not recognize the roadway as an 80 km/h (50 mi/h) highway. To encourage compliance of the speed limits, a multidisciplinary team comprised of Federal, Regional, Provincial transportation officials, as well as the regional police, a traffic psychologist, a graphic design consultant, a driver comfort physiologist, an opinion researcher, and private safety organizations began a study of the problem. The approach taken was to create physical and visual measures that would encourage drivers to obey the 80 km/h (50 mi/h) limit. The measures included: limiting the effective width of the driving lane; replacing the roadside markings with tactile strips; narrowing the driving lane by

widening the centerline markings; and using different roadside marking posts. The study found that speeds were reduced by 5 to 10 km/h (3-6 mi/h) using these measures.

Germany

Speed management in Germany is not as high a priority as in other European countries and programs geared to managing speeds are not conducted at the federal level, but at local levels. This approach is related to public perception that drivers should maintain vehicle speeds that are appropriate for conditions and speeds should not be determined by the government. Rather than set maximum speed limits, transportation officials believe that road users should be alerted to dangerous locations on the roadway. The autobahns in Germany represent only 2 percent of the roadway network, however, these roadways carry about 30 percent of the vehicle travel. General speed limits are not used on these roadways, however, posted speed limits of 80, 100, and 120 km/h (50, 63, and 75 mi/h) are used on about one third of the autobahn network.

Speed limits, in general, are established by highway code. Some of the factors considered in determining speed limits include roadside development and the presence of commercial vehicles. In rural roadways, speed limits are set at 100 km/h (63 mi/h) on German roadways. In built-up areas, the speed limit is 50 km/h (31 mi/h). Residential roadways are set at 30 km/h (19 mi/h) or at 10 km/h (6 mi/h) in historical areas.

Sweden

Speed limits have been raised and lowered many times in Sweden. From 1971 to 1975, roadway and traffic characteristics were used to set speed limits on rural two-lane roads. Since 1975, the primary factor used in setting speed limits has been the crash rate of the roadway. Speed limits in Sweden are generally set at 50 km/h (31 mi/h) or 70 km/h (44 mi/h) where there is good separation between vehicles, pedestrians and bicycles. In 1989, motorway speed limits were reduced from 110 km/h (69 mi/h) to 90 km/h (56 mi/h). Local speed limits in Sweden are set by the local governments. Differentiated speed limits are also used where speed limits vary by vehicle type. On some roadways, double and all triple trailers are limited to 40 km/h (25 mi/h), while the maximum limit for buses is 90 km/h (56 mi/h).

Australia

The review of speed management in Australia is focused on two States: New South Wales and Victoria. The speed management program consists of strategies related to engineering, enforcement, and educational countermeasures. Some of the key elements include:

- Collect speed, crash, and community attitude information to define the problem.
- Communicate to and educate the public.
- Impose credible speed limits and speed zones.
- Insure that the road environment is conducive to speeds that are safe.
- Use enforcement as a mechanism for enhancing deterrence and dealing with offenders.
- Promote legislation and regulations to control the problem and establish penalties that are acceptable to the community.
- Develop strategies to reduce speed-related heavy vehicle crashes.
- Explore and identify technology to improve speed management.
- Continue to monitor and evaluate the effectiveness of the program.

One of the strategies used in setting speed limits is an expert system called "NLIMITS". The expert system is run on a computer providing advisory speeds based on information about traffic, environment and safety factors. The objective of the program is to provide uniformity, or the same speed limit for similar conditions. In most cases, the recommended speed from the expert system is within 5 km/h (3 mi/h) of the 85th percentile speed.

State Speed Laws

The U.S. Department of Transportation, National Highway Traffic Safety Administration compiles and summarizes State speed laws.⁽⁸¹⁾ The summary includes information about the basic speed rule, statutory speed limit and posted speed limits used by each State. No information is provided on local laws. Appendix II summarizes the State speed laws for 51 States, including Puerto Rico and the Virgin Islands reported as of January, 2001.

Basic Speed Rule

Each State specifies a basic speed rule that requires vehicle operators to drive at a speed that is reasonable and prudent. In some cases, the prudent speed is based on conditions such as weather, visibility, traffic and roadway width.

Statutory Speed Limit

The statutory speed limits used by the States vary depending on the roadway classification and adjacent roadway development. Table 1 summarizes the States using statutory speed limits between 20 and 35 mi/h. As shown in the table, most of the States setting speeds on residential roadways set these speeds at 25 mi/h. The Table also shows the statutory speed limits for roadways in business areas and urban districts. Twenty-five mi/h is generally the speed limit used by many States for roadways in business areas. Not many States specify speed limits within urban districts. When speed limits are set within these districts, however, the speed limit is generally set at 30 mi/h.

Posted Speed Limit

In almost all States, the statutory speed limit may be increased or decreased based on an engineering and traffic study. In some States, the posted speed limit can exceed or go below a specific speed limit. The details of the engineering study and traffic investigation are not provided, nor is it stated the conditions that signal the need for these special studies.

Table 1. State Statutory Speed Limits.

20 mi/h	25 mi/h	30 mi/h	35 mi/h
Residential			
	Arkansas Arizona California Maine Montana Nebraska New Jersey (non-Suburban) North Dakota Oregon (Non-City) Rhode Island Virginia West Virginia	Georgia Maryland (Undivided) Montana (Rural) Florida	California (moderate density) Idaho Maryland (Divided) New Hampshire (Rural) New Mexico Wisconsin
Business			
Nebraska Oregon Arkansas Idaho	New Jersey (Non-Suburban) North Dakota Rhode Island Arizona California Colorado Delaware Maine Michigan West Virginia Virginia	New Hampshire Florida Maryland	Idaho Kentucky New Jersey New Mexico Wisconsin

Urban			
	Montana	Arizona Montana New Hampshire Georgia Illinois Indiana Kansas	Idaho New Jersey (Suburb)

Chapter IV

LOW SPEED ROADWAY ATTRIBUTES

Overview

The New Jersey Department of Transportation (NJDOT) uses a minimum speed limit of 25 mi/h unless a lower speed limit is found to be more appropriate for roadway conditions. To obtain information on the characteristics of roadways posted with the less than 25-mi/h speed limit, the research team performed several tasks. These tasks included:

- Contacting NJDOT's Traffic Engineering Division.
- Reviewing locations identified in the State crash database as having a posted speed limit of 25 mi/h or less.
- Reviewing other State speed limit guidelines.
- Reviewed literature on 20-mi/h speed zones that have been implemented in Great Britain.

To further understand whether the 25-mi/h speed limit is appropriate for shared-use roadways, crash data were evaluated to determine the nature of crashes involving pedestrians and bicycles on New Jersey roadways. The following describes the findings of these tasks.

New Jersey State Speed Limit Guidelines

The *New Jersey Permanent Statutes* Title 39 Motor Vehicles and Traffic Regulations requires an engineering and traffic investigation to be performed to set speed limits greater than or less than the statutory speed limits. The results of the engineering and traffic investigation are reviewed by NJDOT's Traffic Engineering Division who is then aware of posted speed limits across the State. To identify roadways in the State that are posted at speed limits less than 25 mi/h, NJDOT's Traffic Engineering Division was contacted. The response from this Division was that few if any roadways within the State are posted at speed limits less than 25 mi/h except for school zones or alleys.

In an attempt to verify this conclusion, speed limits for State roadways were reviewed using the "State Road Speed Limits" website found on the NJDOT web pages.

The review confirmed that on State routes, no speed limit was set at less than 25 mi/h unless within a school zone. The review did identify State routes with a posted speed

Table 2. State Routes Posted at 25 MI/H.

Route	City/County	Location
N.J. 20	Paterson, Passaic County	Between 24th Street and 25th Street (mileposts 13.00 to 12.94)
N.J. 27	Princeton, Mercer County	between Route U.S. 206 (Bayard Lane) and Linden Lane, Princeton Borough, Mercer County (approximate mileposts 0.00 to 0.81)
N.J. 28	Westfield	between Downer Street and Elmer Avenue (approximate mileposts 19.45 to 20.12)
N.J. 28	Cranford Township	between Orchard Street and 395 feet east of Forrest Avenue (approximate mileposts 21.97 to 22.62)
N.J. 34	Seaside Heights	Hamilton Avenue
N.J. 45	Salem, Salem County:	Between Broadway and Grant Street (approximate mileposts 0.00 to 0.16)
Route 48	Penns Grove Borough	from Route U.S. 130 (Main Street) to South Torton Street (approximate mileposts 0.00 to 0.14)
N.J. 49	Salem	Between Oak Street and Ninth Street (mileposts 8.87 to 9.3)
N.J. 49	Millville	Between Brandriff Avenue and Seventh Street (approximate mileposts 36.02 to 36.78)
Route 54	Hammonton, Atlantic County:	between Madison Avenue and Tilton Street (approximate mileposts 10.318 to 10.988); thence

Table 2. State Routes Posted at 25 MI/H.

Route	City/County	Location
Route N.J. 57	Washington Borough:	Between South Wandling Avenue and Route N.,J. 31 (approximate mileposts 10.52 to 11.01)
Route 67	Fort Lee, Bergen County	within the entire corporate limits of Fort Lee Borough (approximate mileposts 0.0 to 1.86)
Route 71	(6) Belmar Borough:	from Route N.J. 71-35 to "F" Street (approximate mileposts 5.41 to 5.56) from 8th Avenue to 5th Avenue (approximate mileposts 5.56 to 5.78)
Route 71-35 Ramps (Ashley Avenue)	Brielle Borough, Monmouth County	between Higgins Avenue and Evergreen Avenue. (Evergreen Avenue) from Ashley Avenue to northerly terminus of New Jersey Department of Transportation jurisdiction south of River View Drive.
Route 88	Lakewood Township	between Route U.S. 9 and Railroad Avenue: (mileposts 0.0 to 0.2)
N.J. 94	Newton	between Liberty Street and High Street-Park Place (approximate mileposts 22.22 to 22.42) (Route U.S. 206 intervenes here) between High Street-Park Place and Park Place-High Street (approximate mileposts 22.42 to 22.61)
Route 161	Clifton, Passaic County	From Allwood Road to Richland Court (approximate mileposts 0.00 to 0.20)

Table 2. State Routes Posted at 25 MI/H.

Route	City/County	Location
Route 166	Dover	between the South Toms River Borough Corporate Line - Dover Township Corporate Line and Walton Street (approximate mileposts 1.08 to 1.48)
Route 172	New Brunswick, Middlesex	Between Commercial Avenue and Route N.J. 18 (mileposts 0.00 to 0.81)
Route 184		Along Pfeiffer Boulevard for one-way direction eastbound, from Route 35 to Chester Street; and along Lawrence Street-Service Road, for one-way direction westbound from Francis Street to Route 35
U.S. 206	Trenton and Lawrence Township	Between Spruce Street and the traffic circle at Route U.S. 1 Business (approximate mileposts 44.50 to 45.01)
U.S. 206	Princeton Borough	between Route N.J. 27 (Nassau Street) and Cleveland Lane (approximate mileposts 53.94 to 54.28)
U.S. 206	Newton Town:	between Woodside Avenue and 275 feet north of Clinton Street (approximate mileposts 108.30 to 109.32)
Route 439		In the City of Elizabeth to Route 28

limit of 25 mi/h. These roadways are identified in Table 2. Future work will be performed to identify the roadway attributes associated with these roadways.

Review of Crash Database

Another approach taken to identify roadways within the State posted at a speed limit of less than 25 was through the use of the NJDOT's crash database. The State's crash

database includes all motor vehicle crashes including fatal, injury or property damage for all counties within the State. The database includes information on the crash location, including the posted speed limit of this roadway. A preliminary search of two counties identified over 100 roadways where the posted speed limit was listed as less than 25 mi/h. These speed limits varied from 5 mi/h to 20 mi/h.

To verify the speed limits, the NJDOT's Straight Line Diagrams were reviewed. These diagrams provide information about many roadways in the State and include information about the average annual daily traffic (AADT), number of lanes, pavement width and the posted speed of the roadway. Locations such as parking lots, driveways or highway ramps were eliminated for review. For the remaining roadways, the straightline diagrams did not confirm posted speed limits of less than 25 mi/h. Although the review was completed for only two counties, it was concluded that the posted speed limits given in the crash database were not reliable when the speed limits are less than 25 mi/h.

State Speed Laws for Roadways Less than 25 MI/H

State speed laws for all States in the U.S. were reviewed to identify conditions where the statutory speed laws are less than 25. Appendix III summarizes the findings of this review. Fifteen miles per hour speed limits were found to be used under the following conditions:

- Alley (Alaska, California, District of Columbia, Illinois, Indiana, Ohio, Oregon, Texas, Wisconsin).
- School Zone/Crossing (Arizona, Maine, New Mexico, Pennsylvania, South Dakota, West Virginia, Wisconsin).
- Streets adjacent to school buildings (D.C.).
- Playgrounds (D.C., Wisconsin).
- Off-Street Parking facilities (Kentucky).
- Beach (Texas).
- Safety zone (Wisconsin).
- State park camps (Washington).

Twenty miles per hour speed limits were found to be used under the following conditions:

- Business district (Alaska, Iowa, Nebraska).
- Narrow, winding mountain highways or blind curves (Colorado).
- School Zone/Crossing (Delaware, North Dakota, Oregon, Rhode Island, Utah, Ohio, Wyoming).
- Within town limits (Virgin Islands).

Ten miles per hour speed limits were found to be used under the following conditions:

- Alley (Montana).
- Manufactured home parks (Montana (10-30 mi/h)).
- Recreational camping areas (Montana).
- Within town limits (Virgin Islands (Trucks/buses)).

Overall, except for business districts in Alaska, Iowa and Nebraska and safety zones in Wisconsin, statutory speed limits less than 25 mi/h are reserved for special purpose roadways.

United Kingdom Slower Speed Initiative

In 1998, a Slower Speed Initiative was launched by pedestrian, bicycle and environmental associates in the United Kingdom. The objective of the initiative was to call on the government to institute a 20 mi/h (32 km/h) speed limit in built-up areas to be enforced using traffic cameras, traffic calming, and better enforcement. The initiative is based on the fact that Britain has one of the worst pedestrian children casualty rates in Europe.

Twenty mile per hour speed zones were first introduced in the United Kingdom in January 1991. By 1996, there were over 250 of these speed zones in England, Wales and Scotland. The speed zones are implemented using signing only or in combination with traffic calming measures. The overall effects of introducing these speed zones has been a reduction in average speeds by 9 mi/h, 60 percent reduction in annual total crashes, and a 67 percent reduction in crashes involving children. There was also a 27 percent reduction in traffic flows in these zones, traffic flow on surrounding roadways, however, increased by 12 percent.

In Scotland, 20 mi/h speed zones were introduced at 75 locations where the previous speed limits were at 30 mi/h. Using signing only to indicate the speed zones, surveys showed that the speed zones resulted in a decrease in average speed at seven sites, speeds increased at one location, and speeds remained the same at five locations.

Pedestrian and Bicycle Crash Analysis

Crash data from 1997 to 2001 were collected from the National Highway Traffic Safety Administration's (NHTSA's) Fatality Analysis Reporting System (FARS) database and from 1997 to 2000 for the New Jersey Department of Transportation (NJDOT) crash database. The FARS database contains data on all vehicle crashes in the United States that occur on a public roadway and involve a fatality in the crash. The database is searchable, allowing queries to be performed to obtain specific types of fatal crashes by State or for all States. NJDOT's crash database includes all crashes including fatal, injury or property damage for all counties and public roadways within the State.

In the FARS database, pedestrian and bicycle crashes were identified as crashes where the person type is stated as "pedestrian" or "bicyclist". Table 3 shows the number of fatal pedestrian and bicycle crashes for 1997 to 2001 for New Jersey. On average,

Table 3. Fatal Pedestrian/Bicyclist Crashes in NJ for 1997 – 2001.

Year	Pedestrians	Bicyclists	Total
1997	146	23	169
1998	149	18	167
1999	168	25	193
2000	165	14	179
2001	133	26	159

Table 4. Percent of Fatal Pedestrian and Bicycle Crashes by Light Condition.

Light Condition	Pedestrian	Bicycles	Total
Daylight	35.9%	45.1%	35.8%
Dark	11.6%	11.5%	11.3%
Dark but Lighted	49.9%	37.2%	46.7%
Dawn	2.6%	1.8%	2.4%
Dusk	0.0%	4.4%	3.8%

there were about 150 fatal crashes per year involving pedestrians and about 21 fatal crashes per year involving bicycles within the time period analyzed.

Light Conditions

As shown in Table 4, a majority of fatal pedestrian and bicycle crashes occur during dark conditions. Thirty-six percent of fatal pedestrian and bicycle crashes occurred during daylight conditions. The remaining 64 percent occurred during “Dark”, “Dark but Lighted”, “Dawn” and “Dusk” light conditions with the largest percentage occurring during “Dark but Lighted” conditions which represent 47 percent of fatal pedestrian and bicycle crashes. A larger percentage of pedestrian crashes occurred during dark conditions when compared to bicycle crashes with fifty percent of pedestrian crashes occurring in “Dark by Lighted” conditions compared to 37 percent of bicycle crashes. Correspondingly, a higher percentage of bicycle crashes occurred during daylight conditions. Forty-five percent of bicycle crashes occurred during daylight conditions compared to 36 percent of pedestrian crashes which occurred in daylight conditions. Although for both fatal pedestrian and bicycle crashes a higher proportion of these crashes occur under dark conditions, dark conditions appear to result in a higher percentage of pedestrian crashes than bicycle crash

Table 5. Percent of Fatal Pedestrian and Bicycle Crashes
by Roadway Functional Classification.

Roadway Functional Classification	Pedestrian	Bicycles	Total
Rural Principal Arterial-Interstate	0.4%	0.0%	0.3%
Rural Principal Arterial-Other	3.5%	1.7%	3.3%
Rural Minor Arterial	1.6%	1.7%	1.6%
Rural Major Collector	1.4%	5.2%	1.9%
Rural Minor Collector	0.4%	0.0%	0.3%
Rural Local Road or Street	0.8%	2.6%	1.0%
Urban Principal Arterial-Interstate	5.6%	3.5%	5.3%
Urban Principal Arterial-Other Freeways	7.4%	0.9%	6.6%
Urban Other Principal Arterial	34.0%	35.7%	34.3%
Urban Minor Arterial	22.8%	20.9%	22.4%
Urban Collector	6.6%	7.0%	6.7%
Urban Local Road or Street	15.4%	20.9%	16.2%
Unknown Urban	0.1%	0.0%	0.1%

Table 6. Percent of Fatal Pedestrian and Bicycle Crashes by No. of Travel Lanes.

No. of Travel Lanes	Pedestrian	Bicycles	Total
1	0.7%	0.0%	0.6%
2	72.0%	82.3%	73.3%
3	14.8%	8.8%	14.1%
4	10.0%	8.0%	9.7%
5	0.9%	0.9%	0.9%
6	0.7%	0.0%	0.6%
7	0.9%	0.0%	0.8%

Roadway Characteristics

The majority of fatal pedestrian and bicycle crashes occur on urban roadways. Table 5 shows the functional classification of roadways on which fatal pedestrian and bicycle crashes occurred. Over 90 percent of these crashes occurred on roadways with an urban Classification, with the largest percentage occurring on “Urban Other Principal Arterial” which represents 34 percent of these crashes.

Table 7. Percent of Fatal Pedestrian and Bicycle Crashes by Speed Limit.

Speed Limit (mi/h)	Pedestrian	Bicycles	Total
25	35.1%	31.9%	34.6%
30	2.8%	2.7%	2.8%
35	11.6%	14.2%	11.8%
40	10.9%	9.7%	10.8%
45	8.3%	12.4%	8.8%
50	15.6%	23.9%	16.7%
55	13.6%	5.3%	12.5%
65	2.1%	0.0%	1.9%

The majority of fatal pedestrian and bicycle crashes occurred on dry, level roadways with two lanes. However, although 82 percent of fatal bicycle crashes occurred on roadways with two travel lanes, a lower percentage of 72 percent of fatal pedestrian crashes occurred on these roadways. As shown in Table 6, a higher percentage of fatal pedestrian crashes occur on roadways with three and four travel lanes compared to fatal bicycle crashes.

Fatal pedestrian and bicycle crashes occurred on roadways with a variety of speed limits. As shown in Table 7, the highest percent of these crashes occurred on roadways with a speed limit of 25 mi/h. The next highest percent of fatal pedestrian and bicycle

crashes occurred on roadways with a speed limit of 50 mi/h. Seventeen percent of fatal pedestrian and bicycle crashes occurred on these roadways.

Crash Locations

The top 20 roadways with the highest fatal pedestrian and bicycle crash frequency in New Jersey are shown in Table 8. The locations include three Interstate roadways, six State routes, county roadways and 8 US Routes. US 9 and the Garden State Parkway (GSP) have the two highest fatal pedestrian and bicycle crash frequencies. The fatal pedestrian and bicycle crashes on these roadways are distributed throughout the length of the roadway. For US 9, the primary functional classification of the roadway where fatal pedestrian and bicycle crashes occur is "Urban Other Principal Arterial". For about half of the crashes, the posted speed limit of US 9 was 50 or 55 mi/h. Only 5 (17 percent) of the 22 fatal pedestrian/bicycle crashes on US 9 occurred on segments where the posted speed limit was 25 mi/h. Also provided are spot locations on a roadway with a high number of pedestrian and bicycle crashes in Table 9 and top locations with a posted speed limit of between 25 and 35 mi/h in Table 10.

Table 8. Roadways with Highest Fatal Pedestrian/ Bicycle Crashes.

Route	<u>No. of Fatal Crashes</u>			<u>Speed Limit (mi/h)</u>		<u>No. of Lanes</u>	
	Total	Pedestrian	Bicycle	Min	Max	Min	Max
US 9	31	27	4	25	55	2	4
GSP 444	22	22	0	55	65	2	5
US 30	20	13	7	35	50	2	4
US 1	19	18	1	40	55	2	4
RT 35	15	14	1	25	50	2	4
CR 501	14	14	0	25	35	2	6
RT 36	14	12	1	45	55	2	4
US 130	14	10	4	45	55	2	5
I 95	13	13	0	45	65	2	6
RT 17	13	13	0	25	55	2	3
US 46	12	11	2	30	50	2	4
US 206	11	10	1	25	50	2	3
I 78	10	10	0	55	65	2	7
I 80	10	9	1	55	65	2	7
CR 601	9	8	1	25	40	2	2
RT 18	9	8	1	35	55	2	4
RT 27	9	8	1	25	50	2	6
RT 33	9	9	1	0	55	0	4
US 322	9	8	1	45	55	2	4
US 22	8	8	0	25	55	2	3

Table 9. Locations with Highest Fatal Pedestrian/Bicycle Crashes.

Route	Roadway Name	City	County	No. of Fatal Crashes
-	12th Ave	Newark	Essex	4
CR 501	JFK Boulevard	North Bergen	Hudson	5
CR 501	Hudson Boulevard	Jersey City	Hudson	7
CR 601	Chancellor Avenue	Newark	Essex	4
-	Frelinghuysen Ave	Newark	Essex	5
RT 15	-	Wharton	Morris	5
RT 18	Memorial Highway	East Brunswick	Middlesex	6
RT 35	-	Ocean Township	Monmouth	4
RT 36	-	Hazlet	Monmouth	6
RT 440	-	Jersey City	Hudson	5
US 1	Tonnelle Avenue	North Bergen	Hudson	4
US 1	Herbert Highway	North Brunswick	Middlesex	4
US 1	-	Edison	Middlesex	5
US 30	Whitehouse Pike	Egg Harbor City	Atlantic	5
US 9	-	Marlboro	Monmouth	4
US 9	-	Old Bridge	Middlesex	4
US 9	Memorial Highway	Howell	Monmouth	5
US 9	River Road	Lakewood	Ocean	5

Table 10. High Crash Locations with 25-35 mi/h Speed Limits.

Roadway	City	County	Speed Limit	No. of Lanes	No. of Fatal Crashes
CR 501	Jersey City	Hudson	25	2	5
US 30	Egg Harbor City	Atlantic	25	4	4
14 th Ave	Newark	Essex	25	2	3
1 st St	Elizabeth	Union	25	2	3
CR 501	North Bergen	Hudson	25	2	3
CR 705	Winslow	Camden	25	2	3
RT 27	Edison	Middlesex	25	2	1
	Elizabeth	Union	25	6	1
	Linden	Union	25	2	1
	Newark	Essex	25	2	1
	North Brunswick	Middlesex	25	2	1
	-	Middlesex	25	2	1
RT 36	Hazlet	Monmouth	25	2	1
	Hazlet	Monmouth	25	2	1
	Keyport	Monmouth	30	2	1
	Middletown	Monmouth	25	2	1
	Sea Bright	Monmouth	25	2	1
	Union Beach	Monmouth	25	2	1
	RT 28	Plainfield	Union	30	2
Cranford		Union	35	2	1
Plainfield		Union	35	2	1
Roselle Park		Union	35	2	1
Somerville		Somerset	30	2	1
RT 33	Freehold	Monmouth	25	1	1
	East Windsor	Mercer	25	2	1

Table 10. High Crash Locations with 25-35 mi/h Speed Limits.

Roadway	City	County	Speed Limit	No. of Lanes	No. of Fatal Crashes
	Freehold	Monmouth	25	2	1
	Trenton	Mercer	-	-	1
	-	Mercer	25	2	1
RT 35	Perth Amboy	Middlesex	25	2	1
	Eatontown	Monmouth	25	2	1
	Ocean Township	Monmouth	25	2	1
	Perth Amboy	Middlesex	25	2	1
	Woodbridge	Middlesex	35	2	1
RT 17	Lodi	Bergen	35	2	1
	Lyndhurst	Bergen	25	2	1
	North Arlington	Bergen	25	2	1
	Wood Ridge	Bergen	25	2	1
RT 18	East Brunswick	Middlesex	25	2	1
	Old Bridge	Middlesex	25	2	1
	East Brunswick	Middlesex	35	2	1
	Old Bridge	Middlesex	25	2	1
RT 49	Millville	Cumberland	25	2	1
	Pennsville	Salem	35	2	1
	Salem	Salem	30	2	1
	-	Cumberland	25	2	1

Chapter V

CRASH DATA ANALYSIS

Data Collection

Motor vehicle crashes involving pedestrians and bicyclists from 1997 to 2000 from the New Jersey Department of Transportation (NJDOT) crash database were used in developing the crash severity logistic model. NJDOT's crash database includes all crashes involving fatal, injury or property damage for all counties within the State. The crash database includes variables found on the police crash report except for the name and full address of the drivers or passengers involved in the crashes. Volume and geometric data were obtained from the State's Straightline diagrams. These diagrams allow one to view a roadway in line format, providing volume and geometric information about roadways within the State. The available geometric data include information on the number of lanes, pavement and shoulder widths, posted speed limit, median type and functional classification.

To use these crash data in the model development, it was necessary to identify the geometric and volume characteristics at the location where each crash occurred. This could not be accomplished for all bicyclist and pedestrian crashes in the State within the scope of this study due to the large number of crashes and therefore, a subset of crashes from the pedestrian and bicyclist crashes occurring between 1997 and 2000 was used in developing the logistic model. The subset included 930 urban and 116 rural crashes occurring on roadways from all counties within the State and covering all roadway functional classifications. Table 11 shows the number of pedestrian/bicyclist crashes by crash severity level. The severity levels for the majority of the crashes are moderate injury and complaint of pain type crashes. Priority was given to include crashes occurring on roadways identified as high crash pedestrian/bicyclist locations. This was done to include as many crashes from one roadway as possible.

From Table 11, which shows the frequency and percent of crashes falling within each variable level, the majority of pedestrian and bicyclist crashes occur on straight and level roadways, under dry roadway surface conditions, clear weather, and daylight

conditions. Over 80 percent of these crashes occur at speed limits between 25 and 35 mi/h.

Table 11. Model Variables.

Variable	Description	Levels	Level-Description	Number	Percent (%)
Y	Injury Severity	1	Killed	22	2.1
		2	Incapacitated	91	8.7
		3	Moderate Injury	328	31.4
		4	Complaint of Pain	493	47.1
		5	Property Damage Only	112	10.7
SL	Speed Limit (mi/h)	15		3	0.3
		25		398	38.0
		30		124	11.9
		35		341	32.6
		40		80	7.6
		45		33	3.2
		50		42	4.0
		55		25	2.4
PV	Pavement Width (ft)	Var.			
NL	Number of Lanes	2-6			
SH	Shoulder Width (ft)	Var.			
RT	Road Category	UPA	Urban Principal Arterial	721	68.9
		UMA	Urban Minor Arterial	164	15.7
		UC	Urban Collector	26	2.5
		UL	Urban Local	19	1.8
		RPA	Rural Principal Arterial	28	2.7
		RMA	Rural Minor Arterial	16	1.5
		RMAC	Rural Major Collector	70	6.7
		RMIC	Rural Minor Collector	2	0.2
RS	Road System	1	State Highway/State Authority	379	36.2
		2	County Road/Municipal	667	63.8
RC	Road Character	1	Straight and Level/ Straight and Grade/	1009	96.5

Table 11. Model Variables.

Variable	Description	Levels	Level-Description	Number	Percent (%)
			Straight and Hillcrest		
		2	Curve and Level/ Curve and Grade/ Curve and Hillcrest	37	3.5
SC	Road Surface	1	Dry	863	82.5
	Condition	2	Other (Wet, Snowy, Icy)	183	17.5
WT	Weather	1	Clear	901	86.1
		2	Other (Rain, Snow, Fog)	145	13.9
LC	Light Condition	1	Daylight	661	63.2
		2	Other (dawn or dusk/ Dark with street light on/ Dark with street light off/ Dark without street light)	385	36.8
RDB	Road Divided By	1	None	877	83.8
		2	Other (guide rail/ concrete bar/ concrete isle/ grass median)	169	16.2
AADT	Average Annual Daily Traffic (vpdpl)	Var.			

For each crash, the following information is provided:

- Injury severity as classified into five levels—killed, incapacitated, moderately injured, complaint of pain, and property damage only.
- The posted speed limit at the crash location.
- Annual average daily traffic (AADT) at or close to the crash location—some of them still need to be collected from municipal DOTs.
- Number of lanes at the crash location.
- Pavement width at the crash location.
- Shoulder width at the crash location.

- Parking information at the crash location.
- Road category, found from the Straight Line Diagram at the NJDOT website, as categorized into urban principal arterial (UPA), urban minor arterial (UMA), urban local (UL), urban collector (UC), rural principal arterial (RPA), rural minor arterial (RMA), rural major collector (RMAC), rural minor collector (RMIC), and rural local (RL).
- Road system as categorized into Interstate, State Highway, State/Interstate Authority, State park or institution, County road, County authority park or institution, Municipal, Private property, and U.S. Government property.
- Road characteristics as divided into straight and level, straight and grade, straight at hillcrest, curve and level, curve and grade, and curve at hillcrest.
- Medium type—guide rail, concrete bar, concrete isle, grass medium, none, and other.
- Medium width at the crash location.
- Road surface type—concrete, blacktop, gravel, steel grid, dirt, and other.
- Surface condition—dry, wet, snowy, icy, and other.
- Weather condition at the crash occurrence—clear, rain, snow, fog, and other.
- Light condition at the crash occurrence—daylight, dawn or dusk, and dark (street lights on, street lights off, no street light).
- Traffic control—police officer, watchman, gates, etc., traffic signal, lane markings, channelization-painted, channelization-physical, warning signal, stop sign, yield sign, flagman, no control present, and other.

Some data entries are not directly available from the crash data set. For each of such characteristic and for each crash, the cross street or milepost information for the involved crash was determined, then the information was checked off from the Straight Line Diagram. For certain data not available from the crash data set or NJDOT, field trips were conducted to collect them (parking information, some of the number-of-lane information and pavement widths).

Model Building Strategies

An ordinal logistic regression was performed to detect the relationship between injury severities with speed limits and various other factors. Let us briefly introduce the ordinal logistic regression first.

Probit Model

Linear regression is widely used in estimating relationships between continuous variables. However, when the dependent variable is binary or ordinal, like the injury severity, linear regression is no longer suitable. In addition, it is obvious that for a binary dependent variable that only takes values of 0 or 1, the linear regression model may generate results that are smaller than 0 or greater than 1, which are impossible for the probability of occurrence of an event.

Ordinal probit model is a multivariate model that can illustrate relationships of independent variables. By analyzing the marginal effect of various independent variables, it also has the ability to determine if different variables significantly influence the injury severity. In general, ordinal probit model takes the form:

$$Y^* = bX + \varepsilon \quad (1)$$

where Y^* is an unobserved variable measuring the risk of injury, X is a vector of non-random independent variables, b is the vector of unknown parameters, and ε is the random error term. With a mean equaling 0.0 and variance equaling 1.0, the error term is normally distributed for all observations.

The observed ordinal injury severity Y is determined by the following model,

$$Y = k \quad \text{if} \quad \mu_k \leq Y^* \leq \mu_{k+1} \quad (2)$$

where k denotes the ordinal category of injury severity, μ_k are estimated thresholds.

Therefore, the probabilities of an ordinal category are as follows:

$$p(Y = k) = \phi(\mu_k - bX) - \phi(\mu_{k-1} - bX) \quad (3)$$

where $p(Y = k)$ represents the probability of injury severity falling in category k , and ϕ denotes the function of cumulative standard normal distribution.

Logistic Regression Model

Compared with probit regression model, the coefficients obtained from logistic regression model are easier to interpret since odds ratio is used effectively. Still more, when the dependent variable is regarded as reflecting an underlying qualitative variable rather than a quantitative one, an ordinal logistic regression model is better than a probit model. There are binary logistic models and ordinal logistic models, which differ in their respective types of dependent variables.

For a binary logistic model, the dependent variable Y takes one of two possible values, for instance 1 or 0. Then, the model has the form,

$$g(X) = \log \frac{\phi(X)}{1-\phi(X)} = \beta_0 + \beta_1 X \quad (4)$$

or,

$$p(Y=1) = \phi(X) = \frac{e^{\beta_0 + \beta_1 X}}{1 + e^{\beta_0 + \beta_1 X}} \quad (5)$$

$$p(Y=0) = 1 - \phi(X) \quad (6)$$

where $p(Y=1)$ denotes the probability of Y taking 1, X represents the vector of dependent variables, β_1 denotes the vector of parameters to be estimated, and β_0 denotes the intercept.

For an ordinal logistic model, the model formulae are as follows:

$$g_k(X) = \log \text{it}(\phi_1(X) + \phi_2(X) + \dots + \phi_k(X)) \quad (7)$$

$$= \log \frac{\phi_1(X) + \phi_2(X) + \dots + \phi_k(X)}{\phi_{k+1}(X) + \phi_{k+2}(X) + \dots + \phi_i(X)} = \beta_k + \beta X$$

and

$$\phi_1(X) + \phi_2(X) + \dots + \phi_{i+1}(X) = 1 \quad (8)$$

where $\phi_1(X), \phi_2(X), \dots, \phi_{i+1}(X)$ represent the probability of dependent variable Y falling in corresponding categories, β_k denotes the intercepts, and β denotes the vector of linear coefficients.

Since the dependent variable in a logistic model is not a continuous outcome, the ordinary least square (OLS) estimation method is no longer suitable for obtaining

coefficients. Instead, the maximum likelihood estimation (MLE) is used to solve this problem.

MLE is a statistical method for estimating the coefficients of independent variables that *maximize the probability of obtaining the observed set of data*. A likelihood function must be built to describe the probability of obtaining the observed data as a function of the unknown independent variables.

As with a binary logistic model, the probability contribution of an event can be expressed as follows:

$$p = \phi(X_i)^{Y_i} [1 - \phi(X_i)]^{1-Y_i} \quad (9)$$

Since each event is assumed to be independent, the likelihood function has the following formula:

$$l(\beta) = \prod_{i=1}^n \phi(X_i)^{Y_i} [1 - \phi(X_i)]^{1-Y_i} \quad (10)$$

It will be more convenient to solve the above problem if the product involved becomes a summation. This is indeed achievable. Taking the logarithmic transform, the following is obtained:

$$L(\beta) = \ln[l(\beta)] = \sum_{i=1}^n \{Y_i \ln[\phi(X_i)] + (1 - Y_i) \ln[1 - \phi(X_i)]\} \quad (11)$$

where $\beta = (\beta_0, \beta_1)$.

The method of obtaining the value of β that maximize $L(\beta)$ is that of taking derivative of $L(\beta)$ with respect to β_0, β_1 , and setting the derivatives equal to zero. The resulting equations are as follows,

$$\sum_{i=1}^n [Y_i - \phi(X_i)] = 0 \quad (12)$$

and

$$\sum_{i=1}^n X_i [Y_i - \phi(X_i)] = 0 \quad (13)$$

Let $\phi_k(X)$ be a function of the unknown parameters, $\theta = (\theta_1, \theta_2, \dots, \theta_k)$ be the values of multinomial outcome with k levels, and $\theta_k = 1$ if $Y=k$, $\theta_i = 0$ otherwise. The likelihood function for n independent data, is

$$l(\beta) = \prod_{i=1}^n [\phi_1(X_i)^{\theta_{1i}} \phi_2(X_i)^{\theta_{2i}} \dots \phi_k(X_i)^{\theta_{ki}}] \quad (14)$$

and the log likelihood is,

$$L(\beta) = \sum_{i=1}^n \theta_{1i} \ln[\phi_1(X_i)] + \theta_{2i} \ln[\phi_2(X_i)] + \dots + \theta_{ki} \ln[\phi_k(X_i)] \quad (15)$$

The parameters coefficients can be obtained by taking the first partial derivatives of $L(\beta)$ with respect to each unknown parameter, and set the resulting equations equal to zero.

Data Processing

The statistical analysis software SAS was used to perform the ordinal logistical regression, so as to find the relationship between injury severities and speed limits at crash locations along with various other factors.

A Brief Introduction to SAS

SAS (Statistical Analysis System), developed by SAS Institute Incorporation, is a statistics software that provides users with data management and statistical analysis tools. It includes a series of data analysis tools such as linear regression and logistic regression, as well as a variety of other functions. In this research, SAS was used to develop the logistic model because of its strong data analysis ability and friendly human-machine interface.

Variable Selection

The SAS software has the capability of producing for a logistic model the intercepts and the coefficients of the parameters that will maximize the likelihood of predicting the observed data. At the same time, it is able to select among all independent variables the ones that contribute the most to the output results. For instance, the number-of-lanes variable will turn out to be insignificant in determining the injury severity of a crash. Before running the software, we need to prescribe rules that let SAS select the variables for us.

In this research, we used full model to select significant variables. All independent variables are included in the model when full model method is used to choose significant independent variables based on a specified significance level, for example, 90 percent significance level was used in this research, thus, independent variables with p-value smaller than 0.1 are selected as significant variables.

Model Parameters

Naturally, each crash's involved injury severity of pedestrian/bicyclist is selected as a dependent variable with five levels. Levels 1, 2, 3, 4, and 5 represent respectively Killed, Incapacitated, Moderately injured, Complaint of pain, and Property damage only. There are a series of independent variables, both quantitative and categorical variables in nature, as in the following.

Quantitative variables:

SL:	posted speed limit;
PV:	pavement width;
NOL:	number of lanes in each direction;
AADTPL:	AADT per lane;
SH:	shoulder width;
MW:	median width.

Categorical variables:

RT:	including UPA (Urban Principal Arterial), UMA (Urban Minor Arterial), UC (Urban Collector), UL (Urban Local), RPA (Rural Principal Arterial), RMA (Rural Minor Arterial), RMAC (Rural Major Collector), and RMIC (Rural Minor Collector);
RS:	1 represents State highway/State authority, 2 represents county road/municipal road
RC:	1 represents straight and level, straight and grade, straight at hillcrest, 2 represents curve and level, curve and grade, curve and hillcrest ;
SC:	1 represents dry surface condition, 2 represents other conditions such as wet, snowy, and icy;

- WT: 1 represents clear weather, 2 represents other weather conditions like rain, snow, fog, and other;
- LC: 1 represents daylight condition, 2 represents other light conditions such as dawn or dusk, dark with street lights on, dark with street lights off, and dark without street lights;
- RDB: 1 represents no median, 2 represents road divided by guide rail, concrete bar, concrete isle, grass, and other.

Let $p_i = p(INJUSEVE = i)$ be the probability that a pedestrian/bicyclist was injured with level i . We expect the model to have the following form,

$$\begin{aligned} \log it(p_1 + p_2 + \dots + p_i) &= \log \frac{p_1 + p_2 + \dots + p_i}{1 - p_1 - p_2 - \dots - p_i} = \log \frac{p_1 + p_2 + \dots + p_i}{p_{i+1} + \dots + p_5} \\ &= \beta_i + \beta_{SL}SL + \beta_{PV}PV + \beta_{NOL}NOL + \beta_{AADTPL}AADTPL + \beta_{SH}SH + \beta_{MW}MW + \sum \beta(k)RT(k) \\ &\quad + \beta_{RS}RS + \beta_{RC}RC + \beta_{SC}SC + \beta_{WT}WT + \beta_{LC}LC + \beta_{RDB}RDB \end{aligned}$$

Here, β_i denotes the intercept for injury severity with level i . A categorical dependent variable with k levels has $k-1$ intercepts. In addition, each of the quantitative variables has a coefficient given by the run result, such as β_{SL} , β_{PV} , and so on. As for the categorical independent variables with k levels, there are $k-1$ parameters which can take one of the three integer values, say 0,1,-1. The value is based on which category the independent variable is. It can be expressed as follows, for instance,

$$RT(k) = \begin{cases} 1, & \text{roadtype}=k; \\ 0, & \text{roadtype} \neq k \text{ or UPA}; \\ -1, & \text{roadtype=UPA (the referral roadtype)}; \end{cases}$$

CHAPTER VI

OPTIMAL SPEED CRITERION

Important Speed Factors

Using the statistical package SAS, an ordinal logistic crash severity model was developed for pedestrian and bicycle crashes. In the research, we used a full model to select significant variables based on a 90 percent confidence interval. The coefficient estimates and p-values for each variable are shown in Table 12. Significant variables are identified with an asterisk.

For the model developed for pedestrian and bicycle crashes in urban locations, the only geometric variable found to be significant was the median type. The traffic and environmental factors found to be significant include posted speed limit, AADT per lane, surface condition (whether the roadway is wet or dry), and light condition (daylight or other light condition). The model results suggest that roadway geometry does not appear to have as significant an impact on pedestrian and bicycle injury levels in urban areas. This may be due to the lower variability in roadway geometry in urban roadways.

Table 12. Ordinal Logit Model for Urban Area and Rural Area.

Parameter	Urban (90% C.I.)		Rural (90% C.I.)	
	Estimate	P-Value	Estimate	P-Value
Intercept β_1	-6.2569	<0.0001	-5.3903	0.0028
Intercept β_2	-4.1742	<0.0001	-3.9474	0.0246
Intercept β_3	-2.2683	0.0001	-1.8336	0.2878
Intercept β_4	0.3209	0.5866	0.1080	0.9504
SL (Speed Limit)	0.0360	0.0023*	0.1362	0.0045*
PV (Pavement Width)	0.0084	0.2595	-0.0438	0.0329*
AADTPL (*1000)	0.0376	0.1019*	0.0438	0.7812
NOL (Number of Lanes)	0.0099	0.9084	-0.0593	0.8394
SH (Shoulder Width)	0.0028	0.7951	-0.0834	0.1226*

MW (Median Width)	0.0084	0.6957	-0.0230	0.6040
RT UC	-0.2655	0.4214	-	-
RT UL	0.0957	0.8128	-	-
RT UMA	0.3209	0.1140*	-	-
RS (Road System)	0.0963	0.2384	0.2291	0.4275
RC (Road Character)	-0.0688	0.7079	0.4519	0.2363
SC (Surface Condition)	0.2285	0.1238*	0.1406	0.8400
WT (Weather)	-0.1424	0.3798	-0.3372	0.6815
LC (Light Condition, Daylight)	-0.2329	0.0005*	-0.4065	0.0463*
RDB (Road Divided By)	0.2164	0.0331*	-0.4017	0.2375
RT RMA	-	-	-0.1829	0.7620
RT RMAC	-	-	1.3773	0.0651*
RT RMIC	-	-	-1.3805	0.2161
Likelihood Ratio	41.6495	0.0003	30.5209	0.0102

For the rural roadway model, the geometric factors found to be significant include pavement and shoulder width. Traffic and environmental factors found to be significant include the posted speed limit and light condition. The model suggests that for rural locations, geometry plays a much more significant role than in urban roadways. Both models, however, indicate that the posted speed limit and light condition is critical in determining the pedestrian and bicycle injury severity.

Table 13 shows the odds ratio or ratio of the probability of an event occurring to the probability of that event not occurring. Interpretation of odds ratio for significant quantitative variables are described here. For the urban model, the odds ratio of speed limit is 1.037, which states that a unit increase in the posted speed limit will result in a 3.7 percent increase in the odds of a more severe injury when other independent variables are held constant; and adjusting for other variables, for each 1000 vehicles increase in traffic volume, the odds of having a more severe injury increases by 3.8 percent. For the rural model, a unit increase in the posted speed limit will result in a 14.6 percent increase in the odds of a more severe injury given the same status of pavement width, shoulder width, road type, and light condition; a unit increase in

pavement width decrease the odds of a more severe injury by $1-0.957=4.3$ percent, and a unit increase in shoulder width decrease the odds of a more severe injury by $1-0.920=8$ percent when other variables are kept constant.

As for the significant categorical variables, the odds ratios for urban roadway types (RT) are compared to an urban principal arterial. For rural roadway types the roadways are compared to a rural principal arterial. For example, the odds ratio for an urban major arterial (UMA) is 1.603. Thus compared to an urban principal arterial (UPA), an urban major arterial has about 1.6 times the odds of a more severe injury when other independent variables are kept constant. Similarly, adjusting for other variables, an urban local roadway has about 1.3 times the odds of a more severe injury than compared to an urban principal arterial. Urban collectors with the odds ratio of 0.892, on the other hand, are less likely to have a more severe injury than an urban principal arterial, namely, has about 0.892 times the odds of a more severe injury when other independent variables are kept constant. Similarly, adjusting for other variables, a roadway under dry surface condition has 1.579 times the odds of a more severe injury than a roadway under other surface conditions, a roadway without median has 1.541 times the odds of a more severe injury than the roadway with median, and a roadway under day light condition decreases the odds of a more severe injury by $1-0.628=37.2$ percent than compared to the roadway with other light conditions.

For rural roadway types, a rural major collector has 3.3 times the odds of a more severe injury than compared to a rural principal arterial. Both a rural major arterial and a rural minor collector are less likely to have a higher severity rating than compared to a rural principal arterial, namely, 0.691 and 0.209 times the odds of a more severe injury. Similarly, a rural roadway under day light condition decreases the odds of a more severe injury by $1-0.443=55.7$ percent than the roadway under other light conditions.

Table 13. Odds Ratio for Urban Area and Rural Area.

Effect	Urban Model			Rural Model		
	Point	95% Wald		Point	95% Wald	
	Estimate	Confidence Limits		Estimate	Confidence Limits	
SL	1.037*	1.013	1.061	1.146*	1.043	1.259
PV	1.008	0.994	1.023	0.957*	0.919	0.996
AADTPL(*1000)	1.038*	0.993	1.086	1.045	0.767	1.424
NOL	1.010	0.853	1.196	0.942	0.531	1.672
SH	1.003	0.982	1.024	0.920*	0.828	1.023
MW	1.008	0.967	1.052	0.977	0.896	1.066
RT UC VS UPA	0.892	0.403	1.974	-	-	-
RT UL VS UPA	1.280	0.480	3.415	-	-	-
RT UMA VS UPA	1.603*	1.103	2.331	-	-	-
RS 1 VS 2	1.212	0.880	1.670	1.581	0.510	4.904
RC 1 VS 2	0.871	0.424	1.791	2.469	0.553	11.017
SC 1 VS 2	1.579*	0.882	2.826	1.325	0.086	20.321
WT 1 VS 2	0.752	0.398	1.420	0.509	0.020	12.761
LC 1 VS 2	0.628*	0.482	0.816	0.443*	0.199	0.987
RDB 1 VS 2	1.541*	1.035	2.295	0.448	0.118	1.698
RT RMA VS RPA	-	-	-	0.691	0.118	4.038
RT RMAC VS RPA	-	-	-	3.291	0.450	24.055
RT RMIC VS RPA	-	-	-	0.209*	0.010	4.356

The probability of each injury severity level can be obtained from Table 13, for example, the logit functions for an urban principal arterial are as follows:

$$\begin{aligned} \log it p_1 &= \log_e \frac{p_1}{1-p_1} \\ &= -6.2569 + 0.036SL + 0.0376AADTPL - 0.2655RT(UC) + 0.0957RT(UL) + 0.3209RT(UMA) \\ &\quad + 0.2285SC - 0.2329LC + 0.2164RDB \end{aligned} \tag{16}$$

$$\begin{aligned} \log it(p_1 + p_2) &= \log_e \frac{p_1 + p_2}{1-(p_1 + p_2)} \\ &= -4.1742 + 0.036SL + 0.0376AADTPL - 0.2655RT(UC) + 0.0957RT(UL) + 0.3209RT(UMA) \\ &\quad + 0.2285SC - 0.2329LC + 0.2164RDB \end{aligned} \tag{17}$$

$$\begin{aligned} \log it(p_1 + p_2 + p_3) &= \log_e \frac{p_1 + p_2 + p_3}{1-(p_1 + p_2 + p_3)} \\ &= -2.2683 + 0.036SL + 0.0376AADTPL - 0.2655RT(UC) + 0.0957RT(UL) + 0.3209RT(UMA) \\ &\quad + 0.2285SC - 0.2329LC + 0.2164RDB \end{aligned} \tag{18}$$

$$\log it(p_1 + p_2 + p_3 + p_4) = \log_e \frac{p_1 + p_2 + p_3 + p_4}{1-(p_1 + p_2 + p_3 + p_4)} \tag{19}$$

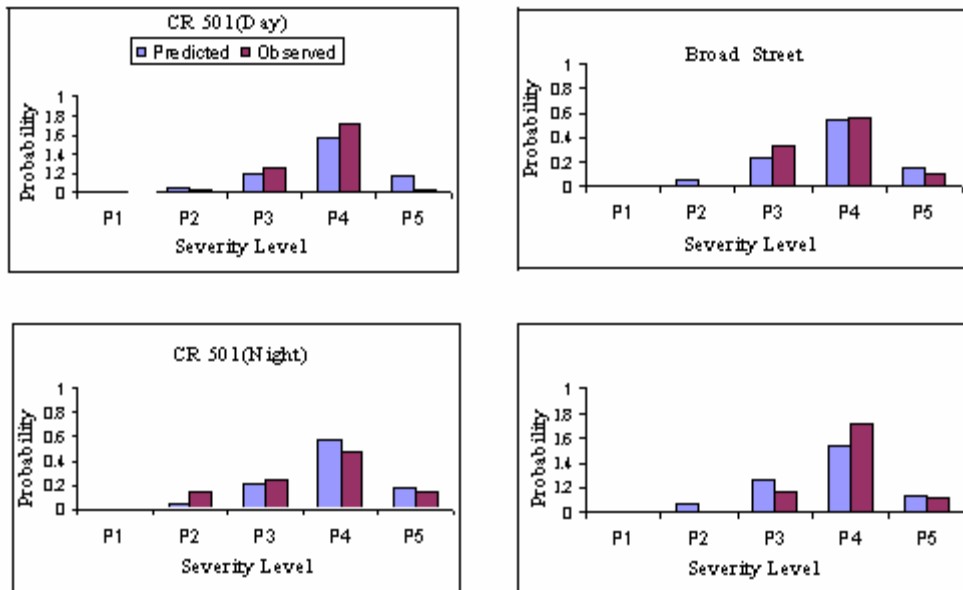


Figure 3. Predicted vs. Observed Probabilities.

$$= -0.3209 + 0.036SL + 0.0376AADTPL - 0.2655RT(UC) + 0.0957RT(UL) + 0.3209RT(UMA) + 0.2285SC - 0.2329LC + 0.2164RDB$$

and

$$p_1 + p_2 + p_3 + p_4 + p_5 = 1$$

Comparisons are made between the model-estimated probabilities and actual observed percentage distribution of crash injury severity. The roadways used in the analysis included county road CR501 in Hudson county in NJ, which is classified as an urban principal arterial, Broad Street, an urban local roadway in Newark, NJ, and CR551 in Camden and Gloucester counties in NJ, which is classified as a urban minor arterial.

Figure 3 shows the observed versus the predicted probability for each roadway and each of the five severity levels, where p1 is killed and p5 is property damage. For the urban principal arterial, CR 501, two conditions are compared. One condition is under daylight condition, and another under nighttime condition.

To describe the impacts of significant variables on pedestrian/bicyclist injury severity, two roadways, CR501 and RT30, were selected as examples to show the changes in independent variables responding to various injury severities. The impacts are shown in Table 14 through Table 17. For example, Table 16 states that a small reduction in speed limit in rural roadway would result in a drastic decrease in injury

Table 14. Impacts of Significant Quantitative Variables on P1+P2 for CR501.

Road	P1+P2 (Predict)	P1+P2 ↓ (Decrease)				P1+P2 ↑ (Increase)			
CR501 (UPA)	0.047	0.04	0.035	0.03	0.025	0.05	0.055	0.06	0.065
ΔSL	0 (25)	-5	-9	-13	-18	+2	+5	+7	+9
ΔAADTPL	0 (5.55)	-4.61	/	/	/	+1.61	+4.27	+6.73	+9.01

Table 15. Impacts of Significant Quantitative Variables on P1+P2+P3 for CR501.

Road	P1+P2+P3 (Predict)	P1+P2+P3 ↓ (Decrease)				P1+P2+P3 ↑ (Increase)			
CR501 (UPA)	0.25	0.22	0.20	0.18	0.15	0.28	0.30	0.35	0.40
ΔSL	0 (25)	-5	-8	-12	-18	+4	+7	+13	+19
ΔAADTPL	0 (5.55)	-4.44	/	/	/	+4.1	+6.69	+12.75	+18.45

Table 16. Impacts of Significant Quantitative Variables on P1+P2 for RT30.

Road	P1+P2 (Predict)	P1+P2 ↓ (Decrease)				P1+P2 ↑ (Increase)			
RT30 (RPA)	0.24	0.20	0.15	0.10	0.05	0.30	0.35	0.40	0.45
ΔSL	0 (35)	-1.7	-4.3	-7.7	-13.1	+2.2	+3.9	+5.5	+7
ΔPV	0 (40)	+5.3	+13.3	+23.8	+40.9	-7	-12.2	-17.1	-21.8
ΔSH	0 (0)	+2.8	+7	+12.5	+21.5	/	/	/	/

Table 17. Impacts of Significant Quantitative Variables on P1+P2+P3 for RT30.

Road	P1+P2+P3 (Predict)	P1+P2+P3 ↓ (Decrease)				P1+P2+P3 ↑ (Increase)			
RT30 (RPA)	0.24	0.20	0.15	0.10	0.05	0.30	0.35	0.40	0.45
ΔSL	0 (35)	-2.5	-5.6	-8.5	-11.6	+1	+3	+5.7	+9.1
ΔPV	0 (40)	+7.8	+17.4	+26.5	+36.1	-3.1	-9.7	-18	-28.2
ΔSH	0 (0)	+4.1	+9.1	+13.9	+18.9	/	/	/	/

severity sustained by pedestrian or bicyclist. The table also indicates that speed limit for rural roadway has greater impact on injury severity than compared to speed limit for urban roadway.

Levels of Injury Severities

By using the injury severity model, optimal speed limits that match probabilities of certain injury severity levels being sustained on a given roadway were determined using the following equations. To use the model, the probability of an injury severity has to be inputted into the model, and then the resulting optimal speed limit will be determined.

For urban roadway,

$$SL = 27.78 \log_e \frac{P_1 + P_2 + P_3}{1 - (P_1 + P_2 + P_3)} - 27.78\beta_3 - 1.04AADTPL + 7.375RT(UC) - 2.66RT(UL) - 8.91RT(UMA) - 6.35SC + 6.47LC - 6RDB \quad (20)$$

For rural roadway,

$$SL = 7.34 \log_e \frac{P_1 + P_2 + P_3}{1 - (P_1 + P_2 + P_3)} - 7.34\beta_3 + 0.32PV + 0.61SH + 1.34RT(RMA) - 10.11RT(RMAC) + 10.14RT(RMIC) + 2.98LC \quad (21)$$

Safety speed limits were determined for five probability conditions. These conditions are described in terms of "Level of Safety". Level of Safety A is the condition where a fatal, incapacitated or moderate injury severity is with a probability of $p_1+p_2+p_3=0.25$. Level of Safety B is the condition where a fatal, incapacitated or moderate injury severity is 1 in 4 crashes or with a probability of $p_1+p_2+p_3=0.3$. Level of Safety C is the condition where a fatal, incapacitated or moderate injury severity is with a probability of $p_1+p_2+p_3=0.35$. Level of Safety D is the condition where a fatal, incapacitated or moderate injury severity is with a probability of $p_1+p_2+p_3=0.4$.

Operational Module

Optimal speed limits developed from the Speed Limit Model (SLM) are intended to reduce the occurrence and severity of pedestrian/bicycle crashes without adversely affecting roadway operation or environmental conditions. Although lower speed limits would result in improving roadway safety, too low of a speed limit could potentially create delays to vehicles on the roadway and could also increase fuel consumption and

vehicle emissions. To better understand the impacts of various speed limits on roadway operations and vehicle emissions, a simulation study was performed. The study sought to identify relationships between speed limits, volume levels and operational and environmental factors.

The simulation model used to estimate the impacts of speed limits on roadway operation and environmental factors is the microsimulation tool CORSIM (CORridor SIMulation). CORSIM is a microscopic simulation model developed by the Federal Highway Administration. The program combines two widely used programs, NETSIM (NETwork SIMulation) and FRESIM (FREeway SIMulation) and has the capability of simulating both intersection and freeway operations. CORSIM can be used to evaluate the operation of a roadway under varying speed limits with several performance measures reported in the output. The performance measures used in this study include average travel time, delay, vehicle emission and fuel consumption.

Study Design

Figure 4 shows the study area used in the analysis. The roadway is divided into three segments of varying lengths. Two of the segments are 2000 feet and one segment is 500 feet. There are three approach lanes included in the roadway and only one-way volume conditions are considered. Also included in the roadway segment are two stop-controlled intersections with the minor roadway stopping. Four volume level conditions were studied including low, medium, high and very high volume conditions. Using a roadway capacity of 1800 vphpl, the volume levels correspond to volume-to-capacity ratios of 0.2, 0.4, 0.6, and 0.8 for the low, medium, high and very high volume level conditions respectively.

For each volume level condition, six speeds were analyzed. The speeds include 15, 20, 25, 30, 35, and 40 mi/h. The speed is inputted in the CORSIM Card Type 11 as the desired mean free-flow speed. The mean free-flow speed is the speed at which vehicles attempt to attain in the absence of any impedance due to other vehicles, pedestrians, or control devices. Each vehicle entering a link is assigned a free-flow speed obtained by multiplying the mean free-flow speed and a percentage based on an assumed driver type. Within CORSIM there are nine driver types. The selection of

driver types is stochastic and varies with the random seed numbers provided by the user. The default percentage multipliers used by CORSIM are shown in Table 18. The table shows that the free flow speed ranges from 75 to 127 of the inputted desired mean free-flow speed. Although these percentage multipliers can be changed, the

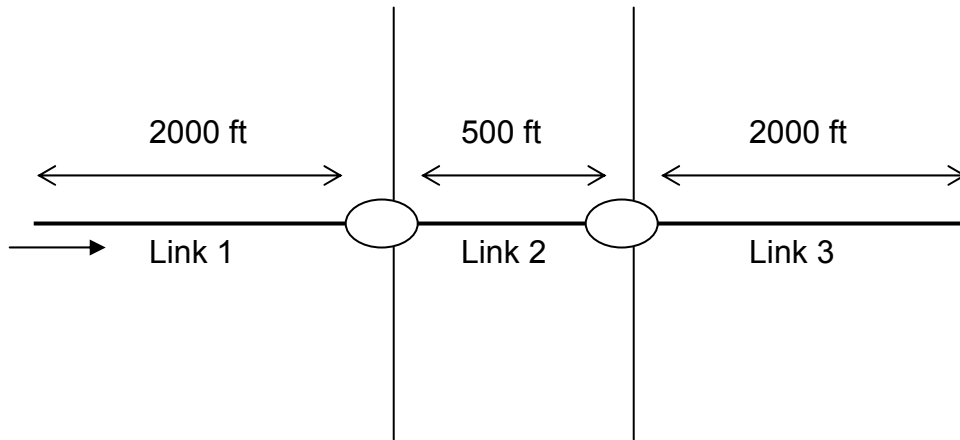


Figure 4. Study Network.

percentages must sum to 1000. This feature ensures that the mean speed does not differ significantly from the inputted desired free flow speed, and also limits the variability between vehicle speeds.

Table 19 shows the mean speed achieved using the default percentage multipliers for the inputted desired mean free-flow speed for each of the four volume levels considered. The Table shows that at low volume conditions, the achieved mean speed is almost identical to desired free-flow speed. As the volume levels increase, however, the difference between the desired free-flow speed and the achieved speed also increases. The largest difference, however, is only 5 mi/h at the highest volume level.

The table also demonstrates that the achieved mean speed is never greater than the inputted desired free flow speed. For this reason, the desired free flow speed cannot be treated as the speed limit but as a percentile speed. Assuming that the

speeds follow a normal distribution, the desired free flow speed ranges from the 60th percentile speed at low volume conditions to about the 85th percentile speed at very high volume conditions.

Results

To quantify the operational and environmental impacts of each speed limit, performance measures were obtained for each simulation run. The measures include: total travel time (veh-minutes), delay (sec/veh), percent stop, volume, vehicle emissions (NC, CO, NO_x), and fuel consumption (Gals). The following describes the results of the simulation model under each of the speed and volume levels studied.

Table 18. Percentage Multiplier of Free-Flow Speed.

	Driver Type									
	1	2	3	4	5	6	7	8	9	10
Percentage Multiplier	75	81	91	94	97	100	107	111	117	127

Table 19. Achieved Mean Speed.

Desired Free-Flow Speed (mi/h)	Achieved Mean Speed (mi/h)			
	Low Volume	Medium Volume	High Volume	Very High Volume
15	14.6	13.5	12.6	11.8
20	19.1	17.9	16.9	15.8
25	24.5	23.4	22.1	20.9
30	29.5	28.0	26.6	25.2
35	34.2	32.4	30.8	29.3
40	39.6	37.6	36.4	34.7

Total Travel Time

The total travel time is the total time on the link for all vehicles, including the moving and delay time. The total travel time increases as the desired free-flow speed decreases for all volume levels. The percent increase in travel time, however, significantly differs depending on the volume level on the roadway. At low volume levels, the percent increase in total travel time as the desired free-flow speed goes from 40 mi/h to 15 mi/h is 170 percent. At very high volume levels, this percent increase is almost 200 percent.

Average Vehicle Delay

The delay is determined by first taking the difference between the total travel time and the moving time. This difference is the time vehicles are delayed if they cannot travel at the free flow speed. The difference is then divided by the number of vehicle trips to determine the seconds of delay per vehicle. Similar to the travel time, delay increases as the desired free-flow speed decreases. At low volume levels, the percent increase in delay as the desired free-flow speed goes from 40 mi/h to 15 mi/h is 383 percent compared to an increase in delay of 331 percent at very high volume levels.

Percent Stops

The percent stops was identified for each desired free-flow speed and volume level. For the conditions studied, the percent stops is very low even at the very high volume level. The maximum percent stops is 6 percent at a 15 mi/h desired free-flow speed and at the highest volume level. At desired free-flow speeds greater than 25 mi/h, the percent stops is zero.

Fuel Consumptions

The fuel consumption for each desired free-flow speed and volume level shows little variation between desired free-flow speeds. The percent increase in fuel consumption from when the desired free-flow speed goes from 40 mi/h to 15 mi/h is 30 percent at low volume conditions and 33 percent at very high volume conditions.

Vehicle Emissions

Vehicle emissions for each desired free-flow speed and volume level was also determined by examining the emission rates of three pollutants: HC, CO and NO_x. As desired free-flow speeds increase, vehicle emissions also increase. The figures suggest that the emission rates decrease as the volume level increases. The result seems counterintuitive and requires further analysis.

Performance Measure Models

Using the results of the simulation, a regression model was developed to estimate each of the performance measures studied. Models were developed for estimating total travel time, delay, fuel consumption, and vehicle emission as a function of the desired free-flow speed, roadway volume, and segment length. A general form of the model is stated as follows:

$$Y = \beta_0 \exp(\beta_1 \text{SPD} + \beta_2 \text{VOL} + \beta_3 \text{LNG}) \quad (22)$$

where: Y = Performance measure to be estimated;
 SPD = Desired free-flow speed (mi/h);
 VOL = One-way volume (vph); and
 LNG = Segment length (feet).

Table 2 summarizes some of the regression parameters including the R² of the model, which describes the predictive ability of the model. Using the model results, total travel time can be estimated as follows:

$$\text{TT} = 4.52 \exp(-0.04\text{SPD} + 0.0004\text{VOL} + 0.0009\text{LNG}) \quad (23)$$

where: TT = total travel time (veh-min).

The model has an R² of 0.984, showing that the model is adequate for estimating total travel time.

The model for estimating the average delay has an R² of 0.902 and is stated as follows:

$$\text{Delay} = 0.39 \exp(-0.058\text{SPD} + 0.0005\text{VOL} + 0.0008\text{LNG}) \quad (24)$$

where: Delay = average delay per vehicle (sec/veh).

The model for estimating fuel consumption has an R^2 of 0.981 and is stated as follows:

$$\text{Fuel} = -1.77 \exp(-0.0084\text{SPD} + 0.0004\text{VOL} + 0.0009\text{LNG}) \quad (25)$$

where: Fuel = fuel consumption (Gals).

Separate models were developed for estimating each of the vehicle emissions considered. Models were developed for estimating HC, CO and NO_x . The variable for the volume was not found to be significant and excluded from each of the models developed. The models do not have as high an R^2 as those previously estimated with an R^2 for HC, CO, and NO_x as 0.782, 0.776, and 0.804 respectively. The models for each of the vehicle emissions are stated as follows:

$$\text{HC} = -5.98 \exp(-0.075\text{SPD} + 0.0002\text{LNG}) \quad (26)$$

$$\text{CO} = -0.478 \exp(-0.047\text{SPD} + 0.0002\text{LNG}) \quad (27)$$

$$\text{NO}_x = -3.7 \exp(-0.056\text{SPD} + 0.0001\text{LNG}) \quad (28)$$

where: HC = Hydrocarbon emissions (grams/mile);
CO = Carbon monoxide (grams/mile);
 NO_x = nitrox oxide emissions (grams/mile).

Chapter VII
POTENTIAL SITES FOR IMPLEMENTATION

Overview

Safety speed limits are proposed for seven roadways based on certain geometric and traffic conditions. The roadways used in the analysis include county road CR501 in Hudson County, Broad Street in the city of Newark, CR551 in Camden and Gloucester Counties, CR603 in Essex County, RT322 in Gloucester County, CR607 in Ocean County, and RT30 in Atlantic County. Characteristics of these seven roadways are summarized in Table 20. Detailed information on these roadways is described in the following section.

Table 20. Roadway Section Characteristics.

Roadway Parameter	CR501	CR603 (ESSEX)	CR551	BROAD STREET	RT322	CR607 (OCEAN)	RT30
Mile Post	23.73- 37.21	0-3.72	11.76- 34.57		26.82- 34.50	0- 18.07	32.66- 46
County							
Road Type	UPA	UPA	UMA	UL	RMA	RMAC	RPA
Spd. Lim. (mi/h)	25	25	25	25	55	30	35-55
PV (feet)	46-60	38-60	22-48	30-126	58	25-75	40-48
AADTPL(/1000)	5.5	3.5	4.2	5.1	4.2	2.2	4.47
No. of Lanes	4,6	4	2	2,4,6,8	4	2,4	4
Should. Wid. (ft)	0	0	0-16	0	10	0	0-24
Median Wid. (ft)	Var.	0	0	0	0	Var.	Var.
Median Type	Var.	None	None	None	None	Var.	Var.

Introduction to the Roadways

CR 501 (Kennedy Boulevard), Jersey City, Hudson County

CR501 is a roadway extending for 53 miles through multiple counties in New Jersey. The counties include Middlesex, Bergen, and Hudson. The selected section is located in Jersey City, Hudson County. It has a length of 13.48 miles, from milepost 23.71 to milepost 37.21. The roadway has between 2 and 6 lanes, and has posted speed limits ranging from 25 to 50 mi/h. In addition, it has shoulder width ranging from 0 to 24 feet and pavement width from 24 to 65 feet. The roadway can be classified as urban principal arterial and urban minor arterial. In this research, the segment in Hudson County, which is categorized as an urban principal arterial, is selected. The reason for its selection is the large number of crashes involving pedestrians and bicyclists on this segment. The posted speed limit for the selected segment is 25 mi/h. The pavement width of the segment varies from 46 to 60 feet, and no shoulder is available on it. Only a small portion of the segment is divided by medians with various widths. On the segment, the annual average daily traffic (AADT) per lane is about 5500 in year 2000.

The vehicle-pedestrian/bicyclist crash numbers in the years 2000 and 1999 on the segment are 67 and 68, respectively. Among the crashes, 77 occurred at daytime and 59 at nighttime. Also, 109 pedestrians/bicyclists involved in crashes with vehicles at clear weather condition while only 27 at other conditions such as rain, snow and fog weather. In addition, 104 of the crashes on this roadway occurred under dry surface condition, and 32 under other surface conditions, including wet, icy, snowy situations. Proposed speed limits at daytime for CR501 corresponding to the four levels of safety are 25, 30, 40, and 45 mi/h, respectively. For nighttime condition, the speed limits are 10, 20, 25, and 30 mi/h, respectively.

Broad Street, Newark, Essex County

Broad Street is an urban local street located in Newark, New Jersey. The entire street is included in the analysis. The street has between 2 and 8 lanes without median, and has a speed limit of 25 mi/h. Pavement width of this street varies from 30 to 126 feet,

and no shoulder is available on the street. The street has an AADT per lane of about 5100 in the year 2000.

There were 19 crashes between motor vehicles and pedestrians/bicyclists in the year 2000. 17 of them occurred at daytime while only 2 occurred at nighttime. Also, 17 of the crashes were under clear weather condition and 2 under other weather conditions. The speed limits for the four levels of safety on Broad Street are 20, 25, 30, and 40 mi/h, respectively.

CR 551 (Kings Highway/Broadway), Gloucester/Camden County

CR 551 has a length of 34.57 miles. The section in Camden and Gloucester County is selected to be included in the analysis. The length of the selected section is 22.81 miles from milepost 11.76 to milepost 34.57. The roadway is primarily an urban minor arterial but includes small portions of rural major collectors. It has 2 lanes and its posted speed limit ranges between 25 and 50 mi/h. The selected section is classified as an urban minor arterial. The posted speed limit on this segment is 25 mi/h. The pavement width on it ranges from 22 to 48 feet, and the shoulder width on it varies from 0 to 16 feet. The AADT per lane on this segment is about 4200 in the year 2000. The roadway is undivided in this segment.

There are 31 vehicle-pedestrian/bicyclist crashes in the database, with 16 crashes occurring in year 2000 and 15 in 1999. Among the crashes, 21 occurred during daytime and 10 during nighttime. There were 25 crashes under clear weather condition and 6 under other weather conditions. Also, 25 occurred on dry road condition and 6 on other conditions. The speed limits for the four levels of safety for this roadway are 20, 25, 30, and 40 mi/h, respectively.

CR 603 (Springfield Avenue), Newark, Essex County

CR603 in Essex County is classified as an urban principal arterial extending for 3.72 miles. It crosses Irvington town and Newark city from west to east. Pavement width of the roadway ranges from 38 to 60 feet, and it has neither shoulder nor median. The AADT on it is 14026 in the year of 2000. There are 4 lanes from milepost 0 to milepost 3.02 and 2 lanes from milepost 3.02 to milepost 3.72.

The number of crashes between vehicles and pedestrians/bicyclists on this roadway is 26 in year 2000 and 15 in 1999. There were 32 crashes occurred at daytime and 9 at nighttime. In addition, 32 of the crashes occurred in clear weather condition and 9 in other weather conditions; 29 of the crashes occurred on dry roadway condition and 12 on other surface conditions. The speed limits for the four levels of safety for CR 603 are 30, 35, 40, and 45 mi/h, respectively.

RT 322 (Black Horse Pike), Monroe, Gloucester County

RT322 is a roadway crossing Gloucester County and Atlantic County in New Jersey. The selected section in this research starts from milepost 26.87 and end at milepost 32.96 in Gloucester County. The roadway has a length of 50 miles, between 2 and 6 lanes, posted speed limit ranging from 30 to 55 mi/h, shoulder width ranging from 0 to 20 feet, and pavement width ranging from 24 to 72 feet. The selected segment, which is classified as a rural minor arterial, has a 55-mi/h posted speed limit, 4 lanes, a 58-foot pavement width, and a 20-foot shoulder width. There is no median on this segment. The AADT per lane in the year of 2000 on the segment was 4200.

Since the section is located in rural areas, there are much less crashes between vehicles and pedestrians/bicyclists than roadways in urban areas. There are only 3 crashes involving pedestrians/bicyclists on the segment in year 2000 and 1 crash in year 1999. The speed limits for the four levels of safety for this roadway are 40, 40, 45, and 45 mi/h, respectively.

CR 607 (Long Beach Boulevard), Long Beach, Ocean County

CR607 in Ocean County is a rural major collector with a length of 18.07 miles. The roadway has 2 or 4 lanes. Its pavement width ranges from 25 to 75 feet, and shoulder width varies from 0 to 22 feet. The posted speed limit on this roadway is 30 or 35 mi/h. The roadway is undivided except there has curbed median on the segment from milepost 11 to milepost 12.31 and from milepost 14.17 to milepost 16.32. The AADT per lane on this roadway is about 2200. Vehicle-pedestrian/bicyclist crash numbers on this roadway are 13 in year 2000, 7 in year 1999, 8 in 1998, and 12 in 1997. Among these 40 crashes, 13 occurred during daytime and 27 during nighttime; 38 occurred at clear weather conditions while only 2 at other weather conditions. The

speed limits for the four levels of safety for CR607 are 20, 25, 25, and 30 mi/h, respectively.

RT 30 (White Horse Pike), Camden/Atlantic County

RT30 is a roadway crossing Camden and Atlantic Counties. The selected section is located in Atlantic County. It has a length of 13.34 miles, from milepost 32.66 to milepost 46. On different segments, the roadway is classified as different roadway types, including rural principal arterial and urban principal arterial. The selected segment is classified as a rural principal arterial. It has 4 lanes. The posted speed limit on the segment ranges from 35 to 55 mi/h. The AADT per lane on the segment is 4470. The pavement width of the segment is 48 feet, and its shoulder width ranges from 0 to 24 feet. A small portion of the segment is divided by unprotected median with various median widths. The crash data were chosen from 1997 through 2000 since there were few crashes involving pedestrians or bicyclists on this rural roadway. The total vehicle-pedestrian/bicyclist crash number is 17 in the four years, consisting of 4 in 2000, 2 in 1999, 6 in 1998, and 5 in 1997. The speed limits for the four levels of safety for RT30 are 20, 20, 25, 25 mi/h, respectively.

Proposed Speed Limits

The proposed speed limits for these roadways are shown in Table 20, where the numbers in the parentheses are the numbers obtained directly from computation while the numbers outside them are the corresponding numbers rounded by 5. Level of Safety A is the condition where a fatal, incapacitated or moderate injury severity is with a probability of $p_1+p_2+p_3=0.25$. Level of Safety B is the condition where a fatal, incapacitated or moderate injury severity is with 1 in 4 crashes or a probability of $p_1+p_2+p_3=0.3$. Level of Safety C is the condition where a fatal, incapacitated or moderate injury severity is with a probability of $p_1+p_2+p_3=0.35$. Level of Safety D is the condition where a fatal, incapacitated or moderate injury severity is with a probability of $p_1+p_2+p_3=0.4$. Also, it is beneficial that speed limits be different under day and night light conditions. The safety speed limits for various roadways can be selected from the proposed speed limits with respect to various levels of safety. As shown in Table 6, the

safety speed limits get higher with the increase of level of safety. By comparing safety speed limits of CR501 at day and night conditions, it was obviously that speed limit should be lowered under the nighttime condition than under the daytime condition.

Table 21. Proposed Speed Limits.

Roadway	Roadway Type	Segment Length	AADTPL (/ 1000)	Existing Speed Limit (mi/h)	Proposed Speed Limit (mi/h) for Level of Safety*			
					A	B	C	D
CR501 (Day)	Urban Prin. Art.	3.16	5.5	25	25(25)	30(31.9)	40(38.3)	45(44.3)
CR501 (Night)	Urban Prin. Art.	3.16	5.5	25	10(12)	20(19)	25(25.4)	30(31.3)
CR603 (Essex)	Urban Prin. Art.	3.72	3.5	25	30(27)	35(34)	40(40.5)	45(46.4)
CR551	Urban Maj. Art.	4.11	4.2	25	20(18.6)	25(25.6)	30(31.9)	40(37.9)
Broad Street	Urban Local	N/A	5.1	25	20(18.6)	25(25.6)	30(31.9)	40(37.9)
RT 322	Rural Min. Art.	7.68	4.2	55	40(40.6)	40(42.5)	45(44.1)	45(45.7)
CR607 (Ocean)	Rural Maj. Coll.	0.98	2.2	30	20(22.4)	25(24.2)	25(25.9)	30(27.5)
RT30	Rural Prin. Art.	1.44	4.47	35	20(19.9)	20(21.7)	25(23.4)	25(24.9)

* Rounded speed (Calculated Speed)

Operational Impacts

Using the models developed to estimate the impact of speed limit on travel time, average delay, fuel consumption, and vehicle emissions, performance measures

describing the operation of the roadway were estimated for the seven roadways proposed for implementing an optimal desired free-flow speed. Tables 22 through 27 show the estimates of total travel time (veh-hrs), average delay (sec/veh), fuel consumption (gals), HC, CO and NO_x emissions, respectively for existing speed limits and for speed limits of the four level of safety speed limits. The estimates are made for a one-mile segment on each of the study roadways using the existing AADT.

The operational impact for the roadway was then determined by using these estimates to determine the total travel cost on a one-mile segment of the roadway for the existing speed limit and for the speed limits associated with Levels of Safety A, B, C and D. Total costs were determined as the sum of the costs of total travel time, fuel consumption and vehicle emissions. The total travel time was converted to a dollar costs assuming an average travel time cost of \$12.00 per hour. Average delay and total travel time are similar values, and therefore, the average delay was not included in the total cost of

Table 22. Estimate of Total Travel Time (Veh-hr).

Study Roadways	Existing Travel Time	Travel Time for Level of Safety			
		A	B	C	D
CR501 (Day)	4,506	4,506	3,671	2,437	1,986
CR501 (Night)	4,506	8,330	5,530	4,506	3,671
CR603 (Essex)	4,356	3,549	2,892	2,356	1,920
CR551	4,408	5,410	4,408	3,592	2,384
Broad Street	4,476	5,493	4,476	3,647	2,421
RT 322	1,290	2,384	2,384	1,943	1,943
CR607 (Ocean)	3,472	5,230	4,262	4,262	3,472
RT30	2,940	5,435	5,435	4,428	4,428

Table 23. Estimate of Average Delay (sec/veh).

Study Roadways	Existing Average Delay	Average Delay for Level of Safety			
		A	B	C	D
CR501 (Day)	25	25	19	11	8
CR501 (Night)	25	60	34	25	19
CR603 (Essex)	24	18	14	10	8
CR551	25	33	25	18	10
Broad Street	25	33	25	19	10
RT 322	4	10	10	8	8
CR607 (Ocean)	18	32	24	24	18
RT30	14	33	33	25	25

Table 24. Estimate of Fuel Consumption (Gals.).

Study Roadways	Existing Fuel Consp.	Fuel Consumption for Level of Safety			
		A	B	C	D
CR501 (Day)	21	21	20	19	18
CR501 (Night)	21	24	22	21	20
CR603 (Essex)	20	20	19	18	17
CR551	21	22	21	20	18
Broad Street	21	22	21	20	18
RT 322	16	18	18	17	17
CR607 (Ocean)	19	21	20	20	19
RT30	19	22	22	21	21

Table 25. Estimate of HC Emissions (Grams/Mile).

Study Roadways	Existing HC Emissions	HC Emissions for Level of Safety			
		A	B	C	D
CR501 (Day)	0.045	0.045	0.066	0.139	0.202
CR501 (Night)	0.045	0.015	0.031	0.045	0.066
CR603 (Essex)	0.045	0.066	0.095	0.139	0.202
CR551	0.045	0.031	0.045	0.066	0.139
Broad Street	0.045	0.031	0.045	0.066	0.139
RT 322	0.426	0.139	0.139	0.202	0.202
CR607 (Ocean)	0.066	0.031	0.045	0.045	0.066
RT30	0.095	0.031	0.031	0.045	0.045

Table 26. Estimate of CO Emissions (Grams/Mile).

Study Roadways	Existing CO Emissions	CO Emissions for Level of Safety			
		A	B	C	D
CR501 (Day)	4.410	4.410	5.566	8.868	11.194
CR501 (Night)	4.410	2.193	3.494	4.410	5.566
CR603 (Essex)	4.410	5.566	7.026	8.868	11.194
CR551	4.410	3.494	4.410	5.566	8.868
Broad Street	4.410	3.494	4.410	5.566	8.868
RT 322	17.835	8.868	8.868	11.194	11.194
CR607 (Ocean)	5.566	3.494	4.410	4.410	5.566
RT30	7.026	3.494	3.494	4.410	4.410

Table 27. Estimate of NOx Emissions (Grams/Mile).

Study Roadways	Existing NOx Emissions	NOx Emissions for Level of Safety			
		A	B	C	D
CR501 (Day)	0.196	0.196	0.260	0.454	0.601
CR501 (Night)	0.196	0.085	0.148	0.196	0.260
CR603 (Essex)	0.196	0.260	0.343	0.454	0.601
CR551	0.196	0.148	0.196	0.260	0.454
Broad Street	0.196	0.148	0.196	0.260	0.454
RT 322	1.051	0.454	0.454	0.601	0.601
CR607 (Ocean)	0.260	0.148	0.196	0.196	0.260
RT30	0.343	0.148	0.148	0.196	0.196

Table 28. Total Travel Cost (\$, dollars).

Study Roadways	Existing Travel Cost	Travel Cost for Level of Safety			
		A	B	C	D
CR501 (Day)	\$54,107	\$54,107	\$44,091	\$29,280	\$23,862
CR501 (Night)	\$54,107	\$100,002	\$66,400	\$54,107	\$44,091
CR603 (Essex)	\$52,311	\$42,627	\$34,737	\$28,308	\$23,070
CR551	\$52,933	\$64,959	\$52,933	\$43,134	\$28,645
Broad Street	\$53,743	\$65,953	\$53,743	\$43,794	\$29,083
RT 322	\$15,507	\$28,645	\$28,645	\$23,344	\$23,344
CR607 (Ocean)	\$41,702	\$62,802	\$51,176	\$51,176	\$41,702
RT30	\$35,311	\$65,255	\$65,255	\$53,174	\$53,174

Table 29. Additional Travel Cost (\$, dollars).

Study Roadways	Total Travel Cost for Level of Safety			
	A	B	C	D
CR501 (Day)	\$0	-\$10,016	-\$24,827	-\$30,245
CR501 (Night)	\$45,896	\$12,293	\$0	-\$10,016
CR603 (Essex)	-\$9,684	-\$17,574	-\$24,003	-\$29,241
CR551	\$12,026	\$0	-\$9,799	-\$24,288
Broad Street	\$12,210	\$0	-\$9,949	-\$24,660
RT 322	\$13,139	\$13,139	\$7,838	\$7,838
CR607 (Ocean)	\$21,100	\$9,473	\$9,473	\$0
RT30	\$29,945	\$29,945	\$17,864	\$17,864

travel. Using the national average cost for a gallon of unleaded gasoline of \$1.74, fuel consumption costs were determined. Vehicle emissions costs were also determined based on average costs for each emission of \$1.28/kg for NO_x and HC and \$0.0063/kg for CO.

Table 28 shows the total travel costs for the existing speed limit and for the speed limits associated with Levels of Safety A, B, C and D for each roadway. To determine the impact of the proposed speed limits for each level of safety, the incremental travel costs were determined and is shown in Table 29. The incremental travel cost is the difference between the travel cost at the existing speed limit and the travel cost at the incremental speed limit. A positive cost is the additional travel cost above existing travel costs and a negative cost is the reduction in travel costs compared to existing travel costs. A cost of zero dollars indicates the speed limit for existing conditions and for the Level of Safety speed is identical and there are no additional travel costs.

CHAPTER VIII

CONCLUSIONS

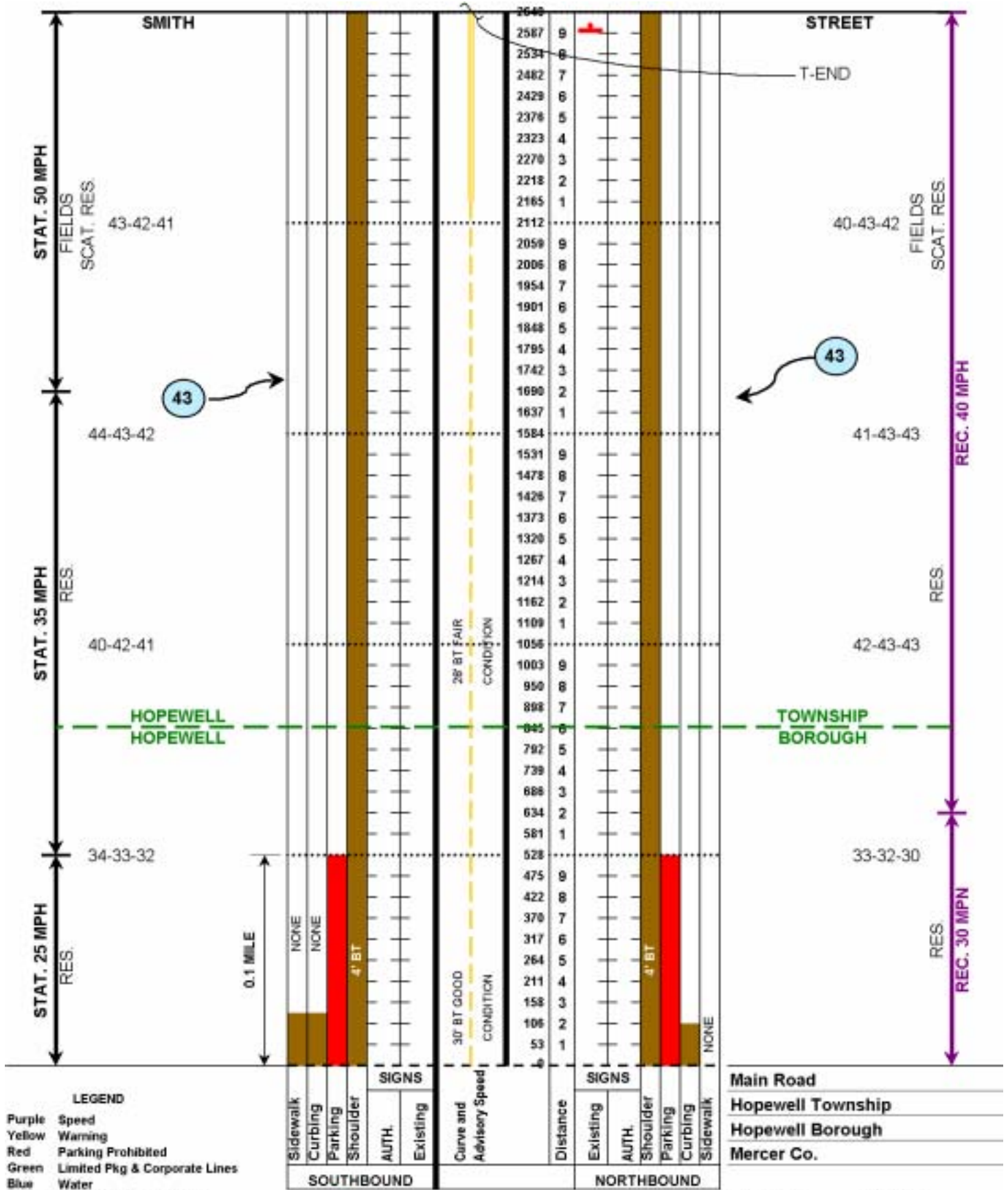
This project is concerned with the determination of vehicle speed limits for roadways that are shared with pedestrians and bicyclists. The center issue is the reduction of auto crashes involving pedestrians and bicyclists on these roadways.

The literature on relationships between vehicle speeds and pedestrian/bicycle crashes was reviewed. State and Federal statutes and regulations concerning the establishment of speed limits and, in particular, speed limits no more than 25 mi/h, were studied. A methodology based on the logistical regression concept that can help to determine the relationship between pedestrian/bicyclist crash severities was developed. The relationship was used to propose speed limits in response to different injury level requirements for different roadway characteristics. Also developed were methods to conduct the operational impacts of the selected roadway speed limits. The actual selection of the speed limit for a given roadway may have to consider both its injury severity impact and its operational implications. Foundations for both assessments were provided.

From the results of the study, we can make the following recommendations:

- When pedestrian/bicyclist safety is used as a primary criterion for setting speed limits, different safety standards should be used for urban and rural roadways.
- Factors other than geometric and traffic conditions, such as light condition and weather, can greatly affect the safety of a roadway; so differentiated speed limits for different light and weather conditions might be considered.
- Safety should be used in concert with other operational impacts including total travel times, average vehicle delays, percent stops, fuel consumptions, and vehicle emissions, to arrive to appropriate speed limits.
- A cost model encompassing impacts from vehicle-vehicle collisions, vehicle-pedestrian/bicycle crashes, and other operational factors may be the most appropriate one to be consulted with while setting speed limits for roadways.

APPENDIX I
SAMPLE REFERENCE SHEETS AND RADAR SPEED CHECK SHEET



- LEGEND**
- Purple Speed
 - Yellow Warning
 - Red Parking Prohibited
 - Green Limited Pkg & Corporate Lines
 - Blue Water
 - Brown Shoulder-Curb-Sidewalk
 - Black Miscellaneous


SOUTHBOUND		NORTHBOUND	
Sidewalk	NONE	Distance	53
Curbing	NONE	Existing	106
Parking	4' BT	AUTH.	158
Shoulder	4' BT	Shoulder	211
SIGN		Parking	264
AUTH.	Existing	Curbing	317
Existing	Existing	Sidewalk	370
Curve and Advisory Speed		SIGN	
30' BT GOOD	CONDITION	Existing	422
20' BT FAIR	CONDITION	AUTH.	475
		Shoulder	528
		Parking	581
		Curbing	634
		Sidewalk	688
			739
			792
			845
			898
			950
			1003
			1056
			1109
			1162
			1214
			1267
			1320
			1373
			1426
			1478
			1531
			1584
			1637
			1690
			1742
			1795
			1848
			1901
			1954
			2006
			2059
			2112
			2165
			2218
			2270
			2323
			2376
			2429
			2482
			2534
			2587
			2649

REFERENCE SHEET TE-17

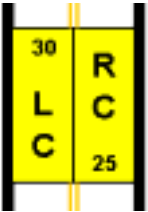
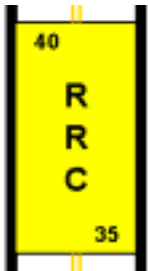
Main Road
Hopewell Township
Hopewell Borough
Mercer Co.

Date: 11-6-02 Pg. 2 of 2
Recorder: E.P. Driver: J.J.

Speed Limit Reference Sheet Legend

Symbol	Meaning
Stat. 25 MPH	Statutory 25 miles per hour
Stat. 35 MPH	Statutory 35 miles per hour
Stat. 50 MPH	Statutory 50 miles per hour
Rec. XX MPH	Recommended Speed Limit
Scat. Res.	Scattered Residences
Res.	Residences
Bus.	Business
H	House / Home
	85 th Percentile Radar Speed Check Data
RC	Right Curve
LC	Left Curve
RT	Right Turn
LT	Left Turn
RRC	Right Reverse Curve
LRC	Left Reverse Curve
RRT	Right Reverse Turn
LRT	Left Reverse Turn
(no symbol)	Winding Road Right/Left

Ball Banking (See page one of Chapter 3.)

Sample Curve	Ball Bank Readings	Sample Curve	Ball Bank Readings
RC	30 MPH 14° - 15° <div style="border: 1px solid black; padding: 2px; display: inline-block;">25 MPH 12° - 11° - 12°</div> 20 MPH 10° - 9°	RRC	40 MPH 13°/ 12° - 13°/ 11° <div style="border: 1px solid black; padding: 2px; display: inline-block;">35 MPH 10°/ 9° - 10°/ 8° - 10°/ 9°</div> 30 MPH 8°/ 5° - 7°/ 5°
	← Advisory Speed		← Advisory Speed

Recorded Trial Runs

Record trial runs every tenth of a mile for both directions of travel at least three times.

Sample: 48-47-46

(Sample Reference Sheets and Radar Speed Check Sheet as follows)

RADAR SPEED CHECK

New Jersey Department of Transportation
 Bureau of Traffic Engineering
 1035 Parkway Avenue
 Trenton, New Jersey 08623

ROADWAY SAMPLE ROAD
 LOCATION AT CROSS STREET
 MUNICIPALITY SAMPLE TOWNSHIP
 COUNTY SAMPLE COUNTY
 DATE JAN. 2, 1975 S M T W T F S
 (Indicate day)
 TIME: FROM 9:00 A.M. TO 11:15 A.M.

WEATHER: Clear - Cloudy - Rain - Snow (Circle)
 ROAD: Wet Dry Icy (Circle)
 UNDIVIDED DIVIDED (Check)
 LEGAL SPEED 25 M.P.H. VOLUME 2,000/DAY
 NO. OF TRAFFIC LAMES IN DIRECTION OF SPEED CHECK 2

ORGANIZATION SAMPLE POLICE DEPT.
 OBSERVER PTL. SMITH
 DIRECTION OF TRAVEL NB SB (Circle) WB (Circle)
 POSTED SPEED 25 MPH.

1	2	3	4	5	6	7	80
							X

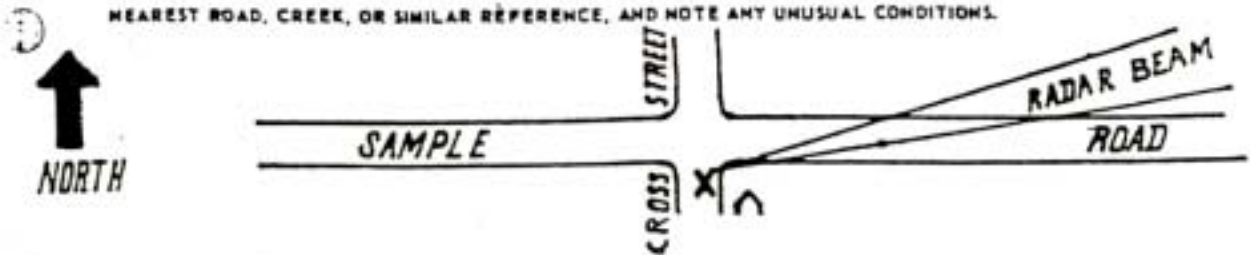
FOR STATE USE ONLY

FIRST ENTRY	CARS										TRUCKS						BUSES						
	2	3	4	7	10	11	14	15	18	19	22	23	25	26	27	29	30	31	33	34	35	37	38
3	6											T	2	8	T			B	4	8	B		
4	2											T			T			B			B		
												T			T			B			B		
												T			T			B			B		
												T			T			B			B		
												T			T			B			B		
												T			T			B			B		
												T			T			B			B		

CHECK (100) VEHICLES IN EACH DIRECTION — USING ONE FORM FOR EACH DIRECTION

The objective is to record the speeds of at least 100 free-flowing vehicles for each direction during normal-favorable traffic conditions, without the drivers knowing their speeds are being monitored. Free-flowing means driving at speeds, not influenced by other conditions, (being passed, passing or slowing).
 The person conducting the check should not use a marked police car or be in police uniform. Checks are made only on weekdays, anytime between 9 A.M. and 4 P.M. under good weather conditions. USE ONE FORM FOR EACH DIRECTION.

SKETCH BELOW EXACT LOCATION OF RADAR AND DIRECTION OF BEAM AND SHOW DISTANCE FROM RADAR TO NEAREST ROAD, CREEK, OR SIMILAR REFERENCE, AND NOTE ANY UNUSUAL CONDITIONS.



APPENDIX II . SUMMARY OF STATE SPEED LAWS

State Code	Name	State Code	Name
AL	Alabama	NE	Nebraska
AK	Alaska	NV	Nevada
AZ	Arizona	NH	New Hampshire
AR	Arkansas	NJ	New Jersey
CA	California	NM	New Mexico
CO	Colorado	NY	New York
CT	Connecticut	NC	North Carolina
DE	Delaware	ND	North Dakota
DC	District of Columbia	OH	Ohio
FL	Florida	OK	Oklahoma
GA	Georgia	OR	Oregon
HI	Hawaii	PA	Pennsylvania
ID	Idaho	PR	Puerto Rico
IL	Illinois	RI	Rhode Island
IN	Indiana	SC	South Carolina
IA	Iowa	SD	South Dakota
KS	Kansas	TN	Tennessee
KY	Kentucky	TX	Texas
LA	Louisiana	UT	Utah
ME	Maine	VT	Vermont
MD	Maryland	VA	Virginia
MA	Massachusetts	VI	Virgin Islands
MI	Michigan	WA	Washington
MN	Montana	WV	West Virginia
MS	Mississippi	WI	Wisconsin
MO	Missouri	WY	Wyoming
MT	Montana		

Summary of State Speed Laws

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
AL	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards than existing.	I. 30 MPH in any urban district '32-5A-171(1) II. 35 MPH on any unpaved road '32-5A-171(2)(a) III. 45 MPH on any county-maintained paved road in an unincorporated area '32-5A-171(2)(b) IV. 55 MPH ¹ on highways (except interstate highways or highways with 4 or more lanes) '32-5A-171(3) V. 70 MPH ¹ on interstate highways '32-5A-171(4) VI. 65 MPH ¹ on a highway with 4 or more lanes '32-5A-171(4) VII. 55 MPH ¹ for vehicles carrying explosives, flammable liquids or hazardous wastes except as authorized by the governor '32-5A-171(5)	I. Based on engineering and traffic investigations, the State Director of Public Safety and the State Highway Director may increase or decrease the above maximum speed limits on the State highway system. ² '32-5A-171(7) & 32-5A-172 II. Based on engineering and traffic investigations and subject to approval by the State highway department, local governments may increase or decrease the speed limits on the highways under their jurisdiction. '32-5A-173 II. State or local authorities may set special maximum safe speed limits for either bridges or elevated structures. ³ '32-5A-176
AK	No person shall drive a vehicle at a speed greater than is reasonable and prudent considering the traffic, roadway and weather conditions. 13 AAC 02.2751	I. 65 MPH on specific sections of either (2) the Alaska interstate system or (2) outside of urbanized areas with populations >50,000. These highway sections are determined via engineering and traffic investigations. 13 AAC 02.280(a) & (b) ¹ II. 25 MPH in a residential area 13 AAC 02.275(b)(3) ¹ III. 20 MPH in a business district 13	I. Based upon engineering and traffic investigations, the above speed limits, except for the 65 MPH limit, may be altered (increased or decreased). ² 13 AAC 02.275(e) & 02.2801 II. Maximum safe speed limits may be established for bridges, elevated structures, tunnels and underpasses. 13 AAC 02.325(f) ¹

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		AAC 02.275(b)(2)1 IV. 15 MPH in an alley 13 AAC 02.275(b)(1)1	
AZ	A person shall not drive a vehicle at a speed greater than is reasonable and prudent speed under the conditions and actual and potential hazards then existing.	I. 15 MPH approaching a school crossing1 '28-701(B)(1) II. 25 MPH in business or residential district1 '28-701(B)(2) III. 65 in other locations1 '28-701(B)(3) IV. 65 MPH on interstate highways outside of urban areas with a population $\leq 50,000$ '28-702.04(A) See II under Posted (Maximum) Speed Limit below. V. 65 MPH (1) for vehicles weighing >26,000 lbs. excluding vehicles designed to carry 16 or more persons including the driver or (2) for vehicles drawing a pole trailer weighing $\leq 6,000$ lbs.	I. (1) Based on engineering and traffic investigations, the Director of the State Department of Transportation may alter or vary the above statutory speed limits on the State highway system.2 '28-702 (2) Based on engineering and traffic investigations, the Department may increase the speed limit for vehicles >26,000 or for vehicles drawing a pole trailer.3 '28-709(B) II. Based on engineering and traffic investigations, the Director of the State Department of Transportation may increase the maximum speed limit on interstate highways outside of urban areas with a population $\leq 50,000$ to 75 MPH. "28-702 & 28-702.04(C) III. Based on engineering and traffic investigations, local governments may increase (but not >65 MPH) or decrease the speed limits on highways under their jurisdiction. '28-703 IV. Based on an investigation, the Director of the State Department of Transportation may establish a safe maximum speed limit of any bridge or

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			elevated structure. '28-706(B) & (C)
AR	No person shall drive a vehicle at speed that is greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards than existing.	Controlled-Access Highways-The maximum speed is determined via engineering and traffic studies.1 '27-51-201(b)(1) 30 MPH2 in urban districts '27-51-201(c)(1) 50 MPH2 for trucks with a capacity of 12 tons in other locations (except controlled access highways) '27-51-201(c)(2) 60 MPH2 for other vehicles in other locations (except controlled access highways) '27-51-201(c)(3)	Based upon engineering and traffic studies, the State Highway Commission may alter the above statutory speed limits on the State highway system.3 '27-51-204 II. Based on engineering and traffic investigations, local governments may increase the speed limits on highways within their jurisdiction. However, no speed limit can be >45 MPH. '27-51-206(b) III. Based on an investigation, the State Highway Commission may establish safe maximum speed limits for bridges or other elevated structures. '27-51-209(a) & (b)
CA	No person shall drive a vehicle at a speed greater than is reasonable or prudent having due regard for weather, visibility, the traffic on, and surface and width of, the highway.1 In no event, shall a speed such as to endanger the safety of persons or property.	65 MPH2 (except as noted below) Veh. Code '22349(a) & 22356 55 MPH on two lane undivided highway Veh. Code '22349(b) 35 MPH (<i>prima facie</i> limit) on non-State highways located in moderate density residential districts within the Town of Apple Valley3 Veh. Code '22352(a)(3) and 22352.1(a) & (b) 25 MPH4 (<i>prima facie</i> limit) in a business or residence district Veh. Code '22352(a)(2)	I. Based on engineering and traffic surveys, the State Department of Transportation may establish <i>prima facie</i> speed limits of 60, 55, 50, 45, 40, 35, 30 or 25 MPH on the State highway system.7 Veh. Code '22354 II. Based on engineering and traffic surveys, a local government may decrease the 65 MPH speed limit on applicable highways within its jurisdiction. Such government may establish <i>prima facie</i> speed limits of 60, 55, 50, 45, 40, 35, 30 or 25 MPH

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		25 MPH near a children's playground ⁵ Veh. Code '22357.1 15 MPH ⁶ (<i>prima facie</i> limit) on any alley Veh. Code '22352(a)(1)(C)	on such highways. Veh. Code "22358(a) & 22360
CO	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions then existing. '42-4-1101(1)	65 MPH ¹ on the interstate system ² '42-4-1101(2)(g). 55 MPH ¹ on an open highway not on the interstate system ² '42-4-1101(2)(f) 30 MPH in a residence district ³ '42-4-1101(2)(c) 40 MPH on open mountain highways ³ '42-4-1101(2)(d) 25 MPH in a business district '42-4-1101(2)(b) 20 MPH on narrow, winding mountain highways or blind curves '42-4-1101(2)(a)	I. State and local authorities, based on traffic investigations and surveys, may alter (increase or decrease) the above speed limits. ⁴ Exceeding this speed limit is <i>prima facie</i> evidence that such speed was not reasonable. However, no posted speed limit may be >75 MPH. "42-4-1101(2)(h) & (4) and 42-4-1102 II. The State, based on traffic investigations and surveys, may establish maximum speed limits for elevated structures. '42-4-1104(2) III. The State may establish highway maintenance, repair and construction zones. Such a zone must be posed with appropriate signs that designate that "double fines" are in effect for speeding violations that are committed in such zones. '42-4-613
CT	Traveling Unreasonably Fast. No person shall drive a motor vehicle at a rate of speed greater than is reasonable, having regard to the	65 MPH on multiple lane, limited access highways which are suitable for such a speed limit "14-218a(b) & 14-219(a) 55 MPH upon other highways '14-	The State Traffic Commission may determine speed limits ¹ on any highway, bridge, or parkway. '14-218a(a)

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	width, traffic and use of highway, road or parking area, the intersection of streets and weather conditions. "14-218a(a) & 14-281a(a)	219(a) . 50 MPH for a school bus on a divided limited access highway '14-281a(a) 40 MPH for a school bus on all other highways '14-281a(a)	
DE	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and without having regard to the actual and potential hazards then existing. Speed shall be so controlled as to avoid a collision. Title 21, '4168(a)	65 MPH on Aall portions of Delaware State Route 1 located between the Red Lion Creek and the Appoquinimink River.@ Any speed in excess of this limit is Aabsolute evidence@ that the speed is Anot reasonable or prudent and that it is unlawful.@ Title 21, '4169(d) 55 MPH on 4 lane roadways and divided highways Title 21, '4169(a)(1)e 50 MPH on 2 lane roadways Title 21, '4169(a)(1)d 25 MPH in either a business or residential district Title 21, '4169(a)(1)a & (a)(1)b 20 MPH at school crossings where signs are in effect during specific time periods Title 21, '4169(a)(1)c	I. Based on engineering studies and traffic investigations, the State Department of Transportation may increase or decrease the above speed limits on any particular portion of a highway.1 Title 21, '4169(b) II. Based on engineering studies and traffic investigations, local authorities, within their respective jurisdictions, may increase or decrease the above speed limits on any particular portion of a highway. However, the alteration of speed limits on State maintained highways requires the approval of the Department of Public Safety. Title 21, '4170(b) & (b)
DC	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and	25 MPH D.C. Code "40-703(a)(6) & 40-712(a) and CDCR 18-22- 2200.6 15 MPH in alleys D.C. Code "40-703(a)(6) & 40-712(a) and CDCR 18-	Based upon engineering and traffic investigations, the statutory speed limits may be increased or decreased on any highway. D.C. Code "40-

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	having regard to the actual and potential hazards then existing. D.C. Code "40-703(a)(6) & 40-712(a) and CDCR 18-22-2200.3	22-2200.7 15 MPH in streets adjacent to school buildings or playgrounds when indicated by official signs D.C. Code "40-703(a) & 40-712(a) and CDCR 18-22-2200.8 & 18-22-2200.9	703(a) & 40-712(a) and CDCR 18-22-2200.2 Note: D.C. law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day.
FL	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards than existing. '316.183(1) & (4)	70 MPH on limited access highways1 '316.187(2)(a) 55 MPH in all locations except as noted '316.183(2) 30 MPH2 in business and residence districts "316.183(2) & 316.189(2)(a)	I. After engineering and traffic investigations, the State or local governments (within their jurisdictions) may increase or decrease the statutory speed limit on a highway.3 However, the State cannot establish a speed limit >70 MPH and local jurisdictions cannot establish a maximum speed limit >60 MPH. '316.187(2)(e) & (2)(e) and 316.189(1) & (2)(b) II. Under separate statutory authority, the State Department of Transportation or a local government may reduce the speed limits otherwise proscribed by law on any highway (or part thereof) or bridge. Such action must be based on the need to avoid damage to such highway or bridge due to either its design or to weather related conditions. '316.555 Note: Under such authority, it may be

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			possible to provide for different speeds for different types of vehicles. ³
GA	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard for the actual and potential hazards than existing. '40-6-180	70 MPH ¹ on interstate system or on physically divided highways outside of urban areas with a population \geq 50,000 '40-6-181(b)(2) 65 MPH ¹ on the interstate system inside urban areas with a population \geq 50,000 '40-6-181(b)(3) 65 MPH ¹ on State divided highways without full access control '40-6-181(b)(4) 55 MPH on other locations '40-6-181(b)(5) 30 MPH in urban or residential district '40-6-181(b)(1) 35 MPH on unpaved county road '40-6-181(b)(1.1)	Based on engineering and traffic investigations, either the State Commissioner of Public Safety or the Commissioner of Transportation may lower the above speed limits on any highway. ² '40-6-182 II. Based on engineering and traffic investigations, local governments, within their jurisdictions, may lower the maximum speed limit on any highway. However, such limit shall neither be less than 30 MPH outside an urban or residential district nor less than 25 MPH within such districts. '40-6-183(a) III. The State or a local government, within its jurisdiction, may establish a maximum speed limit in a construction zone. '40-6-188
HI	A person shall not drive a vehicle at a speed greater than is reasonable and prudent and having regard to the actual and potential hazards and conditions then existing. "291C-101 & 291C-198(a)	35 MPH (58 kilometers per hour) for Mopeds ¹ '291C-198(b)	I. The State Director of Transportation may place signs establishing the maximum speed limit on any highway or Aconstruction area@ under the director's jurisdiction. ² "291C-102(b) & 1 of Act 293 (2000) II. Local governments may establish maximum speed limits on streets, highways or Aconstruction area@

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			under their jurisdiction. "291C-163(a)(5), (10), (15) & (23) and 1 of Act 293 (2000)
ID	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. '49-654(1)	75 MPH on interstate highways '49-654(2)(c) 65 MPH on Stats highways '49-654(2)(d) 55 MPH in other locations '49-654(2)(e) 35 MPH in either a residential, business or urban districts '49-654(2)(a) & (b)	I. Base on engineering and traffic investigations, the State may increase or decrease the above speed limits. ¹ However, no maximum posted speed limit can exceed either 75 MPH for interstate highways or 65 MPH for other State highways. '49-201(4) II. For highways within its jurisdiction, a local government, based on engineering and traffic investigations, may either (1) decrease the speed limit in a residential, business or urban districts or (2) increase the speed limits above the statutory limit for an urban district but not >65 MPH on arterial highways. "49-207(2) & 49-208(1)(i) III. Local authorities within their jurisdictions may establish speed limits for public parks. '49-208(1)(e) IV. Local authorities may lower the speed limits on those portions of State highways that pass through residential or business districts within their jurisdiction. '49-201(4) These speed limits must be less than the maximum speed limits established by

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			the State. '49-208(w)
IL	<p>A person shall not drive a vehicle upon any highway at a speed which is greater than is reasonable and proper with regard to traffic conditions and the use of the highway, or endangers the safety of any person or property. '625 ILCS 5/11-601(a)</p>	<p>65 MPH¹ (1) on Illinois toll highways and (2) on highways that are divided and have at least 4 lanes '625 ILCS 5/11-601(b) & (d) 55 MPH on all other highways, roads or streets outside an urban district '625 ILCS 5/11-601(b) & (d) 55 MPH for Second Division Vehicles weighing >8,001 lbs. '625 ILCS 5/11-601(e) A Second Division Vehicle is defined in Footnote No. 1. 30 MPH in an urban district '625 ILCS 5/11-601(b) & (c)(1) 15 MPH in an urban district alley '625 ILCS 5/11-601(b) & (c)(2)</p>	<p>I. The State Toll Highway Authority, based on engineering and traffic investigations, may establish a maximum speed on toll highways under its authority that are less than 65 MPH. '625 ILCS 5/11-603 II. With certain limitations and based on engineering and traffic investigations, the State may increase or decrease the above speed limits.² '625 ILCS 5/11-602 III. Based on engineering and traffic investigations, a local government may either increase or decrease the maximum speed on highway, streets or roads within its jurisdiction. However, the following limitations apply. (1) The speed limit in an urban district cannot be less than 20 MPH. (2) A speed limit cannot be more than 55 MPH. (3) The speed limit outside of an urban district cannot be less than 35 MPH. (4) And, except as provided in (1), the speed limit in a residential district cannot be less than 25 MPH. '65 ILCS 5/11-40-1 and "625 ILCS 5/11-208 & 5/11-604</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
IN	A person may not drive a vehicle at a speed greater than is reasonable and prudent under the conditions, having regard to the actual and potential hazards than existing. This includes special hazards such as going around a curve, approaching a hill, traveling upon a narrow or winding roadway. "9-21-5-1 & 9-21-5-4	Note: The law is not clear but the following may be <i>prima facie</i> speed limits. '9-21-1-3(a)(11) 65 MPH, except for certain vehicles noted under "Other" below, on an interstate or defense highway located outside an urban area with a population >50,000 '9-21-5-2(3) 55 MPH on other highways '9-21-5-2(2) 30 MPH in an urban district '9-21-5-2(1) 15 MPH in an alley '9-21-5-2(5)	Based on engineering and traffic investigations, the State Department of Transportation may increase or lower the above speed limits on any part of a highway.1 "9-21-5-3 & 9-21-5-12(a) II. Based on engineering and traffic investigations, a local government may increase or decrease the maximum speed on any part of a highway or establish the maximum safe speed on the streets within its jurisdiction.2 "9-21-1-3(a)(5) & (11), 9-21-5-3 and 9-21-5-6(a) & (b)
IA	A person shall drive a motor vehicle at a careful and prudent speed not greater than nor less than is reasonable and proper, having due regard to the traffic, surface and width of the highway and of any other conditions than existing, and no person shall drive any vehicle upon a highway at a speed greater than will permit the person to bring it to a stop within the assured clear distance ahead. "321.285 & 321.288	65 MPH on controlled-access, multilaned highways including interstate highways '321.285 55 MPH on other highways or on surfaced secondary roads1 '321.285 45 MPH in suburban districts '321.285 45 MPH on roads under the control of the State Board of Regents2 '262.68 35 MPH on State parks and preserve roads '461A.36 25 MPH in a residence or school district '321.285 20 MPH in a business district '321.285	I. The State may also establish a speed limit of 65 MPH on certain nonlimited access divided multilaned highways. '321.285 II. Based on engineering and traffic investigations, the State on the primary road system or a city government on streets within its jurisdiction (except primary road extensions) may increase or decrease the above speed limits.3 '321.290 III. The State or a city may lower the 65 MPH speed limit upon highways located within the corporate limits of a city. '321.286(6)

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>IV. Local authorities have the authority to regulate the speed in public parks and alleys. '321.236(5) & (11)</p> <p>V. With State approval, a local government may increase the statutory speed limits listed in '321.285. However, any new speed limit cannot >55 MPH. '321.2934</p> <p>VI. The Natural Resource Commission may reduce the speed limit on State parks and preserve roads when such is needed to improve safety. '461A.36</p> <p>VII. The Board of Regents may establish lower speed limits on roads under their jurisdiction in the interest of safety. '262.68</p>
KS	<p>A person shall not operate a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual hazards than existing. '8-1557</p>	<p>70 MPH on multilaned highways as designated by the State Secretary of Transportation '8-1558(a)(2)</p> <p>65 MPH on all other highways except a county or township highway '8-1558(a)(4)</p> <p>55 MPH on a county or township highway '8-1558(a)(3)</p> <p>30 MPH in an urban district '8-1558(a)(1)</p>	<p>I. The State Secretary of Transportation may decrease the above speed limits.1 '8-1559(a)(1)</p> <p>II. The State Secretary of Transportation or local government authorities may establish a speed limit in a construction zone. '8-1559(a)(c)</p> <p>III. Based on engineering and traffic investigations, a local government may increase or decrease the above speed limits within its jurisdiction.</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>However, the following limitations apply. (1) A speed limit cannot be established greater than 65 MPH. (2) Outside an urban or residence district, the speed limit cannot be less than 20 MPH. (3) Within an urban district school zone, when students are going either to or from school, the speed limit cannot be less than 20 MPH. "8-1560(a) &(b) and 8-2002 IV. Local authorities, which have authority over a county or township, may establish proper highway speed limits within these jurisdictions. Such speed limits may be established with or without an engineering or traffic investigation. However, no speed limit shall established >65 MPH. '8-1560(h)</p> <p>V. Local authorities, within their respective jurisdictions, may establish speed limits within construction zones. '8-1560(f)</p>
KY	<p>A person shall not operate a vehicle at a greater speed than is reasonable and prudent, having regard for the traffic and for the condition and use of the highway. '189.390(2)</p>	<p>65 MPH on interstate highways and divided highways with 4 or more lanes 1 '189.390(3)(a) & (5)(d) 55 MPH outside business or residential districts '189.390(3)(a) 35 MPH in business or residential districts '189.390(3)(a) 15 MPH on off-street parking facilities</p>	<p>Based upon engineering and traffic investigations, the State Secretary of Transportation may increase or decrease the speed limits on any highway.²</p> <p>However, the speed limit on highways, including interstate and 4 lane divided highways which are located in</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		'189.390(c)	<p>urbanized areas, cannot exceed 55 MPH. '189.390(4)(a)</p> <p>II. With the approval of the State Secretary of Transportation, a local government may establish speed limits for the highways or streets within its jurisdiction. However, such limits cannot exceed 55 MPH as noted in I above. '189.390(5)(a) & (b)</p> <p>III. State and local authorities may reduce the speed limits on highways under their respective jurisdictions for reasons of highway design or to reduce highway damage or deterioration due to rain or other natural causes.</p> <p>'189.230(1)</p>
LA	<p>No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and potential hazards then existing, having due regard for the traffic on, and the surface and width of, the highway, and the condition of the weather.</p>	<p>70 MPH on interstate and controlled access highways¹ "32:61(B) & 32:62(A)</p> <p>65 MPH on other multi-lane divided highways which have partial or no control of access¹ "32:61(B) & 32:62(A)</p> <p>55 MPH on other highways¹ "32:61(A) & 32:62(A)</p>	<p>Base on engineering and traffic investigations, the State may increase or decrease the above speed limits.² '32:63(A)</p> <p>Legislative Requests. I. The Louisiana Legislature has requested that the State Department of Transportation and Development "increase the speed limit on Louisiana Highway 23 in Plaquemines Parish on those sections of highway which are outside of the</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>towns and only in those sections in which there are four-lane areas of roadway." House Concurrent Resolution 136 adopted in 1997 Note: The legislature did not recommend a speed limit.</p> <p>II. The Louisiana Legislature has requested that the State Department of Transportation and Development increase the speed limit on Interstate Highway 55 between Pontchatoula and LaPlace from 60 MPH to 70 MPH. House Concurrent Resolution 130 adopted in 1999</p> <p>Legislative Directive. The Louisiana Legislature has directed that the State Department of Transportation and Development lower the speed limit to 45 MPH on Louisiana Highway 964 from its intersection with Louisiana Highway 61 to the East Baton Rouge Parish line. Senate Concurrent Resolution 52 adopted in 1999</p> <p>II. The State can promulgate regulations regulating speed on Louisiana expressways. '48:1272</p> <p>III. Local governments are authorized to establish speed limits or speed zones. However, no speed limit shall be established in excess of the above maximum limits. "32:41(A)(9), 32:42 &</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			40:403
ME	A person shall operate a vehicle at a careful and prudent speed not greater than is reasonable and proper having due regard to the traffic, surface and width of the way and of other conditions then existing. Title 29-A, '2074	45 MPH on all other public ways Title 29-A, '2074(1)(D) Important. For maximum speed limits on the Maine Turnpike and interstate and divided controlled-access highways, see I under Posted (Maximum) Speed Limit below. 25 MPH in business or residential districts Title 29-A, '2074(1)(C) 15 MPH when passing a school during recess or when the students are going to or leaving the school Title 29-A, '2074(1)(A)	I. The State is authorized to increase or decrease the above speed limits. ¹ However, no posted speed limit can exceed 65 MPH for the Maine Turnpike and interstate or divided controlled-access highways or 60 MPH for all other roads. Title 23, '1973(2) & Title 29-A, '2073(1)(C) II. A local government may alter speed limits. However, such alteration cannot be contrary to the State speed laws. Title 29-A, '2075(3)
MD	A person shall not operate a vehicle at a speed that, with regard to the actual and potential dangers existing, is more than that which is reasonable and prudent under the conditions. Tran. '21-801(a)	65 MPH is the maximum speed limit which can be established on any highway. Tran. '21-801.1(e)(2) 55 MPH on (1) highways which are not interstate highways or expressways or (2) divided highways in other locations Tran. '21-801.1(b)(4) & (e)(1) 50 MPH on undivided highways except as noted below Tran. '21-801.1(b)(3) 35 MPH on divided highways in residential districts Tran. '21-801.1(b)(2) 30 MPH on highways in business districts or on undivided highways in residential districts Tran. '21-	I. Based on engineering and traffic investigations, the State Highway Administration may alter the above speed limits. Such alterations may provide for different speed limits (1) at specified times of the day, for certain weather conditions, for various types of vehicles, and for other reasons concerned with highway safety. However, no speed limit shall be (1) >65 MPH on any highway or (2) >55 MPH on highways which are not interstate highways or expressways or divided highways in other locations. Tran. "21-801.1(d) and (e)(1) & (2), 21-

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		801.1(b)(1)	<p>208</p> <p>II. Based on engineering and traffic investigations, local governments¹ may establish posted speed limits.² However, a speed limit of >50 MPH cannot be established in an urban district. In addition, a speed limit <25 MPH cannot be established outside an urban district. Tran. '21-803</p> <p>III. A local government may establish a safe maximum speed limit for an alley. Tran. '21-803(e)</p> <p>IV. The State Highway Administration or a local government on highways under their respective jurisdictions, may establish a speed limit in a designated school zone which is within half-mile of a school.³ However, such speed limit cannot be >35 MPH in a school zone where a school crossing guard is present. Tran. '21-803.1(a), (e) & (f)</p>
MA	No person shall "run" a motor vehicle at a rate of speed greater than is reasonable and proper, having regard to traffic and the use of the way and the safety of the public. ¹ Ch. 90, '17	65 MPH on certain parts of interstate highways ² Ch. 90, '17A	The State or a local government may regulate the speed limit on a highway. Ch. 90, '18 Note: Massachusetts law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day.

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
MI	<p>A person shall operate a vehicle at a careful and prudent speed not greater than nor less than is reasonable and proper, having due regard to the traffic, surface, and width of the highway and of any other condition then existing. '257.627(1)</p>	<p>70 MPH on parts of freeways under a special speed study '257.628(7) 65 MPH, except as noted above, on freeways '257.628(7) 55 MPH on other highways '257.628(1) 25 MPH (<i>prima facie</i> unlawful speed) in business or residence districts, in public parks or in school zones '257.627(2) & 257.627a(2) 25 MPH on county highways or interconnected group of county highways not more than 1 mile in total length that connect with a county road system. '257.628(3)</p>	<p>I. Notwithstanding the above speed limits and based on engineering and traffic investigations, State and local governments may establish maximum speed limits on highways under their jurisdiction. However, not more than 170 miles of the State=s freeways shall have a speed limit <65 MPH. '258.628(1) & (7) Note: Michigan law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day. II. Local authorities may increase or decrease the 25 MPH speed limit in a school zone. '257.627a(4) & 257.606(1)(k) III. Local authorities may increase the <i>prima facie</i> speed limits within their jurisdictions. However, a <i>prima facie</i> speed limit outside either a business or residential district shall not be <25 MPH. A <i>prima facie</i> speed limit of not <15 MPH may be established for publicly owned parks or playgrounds. '257.629(1) & (4) IV. A municipal government may establish speed limits on the properties of any board of education, school</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			district or community college district located within its jurisdiction. '257.961 V. When a state of emergency exists, the governor may reduce the speed limit on any street, highway or freeway via executive order. '257.629b
MN	<p>No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions. '169.14, subs. 1 & 3</p> <p>II. Driving with Due Care. AEvery driver is responsible for becoming and remaining aware of the actual and potential hazards then existing on the highway and must use due care in operating a motor vehicle.@ '169.14, subd. 1</p>	<p>A speed in excess of the following limits is <i>prima facie</i> evidence that such a speed is not reasonable and prudent. '169.14, subd. 2</p> <ol style="list-style-type: none"> 1) 65 MPH on highways during the daytime¹ '169.14, subd. 2(a)(2) 2) 55 MPH on highways during the nighttime² '169.14, subd. 2(a)(3) 3) 30 MPH in an urban district or town road in a rural residential district³ '169.14, subd. 2(a)(1) 4) 25 MPH on residential roadways⁴ '169.14, subd. 2(a)(5) 5) 10 MPH in alleys '169.14, subd. 2(a)(4) 6) 10 to 30 MPH in manufactured home parks⁵ '327.27, subs. 2 & 2a 7) 10 MPH in recreational camping areas '327.27, subd. 2 	<p>Based on engineering and traffic investigations, the State Commissioner of Transportation may increase or decrease the above speed limits. Any speed in excess of these posted limits is <i>prima facie</i> evidence that the speed was not reasonable or prudent. '169.14, subs. 4 & 5 Note: Minnesota law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day.</p> <p>II. If the commissioner establishes a speed limit of >30 MPH for a highway within an urban district, the local government may reduce such limit for quarter-mile segments to 30 MPH. '169.14, subs. 5b</p> <p>III. Based on engineering and traffic investigations, local governments may establish speed limits in school zones.⁶ The speed limit in such zone cannot be <15 MPH nor >20 MPH</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>below the established speed limit where such speed limit is normally 40 MPH. '169.14, subd. 5a</p> <p>IV. Based on engineering and traffic investigations, a local government may establish a speed limit different than above for any alley. '169.14, subd. 5c</p>
MS		<p>70 MPH for private passenger vehicles or passenger buses on interstate highways or on U.S. designated highways with 4 or more lanes. '63-3-501 (&3)</p> <p>65 MPH for private passenger vehicles or passenger buses on other highways. '63-3-501 (&2)</p> <p>60 MPH for trucks or truck-trailers on highways with 4 or more lanes '63-3-501 (&1)</p> <p>55 MPH for trucks or truck-trailers on other highways '63-3-501 (&1)</p>	<p>I. Based on engineering and traffic investigations, the State Highway Commission may decrease the above speed limits. '63-3-503 (&1) Note: Except as noted under Other below, Mississippi law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day.</p> <p>II. Based on engineering and traffic investigations, local governments may decrease the maximum speed limits on streets or highways under their jurisdictions. However, no posted speed limit shall be <15 MPH '63-3-511 (&1)</p> <p>III. Based on engineering and traffic investigations, local governments may adopt speed limits on limited portions of highways that are near schools or churches. The local</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			government may provided that these special limits shall only be in effect during certain days or times. '63-3-515
MO	A person shall operate a motor vehicle in a careful and prudent manner and at a rate of speed so as not to endanger the property of another or the life or limb of any person and shall exercise the highest degree of care. '304.012.1	70 MPH on rural interstate ¹ and freeways ² '304.010.2(1) 65 MPH on rural expressways ³ '304.010.2(2) 60 MPH on urban interstate highways ⁴ , expressways and freeways. '304.010.2(3) 60 MPH on other roads, except State 2 lane "lettered" roads, not located in an urban area. '304.010.2(4) 55 MPH on State 2 lane "lettered" roads '304.010.2(5)	The State may increase the maximum speed limit to 60 MPH on State 2 lane "lettered" roads. '304.010.2(5) See the Note in below. II. Local governments with State approval may establish speed limits on the streets or roads within their jurisdiction. '302.010.4 & .5 III. Under separate statutory authority, the State and local governments on roads under their jurisdiction may fix a speed limit by posting appropriate signs. A violation of this posted speed limit is <i>prima facie</i> evidence of careless and imprudent driving. '304.351.7 IV. Also, under separate authority, cities, towns and villages have the authority to enact ordinances which regulate traffic. This includes establishing speed limits. "77.520, 79.410 & 300.205 V. The State may increased or decrease the maximum speed limits on and State road (e.g., interstate highways, freeways or expressways) not under a

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>local jurisdiction. However, no speed limit shall be established >70 MPH. '304.010.3</p> <p>Note: Except as noted under Other below, Missouri law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day.</p>
MT	<p>Subject to the (maximum) statutory speed limits below, a person shall operate a vehicle in a careful and prudent manner and at a reduced rate of speed no greater than is reasonable and prudent under the conditions existing at the point of operation, taking into account the amount and character of traffic, visibility, weather and roadway conditions.1 '61-8-303(4)</p>	<p>75 MPH² at all times on Federal-Aid interstate highways outside an urbanized area with population \leq50,000 '61-8-303(1)(a)</p> <p>65 MPH² at all times on Federal-Aid interstate highways within an urbanized area with a population \leq50,000 '61-8-303(1)(a)</p> <p>70 MPH² during the daytime³ and 65 MPH² during the nighttime³ on any other public highway '61-8-303(1)(b)</p> <p>65 MPH at all times on U.S. Highway 93 between the Canadian and Idaho borders unless the highway is upgraded to a continuous four lane highway. '61-8-303(2)</p> <p>25 MPH in an urban district '61-8-303(5)</p>	<p>The State Department of Transportation, based on engineering and traffic investigations which indicate that a greater or less speed limit than noted above is reasonable or safe, may establish different speed limits on a segment of a highway less than 50 miles in length. '61-8-309(1) The law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day.</p> <p>II. Based on engineering and traffic investigations, the State may establish safe maximum speed limits for bridges or other elevated structures. '61-8-</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			313(2) & (3) III. Based on engineering and traffic investigations, a local government may increase or decrease the maximum speed limits on highways under its jurisdiction.4 '61-8-310(
NE	A person shall not operate a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. '60-6,185	75 MPH on State freeways ¹ and Federal interstate highways ² '60-6,186(1)(g) 65 MPH on a State expressway ³ '60-6,186(1)(f) 60 MPH on other State highways '60-6,186(1)(e)(II) 55 MPH upon any dustless-surfaced highway not part of the State highway system '60-6,186(1)(d) 50 MPH upon a non dustless-surfaced highway not part of the State highway system '60-6,186(1)(c) 25 MPH in a residential district '60-6,186(1)(a) 20 MPH in a business district '60-6,186(1)(b)	I. Based on engineering and traffic investigations, the State or local governments may increase or decrease the above statutory speed limits. ⁴ However, the State cannot increase the maximum statutory speed limits on rural highways and freeways. And, on county highways that are not part of the State highway system, a local government cannot establish a speed limit <35 MPH outside either a residential or business district. "60-6,186(2) and 60-6,190(1) & (3)
NV	A person shall not drive a vehicle greater than is reasonable or proper, having due regard for the traffic, surface and width of the highway, the	I. A person shall not operate any vehicle at a speed >75 MPH '484.361(4) II. A person shall not operate a motor vehicle >15 MPH ¹ in a school zone or >25 MPH in school crossing zone ²	I. The State Department of Transportation may adopt speed limits of not >75 MPH on highways constructed and maintained by it. Such authority includes the establishment of lower

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	weather and other highway conditions. '484.361(1)	'484.366(1) & (2)	speed limits (1) "where necessary to protect public health and safety" or (2) "for trucks, overweight and oversized vehicles, trailer drawn by motor vehicles and buses." "484.361(3), 484.367(2) & 484.368 II. After appropriate studies, the State may establish special speed zones on a highway where a hazard exists. "484.361(3) & 484.369(1) III. After an appropriate investigation, the State may establish the maximum safe speed limits for bridges and elevated structures. "484.361(3) & 484.375(2) IV. Except for State constructed and maintained highways, local governments and unincorporated towns may establish speed limits within their jurisdictions. "269.185(1)(b), 484.361(3) & 484.367(1)
NH	A person shall not drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. '265:60, I	Operating a motor vehicle above the following speed limits is considered <i>prima facie</i> evidence that such speed is unreasonable. '265:60, II 1) 65 MPH on the interstate system and other highways designated via statute 1 '265:60, II(e) 2) 55 MPH on other highways '265:60,	I. Based on engineering and traffic investigations or in the event of vehicle or weather emergencies, the State Commissioner of Transportation may increase or decrease the <i>prima facie</i> limit on the State highway system or on highways outside the compact area of a city or town. ³ '265:62, I & 236:7

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		<p>II(d) 3) 35 MPH in rural residential districts and class V highways outside the compact part of a city or town '265:60, II(c) 4) 30 MPH in a business or urban residential district '265:60, II(b) 5) 10 MPH below the usual posted speed limit in a school zone² '265:60, II(a) 6) 10 MPH below the usual posted speed limit but in no case >45 MPH on a portion of a highway where persons are at work thereon '265:60, II(f)</p>	<p>II. Based on a petition by the governing body of a local government, the State Commissioner of Transportation may decrease the <i>prima facie</i> speed limit on the State highway system within the compact area of a city or town. However, such reduced limit cannot be <25 MPH. '265:62, IV III. Based on engineering and traffic investigations, a local government may increase or decrease <i>prima facie</i> speed limits within their jurisdictions.⁴ '265:63, I & II</p>
NJ	<p>A person shall drive a vehicle at an appropriate reduced rate of speed when special hazard exist with respect to pedestrians or other traffic or by reason of weather or highway condition.¹ Required reduced rates of speed also includes (1) approaching and crossing an intersection or railway grade crossing, (2) approaching and going around a curve, (3) approaching a hill crease and (4) traveling upon any narrow or winding roadway. '39:4-98</p>	<p>I. 65 MPH on selected portions of State eligible public highways² as determined by the State Commissioner of Transportation in consultation with the State attorney general, the N.J. Highway Authority and the N.J. Transportation Authority "39:4-98.4 & 39:4-98.5 II. It is <i>prima facie</i> unlawful for a person to exceed the following speed limits. '39:4-98 1) 55 MPH on all other highways '39:4-98 (&1) 2) 35 MPH in suburban business or residential district '39:4-98 (&1) 3) 25 MPH in a (non-suburban) business or residential district '39:4-98</p>	<p>I. Based on engineering and traffic investigations, the State Commissioner of Transportation on State highways or local governments on highways under their jurisdiction, may increase or decrease the above speed limits. These new limits will be the <i>prima facie</i> lawful speed limits.³ "39:4-8(b) & 39:4-98 (&2) II. The State Highway Commissioner or a local government on highways under their jurisdiction may designate the right-hand lanes of Basis for a Speed Law Violation: (continued) Posted (Maximum) Speed Limit: (continued) traffic for slow moving</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	(&3)	(&1) 4) 25 MPH either when passing through a school zone during recess, while children are visible from the highway or when children are either going to or leaving a school during opening and closing hours. '39:4-98 (&1)	vehicles and inside lanes for traffic moving at the designated speed. '39:4-88(d) III. The South Jersey Transportation, New Jersey Turnpike and the New Jersey Highway Authorities may establish speed limits on the highways
NM	Speed shall be so controlled as to avoid colliding with any person or vehicle which is either on or entering the highway. All persons shall use due care.1 '66-7-301(B)	75 MPH on highways '66-7-301(A)(3) 35 MPH in business and residential districts '66-7-301(A)(2) 15 MPH in a posted school zone2 '66-7-301(A)(1)	I. Based on engineering and traffic investigations, the State Secretary of Highway and Transportation may increase to not >75 MPH or decrease the above speed limits on any highway within its jurisdiction.3 '66-7-303(A) & (B) II. Based on engineering and traffic investigations and subject to approval by the State Secretary of Highway and Transportation, a local government, may increase or decrease the above speed limits on any highway within its jurisdiction. '66-7-304 III. Based upon investigations, the State Highway Commission may establish safe maximum speed limits for bridges and other elevated structures. '66-7-306(B) & (C)
NY	A person shall not drive a vehicle at a speed greater than is reasonable	65 MPH on parts of certain designated highways1 V&T Law '1180-	I. The State Department of Transportation (1) on highways under

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	and prudent under the conditions and having regard to the actual and potential hazards then existing. V&T Law '1180(a)	See Other below a(2) Repealed December 1, 2005. 55 MPH V&T Law "1180(b) & 1180-a(1) (V&T Law '1180-a on December 1, 2005)	its jurisdiction ² , (2) on county or town roads not in cities or villages via a request by a county or town or (3) on highways on State educational, institutional or agency grounds via a request from such organizations may establish maximum speed limits > or <55 MPH. ³ V&T Law "1180(c) & (d)(1), 1620(a), 1622(1) and 1623(a) Note: New York law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day. II. Certain State created public authorities and commissions may establish maximum speed limits <55 MPH on highways under their
NC	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions then existing. '20-141(a)	70 MPH on the interstate highway system or other controlled-access highways ¹ '20-141(d)(2) 55 MPH on highways outside municipal corporate limits '20-141(b)(2) 35 MPH on highways inside municipal corporate limits '20-141(b)(1)	I. Based on engineering and traffic investigations, the State Transportation Department may increase or decrease the above speed limits on State highways under its jurisdiction (e.g., outside the corporate limits of a municipality or unincorporated municipalities). '20-141(d), (f) & (g) II. Based on engineering and traffic

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>investigations, local governments may increase or decrease the above speed limits on streets under their jurisdiction. However, the maximum speed limit on any street cannot be >55 MPH. '20-141(e) & (f)</p> <p>III. Except for overweight or oversized vehicles requiring special permits to use the highways or when weather or highway conditions require a slower speed, speed limits shall apply uniformly to all types of vehicles. '20-141(l)</p> <p>IV. Local authorities may post lower speed limits than proved for under '20-141(b) on public school property and on private school property subject to the approval of governing body of the private school. '20-141(e1)</p>
ND	<p>No person may drive a vehicle at a speed greater than is reasonable and prudent under the existing conditions having regard to the actual and potential hazards then existing.1 '39-09-01 (&1)</p>	<p>70 MPH (112.65 Kilometers Per Hour) on interstate highways2 '39-09-02(1)(h)</p> <p>65 MPH3 (104.61 Kilometers Per Hour) on certain paved highways during the day time '39-09-02(1)(g)</p> <p>55 MPH4 (88.51 Kilometers Per Hour) on certain paved and unpaved highways during the nighttime '39-09-02(1)(f)</p> <p>25 MPH (40.23 Kilometers Per Hour) in</p>	<p>I. Based on engineering and traffic investigations, the State may increase or decrease the above speed limits on the State highway system.6 "39-09-04 & 39-09-07</p> <p>II. Based on engineering and traffic investigations, a local government may increase (but not >55 MPH/>88.51 Kilometers Per Hour) or decrease the above speed limits on the</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		a business or residential district or a public park '39-09-02(1)(e) 20 MPH (32.19 Kilometers Per Hour) in a school zone ⁵ '39-09-02(1)(b)	highways under its jurisdiction. '39-09-03
OH	No person shall operate a vehicle at a speed greater or less than is reasonable or proper, having due regard to the traffic, surface, and width of the street or highway and any other conditions. '4511.21(A)	65 MPH ¹ , established prior to October 1, 1995, on certain interstate and State freeways '4511.21(B)(12) and (D) 55 MPH for vehicles weighing >8,000 lbs. empty weight and noncommercial busses on interstate and State freeways '4511.21(B)(10) 55 MPH on other freeways inside and outside of municipal corporations '4511.21(B)(8) & (9) and (D) 55 MPH on highways outside of municipal corporations except certain freeways '4511.21(B)(5) and (D) 50 MPH (<i>prima facie</i> speed limit) on controlled-access highways and expressways within municipal corporations '4511.21(B)(4) & (C) 50 MPH (<i>prima facie</i> speed limit) on State routes within municipal corporations outside urban districts '4511.21(B)(6) & (C) 35 MPH (<i>prima facie</i> speed limit) on State routes and through highways ² '4511.21(B)(3) & (C) 25 MPH (<i>prima facie</i> speed limit) on municipal corporation streets ³	Based on geometric and traffic characteristics studies, the State or local governments ⁴ may increase or decrease the above speed limits on any highway. The new posted speed limit on such highway is the <i>prima facie</i> safe speed for that highway. '4511.21(H), (I) & (J)

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		'4511.21(B)(2) & (C) 20 MPH (<i>prima facie</i> speed limit) in school zones during recess or when children are going to or leaving school '4511.21(B)(1)(a) & (C) 15 MPH (<i>prima facie</i> speed limit) on alleys within a municipal corporation '4511.21(B)(7) & (C)	
OK	A person shall drive a vehicle at a careful and prudent speed not greater than nor less than is reasonable and proper, having due regard to the traffic, surface and width of the highway (turnpike) and any other conditions then existing. Title 47, '11-801(A) & (D) and 11-1401(g)	75 MPH on the turnpike system and designated segments of the rural interstate system Title 47, '11-801(B)(1) 70 MPH on 4 lane highways or "super two-lane" highways ¹ Title 47, '11-801(B)(2) 65 MPH on other highways Title 47, '11-801(B)(3) 55 MPH on a county road Title 47, '11-801(E)(1) 45 MPH in the State Capitol Park Area Title 47, '11-801(B)(6) 35 MPH in a State park or wildlife refuge Title 47, '11-801(B)(7) 25 MPH in a school zone on any highway outside of a municipality However, the Oklahoma Department of Transportation, based on engineering and traffic investigations, may establish school zone speed limits >25 MPH at specific locations. Title 47, '11-801(B)(5)	I. Based on engineering and traffic investigations, the State Transportation Commission may increase or decrease ² the above speed limits. ³ Title 47, '11-802 & 11-803(D) II. The State Turnpike Authority has the authority to establish maximum speeds for trucks, buses and automobiles using turnpikes. Title 47, '11-1401(i) III. Subject to certain limitations ⁴ and based on engineering and traffic investigations, local governments may increase or decrease the

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		<p>25 MPH, or an established alternative speed limit, through State schools which are located on State owned land adjoining or outside the limits of a corporate city or town Title 47, '11-801(B)(6)</p> <p>Historical Note: The provisions of Title 47, '11-801, that established lower speed limits for trucks, truck tractors with semitrailers or poletrailers attached and for pick-up trucks hauling livestock, were repealed. '1 of Chapter 324, Laws of 1996</p>	
OR	<p>A person commits an offense if they drive a vehicle at a speed greater than is reasonable and prudent, having due regard to all of the following: The traffic; the surface and width of the highway; the hazard at intersections; weather; visibility; and, other conditions then existing.1 '811.100(1)</p>	<p>It is <i>prima facie</i> evidence of a violation of the basic speed rule to exceed the following speed limits.</p> <p>A) 65 MPH on rural interstate highways '811.105(2)(f), 811.112(1) & 811.123(1)(e)</p> <p>B) 55 MPH on other highways '811.105(2)(g) & 811.123(1)(f)</p> <p>C) 25 MPH in a public park '811.105(2)(d) & 811.123(1)(d)</p> <p>D) 25 MPH in a residential district if the district is not located within a city or urban growth boundary that is a county with a population >100,000 and the highway is neither an arterial nor a collector highway '811.105(2)(e)</p> <p>E) 25 MPH on the ocean shore '811.120(1)(b)</p>	<p>I. Based on engineering and traffic investigations, the State Department of Transportation may increase or decrease the above <i>prima facie</i> speed limits on the highways outside an urban area. '810.180(7)3</p> <p>II. The State Department of Transportation may "supersede" the maximum statutory speed limits ('811.123) for highways in an urban area where such speed limits are not reasonable or safe. '810.180(10)</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		F) 20 MPH in a school zone ² '811.105(2)(c) & 811.123(1)(c) G) 20 MPH in a business district '811.105(2)(b) & 811.123(1)(b) H) 15 MPH in an alley '811.105(2)(a) & 811.123(1)(a)	
PA	No person shall drive vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. Title 75, '3361	65 MPH on certain interstate highways and freeways ¹ Title 75, '3362(a)(1.1) 55 MPH on other highways Title 75, '3362(a)(2) 35 MPH in urban districts Title 75, '3362(a)(1) 15 MPH in a school zone Title 75, '3365(b)	Based on engineering and traffic investigations, the State or a local government on highways under their jurisdictions may increase or decrease the above speed limits on the highways under their jurisdiction. ² Such speed limits "may vary for different weather conditions and other factors bearing on safe speeds." Title 75, "3362(a)(3) & 3363 Note: Pennsylvania law does not specifically state whether different highway speed limits may be established either for different types of vehicles or for different times of the day.
PR	Basic Speed Rule: The speed of a motor vehicle shall be regulated with due care, taking into account the width, volume of traffic, use, and condition of the public highway. Title 9, '841(a)	45 MPH in a rural zone Title 9, '841(b)(2) 25 MPH in an urban zone Title 9, '841(b)(1) 25 MPH in a school zone ¹ Title 9, '841(b)(3)	Based on traffic-engineering research, the Commonwealth or local authorities, on highways under their jurisdiction, may increase or decrease the above speed limits. ² Title 9, '843
RI	No person shall drive a vehicle at a	Speed in excess of the following limits	I. Based on engineering and traffic

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	<p>speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing.¹ '31-14-1 & 31-14-3 In addition, a driver is to exercise due care to avoid colliding with a pedestrian or human-powered vehicle. '31-18-8</p>	<p>is considered <i>prima facie</i> evidence that such speed was not reasonable or prudent. '31-14-2(a) 50 MPH during the daytime² outside a business or residential district. '31-14-2(a)(2) 45 MPH during the nighttime² outside a business or residential district. '31-14-2(a)(3) 25 MPH in a business or residential district. '31-14-2(a)(2) 20 MPH in a school zone³ '31-14-2(a)(4)</p>	<p>investigations, the State Traffic Commission may increase or decrease the <i>prima facie</i> speed limits. "31-14-4 & 31-14-4.1 Note: Rhode Island law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day.</p> <p>II. Based on engineering and traffic investigations, a local government on streets in a business or residential district under their jurisdiction may decrease the <i>prima facie</i> speed limits. '31-14-5</p> <p>III. A local government may increase the <i>prima facie</i> speed limits on through highways and other highways with limited intersections.⁴ '31-14-6</p> <p>IV. Based on engineering and traffic investigations, a local government on streets outside a business or residential district under their jurisdiction may decrease the <i>prima facie</i> speed limits.⁵ '31-14-7</p> <p>V. Based on an investigation, the State Traffic Commission may establish safe maximum speed limits for bridges and other elevated structures. '31-</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			14-12 Note: The State Traffic Commission must approve speed limit alterations by local governments on State highways. '31-14-8
SC	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. '56-5-1520(a) & (c)	70 MPH on the interstate highway system and other freeways ¹ "56-5-1510 & 56-5-1520(b)(1) 60 MPH on multilane divided primary highways '56-5-1520(b)(2) 55 MPH in other locations or on other sections of highways '56-5-1520(b)(3) 40 MPH on unpaved roads '56-5-1520(b)(3) 30 MPH in an urban district ² '56-5-1520(c)	I. Based on engineering and traffic investigations, the State Department of Transportation may increase or decrease the above speed limits on the State highway system including the extension of such system into an urban district. ³ "56-5-1520(e) & 56-5-1530 II. Except as noted in III, based on engineering and traffic investigations, local governments within their respective jurisdictions may increase or decrease the above speed limits. ⁴ "56-5-1520(e) & 56-5-1540(a) III. Based on engineering and traffic investigations, a local government may establish a maximum speed limit of <30 MPH in an urban district. ² However, this authority does not apply to highways within the State highway system. '56-5-1520(d) IV. Based upon an investigation, the State Department of Transportation may establish a safe maximum speed limit for any bridge or elevated

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>structure. '56-5-1570(d)</p> <p>V. The governing boards of State institutions may establish speed limits on the streets, drives and alleys under their jurisdiction. '56-21-10(1)</p> <p>VI. The State Department of Mental Health may promulgate regulations "governing and controlling" the roads and streets within areas of the State Hospital and Midlands Center. '56-21-70 Such regulations could include the establishment of speed limits in these areas.</p>
SD	<p>It is unlawful for a person to drive a motor vehicle at a speed greater than is reasonable and prudent under the conditions then existing. '32-25-3</p>	<p>75 MPH on interstate highways '32-25-4</p> <p>65 MPH on other streets or highways '32-25-1.1</p> <p>55 MPH on township roads '32-25-9.2</p> <p>25 MPH on urban streets that do not have posted speed limits '32-25-12</p> <p>15 MPH in a school zone¹ '32-25-14</p>	<p>I. The State Transportation Commission may establish posted speed limits that are less than the maximum ones for highways under its jurisdiction. '32-25-7 & 32-25-10</p> <p>II. Local governments may (1) establish "speed zones" upon the streets or highways under their jurisdiction or (2) regulate speed on public parks. '32-14-3, 32-14-4, 32-25-9.1 & 32-25-16 Note: The authority granted under these provisions could be used to increase as well as to decrease the speed limits on township roads which have a statutory speed limit of 55</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>MPH ('32-25-9.2).</p> <p>III. Based upon an investigation, the State Transportation Commission may establish a safe maximum speed for any public bridge, causeway or viaduct. "32-25-18 & 32-25-19</p> <p>IV. A county road district² may establish speed limits on the roads under its jurisdiction. "31-12A-21(6) & 32-25-9.1</p>
TN	<p>Note: This State does not have a law establishing a basic speed rule.</p>	<p>70 MPH for on interstate highways '55-8-152(d)</p> <p>65 MPH on all other highways or roads¹ '55-8-152(a) & (d)</p>	<p>I. The State Department of Transportation is authorized to lower the above speed limits on the State system of roads and highways. '55-8-152(g)(1)(A)</p> <p>II. Based on engineering and traffic investigations, the State Department of Transportation may lower the speed limits in business, urban or residential districts. '55-8-153(a)</p> <p>III. Local governments may lower the maximum speed limits on roads and streets under their jurisdiction. "55-8-152(g)(1)(C) & 55-8-153(d)</p> <p>IV. The State Department of Transportation may establish a safe maximum speed limit for any bridge or elevated structure. '55-8-156(b)</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>V. Based on engineering investigations, a local government may establish special speed limits adjacent to schools. This limit cannot be <15 MPH.²</p> <p>'55-8-152(e)(1) & (2)</p> <p>VI. The State Department of Transportation may establish special speed limits at school entrances and exits and from controlled access highways.</p> <p>'55-8-152(d)(1)(C)</p>
TX	<p>No person shall drive a vehicle at a speed greater than is reasonable and prudent under the circumstances then existing or under the conditions and having regard to actual and potential hazards. Tran. Code '545.351(a) & (b)(1)¹</p>	<p>Operating a vehicle in excess of the following speed limits is <i>prima facie</i> evidence that such speed is not reasonable and prudent and is unlawful.</p> <p>Tran. Code '545.352(a)</p> <p>A) 70 MPH during the daytime on "numbered" highways and farm/ranchto-market roads outside an urban district²</p> <p>Tran. Code '545.352(b)(2)</p> <p>B) 65 MPH during the nighttime on "numbered" highways and farm/ranchto-market roads outside an urban district²</p> <p>Tran. Code '545.352(b)(2)</p> <p>C) 60 MPH during the daytime on highways that are not "numbered" and</p>	<p>Based on engineering and traffic investigations, the Texas Transportation Commission may alter the <i>prima facie</i> speed limits on State highways and limited-access or controlled highways inside or outside of any municipality.³ Tran. Code '545.353(a) & (f)</p> <p>II. Based on engineering and traffic investigations, the Texas Turnpike Authority or any Regional Tollway Authority may alter the <i>prima facie</i> speed limits on highways under its jurisdiction including those inside or outside any municipality.⁴ Tran. Code '545.354(a) & (d)</p> <p>III. Based on engineering and traffic investigations, county court</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		<p>that are outside of an urban district Tran. Code '545.352(b)(3)</p> <p>D) 55 MPH during the nighttime on highways that are not "numbered" and that are outside of an urban district Tran. Code'545.352(b)(3)</p> <p>E) 30 MPH in an urban district Tran. Code '545.352(b)(1)</p> <p>F) 15 MPH in an alley Tran. Code '545.352(b)(1)</p> <p>G) 15 MPH on a beach Tran. Code '545.352(b)(5)</p> <p>H) 15 MPH on a road adjacent to a public beach if declared by the commissioners court of the county. Tran. Code '545.352(b)(6) For counties with a population >200,000, this authority may be delegated to the county engineer. Tran. Code '251.159</p> <p>I) Certain subdivision residents abutting a private road, not in a municipality, may petition the Texas Transportation Commission to extend the speed restrictions to such road. This applies only if there are at least 400 people that live in a subdivision and/or an across adjacent subdivision. Tran. Code '542.006(a)</p> <p>J) Twenty-five percent (25%) of the property owners of a subdivision with privately maintained roads or the governing body of the entity that</p>	<p>commissioners may increase the <i>prima facie</i> speed limits on highways under their jurisdiction. In addition, they may declare lower speed limits if the <i>prima facie</i> limits are unreasonable or unsafe.5 Tran. Code '545.355(a)</p> <p>For counties with a population >200,000, this authority may be delegated to the county engineer. Tran. Code '251.159</p> <p>IV. Based on engineering and traffic investigations, municipalities may alter the <i>prima facie</i> speed limits on highways under their jurisdiction.6 Tran. Code '545.356(a) & (b)</p> <p>V. Texas law gives United States military commanders the authority to alter the <i>prima facie</i> speed limits on state highways within a United States military reservation.7 Tran. Code '545.358</p> <p>VI. Based on investigations, the Texas Transportation Commission, the Texas Turnpike Authority or a local government may establish safe maximum speed limits for bridges or other elevated structures under their jurisdiction. Tran. Code '545.361(e)</p> <p>VII. The State Transportation Commission and local governments are</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		maintains these roads may petition the commissioners court of a county to extend any or all of the traffic rules (e.g., speed limits) to such subdivision=s roads. Tran. Code '542.007	required hold public hearings upon request once each calendar year to consider <i>prima facie</i> speed limits on highways that are under their respective jurisdictions and that are either near (1) public or private
UT	A person may not operate a vehicle at a speed greater than is reasonable and prudent under the existing conditions, giving regard to the actual and potential hazards then existing. '41-6-46(1)	If the following speed limits are exceeded, it is <i>prima facie</i> evidence that such speed was not reasonable or prudent. '41-6-46(3) A) 55 MPH, except as noted, on highways or streets '41-6-46(2)(c) Note: See "I" under Posted Speed limits below. B) 25 MPH in an urban district '41-6-46(2)(b) C) 20 MPH in a "reduced speed school zone" "41-6-20.1, 41-6-48.5(1) & 41-6-46(2)(a)	I. Based on traffic engineering and safety studies, the State Department of Transportation may establish different speed limits on highways under its jurisdiction.1 '41-6-47(1) & (2) Important. The maximum posted speed limit cannot be >65 MPH on regular highways or >75 MPH on limited access ones. '41-6-47(3)(a) II. Based on traffic engineering and safety studies, a local government may establish different speed limits on highways under its jurisdiction. '41-6-48(1) & (2) Important. The maximum posted speed limit cannot exceed those noted above. "41-6-47(3)(a) & 41-6-48(1) III. Based on an investigation, the State Department of Transportation may establish a safe maximum speed for any bridge or elevated structure. '41-6-50

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
VT	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions, having regard for the actual and potential hazards then existing. Title 23, '1081(a)	50 MPH on any highway Title 23, '1081(b)	<p>I. The State may establish via regulations¹ speed limits for interstate, limited access and controlled access highways. The speed limits that are established via regulation can be greater or less than the above statutory speed limit. Title 23, "1004(a) & 1081(c)</p> <p>II. Based on engineering and traffic investigations, the State may increase or decrease the above speed limit on non-interstate highways.² Title 23, "1003 & 1081(c)</p> <p>III. Based on engineering and traffic investigations, a municipal or city government may increase or decrease the above speed limit on highways or streets under its jurisdiction. However, no speed limit shall be >50 MPH or <25 MPH. Title 23, "1007(a) & (b) and 1081(c)</p> <p>IV. Without an engineering and traffic investigation, a municipal government may establish a speed limit on all or a portion on any unpaved highway within its jurisdiction at not more than 50 MPH nor less than 35 MPH. Title 23, '1007(a) Note: Although a formal engineering and traffic investigation is not required, the law does provide that the municipality</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>consider Aneighborhood character, abutting land use, bicycle and pedestrian use and physical characteristics of the highways....@ Title 23, '1007(a)(1) V. Based upon an investigation, the State may establish a safe maximum speed for any bridge or elevated structure. Title 23, '1083(b) & (c)</p>
VA	<p>A person cannot drive so as to exceed a reasonable speed under the circumstances and traffic conditions existing at the time, regardless of any posted speed limit.1 '46.2-861</p>	<p>65 MPH on rural interstate highways, certain highways constructed by the Virginia Highway Corporation and other limited access highways in counties with a population iŸ45,700 but iŸ45,800 '46.2-870 (&3) 65 MPH on Virginia Route 288 '46.2-870 (&3) 55 MPH on other interstate highways, limited access highways with divided roadways, nonlimited access highways with 4 or more lanes and all State primary highways '46.2-870 (&1) 55 MPH on all other highways for passenger motor vehicles, busses, pickup or panel trucks or motorcycles '46.2-870 (&2) 45 MPH on all other highways for trucks, tractor trucks, a combination of vehicles designed to transport property or a vehicle which is towing either another motor vehicle or a house trailer</p>	<p>I. Based on traffic engineering investigations, the Commonwealth Transportation Commission or other authority may either (1) decrease the speed limits established under '46.2-870 or (2) increase or decrease the speed limits established under "46.2-873 through 46.2-875 on any highway under its jurisdiction.2 "46.2-873.1 & 46.2-878 II. Based on an investigation, the Commonwealth Transportation Commission may establish a safe maximum speed limit for public bridges, causeways, viaducts or tunnels. '46.2-881 III. A town, with population between 14,000 and 15,000, may prohibit driving iŸ20 MPH in excess of the speed limit in a residence district. '1 of Chapter 865 (Acts 1999)</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		'46.2-870 (&2) 35 MPH on highways within a city or town excluding interstate or other limited access divided highways '46.2-875 35 MPH on nonsurface treated highways '46.2-873.1 25 MPH in a business or residential district '46.2-874	IV. A city with a population between 9,000 and 11,000 may prohibit motor vehicle operations at a speed >15 MPH in excess of the maximum speed limit in a residence district. '2 of Chapter 865 (Acts 1999) (as amended by Chapters 940 & 957 (Acts of 2000))
VI	No person shall drive a motor vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. Title 20, '494(a)	55 MPH (40 MPH for trucks or busses) on the Melvin H. Evans Highway on St. Croix Title 20, '494(b) & (c) 40 MPH on certain portions of Centerline Road1 Title 20, '494(b) 35 MPH for motorcars, pick-up trucks or motorcycles outside town limits Title 20, '494(b) 20 MPH for motorcars, pick-up trucks or motorcycles within town limits Title 20, '494(b) 30 MPH for trucks or busses outside town limits Title 20, '494(c) 10 MPH2 for trucks or busses within town limits Title 20, '494(c)	I. The Police Commissioner3 may reduce the above speed limits where there such action "is necessary for the public safety." Title 20, '494(e) Note: Virgin Island law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day. II. The Police Commissioner is authorized to establish maximum speed limits of not >20 MPH on streets and roads in housing projects or developments. Title 20, '494(f)
WA	No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and	60 MPH on State highways '46.61.400(2)(c) Important. See "II" below under Posted (Maximum) Speed Limit below.	I. Based on engineering and traffic investigations, the State Secretary of Transportation may decrease the above speed limits on any Sate

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	<p>having regard to the actual and potential hazards then existing.1 '46.61.400(1) & (3)</p>	<p>50 MPH on county roads '46.61.400(2)(b) 25 MPH on city or town streets '46.61.400(2)(a)</p>	<p>highway.2 '46.61.405 II. Based on engineering and traffic investigations, the State Secretary of Transportation may increase the above speed limits on any State highway.2 However, a posted speed limit cannot be >70 MPH. '64.61.410(1)(a) III. Based on engineering and traffic investigations, a local government may increase or decrease the above speed limits on streets and roads under its jurisdiction.2 However, a posted speed limit cannot be established >60 MPH or <20 MPH. '46.61.415(1) & (2) IV. The State Secretary of Transportation or a local government may establish maximum speed limits for bridges, elevated structures, tunnels or underpasses within their jurisdiction. '46.61.450 V. 15 MPH in State park camps, picnic, headquarters or general public assemblage areas or 25 MPH in other park areas. WAC 352-20-030</p>
WV	<p>No person may drive a vehicle at speed greater than is reasonable and prudent under the existing</p>	<p>55 MPH on open country highways, controlled-access highways and interstate highways '17C-6-1(b)(3) & (d) Note: The law provides, that for</p>	<p>I. Based on engineering and traffic investigations, the Commissioner of Highways2 may increase or decrease the above speed limits on any</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
	<p>conditions and the actual and potential hazards. '17C-6-1(a)</p>	<p>controlled-access and interstate highways, the speed limit shall be not be less than @ 55 MPH. '17C-6-1(d) 25 MPH in a business or residential district '17C-6-1(b)(2) 15 MPH in a school zone1 '17C-6-1(b)(1)</p>	<p>interstate or State highway. '17C-6-2 Note: West Virginia law does not specifically state whether different highway speed limits may be established either for different types of vehicles, for various weather conditions or for different times of the day. Legislative Request. The West Virginia Legislature has requested (1) that the speed limits on all interstate highways be increased to 70 MPH and (2) that the speed limits on all State four-lane highways be increased to 65 MPH. House Concurrent Resolution 21 adopted in 1997 II. Based on engineering and traffic investigations, a local government may decrease the above speed limits at intersections.3 "17C-2-8(a)(5) & (a)(10) and 17C-6-3(a) III. Local governments may increase the above 25 MPH speed limit on highways within a business or residential district.3 However, no speed limit shall be >55 MPH. '17C-6-3(b) VI. Based on engineering and traffic investigations, a local government may decrease the above 55 MPH</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>speed limit on open country highways outside a business or residential district.³ However, no limit shall be <35 MPH. '17C-6-3(c)</p> <p>V. A local government may decrease the 25 MPH speed limit in a residential district.² '17C-6-3(d)</p> <p>VI. Based upon an investigation, the Commissioner of Highways² may establish safe maximum speed limits for bridges or elevated structures. '17C-6-5(b) & (c)</p>
WI	<p>No person drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard for the actual and potential hazards then existing. '346.57(2)</p>	<p>65 MPH on any freeway or expressway when posted '346.57(4)(gm)</p> <p>55 MPH on highways not posted '346.57(4)(h)</p> <p>45 MPH on designated rustic roads '346.57(4)(k)</p> <p>35 MPH on highways within semiurban district outside city or village corporate limits '346.57(4)(g)</p> <p>35 MPH on outlying district highways within city or village corporate limits '346.57(4)(f)</p> <p>35 MPH on certain highway in business, industrial and residential districts '346.57(4)(j)</p> <p>25 MPH on service roads with city or village corporate limits '346.57(4)(em)</p>	<p>I. Based on engineering and traffic investigations, the State may increase or decrease the above speed limits on highways under its jurisdictions. However, no speed limit can be >65 MPH on freeways or expressways or 55 MPH on other highways.¹ "346.57(5) and 349.11(1)(a), (2)(a), (8)(a) & (8m)</p> <p>II. Based on engineering and traffic investigations, a local government may increase or decrease the above speed limits on highways under its jurisdictions. However, no speed limit can be >55 MPH² "346.57(5) and 349.11(1)(a), (3)(a) & (8m)</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
		<p>25 MPH on other highways within city or village corporate limits '346.57(4)(e)</p> <p>15 MPH in an alley '346.57(4)(d)</p> <p>15 MPH in a safety zone occupied by pedestrians and where a public passenger vehicle@ has stopped to receive or discharge passengers '346.57(4)(c)</p> <p>15 MPH in a "school crossing" '346.57(4)(b)</p> <p>15 MPH when passing a school during times when children are either going to or from a school or when children "are playing within the sidewalk area at or about the school." '346.57(4)(a)</p> <p>15 MPH in town parks or recreation area when children are going to or from or playing within such areas. '346.57(4)(i)</p>	
WY	<p>No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. '31-5-301(a)</p>	<p>75 MPH on interstate highways '31-5-301(b)(iii) & (v)(A)</p> <p>65 MPH on other highways '31-5-301(b)(iv) & (v)(B)</p> <p>30 MPH in an urban district '31-5-301(b)(ii)</p> <p>20 MPH in a school zone or crossing '31-5-310(b)(i)</p>	<p>I. Based on engineering and traffic investigations, the State may increase or decrease the above speed limits on the State highway system.1 "31-5-301(c) & 31-5-302 The State highway system includes city streets that are designated as State highways. '24-1-127</p> <p>II. Based on engineering and traffic investigations, local governments may</p>

State	Basic Speed Rule	Statutory Speed Limit	Posted Speed Limit
			<p>increase or decrease the above speed limits on the highways or streets under their jurisdiction.² "31-5-301(c) and 31-5-303(a) & (b)</p> <p>III. Based on investigations, the State or a local government may establish safe maximum speed limits for any bridges or elevated structures under their jurisdiction. '31-5-305(a) & (b)</p>

Appendix III
State Speed Laws for Speed Limits Less than 25 mph

State	State Speed Laws
Alaska	20 MPH in a business district 15 MPH in an alley
Arizona	15 MPH approaching a school crossing
California	15 MPH (<i>prima facie</i> limit) on any alley
Colorado	20 MPH on narrow, winding mountain highways or blind curves
Delaware	20 MPH at school crossings where signs are in effect during specific time periods
District of Columbia	15 MPH in alleys 15 MPH in streets adjacent to school buildings or playgrounds when indicated by official signs
Illinois	The speed limit in an urban district cannot be less than 20 MPH. 15 MPH in an urban district alley
Indiana	15 MPH in an alley
Iowa	20 MPH in a business district
Kansas	Outside an urban or residence district, the speed limit cannot be less than 20 MPH. Within an urban district school zone, when students are going either to or from school, the speed limit cannot be less than 20 MPH.
Kentucky	15 MPH on off-street parking facilities
Maine	15 MPH when passing a school during recess or when the students are going to or leaving the school
Michigan	A <i>prima facie</i> speed limit of not <15 MPH may be established for publicly owned parks or playgrounds.
Montana	Based on engineering and traffic investigations, local governments may establish speed limits in school zones. The speed limit in such zone cannot be <15 MPH nor >20 MPH below the established speed limit where such speed limit is normally 40 MPH. 10 MPH in alleys 10 to 30 MPH in manufactured home parks 10 MPH in recreational camping areas
Mississippi	Based on engineering and traffic investigations, local governments may decrease the maximum speed limits on streets or highways under their jurisdictions. However, no posted speed limit shall be <15 MPH
Nebraska	20 MPH in a business district
Nevada	A person shall not operate a motor vehicle >15 MPH ¹ in a school zone or >25 MPH in school crossing zone ²

State	State Speed Laws
New Mexico	15 MPH in a posted school zone
North Dakota	20 MPH (32.19 Kilometers Per Hour) in a school zone
Ohio	20 MPH (<i>prima facie</i> speed limit) in school zones during recess or when children are going to or leaving school 15 MPH (<i>prima facie</i> speed limit) on alleys within a municipal corporation
Oregon	20 MPH in a school zone ² 20 MPH in a business district 15 MPH in an alley
Pennsylvania	15 MPH in a school zone
Rhoe Island	20 MPH in a school zone ³
South Dakota	15 MPH in a school zone ¹
Tennessee	Based on engineering investigations, a local government may establish special speed limits adjacent to schools. This limit cannot be <15 MPH.
Texas	15 MPH in an alley 15 MPH on a beach 15 MPH on a road adjacent to a public beach if declared by the commissioners court of the county.
Utah	20 MPH in a "reduced speed school zone"
Virginia	A town, with population between 14,000 and 15,000, may prohibit driving 20 MPH in excess of the speed limit in a residence district. A city with a population between 9,000 and 11,000 may prohibit motor vehicle operations at a speed >15 MPH in excess of the maximum speed limit in a residence district.
Virgin Islands	20 MPH for motorcars, pick-up trucks or motorcycles within town limits 10 MPH ² for trucks or busses within town limits The Police Commissioner is authorized to establish maximum speed limits of not >20 MPH on streets and roads in housing projects or developments.
Washington	III. Based on engineering and traffic investigations, a local government may increase or decrease the above speed limits on streets and roads under its jurisdiction. ² However, a posted speed limit cannot be established >60 MPH or <20 MPH. 15 MPH in State park camps, picnic, headquarters or general public assemblage areas or 25 MPH in other park areas.
West Virginia	15 MPH in a school zone ¹
Wisconsin	15 MPH in an alley 15 MPH in a safety zone occupied by pedestrians and where a A public passenger vehicle@ has stopped to

State	State Speed Laws
	receive or discharge passengers 15 MPH in a "school crossing" 15 MPH when passing a school during times when children are either going to or from a school or when children "are playing within the sidewalk area at or about the school." 15 MPH in town parks or recreation area when children are going to or from or playing within such areas.
Wyoming	20 MPH in a school zone or crossing

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