Effects of Raising and Lowering Speed Limits on Selected Roadway Sections

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FOREWORD

This report may be of interest to traffic engineers and policy makers responsible for making decisions involving the setting of speed limits on short segments on surface streets and highways in suburban and rural areas. The report results DO NOT involve changing speed limits on limited access highways (freeways). Measurements were also made on only four sections of Interstate highways and the results are presented in an appendix. The limited results of the freeway studies are an indication of the effects of raising the speed limit at the study sites only. Thus, use of the study findings should not be made in discussions about roadways that were formerly subject to the recently repealed National Maximum Speed Limit.

Because of the controversial nature of the subject of changing speed limits, and because the results are somewhat contrary to what many expect when speed limits are raised or lowered, the Transportation Research Board conducted a workshop at FHWA's request with this report as the primary resource paper. The purpose of the workshop was to get a thorough review of the methods of data collection and analyses to ensure that there are no questions as to the validity of the reported results. As recommended by the workshop participants, we are publishing this report with the few minor modifications identified. The changes dealt mostly with the following: removing the author's opinions that were not based on the research results, indicating why the initial experimental plan could not be followed, describing the three types of sites where speed limits were changed, doing an accident analysis based on accident rates to accommodate sites where traffic volumes had changed, and putting the freeway analysis in an appendix and noting that freeway data is much different than surface roadway site data in both speed changes and accident results. Also, the report title was changed to indicate that the sites studied were "selected roadway sections."

The reader should remember that this report addresses the observed behavior of a very large number of drivers operating under a wide variety of highway conditions and various speed limit scenarios. The report describes the results of one of the broadest speed behavior studies ever undertaken, and it is believed to offer valuable insight on the relationship of highway geometrics, speed limits, driver behavior, and highway accidents. The report should be considered as a resource document as opposed to a speed policy recommendation.

Sufficient copies of this report are being distributed to provide a minimum of two copies to each FHWA regional office and six copies to each Division office. Four of the Division office copies should be sent to their State highway agency by the division

A. George Ostensen, Director
Office of Safety and Traffic Operations
Research and Development

NOTICE

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t6. Abstract

The objective of this research was to examine the effects of raising and lowering posted speed limits on driver behavior for urban and rural nonlimited access highways. Sites selected for study were furnished by the participating States. The study was conducted during the period from October 1985 to September 1992, when the maximum speed limit was 5 5 mi/h (89 km/h) on nonlimited access highways. During this period, the States and localities lowered and raised posted speed limits on short roadway segments, typically less than 2 mi (3.2 km) in length. The general types of sites included in the study were short sections, i.e. , 0.5mi (0.8-km) segments in rural communities, I-mi (1.6-km) sections in urban and rural communities, and 2-to 12-mi (3-to 19-km) rural sections where speed limits were raised. The study included the collection of driver behavior and crash data in 22 States. The data were collected at 100 sites on nonlimited access highways, consisting of 172 mi (277 km) where speed limits were either lowered or raised, and at 83 comparison sites, consisting of 132 mi (213 km) where no changes in the posted speed limits were made. Changes in the posted speed limits ranged from lowering the speed limit by 5, IO, 15, or 2 0 mi/h (8, 16, 24, or 32 km/h) to raising the speed limit by 5, 10, or 15 mi/h (8, 16, or 24 km/h). Only one change in the posted speed limit was made at each site during the study.

There is statistically sufficient evidence in thi s dataset to reject the hypothesis that driver speeds do not change when posted speed limits are either raised or lowered. However, the differences in speeds, less than 1.5 mi/h (2.4 km/h), are not sufficiently large to be of practical significance, and are due primarily to large sample sizes. Although the changes in vehicle speeds were small, driver violations of the speed limits increased when posted speed limits were lowered. Conversely, violations decreased when speed limits were raised. This does not reflect a change in driver behavior, but a change in how compliance is measured, i.e., From the posted speed limit. There is not sufficient evidence in thi s dataset to reject the hypothesis that crash experience changed when posted speed limits were either lowered or raised.

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METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in) = 2.5 centimeters (cm)
1 foot (ft) = 30 centimeters (cm)
1 yard (yd ▫ 0.9 meter (m)
1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2 = 6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2 = 0.09 square meter (m^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)
1 acre = 0.4 hectares (he) = 4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gr)
1 pound (lb) = .45 kilogram (kg)
1 short ton = 2,000 pounds (Lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)
1 tablespoon (tbsp ▫ 15 milliliters (ml)
1 fluid ounce (fl oz) = 30 milliliters (ml)
1 cup (c) = 0.24 liter (l)
1 pint (pt) = 0.47 liter (l)
1 quart (qt) = 0.96 liter (l)
1 gallon (gal) = 3.8 liters (l)
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

[(x-32)(5/9)] ^oF ▫ y ^oC

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)
1 centimeter (cm) = 0.4 inch (in)
1 meter (m) = 3.3 feet (ft)
1 meter (m) = 1.1 yards (yd)
1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
1 hectare (he) = 10,000 square meters (m^2) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gr) = 0.036 ounce (oz)
1 kilogram (kg) = 2.2 pounds (lb)
1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

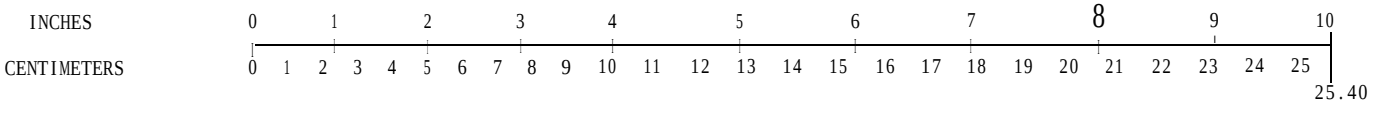
VOLUME (APPROXIMATE)

1 milliliters (ml) ▫ 0.03 fluid ounce (fl oz)
1 liter (1) = 2.1 pints (pt)
1 liter (l) = 1.06 quarts (qt)
1 liter (l) = 0.26 gallon (gal)
1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)

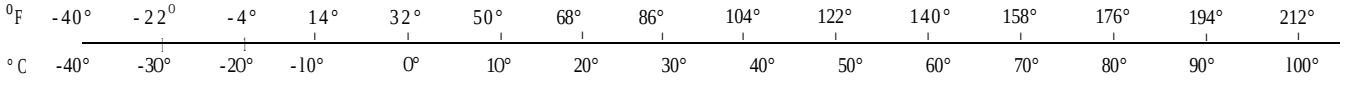
TEMPERATURE (EXACT)

[(9/5) y + 32] ^oC ▫ x ^oF

QUICK INCH-CENTIMETER LENGTH CONVERSION



QUICK FAHRENHEIT-CELSIUS TEMPERATURE CONVERSION



For more exact and or other conversion factors, see NBS Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50. SD Catalog No. C13 10286.

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INTRODUCTION

This study was conducted to examine driver behavior effects when posted speed limits are raised and lowered on nonlimited access urban and rural highways. In the event that altering the posted speed limits had an impact on traffic speeds, crash data were collected to examine the safety effects. While much research in recent years has focused on the effects of the 55- and 65-mi/h (89- and 105-km/h) speed limits on limited access high-speed facilities, this research concentrated on lower speed urban streets and rural highways that were posted between 20 and 55 mi/h (32 and 89 km/h).

A maximum speed limit is posted or set by statute on a highway to inform motorists of the highest speed considered to be safe and reasonable under favorable road, traffic, and weather conditions.

A review of early vehicle speed legislation in the United States suggests that speed regulations were established to improve public safety!] The rationale for government regulation of speed is based on the fact that unreasonable speed may cause damage or injury. Speed laws also provide a basis for punishing the unreasonable behavior of an individual driver.

Every State has a basic speed statute requiring drivers to operate their vehicles at a speed that is reasonable and prudent under existin g conditions.[2] This law recognizes that the maximum safe speed varies due to traffic, roadway, weather, light, and other conditions, and places the responsibility of selecting a safe and reasonable speed on the driver.

Most traffic engineers believe that speed limits should be posted to reflect the maximum speed considered to be safe and reasonable by the majority of drivers using the roadway under favorable conditions.[3] Procedures used to set speed limits have evolved through years of experience and research. Most States and localities set maximum speed limits based on the results of an engineering and traffic investigation.

The 85th percentile speed is used as a major factor in selecting the appropriate speed limit for a street or highway; however, other factors, such as roadside development, crash experience, and design speed, are ofte n considered.[3] While traffic engineers and enforcement officials consider a number of factors when determining the speed limit to post, public and political opinions can and do influence their decision.

There are a number of strongly held opinions by the public concerning the effects of a posted speed limit. One of the opinions often expressed is that setting low speed limits will reduce vehicle speeds and crashes. Also, it has been frequently suggested that most motorists drive 5 to I O mi/h (8 to 16 km/h) over the posted speed limit, so lower speed limits should be established to account for this condition.

Conversely, it is believed that raising the posted speed limit on nonlimited access highways increases vehicle speeds and crashes. For example, following a severe crash, one of the most frequent requests made to highway jurisdictions is to lower the

speed limit. These requests are founded on public knowledge that crash severity increases with increasing vehicle speed, because in a collision, the amount of kinetic energy dissipated is proportional to the square of the velocity. Simply stated, when a vehicle is involved in a crash, the higher the vehicle speed, the greater the chance of being seriously injured or killed. However, as noted by a number of researchers, the potential for being involved in a crash is highest when traveling at a speed much lower or much higher than the majority of motorists.[4-7]

For years, traffic engineering texts have supported the conclusion that motorists ignore unreasonable speed limits.[8] Both formal research and informal operational observations conducted over many years indicate that there is very little change in the mean or 85th percentile speed as the result of raising or lowering the posted speed limit on urban and rural nonlimited access highways.[9]

Highway administrators, enforcement officials, the judiciary, and the public need factual information concerning the effects of posted speed limits on driver behavior for nonlimited access roadways. For example, will lowering the posted speed limit on a two-lane roadway section through a rural community reduce vehicle speeds? Does raising the posted speed limit to the 85th percentile speed on a short segment of roadway increase vehicle speeds? Do most motorists drive 5 to 10 mi/h (8 to 16 km/h) above the posted speed limit? What are the effects of lowering or raising speed limits on driver compliance?

OBJECTIVES AND SCOPE

The objective of this research was to determine the effects of raising and lowering speed limits on driver behavior for urban and rural nonlimited access highways. During the period the study was conducted, from October 1985 until September 1992, the maximum speed limit was 55 mi/h (89 km/h) on nonlimited access highways. During this time, the locations where States and localities raised and lowered posted speed limits were typically limited to roadway segments less than 2 mi (3.2 km) in length. Consequently, the sites selected for study were limited to roadway sections with an average site length of 1.7 mi (2.7 km).

Driver behavior effects examined in this study included the speed distribution (percentile speeds), mean speeds, speed variance, percent of drivers exceeding the posted speed limit, and close following behavior. Anticipating that changing the posted speed limit could have an effect on driver speeds, crash data were collected to examine the safety effects. The crash data included police-reported crashes, crashes involving injury or death, and multiple-vehicle and single-vehicle crashes.

It is important to emphasize that this research was limited to examining driver behavior effects as a result of changing the posted speed limit only. It is recognized that enforcement and public education are key components in making any traffic regulation effective, including speed limits. While highly visible enforcement is essential to detecting and deterring speeding motorists, and public educational campaigns can influence motorists' attitudes, this research did not examine these factors.

The scope of the study included the collection of driver behavior and crash data in 22 States, as shown in figure 1. The data were collected at 100 sites on nonlimited access highways, consisting of 172 mi (277 km) where speed limits were either raised or lowered, and at 83 comparison sites, consisting of 132 mi (213 km) where no changes in the posted speed limits were made.

Repeated speed measurements were made at 11 selected sites to examine the time effects of speed limit changes. Data were also collected at five sites that were contiguous to four experimental roads to determine if speed limit changes on the experimental sites had indirect effects on driver behavior on the contiguous sections.

In April 1987, at the end of the site-selection phase of the study, Congress permitted States to raise speed limits on selected limited access facilities to 65 mi/h (105 km/h). To obtain some information concerning the speed effects on these high-speed facilities, four sites consisting of 94 mi (151 km) were nonrandomly selected in three States. Due to the small sample size and the nonrandom selection of sites, the results of the speed and crash data collected at these sites are not included in the main section of the report, but are discussed in a separate appendix.

Figure 1. States participating in the study.

METHODOLOGY

Early in the development of the methodology for the study, the researchers proposed that a before-and-after with randomized control group experimental design be utilized to determine the effects of raising and lowering posted speed limits on driver behavior and crashes. With this design, roadway sections would be randomly drawn from the population of nonlimited access highways in the United States. The selected sections would then be randomly assigned to experimental and control groups. Posted speed limits on highways in the experimental group would either be raised or lowered. No changes in the posted speed limits would be made at the control sites.

Utilizing this experimental plan would reduce the major threats to internal and external validity, i.e., one would be able to generalize the findings to the population of nonlimited access roadways from which the sites were drawn.

It was recognized by the sponsor and the researchers that this experimental design would be extremely difficult, if not impossible, to implement. On late 1985, letters were sent to the 50 State transportation agencies requesting their participation in the experiment. Written responses and telephone conversations with agency personnel indicated that only three States had a limited interest in permitting the researchers to randomly select roadways for speed limit changes.

The major reasons cited by the States for not participating are listed below:

- By law, the States are responsible for setting speed limits on the basis of a traffic and engineering investigation. To raise or lower the speed limit on a randomly selected roadway section for research purposes would not meet the requirements of State and local statutes.

- The potential for tort liability resulting from changing the speed limit on a selected experimental section, where the decision to alter the limit was not based on an engineering investigation, was a major objection. Also, there were liability concerns for not changing the speed limit on a comparison section if an investigation indicated that the limit should be altered.

- There were concerns that the credibility and reputation of the transportation agency would be diminished if they allowed the researchers to select the sites for speed limit changes. The primary concern was that the speed limit change would be controversial or would not be supported by the public.

From the responses received, it was clear that the study could not be conducted as proposed. Members of the American Association of State Highway and Transportation Officials' (AASHTO) Subcommittee on Traffic Engineering were instrumental in assisting with the development of a realistic plan that would provide information on the effects of speed limit changes. Major considerations, provided by the AASHTO Subcommittee, that influenced the selection of the final plan are summarized on the following page:

- Experimental sections for the study would have to be drawn from roadways where speed limit changes were made by the agencies based on the results of a traffic and engineering investigation.

- During any given 12-month period, it was estimated that speed limits were altered on approximately 100 mi (161 km) of roadway in the United States.

- The average length of a section where speed limits were altered was 0.5 mi (0.8 km); however, some sections were 1mi (1.61 km) in length or greater.

- After the decision is made to change a speed limit on a roadway, the new limit is typically posted within a period ranging from 1 week t o 1month. This time constraint would not permit the collection and analysis of speed, volume, and crash data needed to properly select and match comparison and experimental site characteristics.

- Due to the 55-mi/h (89-km/h) National Maximum Speed Limit in effect during the study, most posted speed limit changes occurred on short sections of nonlimited access facilities located in urban fringe, suburban areas, and small rural towns.

Because random selection and assignment of sites to experimental and comparison groups was not possible, the sponsoring agency and the researchers made a decision to select the experimental sites from roadway sections where State and local jurisdictions planned to make speed limit changes based on the results of routine traffic and engineering investigations.[10] The comparison sites were selected by the research team after the experimental sites were identified.

Speed limits on the experimental sites were either raised or lowered by the participating State or local highway agency for various reasons as listed below:

- As a result of a request from the public, political leaders, or enforcement officials.

- To ensure that speed limits were appropriate for roadway and traffic conditions.

- As a result of a high incidence of traffic crashes.

- To comply with local laws or ordinances.

- In response to changing traffic volume and land-use patterns.

Nonrandom selection and assignment of sites to experimental and comparison groups can produce biased results and limits the findings and conclusions only to the locations studied. The findings may apply to similar sites where the speed limits are changed for similar reasons. Generalizations to other roadways are not appropriate.

It is important to reiterate that speed limit changes at the study sites were not made for the purpose of experimentation. Consequently, the researchers were not involved in determining the speed limit change, nor was a study of an individual State's method of setting speed limits undertaken. All speed limit changes were reported to the public in the routine manner used by the State or local jurisdiction. To the author's knowledge, no special enforcement or public information campaigns were initiated after the new speed limit was posted at any of the study sites.

Selection of Experimental Sections

With the modified plan, 33 States formally agreed to participate in the study by notifying the researchers of nonlimited access roadway sections where they planned to make speed limit changes. Using input from the participating jurisdictions, experimental sites were selected during the period of May 1986 through April 1987. Experimental sites were selected based on the following considerations:

- Generally, sections less than 0.5 mi (0.8 km) in length were not selected. In some cases, however, the segment where the speed limit change occurred was shorter than originally proposed when the site was selected. Thus, the study includes some sites less than 0.5 mi (0.8 km) in length.

- Sections that were recently reconstructed or were subject to construction during the before or after study periods were not used.

- Sections were used when the only physical site changes during the study period were due to routine maintenance, such as repairing potholes, regrading shoulders, repainting center and edge lines, etc. In some cases, sections were included that received minor safety improvements such as replacing worn traffic signs with new signs. The pavement was resurfaced at four experimental sites after the speed limits were raised, and the speed effects at these locations are noted in a subsequent section of this report.

- Sections with more than one speed limit change during the study period were eliminated because the effects of multiple changes could confound the results.

- Sites were selected in States to represent a wide range of geographic and urban and rural conditions.

- Sites were selected to provide a mixture of typical locations where speed limits were either raised or lowered by the States and local jurisdictions during the time period the study was conducted.

- Time constraints played a role in the selection of some sites. As previously mentioned, the time period between notification of an available site and the time the new speed limit was scheduled to be posted varied between 1 week

and 1 month. Some sites were not selected for study because there was insufficient time for the data collection crews to complete their current assignment and travel to the next site before the new speed limit was posted.

Approximately 20 percent of the sites submitted by the States and jurisdictions were actually selected for the study. The predominate reasons for not selecting sites were that the sections were less than 0.5 mi (0.8 km) in length, and major construction or safety improvements were made or planned at the sites either during the before or after study periods.

The experimental plan for the study called for a minimum of 100 mi (161 km) each of experimental and comparison sections based on estimated fatal and injury crash counts.[10] As sites were selected, it became clear that the crash counts on the sections were lower than estimated, thus the final sample was increased to contain 172 mi (277 km) of experimental sites and 132 mi (213 km) of comparison sites.

The experimental sites on nonlimited access highways included in the study can be categorized into three basic groups:

1. A roadway section in a small rural town or community where the speed limit on the adjoining roadway sections was 55 mi/h (89 km/h). Typically, the length of these sections varied between 0.5 and 1 mi (0.81 and 1.61 km). The speed limit on these roadways was usually lowered, but in some cases, the limit was raised.

2. A roadway section in an urban. suburban. or rural area where public or political requests or increases or decreases in the adjacent land use and corresponding traffic volumes dictated the need for a change in the speed limit. These sections were typically 1 mi (1.61 km) in length. The speed limit on some of these roadways was raised, but was lowered at other sites.

3. A two- or four-lane nonlimited access roadway section in a rural area where the speed limit was raised to 55 mi/h (89 km/h). These sections were generally between 2 and 12 mi (3.2 and 19.3 km) in length.

Shown in figure 2 is a roadway section in a small rural community where the speed limit was lowered from 55 mi/h to 45 mi/h (89 km/h to 72 km/h). The roadway section is 0.52 mi (0.84 km) in length, and the speed limit on the adjoining sections is 55 mi/h (89 km/h).

Shown in figure 3 is a typical roadway in a small urban area where the speed limit was lowered from 35 to 25 mi/h (56 to 40 km/h). The section is 0.74 mi (1.2 km) in length. Speed limits on the adjoining sections are 25 and 35 mi/h (40 and 56 km/h).

Depicted in figure 4 is a rural location where the speed limit was raised from 50 to 55 mi/h (81 to 89 km/h). The roadway segment is 7.33 mi (11.8 km) in length. The speed limit was raised as a result of a routine review of speed limits.

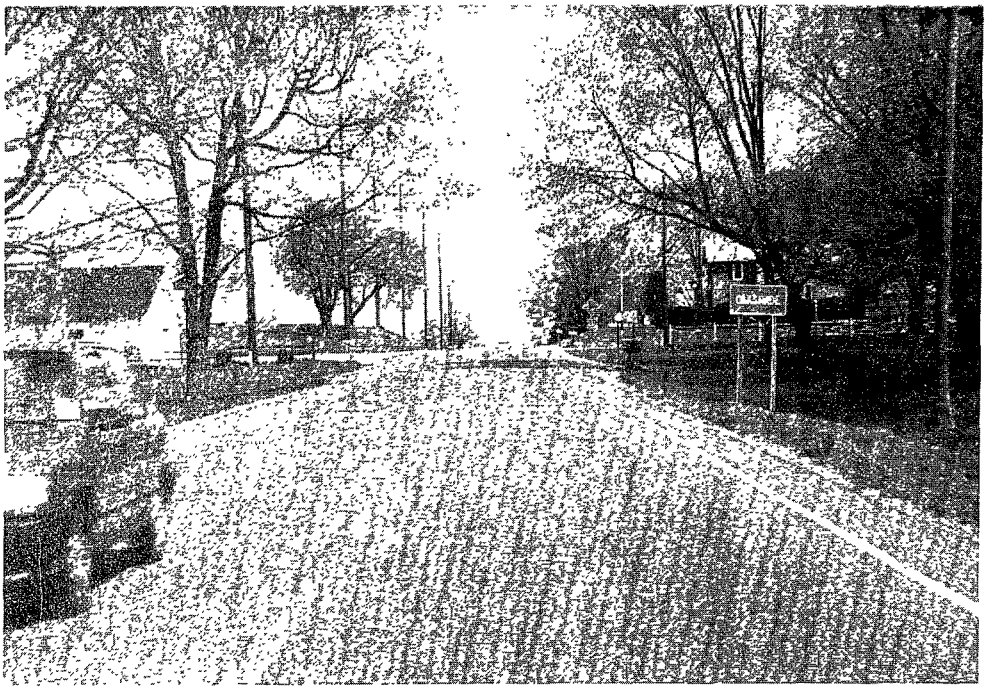


Figure 2. Roadway in rural community where the speed limit was lowered.

Figure 3. Roadway in urban area where the speed limit was lowered.

Figure 4. Roadway in rural area where the speed limit was raised.

Selection of Comparison Sections

As previously mentioned, comparison sites were not randomly drawn from the population of nonlimited access facilities or from the same source that produced the experimental sites (i.e., sites studied by the highway agencies for speed limit revisions). Although attempts were made, it was not usually possible to obtain timely information on segments that were studied for speed limit revisions, but where no speed limit changes were made. Consequently, comparison sites were selected by the research team during their field review of the experimental sites.

Although the comparison sites were not drawn from the same source as the experimental sites, the researchers decided that it was important to select comparison sites and to collect speed data at these locations in an attempt to control for factors such as weather, special events in the area, and other similar conditions that can affect driver behavior. The basic premise used to make this decision was that large before and after speed differences would be found at the experimental sites.

Guidelines for selecting comparison sites were based on matching, as closely as possible, the geometric, volume, and speed characteristics of the experimental sites. The matching process, although imprecise because data could not be collected in advance of site selection, was used in an attempt to find comparison locations with operational and safety characteristics that were similar to the experimental sites. For

example, if the experimental site was a two-lane roadway carrying 2,000 vehicles per day, the research team would attempt to select another two-lane roadway in the jurisdiction with similar volume and speed characteristics.

Although efforts were made to find locations with the same posted speed limit, the comparison site did not always have the same posted speed limit as the experimental site. Also, it was not always possible to find a comparison site in the jurisdiction that exactly matched the volume and speed characteristics of the experimental site. In each case, however, the experimental and comparison site pair have the same number of lanes. Most comparison sections were located within 5 mi (8 km) of the experimental sites.

In some cases, for economic efficiency, one comparison site was matched with two similar experimental sites. At three locations, speed limit changes were made at the comparison sites after the before data were collected. These segments were then reclassified as experimental sections. In one case, the speed limit was not changed on the experimental section, but the agency changed the speed limit on the comparison section. The two sections were renamed and used in the study.

Data Collection

Before data were collected at 123 experimental sites and 114 comparison sites by 3 two-person data collection teams. Some sections were eliminated from the study because the planned speed limit alterations were not made, or road and/or utility construction was in progress. At one site in Maryland, two sites in Mississippi, and one site in Tennessee, the roadway on the experimental section was resurfaced after the before data were collected. Instead of eliminating these segments from the study, it was decided to collect after data at these locations to examine the speed changes. The results are presented in a subsequent section of this report.

When the data collection phase of the study was completed, before and after data were collected on 100 experimental sections consisting of 172 mi (277 km) and 83 comparison locations totaling 132 mi (213 km). Complete speed and headway data were available for 98 experimental sites and their corresponding comparison sites. The termini of two experimental sites were incorrectly given, thus speed data were taken at the wrong locations. These data are not used in the subsequent analysis of speed effects. Crash data were available for 99 experimental locations and their corresponding comparison sites. One locality could not provide crash data for a site located in their jurisdiction.

The speed limits on the experimental sections were changed between July 1986 and May 1989. Collection of the before data ranged from several days to 2 years prior to the speed limit change. Similarly, collection of the after data ranged from several days to as much as 2 years following the speed limit change. The before data were collected between June 1986 and June 1988. The after data were collected between August 1987 and July 1989.

Selection of Free-Flow Vehicles

One of the basic premises of posting speed limits is to influence driver behavior. Most States and localities measure speeds for setting speed limits based on selecting the speed of free-flow or unimpeded vehicles. The rationale for this procedure is that drivers who are in a platoon have their speed and maneuverability influenced by other vehicles and are not free to select their speed based on geometry, traffic control (which includes posted speed limits), and prevailing environmental conditions. Accordingly, if speed limits affect driving behavior, free-flow drivers are most likely to be influenced by speed limit changes. In an attempt to measure the speeds of free-flow vehicles, it was necessary to select a method to measure free-flow behavior.

The determination of impeded vs. unimpeded vehicles is a complex issue that has not been fully investigated. A minimum headway criterion is typically used to identify free-flow vehicles. A review of the literature indicated that free flow has been defined as having a minimum headway between vehicles of 3 to 9 s.[11-13] The most commonly used minimum headway values in practice and in research studies were between 4 and 6 s.

In preparing to collect data for this study, it was decided to use a 4-s or greater headway, based on research conducted by Hanscom and others.[14,15] Hanscom found that the mean speeds of platoon leaders and following vehicles in the platoon were significantly different for a headway time of 4 s or greater. In other words, when the platoon leader begins to pull away from the following vehicle, the structure of the platoon is no longer maintained.

Examination of the before data collected at the experimental sites in this study revealed that an average of 82 percent of the vehicles sampled had a headway of 4 s or greater and 76.5 percent of the vehicles had a headway of 6 s or greater. The difference is 5.5 percent. In other words, if a 6-s definition of free flow would have been used instead of a 4-s definition, only 5.5 percent fewer vehicles would have been used in the analysis.

As headway is a function of traffic flow, there is considerable variation in the average values mentioned. At a low-volume site (24-h volume of 318 vehicles), 2.5 percent of the vehicles had a headway of less than 4 s and 3.1 percent of the vehicles had a headway of less than 6 s. At a high-volume site (24-h volume of 19,024 vehicles), 37.7 percent of the vehicles had a headway of less than 4 s and 49.8 percent of the vehicles had a headway of less than 6 s.

Regardless of which minimum headway criterion is selected, it is possible that situations occurred where headways were greater than 4 or 6 s, but vehicle speeds were impeded. For example, under heavy flow conditions, drivers may choose not to adjust their speed. Also, the platoon leader may just be driving slowly. Within the scope of the study and the equipment used, there was no method available to detect these conditions or to ensure that all vehicles with a headway of 4 s or more were unimpeded.

Because the speed and headway data were collected by automated equipment in bins, it is not possible to reanalyze the data using a 6-s or any other headway criterion. Consequently, it is unknown whether a 6-s headway would have made a difference in the before and after speed data presented in this report.

While the speeds of all vehicles were measured, only the speeds of free-flow vehicles having a headway of 4 s or more were used in the analyses presented in this report. An examination of the all-vehicle speeds vs. free-flow speeds indicated that free-flow speeds at the study sites were normally less than 2 mi/h (3 km/h) higher than the all-vehicle speeds.

Speed and Headway Data Collection

Volume, speed, and headway data were collected for a 24-h period simultaneously at each experimental and comparison site pair. The data were collected prior to the speed limit change on the experimental section, and again after the change was made. In most cases, the after data were collected in the same season and on the same weekday period as the before data. Data were collected during weekday and weekend periods, except no data were collected the day before, during, or after a holiday. At selected sites, multiple measurements were taken to examine seasonal and other effects. The speeds and headways of approximately 1.6 million vehicles were collected during the study.

The volume, speed, and headway data were collected with Sarasota VC1 900 automated roadside units.[16] Due to the memory limitations of the equipment, the data were recorded in 2-h increments for a 24-h period. The units were programmed to collect free-flow vehicle speeds by direction of travel and for two vehicle-length categories. Vehicles with a length of less than 20 ft (6.1 m) were classified as short vehicles. Vehicles 20 ft (6.1 m) in length or longer were classified as long vehicles. For each vehicle length, the equipment classified free-flow vehicle speeds in 1-mi/h (1.6-km/h) bins from 1 to 128 mi/h (1.6 to 206 km/h). The accuracy of the equipment for speed measurement was 0.5 mi/h (0.8 km/h), and the accuracy for length measurement was 1.5 ft (0.5 m).[16] A field check of the accuracy of the equipment was made during each data collection session with either a stopwatch using a defined distance or a vehicle with a calibrated speedometer.

Headway data were collected in 11 bins. Data in the first bin included the number of vehicles with headways of less than 2 s; the second bin included the number of vehicles with headways ranging from 2.00 to 2.99 s, etc. The 1 Ith bin included the number of vehicles with headways of 11 s or more. The accuracy of the equipment for headway measurement was 0.5 s.[16]

The data were collected for both directions of travel at a point representative of typical conditions on the roadway section. At most sites, the data collection points were located on tangent, level sections. Shown in figure 5 is a data collection setup showing the inductive loop mats in the roadway and the roadside units chained to a utility pole.

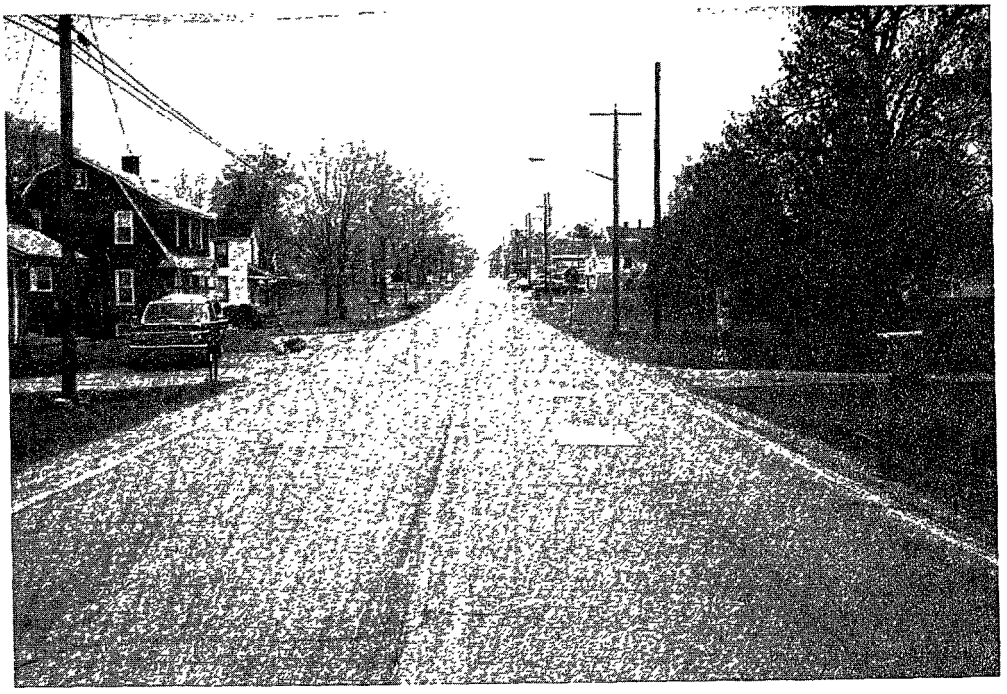


Figure 5. Typical field data collection setup.

Two inductive loop mats were deployed in the center of each lane at each site to detect vehicle speeds and one loop mat was deployed in each lane to collect headway data. For speed data collection , 3- by 6-ft (0.9- by 1.8-m) inductive loop mats were placed at a distance of 10 ft (3 m) from leading edge to leading edge. Temporary inductive loop mats were used as sensors to differentiate speeds by vehicle length.

Before and after data were collected at the same point on the roadway to permit comparisons and eliminate locational differences. Data were not collected near major intersections, driveways, or other features that would atypically affect normal driving speeds. Every attempt was made to conceal the roadside units and to make the sensors as inconspicuous as possible.

The data were extracted from the roadside units with a laptop computer and stored on diskettes. A computer program, written especially for the study, was used to summarize the speed and headway data for analysis. At each site, the free-flow speed data were summarized for short vehicles (less than 20 ft (6.1 m) in length), long vehicles (20 ft (6.1 m) in length or greater), and for both vehicle lengths combined. A sample printout of the 24-h speed data for all free-flow vehicles with both vehicle lengths combined is shown in table 1.

The two-person data collection teams also recorded geometric and roadway features such as the number of lanes, lane width, number of public streets, number of commercial and residential driveways, and number of speed limit signs.

Table 1. Sample of 24-h free-flow speed data collected at a site.

SITE NUMBER · OK03EB — AREA AND ROAD TYPE - Small Urban Two-Lane

STATE - Oklahoma — JURISDICTION - City of Sallisaw

ROUTE - 59 (Wheeler Avenue) — DIRECTION - Northbound and Southbound — CHANNEL NUMBER - 1 and 2

SPEED LIMIT - 35 mi/h — FREE-FLOW GAP = > 4 Seconds — LONG VEHICLE LENGTH = > 20 Feet

BEGINNING DATE -August 26, 1986 — RECORDING INTERVAL - 2 Hours

SUMMARY FOR ALL VEHICLE LENGTHS COMBINED

END TIME PERIOD	MEAN SPEED mi/h	STD DEV mi/h	TOTAL VOL.	FREE-FLOW VOL.	PCT. FREE-FLOW	PERCENTILE SPEEDS mi/h 10	15	25	35	50	65	75	85	90	95	99	PERCENT EXCEEDING SPEED LIMIT BY (mi/h) 0	5	10	15	10-mi/h PACE LL	10-mi/h PACE UL	PCT. IN	SKEW. INDEX
1300	39.5	6.2	729		80.6	25	29	32	34	36	38	40	42	44	46	48	50	55	78.4	44.8	18.7	4.4	0.8	35	44	62.0	1.00
1500	39.5	6.0	763	626	82.0	22	29	33	35	37	39	40	42	44	45	47	49	53	81.6	48.6	14.4	3.8	0.2	36	45	67.3	0.89
1700	38.8	6.2	972	742	76.3	23	28	31	33	35	37	40	42	43	46	47	49	52	74.9	43.1	15.5	2.6	0.3	34	43	59.6	0.89
1900	39.5	5.8	898	711	79.2	24	31	33	35	36	38	40	42	44	46	47	49	53	80.3	47.0	18.0	3.1	0.4	35	44	64.0	0.94
2100	39.2	5.6	542	468	86.3	26	31	33	34	36	38	40	42	43	48	47	49	52	78.2	44.4	15.2	2.8	0.6	34	43	65.0	1.00
2300	38.9	5.6	388	343	88.9	25	31	33	34	36	37	39	41	43	45	47	49	53	75.2	40.5	14.6	2.3	0.0	35	44	65.3	1.06
100	39.7	6.0	147	139	94.6	23	30	33	35	36	38	40	42	43	46	47	50	56	84.2	46.0	16.5	3.6	1.4	36	45	67.6	0.94
300	40.4	6.6	51	51	100.0	31	32	32	33	35	38	40	43	44	49	50	50	54	72.5	47.1	23.5	5.9	0.0	35	44	56.9	1.11
500	37.9	5.6	58	53	91.4	23	31	32	33	35	36	37	39	42	45	47	48	50	71.7	28.3	15.1	0.0	0.0	31	40	67.9	1.25
700	39.2	6.1	275	249	90.5	23	28	32	34	36	38	40	42	43	45	48	50	54	78.7	43.0	14.9	4.4	0.4	35	44	66.3	0.90
900	39.6	5.6	796	603	75.8	25	30	33	35	36	38	40	42	44	46	47	49	52	81.3	48.6	15.8	2.8	0.3	36	45	65.5	1.00
1100	38.9	6.2	668	551	82.7	24	28	31	33	36	37	39	42	43	46	48	49	53	75.7	43.6	16.7	1.6	0.9	35	44	60.4	0.95
TOTALS																											
PERIODS 12	39.3	6.0	6,283	5,125	81.6	24	29	32	34	36	38	40	42	43	46	47	49	54	78.4	45.1	16.2	3.1	0.5	35	44	63.0	0.94

1 ft = 0.31 m
1 mi/h = 1.61 km/h

Crash Data Collection

The crash data base for this study contains 6,307 police-reported crashes from 22 States. For most sections, crash data were available for a 3-yr period before the speed limit was changed and for a 2-yr after period. The participating transportation agencies furnished the data in a variety of formats, including copies of the crash reports, computer summaries, and individual crash listings.

The original crash data from each jurisdiction were encoded in the format received using dBASE IV, then summarized in a compatible format for analysis. The variables coded for each crash include site number, date, day of week, hour, severity (i.e., fatal crash, injury crash, or property damage only crash), the number of persons injured and killed, type of collision, number of vehicles, lighting and roadway surface conditions, intersection relatedness, and estimated vehicle speed (when speeds were recorded on the crash report). Other crash variables, such as contributing circumstance, were not collected because they were either not available or not consistently reported.

A sample printout of the crash data that were collected and summarized at a site is shown in table 2.

Table 2. Sample of crash data collected at a site.

Site Number	Crash Date	Day of Week	Hour	Crash Severity	No. Inj.	No. Fatal	Crash Type	No. Veh.	Light Cond.	Surface Cond.	Int. Related	Estimated Speed, mi/h Veh. 1	Veh. 2	Veh. 3
AZ01 E	10/25/84	Thu	15	Injury	3	0	Head-on	2	Day	Dry	Yes	30	15	NA
AZ01 E	06/15/65	Sat	7	Injury	3	0	Head-on	2	Day	Dry	No	50	25	NA
AZ01 E	06/19/85	Wed	10	injury	1	0	Other	2	Day	Dry	No	NS	35	NA
AZ01 E	06/19/85	Wed	16	PDO	0	0	Angle	2	Day	Dry	Yes	15	37	NA
AZ01 E	11/16/85	Sat	16	PDO	0	0	Angle	2	Day	Dry	No	3	35	NA
AZ01 E	11/24/86	Mon	a	PDO	0	0	Rear-end	2	Day	Dry	Yes	20	2	NA
AZ01 E	03/24/87	Tue	18	PDO	0	0	Ran-off-road	1	Dusk	Other	Yes	54	NA	NA
AZ01 E	05/11/87	Mon	16	PDO	0	0	Rear-end	3	Day	Dry	Yes	40	15	45
AZ01E	12/15/87	Tue	10	Injury	1	0	Rear-end	2	Day	Dry	Yes	40	5	NA
AZ01 E	03/17/88	Thu	17	Injury	1	0	Angle	2	Day	Dry	Yes	40	15	NA
AZ01 E	03/31/88	Thu	Ia	PDO	0	0	Other	1	Dusk	Dry	No	40	NA	NA
AZ01 E	07/14/88	Thu	23	PDO	0	0	Fixed-object	1	Dark	Dry	No	40	NA	NA
AZ01 E	11/28/88	Mon	6	Injury	3	0	Rear-end	4	Day	Dry	Yes	28	0	0
AZ01 E	01/12/89	Thu	6	PDO	0	0	Rear-end	2	Dark	Dry	Yes	45	0	NA
AZ01 E	02/18/89	Sat	20	Injury	1	0	Angle	2	Dark	Dry	Yes	45	10	NA
AZ01 E	03/28/89	Tue	6	Injury	2	0	Ran-off-road	1	Day	Dry	No	40	NA	NA
AZ01 E	04/01/89	Sat	10	PDO	0	0	Ran-off-road	2	Day	Dry	No	5	45	NA

1 mi/h = 1.61 km/h
Note: PDO = Property Damage Only crash
NS = Not Stated
NA = Not Applicable

SITE CHARACTERISTICS

Of the 100 experimental sites on nonlimited access highways that were examined in the study, speed limits were lowered at 59 locations and raised at 41 sites. The number of experimental sites and their section length, stratified by area population and level of speed limit change, is shown in table 3. Changes in the posted speed limit ranged from lowering speed limits by 20 mi/h (32 km/h) on three sections to raising the posted limit by 15 mi/h (24 km/h) at three other locations. Of the 100 sites, 6 roadways were multilane, covering 14 mi (23 m). The remainder of the sections were two-lane highways.

The largest number of experimental sites (63), and nearly 80 percent of the total mileage included in the study, were located in rural areas with a population of less than 5,000 persons. Of the 63 rural sites, 24 sections were located on primary highways that passed through small towns and unincorporated areas. Speed limits were raised at 25 of the 63 rural locations and lowered at 38 sites.

In addition, 22 sites, which were typically less than 1 mi (1.6 km) in length, were located in small urban areas with a population between 5,000 and 50,000 persons. Speed limits were raised at 5 of the 22 small urban sites and lowered at 17 sites.

Finally, 15 sites were located in urban areas with a population of more than 50,000 persons. Speed limits were raised at 11 urban sites and lowered at only 4 locations.

Speed limits were lowered by 10 mi/h (16 km/h) at 35 percent of the sites. The second largest speed limit change occurred at 26 sites, where speed limits were raised by 5 mi/h (8 km/h). The raised 5-mi/h (8-km/h) group also contained approximately 43 percent of the total study mileage. Most of this mileage was at the rural sites where the average section length was 4 mi (6 km).

Sites where speed limits were lowered by either 15 or 20 mi/h (24 or 32 km/h) had the highest before posted speed limits, i.e., 50 or 55 mi/h (81 or 89 km/h). By contrast, sites where speed limits were raised by 10 or 15 mi/h (16 or 24 km/h) had the lowest before posted speed limits, i.e., between 20 and 40 mi/h (32 and 64 km/h).

The 24-h before traffic volumes at the experimental sites ranged from 300 vehicles at a low-volume site to 17,000 vehicles at a high-volume location. The average 24-h before volume for all experimental sites was 4,500 vehicles. At the comparison sites, the 24-h before volumes ranged from a low of 200 vehicles to a high of 22,000 vehicles. The average 24-h before volume for all comparison sites was 3,400 vehicles.

A summary of the characteristics for each experimental and comparison site is given in appendix A. The sites are grouped in appendix A by the amount the posted speed limit was changed at the experimental sites to provide consistency with the analyses presented in subsequent sections of this report.

Table 3. Experimental sites by area type and level of speed limit change.

Area*	Speed Limit Change, mi/h							Total
	Lower Limit				Raise Limit			
	-20	-15	-10	-5	+5	+10	+15	
Rural								
Sites	2	7	22	7	16	7	2	63
Miles	9.45	10.03	29.04	12.52	64.24	9.86	1.12	136.26
Small Urban								
Sites	1	-	11	5	3	2	-	22
Miles	0.80	-	9.19	5.49	2.21	2.03	-	19.72
Urban								
Sites	-	-	2	2	7	3	1	15
Miles	-	-	1.25	1.88	8.15	3.01	1.74	16.03
Total								
Sites	3	7	35	14	26	12	3	100
Miles	10.25	10.03	39.48	19.89	74.60	14.90	2.86	172.01

1 mi/h = 1.61 km/h
1 mi = 1.61 km
*Note: Rural = area population <5,000 persons
Small Urban = area population 5,000 to 49,999 persons
Urban = area population >50,000 persons

In addition to simply noting how much the speed limit was raised or lowered in mi/h (km/h), another way of describing the change in posted speed limit at a site is to compare where the posted speed limit is set relative to the distribution of vehicle speeds before and after the speed limit change. For example, a speed limit set at the 85th percentile speed would have 85 percent of the drivers traveling at or below the speed limit and 15 percent driving above the limit. In this example, the percentile speed posted would be the 85th percentile.

Using the before and after 24-h free-flow speed data collected during the study, the percentile speed posted was determined for each experimental site. Speed data were available for 57 of the 59 sites where speed limits were lowered and for 41 sites where speed limits were raised. Shown in table 4 are the experimental sites grouped by percentile speed posted before and after the speed limits were changed.

Of the 57 sites where speed limits were lowered, 42 locations had speed limits set above the 70th percentile speed before the limits were changed. After the limits were lowered, only three sites had limits posted above the 70th percentile speed. The number of sites posted below the 30th percentile speed increased from 3 before the limits were changed to 24 after the new limits were posted.

Table 4. Distribution of experimental sites by before and after percentile speeds posted.

Before Percentile Speed Posted	After Lowering Speed Limit Percentile Speed Posted						
	<30	30-50	50-70	70-85	85-90	>90	Total
	Number of Sites						
<30	3	-	-	-	-	-	3
30-70	11	1	-	-	-	-	12
>70	10	20	9	3	-	-	42
Total	24	21	9	3	-	-	57
Before Percentile Speed Posted	After Raising Speed Limit Percentile Speed Posted						
	<30	30-50	50-70	70-85	85-90	>90	Total
	Number of Sites						
<30	6	7	11	4	3	8	32
30-70			3	4	1	-	8
>70						1	1
Total	6 7		14 8		4	2	41

Note: The percentile speed posted is the point on the speed distribution where the speed limit is posted.

Before the speed limits were lowered, the typical site was posted at the 78th percentile speed. At the lower end, one site was posted at the 20th percentile speed, while at the higher end, one site was posted at the 99th percentile speed. After the speed limits were lowered, the speed limit at a typical site was posted at the 33rd percentile speed. One site was posted at the 1st percentile speed, while at the higher end, one site was posted at the 75th percentile speed.

As illustrated in table 4, before the speed limits were raised, 32 of the 41 sites had speed limits set below the 30th percentile speed. After the speed limits were raised, only six sites had limits below the 30th percentile. In contrast, before the speed limits were raised, only one site had a speed limit above the 70th percentile speed. After the limits were raised, 14 of the 41 sites had limits above the 70th percentile speed.

At sites where speed limits were raised, the before speed limit was typically posted at the 20th percentile speed. One site was posted at the 1st percentile speed. At the other extreme, one site was posted at the 70th percentile speed. After the speed limits were raised, the typical speed limit was posted at the 58th percentile speed. One site was posted at the 10th percentile speed and another site was posted at the 97th percentile speed.

After the speed limit changes were made at the experimental sites, on average, the speed limit was posted at the 43rd percentile speed. By way of comparison, the speed limit posted at the comparison sites, where no speed limit changes were made, was, on average, the 45th percentile speed.

For the sites included in this study, these data suggest that the participating jurisdictions typically post speed limits below the 50th percentile speed. The 85th percentile speed has been cited as one factor considered by all States and most localities in making speed limit changes.[3] Based on the data collected at the study sites, it appears that other factors are more important than the 85th percentile speed in the decision-making process.

Shown in figure 6 is the range in 85th percentile speeds by posted speed limit after the limits were changed on the experimental sections. On average, the speed limits were posted 5 to 16 mi/h (8 to 26 km/h) below the 85th percentile speed. The largest difference occurred at a site with a 47-mi/h (76-km/h) 85th percentile speed and a posted limit of 25 mi/h (40 km/h). At the other extreme, one site had an 85th percentile speed of 41 mi/h (66 km/h) and a posted limit of 45 mi/h (72 km/h).

The range in mean speeds by posted limit, after the limits were changed on the experimental sites, is presented in figure 7. The data illustrate that the posted limits were set slightly below the average speed of traffic for the majority of sites.

The range in 85th percentile speeds by posted speed limit for the comparison sites is shown in figure 8. The data indicate that the existing speed limits on these sections were posted 4 to 12 mi/h (6 to 19 km/h) below the 85th percentile speed. The range in mean speed by posted limit for the comparison sites is illustrated in figure 9.

The findings on the comparison sites are similar to those at the experimental sites, i.e., on average, the speed limits on the comparison sites were posted below the 50th percentile speed or average speed of traffic.

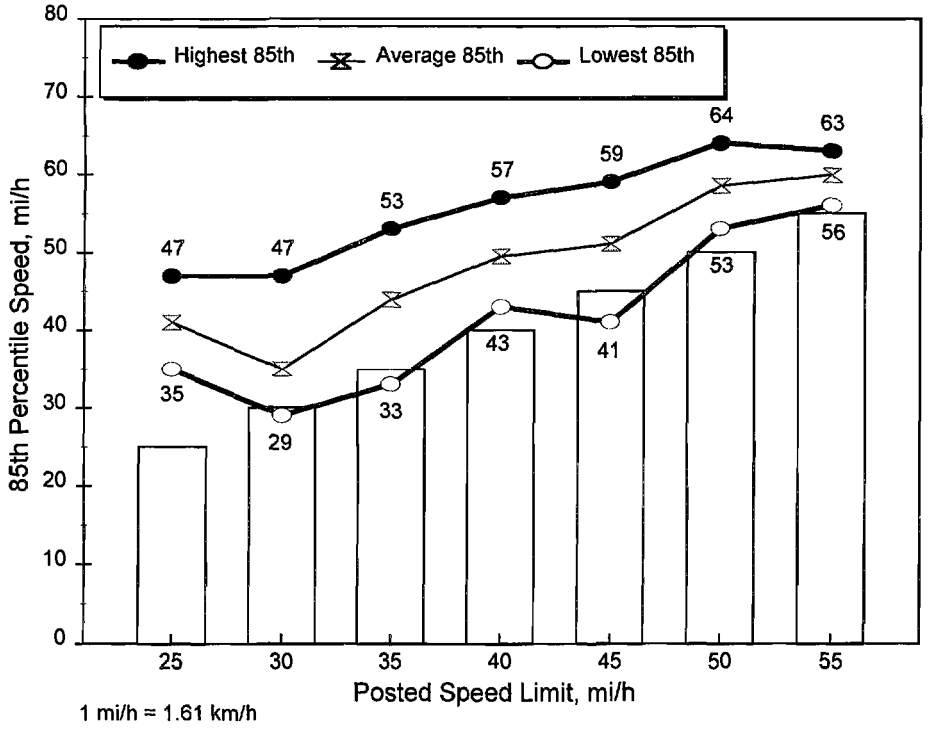


Figure 6. 85th percentile speed vs. posted speed limit for the experimental sites after the speed limits were altered.

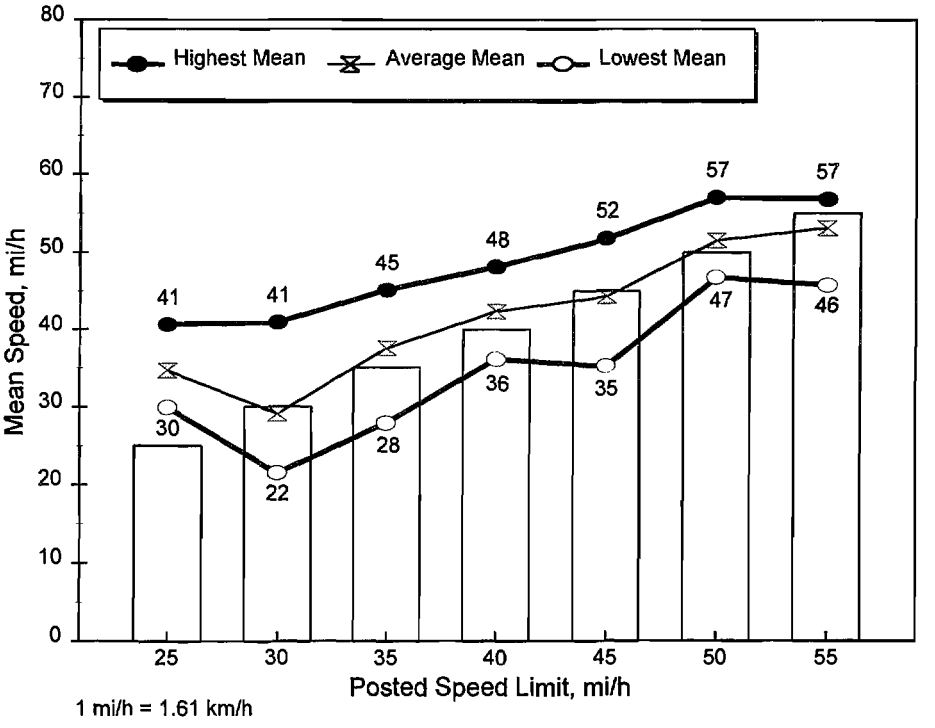


Figure 7. Mean speed vs. posted speed limit for the experimental sites after the speed limits were altered.

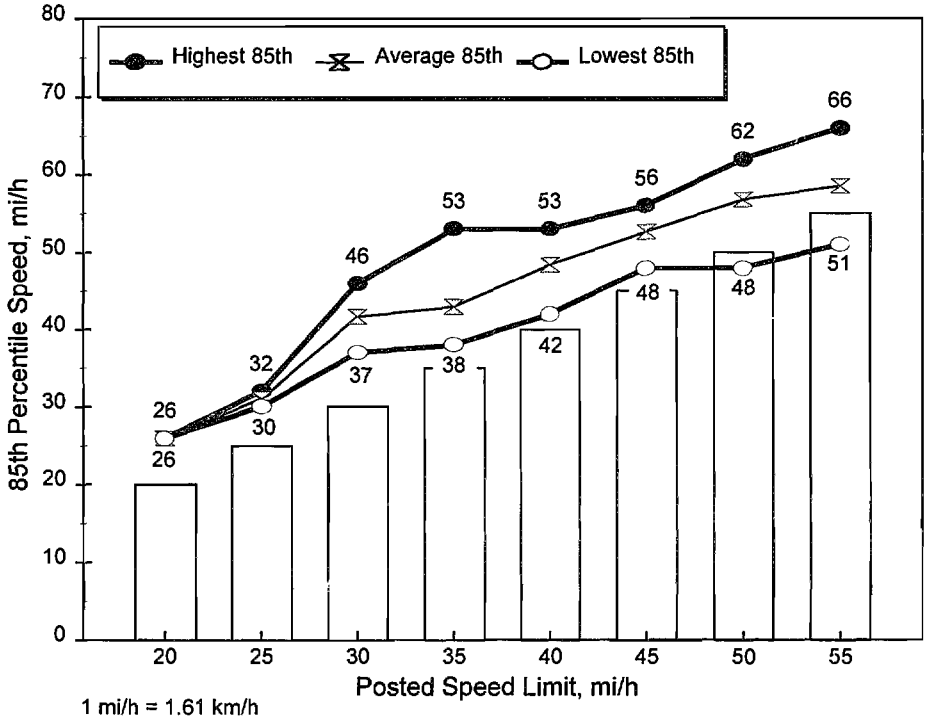


Figure 8. 85th percentile speed vs. posted speed limit for the comparison sites.

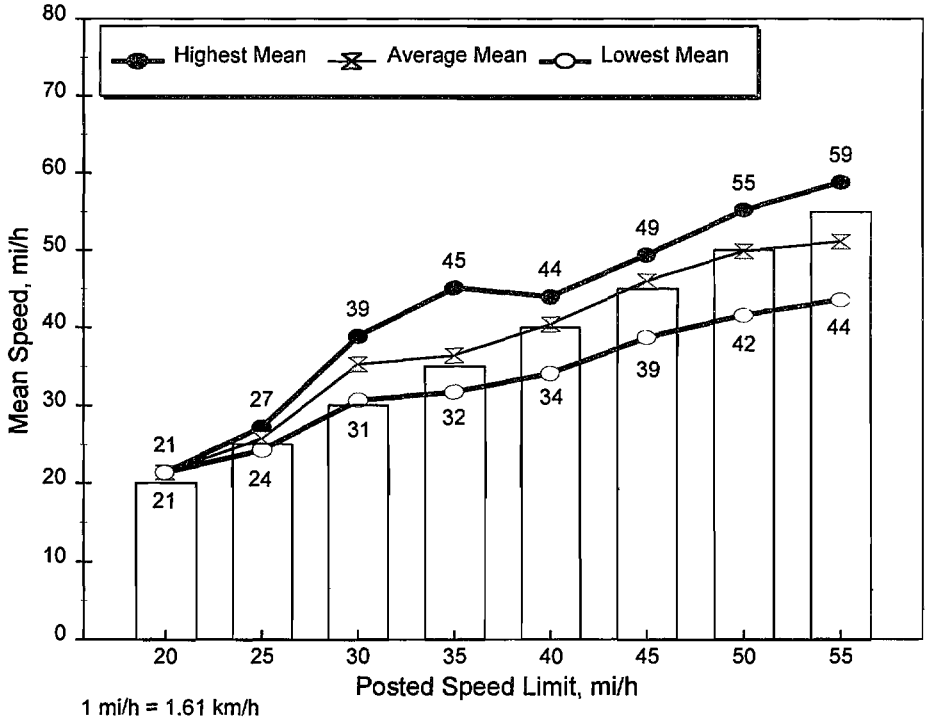


Figure 9. Mean speed vs. posted speed limit for the comparison sites.

EFFECTS ON DRIVER BEHAVIOR

The effects of raising and lowering posted speed limits on driver behavior at the nonlimited access roadway sites selected for study are presented in this section. The specific effects of speed limit changes on driver behavior include changes in the speed distribution, driver compliance, and close following.

Also presented in this section are the results of repeated speed measurements taken at 11 sites to examine speed changes over time, and the results of before and after speed data collected to examine the indirect effects of speed limit changes at 5 contiguous sites. The section concludes with a general discussion of the findings.

Effects on Speed

The before and after results for the 98 experimental sites where speed data were collected are presented in this section, followed by a discussion of speed changes at 4 sites where the pavement was also resurfaced after speed limits were raised. Finally, before and after speed changes at sites where the speed limits were lowered more than 5 mi/h (8 km/h) below the 85th percentile speed are given along with the results of speed changes at sites where the speed limits were raised to within 5 mi/h (8 km/h) of the 85th percentile speed.

The primary objective of the data analysis was to examine before and after differences in driver behavior. The first step in the analysis was to examine before and after differences in driver behavior at each site. The next step was to decide how to group or categorize the sites to simplify presentation of the results. Because raising posted speed limits could produce speed effects that were different than lowering speed limits, the sites were subdivided into raised posted speed limit (41 sites) and lowered posted speed limit (57 sites) groups. In addition to this basic subdivision, the sites were grouped into a number of categories, including amount of posted speed limit change, area population, geographic area (Western States, Southeastern States, etc.), number of lanes, traffic volume level, section length, and operating speed. Irrespective of how the sites were grouped, the results were similar. For presentation purposes in this report, the sites were grouped by amount of posted speed limit change.

Although the sites were grouped by level of posted speed limit change, considerable individual site data are presented in this section and more detailed information is included in appendix B.

Posted speed limit changes at the 98 experimental sites with before and after speed data ranged from lowering the limit by 20 mi/h (32 km/h) at 2 sites, to raising the limit by 15 mi/h (24 km/h) at 3 other sites. However, as the posted limit was lowered by 20 mi/h (32 km/h) at only two sites, these locations were grouped with the 15-mi/h (24-km/h) lower limit sites for analysis. Similarly, as the speed limit was raised by 15 mi/h (24 km/h) at only three sites, these sites were grouped with the 10-mi/h (16-km/h) raised limit sites for analysis.

The posted speed limit groups and the number of experimental sites in each group are shown below.

Category	Posted Speed Limit Group	Number of Experimental Sites
Lower Limit	-15 & -20 mi/h	9
	-10 mi/h	34
	-5 mi/h	14
Raise Limit	+5 mi/h	26
	+10 & +15 mi/h	15

1 mi/h = 1.61 km/h

Speed Variables

As discussed earlier, 24-h speed data were collected for free-flow vehicles (vehicles with a headway of 4 s or more) simultaneously at the experimental and comparison sites before and after the new speed limits were posted. In addition to total volume and free-flow volume, the following spot speed statistics were summarized for analysis:

- Mean speed.
- Standard deviation of speeds.
- Percentile speeds, ranging from the 1st to the 99th percentile.
- Percentage of vehicles exceeding the speed limit by 0, 5, 10, 15, and 20 mi/h (0, 8, 16, 24, and 32 km/h).
- Lower and upper limits of the 10-mi/h (16-km/h) pace and percentage of vehicles in the pace.
- Skewness index.

The skewness index, a measure of the departure of the speed distribution from symmetry, is defined as:

$$SI = \frac{2(P_{93} - P_{50})}{P_{93} - P_7}$$

where: SI = Skewness index
P_7 = 7th percentile speed
P_{50} = 50th percentile speed
P_{93} = 93rd percentile speed

Results

A summary of the effects of changing posted speed limits on vehicle speeds is presented in this section. Detailed before and after speed data for each experimental and comparison site are shown in appendix B. Also included in appendix B are tables showing the differences in the before and after speed characteristics at each site.

Previous studies of posted speed limit alterations primarily focused on changes in the mean and 85th percentile speeds. Shown in figure 10 are the before and after 85th percentile speeds for the 57 experimental sites where speed limits were lowered. The before and after 85th percentile speeds for the 41 sites where speed limits were raised are shown in figure 11

If lowering the posted speed limit reduces the 85th percentile speed, then the symbols shown in figure 10 would fall below the diagonal line. Conversely, if raising speed limits increases the 85th percentile speed, then the symbols shown in figure 11 should fall above the diagonal line. However, as shown in figures 10 and II, the symbols appear to be uniformly distributed around the diagonals, irrespective of how much the speed limit was lowered or raised.

Lowering or raising the posted speed limits at the experimental sites had little effect on driver behavior as reflected by the 85th percentile speeds. Lowering the speed limit by 5, 10, 15, or 20 mi/h (8, 16, 24, or 32 km/h) at the study sites did not result in major reductions such as 5 mi/h (8 km/h) or more in the 85th percentile speeds. Raising the speed limit by 5, 10, o r 15 mi/h (8, 16, or 24 km/h) at the study sites also did not result in major increases such as 5 mi/h (8 km/h) or more in the 85th percentile speeds.

Figures 10 and 11 provide a graphical illustration of the before and after 85th percentile speeds for each site. The sites were grouped by level of posted speed limit change, and the before and after differences in 85th percentile speeds are shown in figure 12. The average change in 85th percentile speed for the sites in each speed limit group, as well as the largest change at any individual experimental site in the group, is shown in figure 12. For example, for the group of sites where speed limits were lowered by 15 or 20 mi/h (24 or 32 km/h), the average change in 85th percentile speed was a 0.1-mi/h (0.16-km/h) decrease. Among the nine sites in this group, the largest decrease in 85th percentile speed at an individual site was 1 mi/h (1.6 km/h). The largest increase in 85th percentile speed at an individual site was 2 mi/h (3.2 km/h).

The data in figure 12 illustrate that major reductions, 5 mi/h (8 km/h) or more, in the 85th percentile speeds did not occur even for large reductions in the posted speed limit. Also, major increases in the 85th percentile speeds did not occur at sites where the speed limits were raised. As shown in figure 13, small changes in the 85th percentile speeds also occurred at the comparison sites where speed limits were not altered.

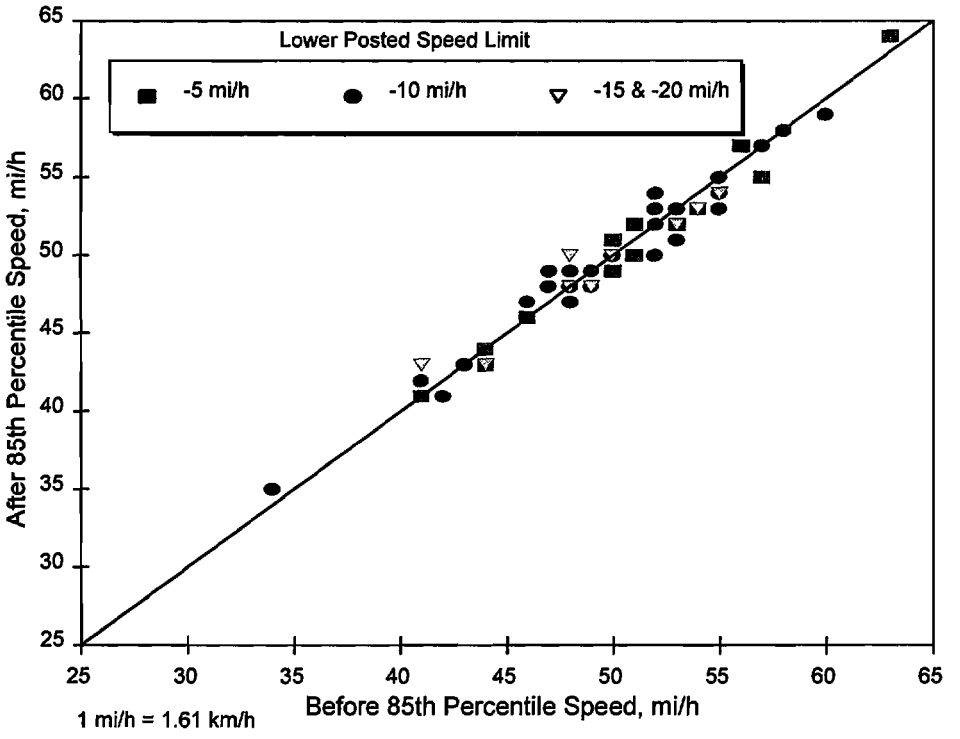


Figure 10. 85th percentile speeds before and after lowering posted speed limits at 57 experimental sites.

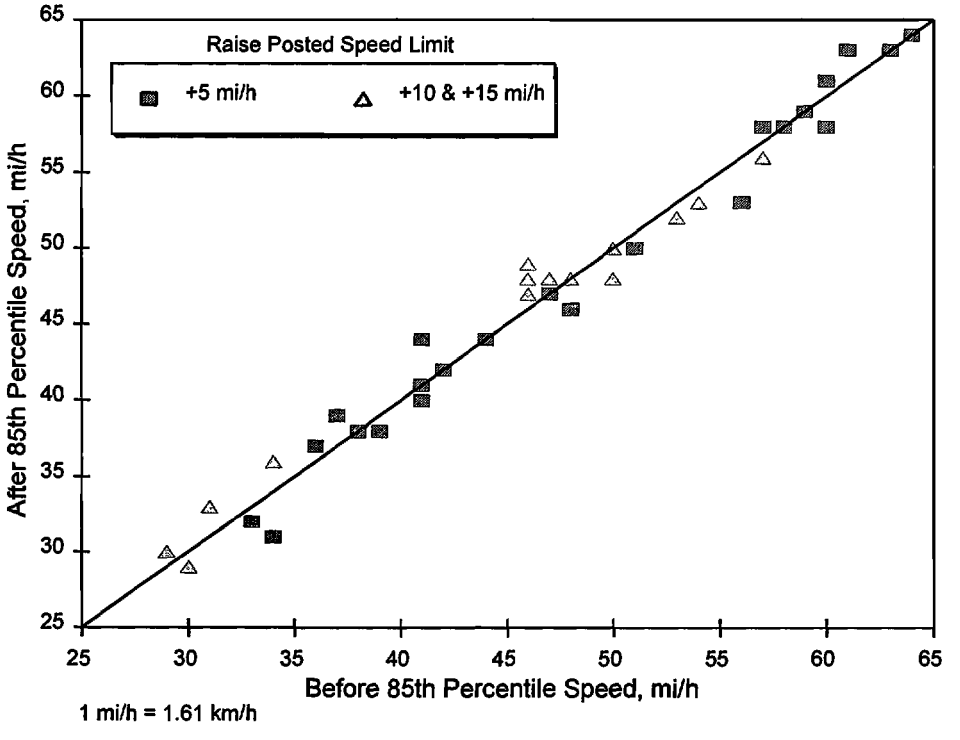


Figure 11. 85th percentile speeds before and after raising posted speed limits at 41 experimental sites.

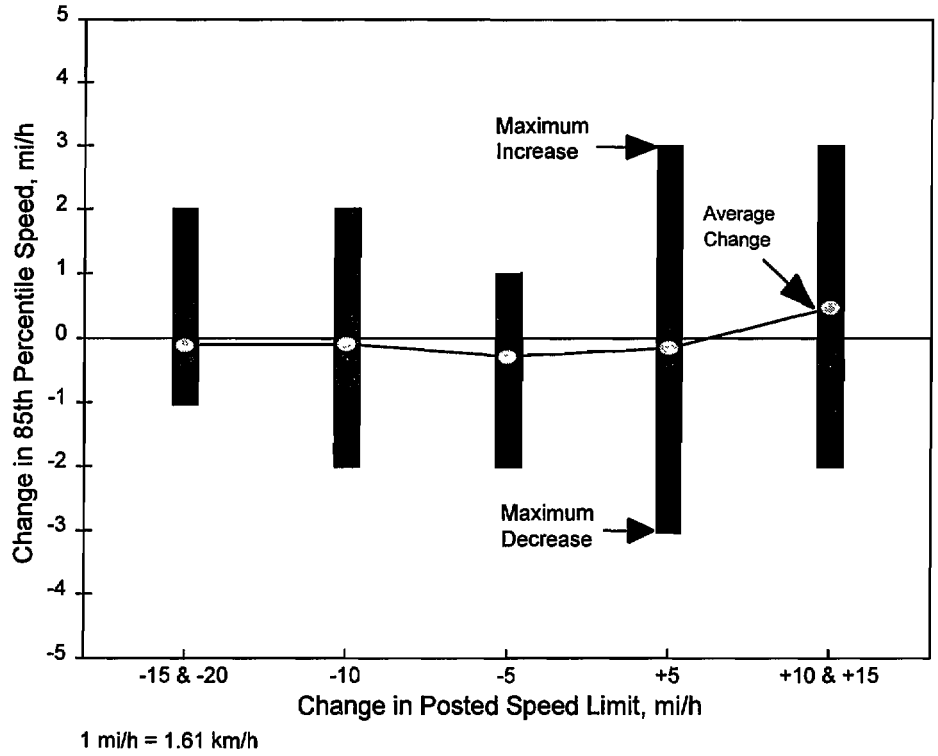


Figure 12. Maximum and average changes in the 85th percentile speeds at the experimental sites.

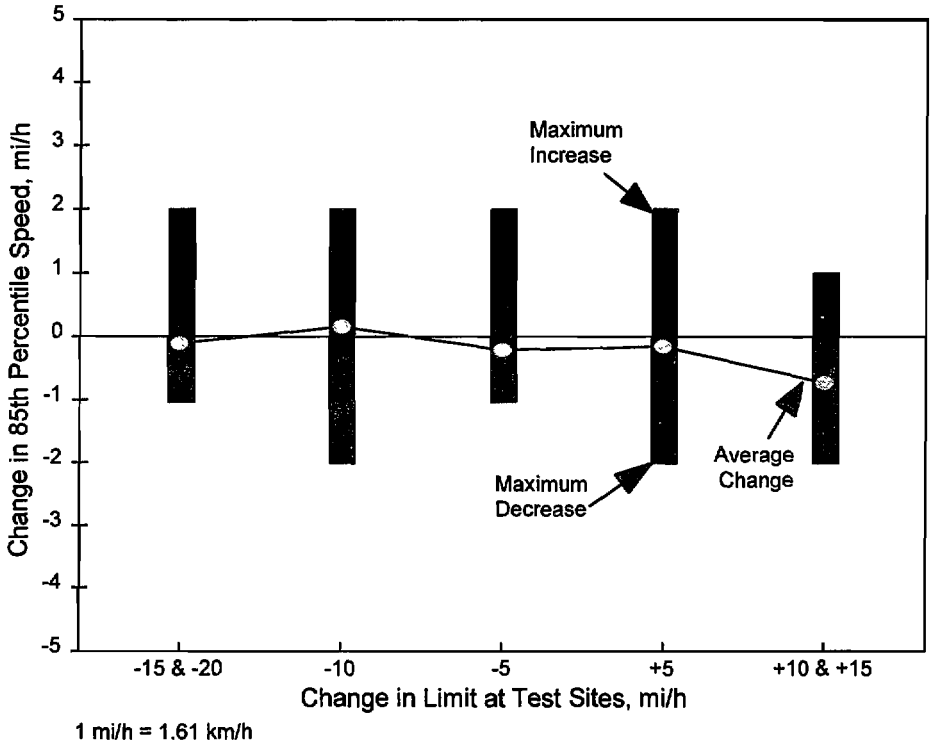


Figure 13. Maximum and average changes in the 85th percentile speeds at the comparison sites.

The 85th percentile speed is only one parameter in the speed distribution. Shown in table 5 are the before and after means, 85th percentile speeds, and the differences in speeds for each of the raised and lowered speed limit groups. The data for each experimental and comparison site are shown in table 6.

Examination of table 5 reveals that there were small differences (less than 1 mi/h (1.6 km/h)) in the group mean and 85th percentile speeds for each posted speed limit group. The standard deviation of the differences, however, is large, indicating considerable site-to-site variation.

A review of the speed data in table 6 at each experimental site revealed that before and after differences in the mean, standard deviation, and 85th percentile speed were generally less than 2 mi/h (3.2 km/h). In addition, there were increases in speeds at some sites and decreases in speeds at other sites, irrespective of whether the speed limit was raised or lowered or the amount the speed limit was changed. As also shown in table 6, similar differences in speed occurred at the comparison sites where posted speed limits were not changed. It should be noted that many of the speed differences of 1 mi/h (1.6 km/h) or more are statistically significant due to the large 24-h speed samples collected.

Table 5. Before and after group mean and 85th percentile speeds.

Experimental Sites								
Speed Limit Group	Group Mean Speed			Std. Dev. Diff.	Group 85th Percentile Speed			Std. Dev. Diff.
	Before	After	Diff.		Before	After	Diff.	
-15 & -20	42.1	42.2	0.1	0.9	49.1	49.0	-0.1	1.3
-10	42.7	42.7	0.1	1.0	50.0	49.9	-0.1	1.0
-5	43.7	43.7	-0.0	0.6	50.7	50.4	-0.3	1.0
+5	41.9	42.2	0.2	1.2	48.5	48.4	-0.2	1.4
+10 & +15	36.7	37.5	0.8	1.5	43.3	43.8	0.5	1.5
Comparison Sites								
Speed Limit Group	Group Mean Speed			Std. Dev. Diff.	Group 85th Percentile Speed			Std. Dev. Diff.
	Before	After	Diff.		Before	After	Diff.	
-15 & -20	47.7	47.7	0.1	1.1	55.6	55.4	-0.1	1.1
-10	47.8	48.1	0.4	1.0	55.3	55.5	0.2	1.0
-5	46.2	46.4	0.2	1.0	53.1	52.9	-0.2	1.0
+5	40.5	40.4	-0.1	1.1	47.0	46.8	-0.2	1.1
+10 & +15	32.9	32.9	-0.0	1.1	39.5	38.8	-0.7	1.1

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 6. Before and after vehicle speeds for the experimental and comparison sites.

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std Dev. Speed	Diff. Std. Dev. Speed	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites												
NJ04E	50	30	-20	37.7	37.8	0.1	6.6	5.5	-1.1	44	43	-1
TX03E	55	35	-20	36.2	37.9	1.7	5.0	4.7	-0.3	41	43	2
DE02E	50	35	-15	45.7	44.9	-0.8	6.8	6 6	-0.2	53	52	-1
NM01E	55	40	-15	44.5	45.2	0.7	9.5	9.0	-0.5	55	54	-1
NM03E	55	40	-15	42.0	41.1	-0.9	7.6	7.8	0.2	50	50	0
NM04E	55	40	-15	40.4	41.4	1.0	7.5	7.8	0.3	48	50	2
OH02E	55	40	-15	42.6	42.1	-0.5	6.3	6.1	-0.2	49	48	-1
OH13E	55	40	-15	41.9	41.9	0.0	5.7	5.4	-0.3	48	48	0
TX05E	55	40	-15	47.9	47.5	-0.4	5.5	5.3	-0.2	54	53	-1
Average for 9 sites				42.1	42.2	0.1	6.7	6.5	-0.3	49.1	49.0	-0.1
Speed Limit Lowered by 10 mi/h at Experimental Sites												
CA01E	35	25	-10	34.3	33.8	-0.5	6.9	6.7	-0.2	42	41	-1
DE03E	50	40	-10	45.0	45.1	0.1	6.9	6.8	-0.1	52	52	0
DE04E	50	40	-10	48.7	48.1	-0.6	7.9	7.9	0.0	57	57	0
IL01E	50	40	-10	43.6	42.9	-0.7	5.1	4.7	-0.4	49	48	-1
IN01E	55	45	-10	46.9	46.7	-0.2	5.8	5.6	-0.2	53	53	0
MA01E	40	30	-10	41.9	40.9	-1.0	5.8	5.4	-0.4	48	47	-1
ME02E	45	35	-10	33.0	33.4	0.4	7.2	7.2	0.0	41	42	1
MI09E	55	45	-10	49.7	50.5	0.8	8.8	7.9	-0.9	58	58	0
NE01E	55	45	-10	44.2	42.5	-1.7	7.5	6.7	-0.8	52	50	-2
NJ02E	45	35	-10	37.7	37.7	0.0	8.0	7.0	-1.0	46	46	0
NJ03E	45	35	-10	41.0	41.5	0.5	6.8	6.3	-0.5	48	48	0
OH01E	55	45	-10	53.0	51.7	-1.3	7.0	7.4	0.4	60	59	-1
OH03E	55	45	-10	48.2	48.6	0.4	6.3	6.2	-0.1	55	55	0
OH04E	55	45	-10	45.8	45.1	-0.7	7.6	7.3	-0.3	54	53	-1
OH05E	45	35	-10	38.7	38.8	0.1	7.6	6.6	-1.0	46	46	0
OH06E	55	45	-10	44.1	44.6	0.5	9.0	8.1	-0.9	53	53	0
OH07E	55	45	-10	43.3	44.4	1.1	6.4	5.8	-0.6	50	50	0
OH08E	55	45	-10	39.1	39.8	0.7	7.5	8.1	0.6	47	49	2
OH09E	55	45	-10	42.7	42.7	0.0	6.8	6.7	-0.1	49	49	0
OH10E	55	45	-10	46.7	44.7	-2.0	6.3	5.8	-0.5	53	51	-2

Comparison Site Number	Posted Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std. Dev. Speed	Diff. Std. Dev. Speed	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Comparison Sites where Posted Speed Limits were not changed										
NJ04C	50	47.6	46.6	-1.0	5.5	6.0	0.5	54	53	-1
TX03C	55	49.6	52.3	2.7	10.4	7.8	-2.6	59	60	1
DE02C	50	44.5	44.9	0.4	6.9	7.5	0.6	51	53	2
NM01C	55	52.2	52.2	0.0	7.7	7.9	0.2	60	60	0
NM03C	40	44.2	43.6	-0.6	9.8	8.5	-1.3	54	53	-1
NM04C	40	44.2	43.6	-0.6	9.8	8.5	-1.3	54	53	-1
OH02C	55	46.6	45.9	-0.7	7.2	7.0	-0.2	55	54	-1
OH13C	55	47.5	47.6	0.1	6.2	6.7	0.5	54	54	0
TX05C	55	52.6	53.0	0.4	6.4	6.0	-0.4	59	59	0
Average for 9 sites		47.7	47.7	0.1	7.8	7.3	-0.4	55.6	55.4	-0.1
Comparison Sites where Posted Speed Limits were not changed										
CA01C	30	34.0	33.5	-0.5	5.6	5.4	-0.2	40	39	-1
DE03C	50	49.5	49.6	0.1	8.6	8.7	0.1	58	58	0
DE04C	50	49.3	49.5	0.2	8.7	8.8	0.1	58	58	0
IL01C	45	43.6	43.3	-0.3	5.6	4.9	-0.7	49	48	-1
IN01C	55	52.9	53.4	0.5	6.6	6.7	0.1	60	60	0
MA01C	30	37.9	38.0	0.1	6.3	5.7	-0.6	45	44	-1
ME02C	45	46.5	47.7	1.2	7.5	6.9	-0.6	54	55	1
MI09C	55	56.7	57.0	0.3	7.2	6.8	-0.4	64	64	0
NE01C	55	52.1	52.6	0.5	8.3	7.8	-0.5	59	60	1
NJ02C	50	50.6	50.5	-0.1	7.9	7.0	-0.9	59	57	-2
NJ03C	50	50.2	50.5	0.3	7.7	7.0	-0.7	58	58	0
OH01C	55	51.6	50.9	-0.7	9.4	9.5	0.1	61	60	-1
OH03C	55	52.9	52.9	0.0	7.7	7.6	-0.1	61	61	0
OH04C	55	46.8	47.5	0.7	5.9	5.9	0.0	53	54	1
OH05C	55	50.0	50.2	0.2	11.1	10.5	-0.6	59	60	1
OH06C	55	52.7	53.2	0.5	7.4	7.9	0.5	61	61	0
OH07C	55	43.8	43.6	-0.2	8.4	7.2	-1.2	52	51	-1
OH08C	55	56.4	56.8	0.4	8.5	9.0	0.5	65	66	1
OH09C	55	54.4	54.7	0.3	6.4	6.0	-0.4	61	61	0
OH10C	55	54.4	54.7	0.3	6.4	6.0	-0.4	61	61	0

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 6. Before and after vehicle speeds for the experimental and comparison sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std. Dev. Speed	Diff. Std. Dev. Speed	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)												
OH11E	50	40	-10	35.5	37.4	1.9	12.6	10.5	-2.1	48	48	0
OH12E	55	45	-10	45.6	44.3	-1.3	7.3	7.4	0.1	53	52	-1
OK01E	45	35	-10	36.4	36.0	-0.4	6.3	6.5	0.2	43	43	0
OK02E	35	25	-10	29.5	29.9	0.4	4.8	4.5	-0.3	34	35	1
OK03E	35	25	-10	39.3	40.6	1.3	6.0	5.9	-0.1	46	47	1
OK04E	45	35	-10	42.7	42.3	-0.4	5.7	6.4	0.7	49	49	0
TX02E	55	45	-10	48.4	47.5	-0.9	6.5	5.9	-0.6	55	54	-1
TX04E	55	45	-10	40.4	41.7	1.3	7.2	7.0	-0.2	48	49	1
VA01E	55	45	-10	47.4	46.5	-0.9	7.2	6.6	-0.6	55	53	-2
VA03E	55	45	-10	44.0	44.8	0.8	6.4	6.2	-0.2	51	52	1
VA04E	55	45	-10	40.2	40.7	0.5	6.9	6.9	0.0	47	48	1
VA05E	55	45	-10	44.8	45.0	0.2	8.5	7.7	-0.8	54	53	-1
VA07E	55	45	-10	44.4	46.8	2.4	7.0	6.4	-0.6	52	54	2
WV03E	45	35	-10	44.0	45.1	1.1	7.1	7.0	-0.1	52	53	1
Average for 34 sites				42.7	42.7	0.1	7.1	6.7	-0.3	50.0	49.9	-0.1
Speed Limit Lowered by 5 mi/h at Experimental Sites												
AZ01E	50	45	-5	44.8	44.2	-0.6	5.5	5.2	-0.3	51	50	-1
CT02E	45	40	-5	39.9	39.9	0.0	5.7	5.6	-0.1	46	46	0
CT05E	45	40	-5	44.4	45.4	1.0	5.4	5.3	-0.1	50	51	1
DE01E	40	35	-5	45.3	45.1	-0.2	8.4	7.1	-1.3	54	53	-1
ID01E	55	50	-5	49.6	48.6	-1.0	6.9	6.0	-0.9	57	55	-2
ID02E	55	50	-5	50.3	50.7	0.4	5.8	5.5	-0.3	56	57	1
IL02E	50	45	-5	44.8	44.0	-0.8	5.2	5.2	0.0	50	49	-1
IN05E	45	40	-5	41.7	41.1	-0.6	7.1	6.7	-0.4	50	49	-1
IN06E	50	45	-5	45.4	45.0	-0.4	7.2	6.6	-0.6	53	52	-1
IN07E	50	45	-5	44.1	44.7	0.6	7.4	7.3	-0.1	51	52	1
MA03E	30	25	-5	33.9	34.2	0.3	6.1	6.4	0.3	41	41	0
ME01E	45	40	-5	36.1	36.1	0.0	7.0	7.2	0.2	44	43	-1
NJ01E	40	35	-5	38.3	38.7	0.4	5.7	5.7	0.0	44	44	0
NM02E	55	50	-5	53.8	54.6	0.8	8.8	8.8	0.0	63	64	1
Average for 14 sites				43.7	43.7	-0.0	6.6	6.3	-0.3	50.7	50.4	-0.3

Comparison Site Number	Posted Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std. Dev. Speed	Diff. Std. Dev. Speed	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Comparison Sites where Posted Speed Limits were not changed										
OH11C	50	41.6	41.6	0.0	6.4	6.2	-0.2	48	48	0
OH12C	55	53.3	52.3	-1.0	7.4	6.8	-0.6	61	59	-2
OK01C	45	46.6	47.6	1.0	7.0	6.4	-0.6	54	54	0
		Comparison site was not available.								
		Comparison site was not available.								
OK04C	35	32.0	31.7	-0.3	5.5	5.6	0.1	38	38	0
TX02C	55	49.6	52.3	2.7	10.4	7.8	-2.6	59	60	1
TX04C	55	50.5	51.3	0.8	8.6	7.3	-1.3	59	59	0
VA01C	55	44.7	46.0	1.3	6.1	5.9	-0.2	51	52	1
VA03C	55	45.2	45.8	0.6	6.7	8.4	1.7	53	54	1
VA04C	55	45.2	45.8	0.6	6.7	8.4	1.7	53	54	1
VA05C	55	45.2	46.8	1.6	6.7	8.1	1.4	53	55	2
VA07C	55	49.4	50.2	0.8	8.1	8.3	0.2	57	59	2
WV03C	45	39.0	38.7	-0.3	7.8	8.9	1.1	47	48	1
Average for 32 sites		47.8	48.1	0.4	7.5	7.3	-0.2	55.3	55.5	0.2
Comparison Sites where Posted Speed Limits were not changed										
AZ01C	45	46.9	46.7	-0.2	6.5	6.3	-0.2	54	53	-1
CT02C	45	40.7	40.3	-0.4	8.8	9.0	0.2	49	49	0
CT05C	45	48.3	49.4	1.1	5.6	5.6	0.0	54	55	1
DE01C	40	33.2	34.1	0.9	6.2	7.4	1.2	40	42	2
ID01C	55	51.5	51.6	0.1	6.6	5.7	-0.9	58	57	-1
ID02C	55	51.5	51.6	0.1	6.6	5.7	-0.9	58	57	-1
IL02C	45	43.6	43.3	-0.3	5.6	4.9	-0.7	49	48	-1
IN05C	45	48.0	48.1	0.1	6.6	6.1	-0.5	55	54	-1
IN06C	50	51.0	51.2	0.2	6.6	6.5	-0.1	58	58	0
IN07C	50	51.0	51.2	0.2	6.6	6.5	-0.1	58	58	0
MA03C	30	37.6	37.6	0.0	6.8	6.5	-0.3	45	44	-1
ME01C	45	46.5	47.7	1.2	7.5	6.9	-0.6	54	55	1
NJ01C	40	44.4	44.0	-0.4	6.3	6.0	-0.3	51	50	-1
NM02C	55	52.2	52.2	0.0	7.7	7.9	0.2	60	60	0
Average for 14 sites		46.2	46.4	0.2	6.7	6.5	-0.2	53.1	52.9	-0.2

1 mi/h = 1.61 km/h
Note. All speed limits and vehicle speeds are shown in mi/h.

Table 6. Before and after vehicle speeds for the experimental and comparison sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std. Dev. Speed	Diff. Std. Dev.	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Speed Limit Raised by 5 mi/h at Experimental Sites												
AZ02E	25	30	5	31.8	31.9	0.1	5.6	5.4	-0.2	38	38	0
AZ03E	30	35	5	32.6	33.6	1.0	5.4	4.5	-0.9	39	38	-1
CA06E	45	50	5	48.9	46.8	-2.1	6.4	6.2	-0.2	56	53	-3
CA07E	45	50	5	53.1	51.3	-1.8	5.9	6.2	0.3	60	58	-2
CO01E	30	35	5	38.9	38.8	-0.1	4.8	4.5	-0.3	44	44	0
CO03E	40	45	5	43.3	42.8	-0.5	7.1	6.8	-0.3	51	50	-1
CT01E	45	50	5	56.4	57.0	0.6	7.0	6.9	-0.1	64	64	0
CT04E	30	35	5	43.2	43.0	-0.2	7.2	7.1	-0.1	51	50	-1
DE05E	35	40	5	37.6	37.6	0.0	8.2	7.7	-0.5	48	46	-2
IN02E	25	30	5	27.6	24.8	-2.8	5.9	5.7	-0.2	34	31	-3
IN03E	25	30	5	26.9	26.5	-0.4	5.6	5.6	0.0	33	32	-1
MD01E	50	55	5	54.8	56.4	1.6	6.3	6.1	-0.2	61	63	2
MD02E	50	55	5	51.2	52.1	0.9	5.4	5.3	-0.1	57	58	1
MD03E	50	55	5	51.2	51.1	-0.1	6.9	7.2	0.3	58	58	0
MD04E	50	55	5	53.3	53.6	0.3	6.3	6.8	0.5	60	61	1
MD05E	50	55	5	53.8	54.9	1.1	6.1	6.7	0.6	60	61	1
MD06E	30	35	5	40.6	40.8	0.2	6.0	6.0	0.0	47	47	0
MD07E	30	35	5	35.7	36.0	0.3	6.0	5.7	-0.3	42	42	0
MD08E	30	35	5	30.7	33.1	2.4	5.9	6.3	0.4	37	39	2
MD09E	30	35	5	35.2	35.9	0.7	5.0	4.6	-0.4	41	41	0
MD10E	50	55	5	53.7	54.2	0.5	5.0	5.0	0.0	59	59	0
MS02E	30	35	5	34.0	35.9	1.9	6.9	7.6	0.7	41	44	3
TN01E	50	55	5	56.8	56.8	0.0	6.2	6.1	-0.1	63	63	0
TX06E	30	35	5	33.0	33.3	0.3	7.1	6.6	-0.5	41	40	-1
TX07E	40	45	5	35.1	35.2	0.1	5.9	6.0	0.1	41	41	0
TX08E	30	35	5	30.6	32.5	1.9	4.8	4.7	-0.1	36	37	1
Average for 26 sites				41.9	42.2	0.2	6.1	6.1	-0.1	48.5	48.4	-0.2

Comparison Site Number	Posted Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std. Dev. Speed	Diff. Std. Dev. Speed	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Comparison Sites where Posted Speed Limits were not changed										
AZ02C	30	31.0	30.6	-0.4	5.7	5.6	-0.1	38	37	-1
AZ03C	30	32.1	32.6	0.5	6.9	7.1	0.2	39	40	1
CA06C	45	49.9	48.4	-1.5	6.9	6.8	-0.1	57	55	-2
CA07C	45	49.9	48.0	-1.9	6.9	6.6	-0.3	57	55	-2
CO01C	30	32.0	32.0	0.0	4.7	4.8	0.1	37	37	0
CO03C	30	37.4	36.6	-0.8	5.6	5.4	-0.2	43	42	-1
CT01C	45	49.2	49.3	0.1	6.6	6.8	0.2	56	56	0
		Comparison site was not available.								
DE05C	35	34.0	33.5	-0.5	7.7	7.4	-0.3	42	42	0
IN02C	25	25.2	24.2	-1.0	5.7	5.8	0.1	31	30	-1
IN03C	25	25.2	24.2	-1.0	5.7	5.8	0.1	31	30	-1
MD01C	50	54.5	55.0	0.5	6.6	6.5	-0.1	61	62	1
MD02C	50	52.5	52.0	-0.5	6.5	6.7	0.2	59	58	-1
MD03C	50	53.0	53.9	0.9	5.7	5.6	-0.1	58	60	2
MD04C	50	44.7	46.1	1.4	6.9	7.0	0.1	52	54	2
MD05C	50	53.8	55.2	1.4	5.9	5.4	-0.5	60	61	1
MD06C	30	34.9	34.6	-0.3	7.2	6.9	-0.3	42	42	0
MD07C	30	34.9	34.6	-0.3	7.2	6.9	-0.3	42	42	0
MD08C	30	34.9	34.6	-0.3	7.2	6.9	-0.3	42	42	0
MD09C	30	37.2	37.7	0.5	6.0	5.5	-0.5	44	44	0
MD10C	50	50 1	50.3	0.2	5.2	5.1	-0.1	55	55	0
MS02C	30	34.4	34.5	0.1	5.2	4.9	-0.3	40	40	0
TN01C	55	59.2	58.8	-0.4	6.1	6.1	0.0	66	65	-1
TX06C	30	36.5	37.9	1.4	7.2	6.9	-0.3	44	45	1
TX07C	35	33.0	32.4	-0.6	5.3	5.0	-0.3	39	38	-1
TX08C	35	33.0	32.4	-0.6	5.3	5.0	-0.3	39	38	-1
Average for 25 sites		42.3	42.5	0.2	6.2	6.0	-0.2	48.7	48.9	0.1

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 6. Before and after vehicle speeds for the experimental and comparison sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std. Dev. Speed	Diff. Std. Dev. Speed	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites												
CO02E	30	40	10	40.9	42.3	1.4	5.6	5.4	-0.2	47	48	1
CT03E	30	40	10	44.9	45.4	0.5	7.1	6.7	-0.4	53	52	
ID03E	20	30	10	24.2	25.0	0.8	4.8	4.4	-0.4	29	30	1
ID04E	20	30	10	23.1	24.1	1.0	6.0	5.6	-0.4	29	30	1
ID05E	20	30	10	21.7	21.5	-0.2	7.6	6.6	-1.0	30	29	-1
ID06E	25	35	10	29.0	30.6	1.6	4.9	5.5	0.6	34	36	2
ID07E	25	35	10	27.1	27.9	0.8	4.0	4.6	0.6	31	33	2
ID08E	35	45	10	39.2	41.0	1.8	5.8	5.3	-0.5	46	47	1
MA02E	30	40	10	41.9	41.9	0.0	6.1	5.8	-0.3	40	48	0
ME03E	35	45	10	46.7	46.1	-0.6	7.0	6.7	-0.3	54	53	-1
MS01E	35	45	10	38.9	42.8	3.9	6.8	6.5	-0.3	46	49	3
VA02E	35	45	10	39.9	43.0	3.1	5.2	5.2	0.0	46	48	2
CA04E	30	45	15	43.6	42.2	-1.4	5.7	5.3	-0.4	50	48	-2
IN04E	30	45	15	41.8	43.1	1.3	7.3	6.6	-0.7	50	50	0
TX01E	40	55	15	47.3	45.8	-1.5	10.0	9.1	-0.9	57	52	-1
Average for 15 sites				36.7	37.5	0.8	6.3	6.0	-0.3	43.3	43.8	0.5

Comparison Site Number	Before Posted Speed Limit	After Posted Speed Limit	Diff. Posted Speed Limit	Before Mean Speed	After Mean Speed	Diff. Mean Speed	Before Std. Dev. Speed	After Std. Dev. Speed	Diff. Std. Dev. Speed	Before 85th Speed	After 85th Speed	Diff. 85th Speed
Comparison Sites where Posted Speed Limits were not changed												
CO02C	30	32.0	32.0	0.0	4.7	4.8	0.1	37	37	0		
Comparison site was not available.												
ID03C	20	21.3	21.3	0.0	5.3	4.8	-0.5	28	26	-2		
ID04C	20	21.3	21.3	0.0	5.3	4.8	-0.5	28	26	-2		
ID05C	20	21.3	21.3	0.0	5.3	4.8	-0.5	28	26	-2		
ID06C	25	27.3	27.2	-0.1	4.2	4.3	0.1	32	32	0		
ID07C	25	28.0	27.2	-0.8	4.2	4.3	0.1	32	32	0		
ID08C	35	32.8	32.6	-0.2	6.2	5.8	-0.4	40	38	-2		
MA02C	30	37.9	38.0	0.1	6.3	5.7	-0.6	45	44	-1		
ME03C	35	42.2	42.8	0.6	7.5	7.6	0.1	50	50	0		
MS01C	35	43.7	45.1	1.4	7.8	7.6	-0.2	52	53	1		
VA02C	35	40.3	40.6	0.3	5.3	5.3	0.0	46	46	0		
CA04C	30	40.1	38.8	-1.3	6.7	7.1	0.4	47	46			-1
IN04C	30	34.7	35.8	1.1	7.6	7.4	-0.2	42	43	1		
TX01C	40	38.0	36.8	-1.2	7.6	7.3	-0.3	46	44	-2		
Average for 15 sites		32.9	32.9	-0.0	6.0	5.8	-0.2	39.5	38.8	-0.7		

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown i n mi/h.

Unlike many previous studies which only reported changes in the mean and 85th percentile speeds, the 24-h data collected during this effort permitted examination of the entire speed distribution. Shown in figure 14 is the before and after cumulative frequency distributions of free-flow vehicle speeds for a site in Ohio (OH01 E) where the speed limit was lowered from 55 to 45 mi/h (89 to 72 km/h) in a rural community. The two-lane site is 0.52 mi (0.84 km) long and the before 24-h volume was 3,900 vehicles. As indicated in the figure, before and after speed differences along the entire distribution are 2 mi/h (3 km/h) or less, which is typical of the findings at most of the experimental and comparison sites.

Another example of the before and after speed distributions is given in figure 15 for a main two-lane street in an Idaho cit y (ID03E) where the population was less than 5,000 persons. The speed limit on the 1.79-mi (2.88-km) section was raised from 20 to 30 mi/h (32 to 48 km/h). The before 24-h volume was 1,400 vehicles. As shown in figure 15, the before and after speed differences are 2 mi/h (3 km/h) or less.

The changes in the speed distributions illustrated in figures 14 and 15 are but 2 examples from the 98 experimental sites. As shown in more detail in appendix B, there were site-to-site variations in the before and after percentile speeds for both the experimental and comparison locations.

To provide a summary of the before and after speed differences, the sites were grouped by amount of posted speed limit change. Mean changes in the speed distribution were calculated for each posted speed limit group. The mean changes for the speed limit groups are summarized in appendix B. Because 24-h free-flow speed data were collected before and after speed limits were changed, the samples are large. For example, the speed limit group with the smallest sample is nine sites where speed limits were lowered by 15 or 2 0 mi/h (24 or 32 km/h). For this group, the before period 50th percentile contains the speeds of more than 8,900 free-flow vehicles. The 1st and 99th percentiles each contain approximately 180 vehicle speeds. The speed limit group with the largest number of sites (lowered by 1 0 mi/h (16 km/h)) contains more than 61,000 free-flow vehicle speeds in the 50th percentile, and more than 1,200 vehicle speeds each in the 1st and 99th percentiles.

Mean differences in the before and after percentile speeds for the group of sites where speed limits were lowered and raised, by amount of posted speed limit change, are shown in figures 16 and 17, respectively. Mean changes in the before and after percentile speeds for the comparison site groups, where speed limits were not changed, are shown in figures 18 and 19, respectively. Finally, the net effects of the changes, obtained by subtracting the differences at the comparison sites from the differences at the experimental sites, are shown in figures 20 and 21.

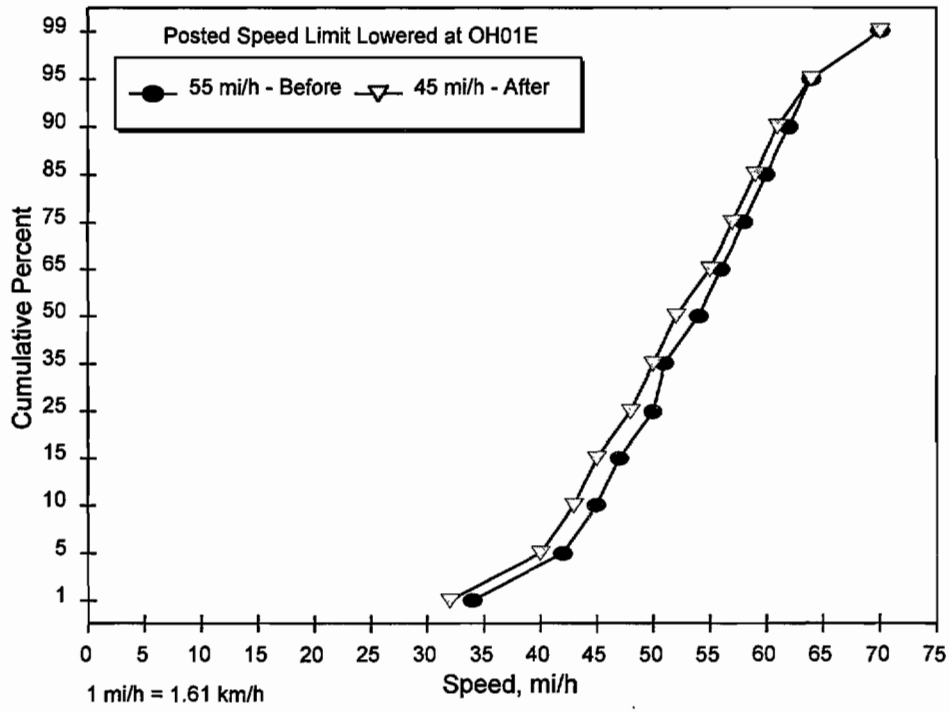


Figure 14. Before and after cumulative speed distributions at an experimental site where the posted speed limit was lowered.

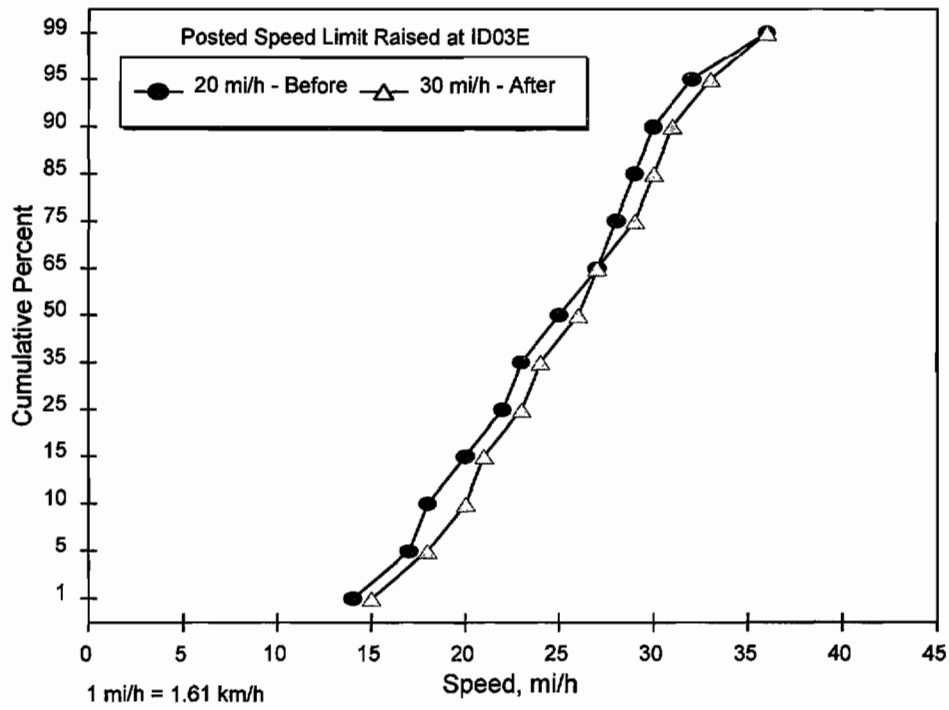


Figure 15. Before and after cumulative speed distributions at an experimental site where the posted speed limit was raised.

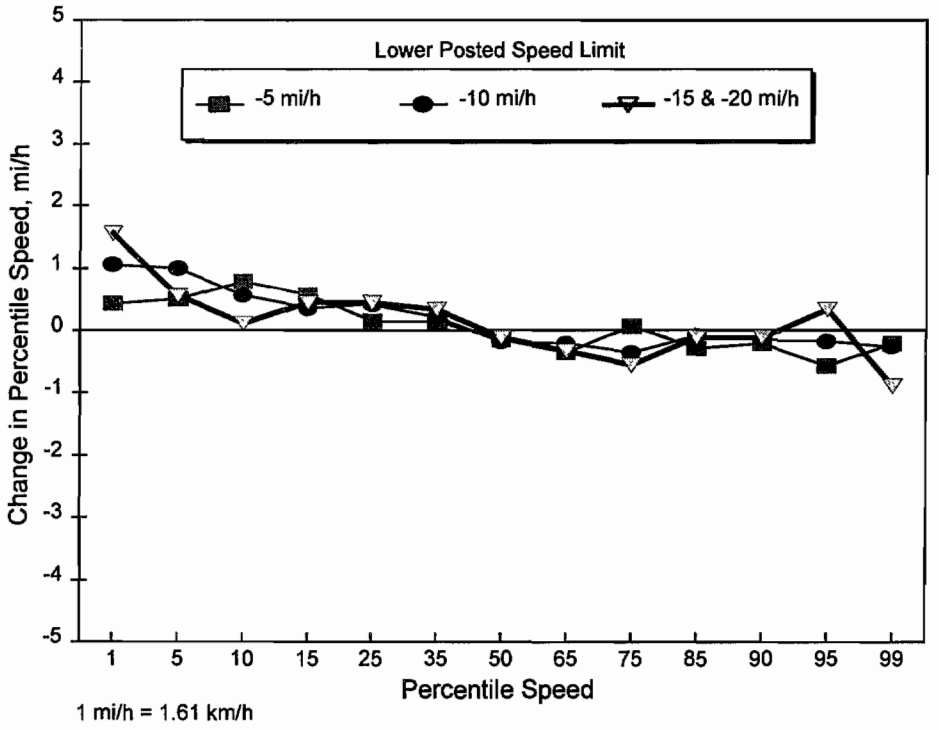


Figure 16. Before and after changes in percentile speeds at the experimental sites where speed limits were lowered.

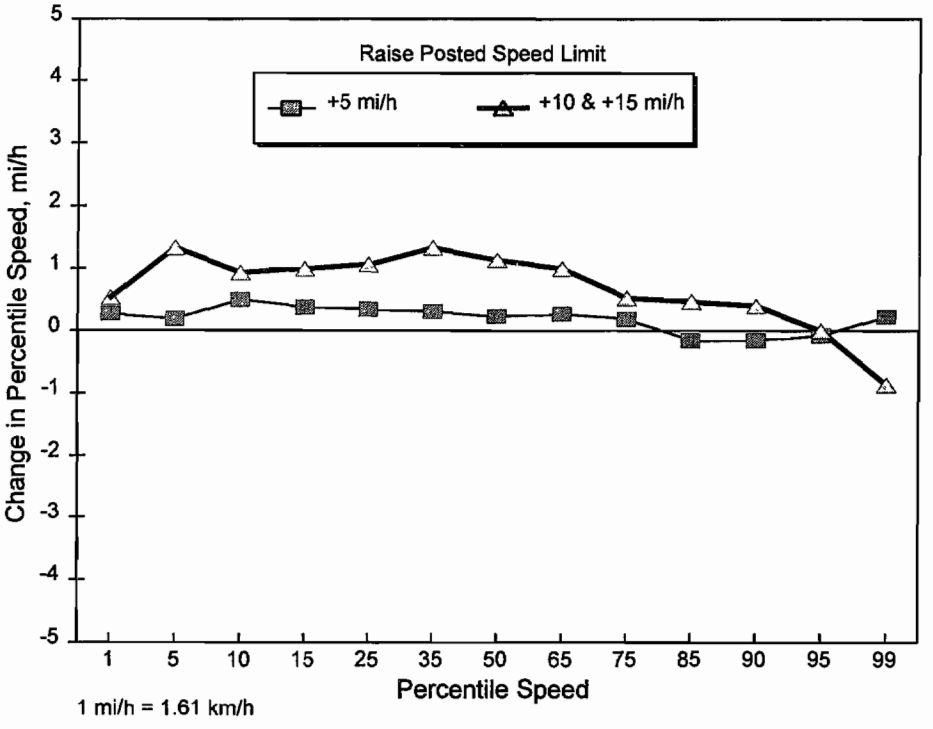


Figure 17. Before and after changes in percentile speeds at the experimental sites where speed limits were raised.

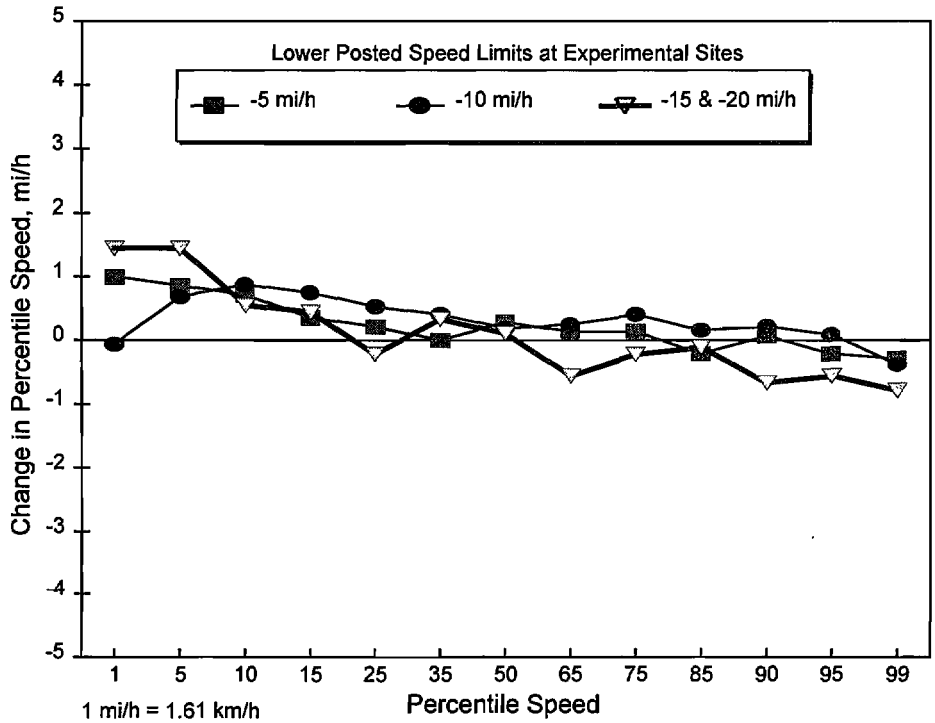


Figure 18. Before and after changes in percentile speeds at the comparison sites corresponding to the experimental sites where speed limits were lowered.

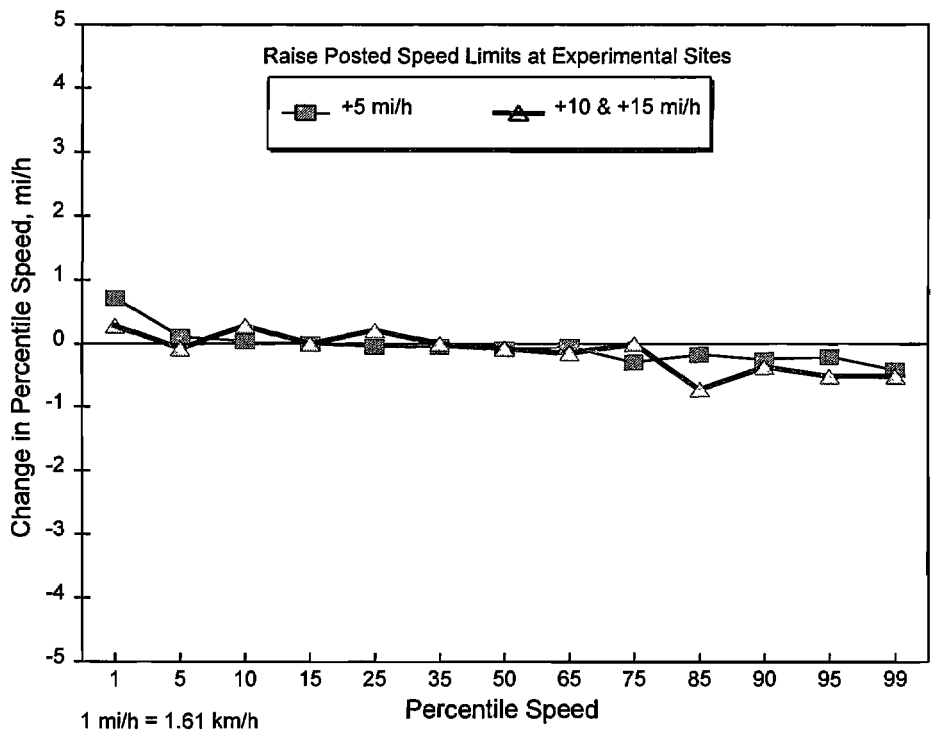


Figure 19. Before and after changes in percentile speeds at the comparison sites corresponding to the experimental sites where speed limits were raised.

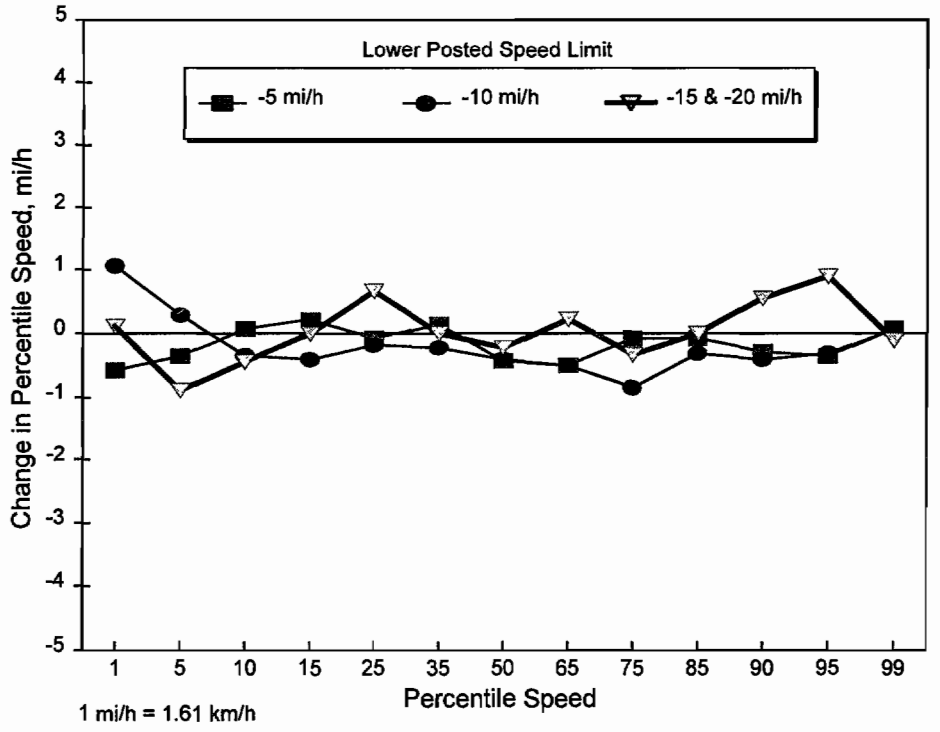


Figure 20. Net change (experimental minus comparison) in percentile speeds at sites where speed limits were lowered.

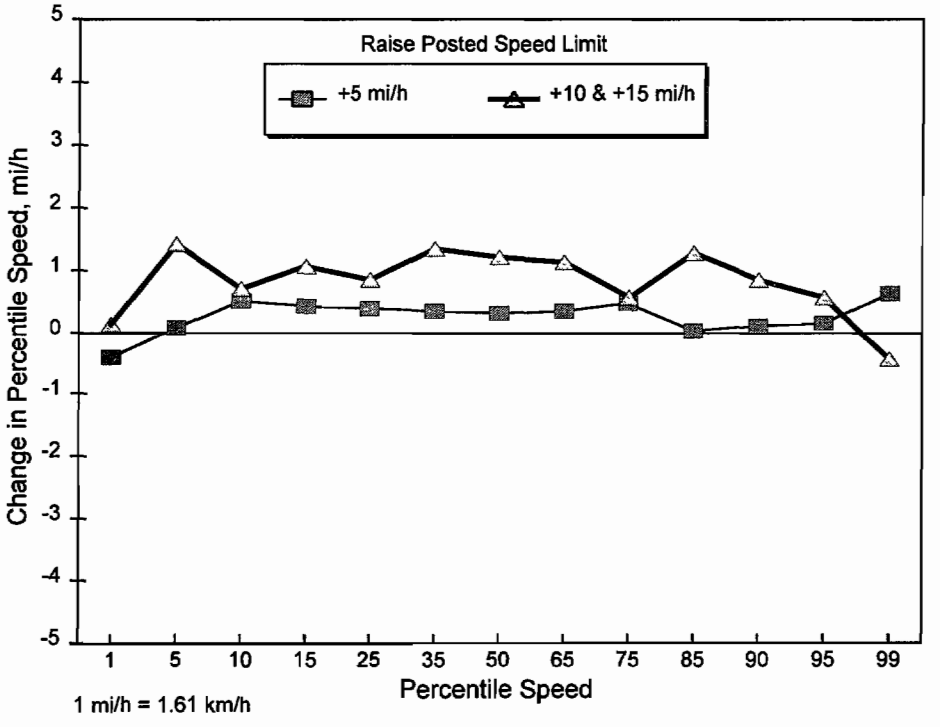


Figure 21. Net change (experimental minus comparison) in percentile speeds at sites where speed limits were raised.

At sites where speed limits were lowered, percentile speeds below the 50th percentile speed tended to increase, and percentile speeds above the 50th percentile speed tended to decrease. However, as shown in figure 18, a similar trend occurred at the comparison sites where the posted speed limits were not changed. The net effects, shown in figure 20, indicate that when speeds were reduced by 10 mi/h (16 km/h), the slowest drivers (1st percentile) increased their speed approximately 1 mi/h (1.6 km/h). There were no changes in the highest speed drivers (99th percentile); however, when speed limits were lowered by 15 or 20 mi/h (24 or 32 km/h), there was approximately a 1-mi/h (1.6-km/h) increase in the 95th percentile speed.

At sites where posted speed limits were raised, generally there was a small increase in speeds below the 75th percentile (less than 1.5 mi/h (2.4 km/h)). The net effects, shown in figure 21, indicate that there was a small decrease in the 99th percentile speed when speed limits were raised by IO or 1 5 mi/h (16 or 24 km/h).

As described in the Methodology section of the report, the comparison sites were not selected from the same source as the experimental sites. Consequently, the net effects mentioned above may be biased. Even if one excludes the comparison site data altogether, the findings for the experimental groups remain unchanged.

Other measures of the distribution of vehicle speeds include the standard deviation of speeds, the percentage of vehicles in the 10-mi/h (16-km/h) pace, and the skewness index. These data are given in appendix B for each experimental and comparison site.

For the experimental site groups examined in this study, there was a general reduction in the standard deviation of speeds, ranging from 0.1 to 0. 3 mi/h (0.16 to 0.5 km/h), irrespective of whether speed limits were raised or lowered. In addition, the percentage of vehicles in the 10-mi/h (16-km/h) pace increased by approximately 2 percent for all posted speed limit groups. There was very little change in the skewness index.

In order to compare speed variations between groups of sites with different speed zones, the coefficient of variation (the standard deviation of speeds divided by the mean speed) was calculated for each speed limit group. Generally, the coefficient of variation decreased by 1 percent for all speed groups, which implies that the distribution of speeds decreased slightly after the speed limits were altered.

It should be noted that statistical tests (i.e., t-test for means, f-test for variance, or Kolomogorov-Smirnow for shifts in distribution), applied to any of the datasets, produce statistically significant results. The reason significant results are achieved is based on the fact that data at each site were collected for a 24-h period, which typically produces a large sample. When the data are combined for groups of speed limit changes, the samples are very large. With the large samples used in this dataset, the statistical tests always indicate that the results are highly significant. Consequently, changes such as 1mi/h (1.6 km/h), as mentioned above, are statistically significant, but not practically meaningful.

Resurfaced Sections

Throughout the site selection process, the researchers coordinated efforts with the participating transportation agencies to ensure that a change in posted speed limit was the only change contemplated at the experimental sites. However, because the study was conducted over several years, the agencies could not guarantee that other changes would not be made.

As the data collectors were preparing to collect after data, they reported that a bituminous concrete riding surface had been applied to four of the experimental sections after the posted speed limits were raised. None of the experimental sites where speed limits were lowered or comparison sites in the study were resurfaced. Because improvements in riding quality may increase vehicle speeds, the first thought was to eliminate the sections from the study. After reconsideration, it was decided to collect the after data and examine the differences in speed. It should be noted, however, that the experimental sections discussed below received both a posted speed limit change and a new pavement surface; consequently, it is not possible to determine if the speed differences are due to the new speed limit, the resurfaced pavement, or both.

The sections resurfaced include MD04E, a 5.83-mi (9.39-km) rural two-lane roadway in Maryland where the speed limit was raised from 50 to 55 mi/h (81 to 89 km/h). Two sites in Brandon, Mississippi, a small urban area (population between 5,000 and 50,000 persons), were also resurfaced. MS01E is a 0.43-mi (0.69-km) two-lane section that transitions from a rural to an urban area. The speed limit on the section was raised from 35 to 45 mi/h (56 to 72 km/h). MS02E is a 0.68-mi (1.09-km) two-lane urban section where the limit was raised from 30 to 35 mi/h (48 to 56 km/h). In Tennessee, TN01E is a 6.16-mi (9.92-km) rural four-lane divided highway where the speed limit was raised from 50 to 55 mi/h (81 to 89 km/h).

The before and after differences in speed characteristics for the four resurfaced sections are shown in table 7. The speed data for their corresponding comparison sites are shown in table 8.

Examination of the speed data shown in table 7 indicates that at the two rural long sections (MD04E and TN01E), the speed changes were minor, i.e., generally less than 1 mi/h (1.6 km/h).

At the two small urban area sites (MS01E and MS02E), the 85th percentile speeds increased by 3 mi/h (4.8 km/h). There was a corresponding increase in the mean speed at these locations, as well as a general increase in speeds through the speed distribution. These changes are statistically significant. The changes in speed at the corresponding comparison sites do not reflect a general increase in speeds in the area. The increase in speeds at these locations are among the largest recorded in the study; however, there were several other locations (i.e., IN02E, VA02E, and VA07E) that had similar changes in before and after speeds, but were not resurfaced.

Table 7. Differences in speed characteristics for the resurfaced experimental sites.

Experimental Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds															10-mi/h Lower Limit	10-mi/h Upper Limit
							1	5	10	15	25	35	50	65	75	85	90	95	99				
MD04E	5	0.3	0.5	1,060	710	-5.5	4	-	1	0	0	0	0	0	1	0	1	0	1	0		0	
MS01E	10	3.9	-0.3	727	484	-0.9	-	2	4	4	5	5	5	4	5	3	3	3	2	1		5	
MSO2E	5	1.9	0.7	119	233	1.8	2	-	1	0	0	2	2	3	3	2	3	2	2	2		3	
TN01E	5	0.0	-0.1	1,185	880	-1.5	1	0	0	1	1	0	0	0	0	0	0	0	0	0		1	

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 8. Differences in speed characteristics for the corresponding comparison sites.

Comparison Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds															10-mi/h Lower Limit	10-mi/h Upper Limit
							1	5	10	15	25	35	50	65	75	85	90	95	99				
MD04C	50	1.4	0.1	182	155	-1.3	-1	0	1	1	1	3	2	1	1	2	1	0	2			2	
MS01C	35	1.4	-0.2	496	412	-1.1	4	2	2	1	1	1	1	1	2	1	2	1	3			1	
MS02C	30	0.1	-0.3	247	259	0.9	10	0	0	0	0	0	0	0	0	0	0	-1	1				
TN01C	55	-0.4	0.0	498	422	-2.1	1	0	0	-1	-1	0	-1	0	0	-1	0	0	-1			-1	-1

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown i n mi/h.

As before and after pavement roughness information was not available for any of the sites, it is not known if the riding quality significantly changed after the sections were resurfaced.

As the sample of sites is small, no conclusions concerning the effects of resurfacing and raising posted speed limits can be drawn from this data set.

85th Percentile Speed and Posted Speed Limits

The 85th percentile speed is used as one factor in determining the numerical value of the speed limit to post by all State and most local transportation agencies.[3] As previously shown in figure 6, after the posted limits were changed on the experimental sections, the limits posted typically ranged from 5 to 16 mi/h (8 to 26 km/h) below the 85th percentile speed. Some sites, however, had speed limits set within 5 mi/h (8 km/h) of the 85th percentile speed.

The data collected for this study provide an opportunity to examine changes in vehicle speeds when speed limits are posted within 5 mi/h (8 km/h) of the 85th percentile speed versus changes in speeds when limits are set at more than 5 mi/h (8 km/h) below the 85th percentile speed.

Examination of the data revealed that 34.experimental sites had speed limits set within 5 mi/h (8 km/h) of the 85th percentile speed before the new speed limits were posted. Posted speed limits on the 34 sections were lowered more than 5 mi/h (8 km/h) below the 85th percentile speed, i.e., the after speed limits were posted from 6 to 17 mi/h (10 to 27 km/h) below the 85 percentile speed on these sections.

At 21 other experimental sites, the before posted speed limit was more than 5 mi/h (8 km/h) below the 85th percentile speed. At these locations, the before speed limit ranged from 6 to 20 mi/h (10 to 32 km/h) below the 85th percentile speed. The speed limits on these sections were raised to within 5 mi/h (8 km/h) of the 85th percentile speed.

The before and after differences in speed characteristics for the 34 sites where the speed limits were lowered more than 5 mi/h (8 km/h) below the 85th percentile speed are shown in table 9. The data for the 21 sites where speed limits were raised to within 5 mi/h (8 km/h) of the 85th percentile speed are given in table 10.

Similar to the results of other analyses, the differences in the before and after speeds at the sites were typically less than 2 mi/h (3 km/h), regardless of whether the . posted limit was lowered more than 5 mi/h (8 km/h) below the 85th percentile speed or raised to within 5 mi/h (8 km/h) of the 85th percentile speed.

Table 9. Differences in speed characteristics at sites where speed limits were lowered more than 5 mi/h (8 km/h) below the 85th percentile speed.

Experimental Site Number	Diff. Limit	Mean speed	Std. Dev. Speeds	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	10-mi/h Pace Upper Limit
DE02E	-15	-0.8	-0.2	2	-1	-1	0	0	0	-1	-1	-2	-1	-1	0	-2	-2	-2
NM01E	-15	0.7	-0.5	0	2	2	3	2	1	0	-1	-1	-1	0	2	3	-3	-3
NM03E	-15	-0.9	0.2	-1	-2	-2	-2	-1	0	-1	-2	-1	0	0	-1	-2	-1	-1
TX05E	-15	-0.4	-0.2	1	1	0	0	0	-1	0	0	-1	-1	-1	0	-1	-1	-1
DE03E	-10	0.1	-0.1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
IL01E	-10	-0.7	0.4	-1	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-2	-1	-1
IN01 E	-10	-0.2	-0.2	0	1	0	0	0	0	-1	-1	0	0	0	0	0	0	0
ME02E	-10	0.4	0.0	1	1	1	0	0	0	0	1	1	1	2	1	0	-2	-2
MI09E	-10	0.8	-0.9	2	3	3	3	2	1	0	0	-1	0	0	0	-1	-1	-1
NJ02E	-10	0.0	-1.0	2	2	1	1	1	1	0	0	-1	0	-1	-1	-2	0	0
NJ03E	-10	0.5	-0.5	-6	4	3	2	1	0	0	0	0	0	-1	-1	-1	0	0
OH01E	-10	-1.3	04	-2	-2	-2	-2	-2	-1	-2	-1	-1	-1	-1	0	0	-2	-2
OH03E	-10	0.4	-0.1	1	1	0	0	0	0	0	0	0	0	0	-1	2	0	0
OH04E	-10	-0.7	-0.3	1	0	0	0	-1	-1	-1	-1	-1	-1	0	0	0	-2	-2
OH05E	-10	0.1	-1.0	6	3	0	1	1	0	-1	-1	-1	-1	0	0	0	-1	-1
OH06E	-10	0 5	-0.9	5	2	2	1	1	0	0	-1	-1	0	1	0	-1	-2	-2
OH10E	-10	-20	-0.5	0	-1	-2	-1	-1	-2	-2	-3	-2	-2	-2	-3	-3	-2	-2
OH11E	-10	1.9	-2.1	2	3	4	5	9	3	1	0	-1	0	0	-1	-1	-1	-1
OH12E	-10	-1.3	0.1	2	-1	-1	-1	-2	-2	-2	-1	-2	-1	-2	0	1	-2	-2
OK01E	-10	-0.4	0.2	-1	-2	0	0	0	0	0	-1	-1	0	0	0	1	-2	-2
OK02E	-10	0.4	- 0 3	2	1	0	0	1	0	0	0	0	1	0	0	0	0	0
OKO4E	-10	-0.4	0.7	-3	-2	-1	-1	-1	0	0	0	0	0	0	0	1	0	0
TX02E	-10	-0.9	-0.6	2	0	0	-1	-1	-1	-1	-1	-1	-1	-2	-1	-1	-2	-2
VA01 E	-10	-0.9	-0.6	1	1	0	0	-1	-1	-1	-1	-2	-2	-1	-1	-1	-2	-2
VA03E	-10	0.8	-0.2	1	1	1	1	1	1	0	0	0	1	0	0	-1	1	1
VA05E	-10	0.2	-0.8	1	4	1	0	1	1	0	0	0	-1	-1	-1	0	3	3
VAO7E	-10	2.4	-0.6	4	3	4	3	3	2	3	2	1	2	2	2	1	2	2
CT02E	-5	0.0	-0.1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CT05E	-5	1.0	-0.1	1	1	2	1	1	1	1	1	1	1	1	1	1	0	0
ID02E	-5	0.4	-0.3	1	1	1	1	0	1	1	0	1	1	-1	-1	-1	2	2
IN05E	-5	-0.6	-0.4	1	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1	1	1
IN08E	-5	-0.4	-0.6	0	1	1	1	-1	0	-1	-1	0	-1	-1	-1	-1	-1	-1
IN07E	-5	0.6	- 0 1	1	1	1	1	1	1	0	0	1	1	1	0	2	0	0
NJ01E	-5	0.4	0.0	0	0	1	0	0	0	0	0	1	0		0	0	0	0
34 Sites	Mean Diff.	-0.01	-0.35	0.76	0.76	0.59	0.50	0.41	0.15	-0.29	-0.44	-0.47	-0.21	-0.26	-0.26	-0.29	-0.62	-0.6

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 10. Differences in speed characteristics at sites where speed limits were raised to within 5 mi/h (8 km/h) of the 85th percentile speed.

Experimental Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Percentile Speeds													10-mi/h Pace			
				1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
AZ03E	5	1.0	-0.9	3	2	2	2	1	1	1	1	1	-1	0	0	-1	1	1	9.6	0.01
CA06E	5	-2.1	-0.2	-1	-2	-1	-2	-2	-2	-2	-2	-2	-3	-3	-3	-2	-2	-2	2.2	-0.05
CO03E	5	-0.5	-0.3	1	0	-1	-1	-1	0	0	0	0	-1	-2	-3	0	2	2	-2.7	-0.19
IN02E	5	-2.8	-0.2	0	-1	-2	-2	-3	-4	-4	-3	-3	-3	-3	-3	-2	-3	-3	-2.1	0.18
IN03E	5	-0.4	0.0	-1	-1	-1	0	-1	0	0	-1	0	-1	-1	-1	-1	-1	-1	0.4	-0.07
MD02E	5	0.9	-0.1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	2.4	-0.07
MD03E	5	-0.1	0.3	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-0.04
MD08E	5	2.4	0.4	0	1	2	3	2	3	3	3	2	2	3	3	3	3	3	1.2	-0.16
MD10E	5	0.5	0.0	1	0	1	0	1	0	1	1	1	0	1	0	0	0	0	-0.2	0.00
TX06E	5	0.3	-0.5	1	1	2	1	1	1	0	0	0	-1	-1	0	0	0	0	5.5	0.09
TX08E	5	1.9	-0.1	1	2	3	2	2	2	2	2	2	1	2	1	1	2	2	1.9	0.00
ID03E	10	0.8	-0.4	1	1	2	1	1	1	1	0	1	1	1	1	0	1	1	3.3	-0.01
ID04E	10	1.0	-0.4	1	2	2	2	1	1	1	1	0	1	1	1	-1	0	0	3.3	0.04
ID05E	10	-0.2	-1.0	1	1	0	1	1	1	0	0	-1	-1	-1	-1	-4	-1	-1	3.4	-0.06
ID06E	10	1.6	0.6	0	0	-1	1	2	2	2	3	3	2	2	2	0	2	2	-2.2	-0.13
ID07E	10	0.8	0.6	-1	-1	-1	0	1	1	1	1	1	2	2	1	1	1	1	-7.1	-0.05
ID08E	10	1.8	-0.5	1	2	2	2	2	3	3	2	2	1	1	0	1	3	3	4.0	-0.25
VA02E	10	3.1	0.0	2	4	3	4	3	4	3	3	3	2	3	3	5	3	3	1.9	0.00
CA04E	15	-1.4	-0.4	-2	0	-1	-2	-1	-1	-2	-2	-2	-2	-2	-2	-3	-1	-1	3.1	0.07
IN04E	15	1.3	-0.7	2	2	3	2	1	1	2	2	0	0	-1	-2	-2	1	1	5.4	-0.14
TX01E	15	-1.5	-0.9	2	2	-1	-2	-2	-1	-1	-2	-2	-1	-1	-2	-8	-2	-2	0.1	-0.08
21 Sites	Mean Diff.	0.40	-0.22	0.57	0.71	0.62	0.62	0.48	0.67	0.57	0.48	0.33	-0.05	0.10	-0.24	-0.57	0.48	0.48	1.56	-0.04

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

The mean differences in the before and after percentile speeds were calculated for both groups of sites and the results are presented graphically in figures 22 and 23. As shown in figure 22, for the group of 34 sites where speed limits were lowered more than 5 mi/h (8 km/h) below the 85th percentile speed, there was a small increase-less than 1 mi/h (1.6 km/h)-in speed below the 50th percentile. For this group of sites, there was a small decrease-less than 1 mi/h (1.6 km/h)-in speeds above the 50th percentile.

As shown in figure 23, there was a small increase-less than 1 mi/h (1.6 km/h)-in speeds below the 85th percentile speed for the group of 21 sites where speed limits were raised to within 5 mi/h (8 km/h) of the 85th percentile speed. For this group, there was a small decrease in speeds above the 85th percentile speed.

These data suggest that there is a statistically significant difference in free-flow vehicle speeds when posted limits are set more than 5 mi/h (8 km/h) below the 85th percentile speed or within 5 mi/h of the 85th percentile speed; however, for the sites selected in this study, the difference was less than 1mi/h (1.6 km/h).

Effects on Driver Compliance

Driver compliance with a posted speed limit is defined as the percentage of vehicles traveling at or below the posted limit . For example, if 75 percent of the drivers sampled in a 50-mi/h (81-km/h) posted speed zone are traveling at or below 50 mi/h (81 km/h), then driver compliance would be reported as 75 percent. Traffic engineering and enforcement officials have not defined specific numerical thresholds for acceptable driver compliance.

Average driver compliance with speed limits for the group of 57 experimental sites, before the speed limits were lowered, is shown in figure 24 for posted speed limits ranging from 30 to 5 5 mi/h (48 to 89 km/h). Generally, driver compliance could be considered as acceptable for limits posted at 45 mi/h (72 km/h) or greater. However, for sections where the posted limits were less than 4 5 mi/h (72 km/h), driver compliance was poor. As shown in figure 25, average driver compliance at the 41 experimental sites, before the speed limits were raised, was very poor for all posted limits.

Average driver compliance for the group of comparison sites, where posted speed limits were not changed, is shown in figure 26. At limits posted below 55 mi/h (89 km/h), driver compliance at these locations was also poor.

As noted in the previous section on speed effects, most drivers at the study sites did not make major alterations in their speed after the new speed limits were posted. It appears that the new posted speed limits alone, without some additional engineering, enforcement, or educational measures, did not have a major effect on driver behavior or encourage most drivers to comply with the posted speed limit. In the remaining discussion on driver compliance, it is important to realize that the before and after changes mentioned are basically attributable to the way compliance is measured (i.e., from the posted speed limit) and not to actual changes in driver behavior.

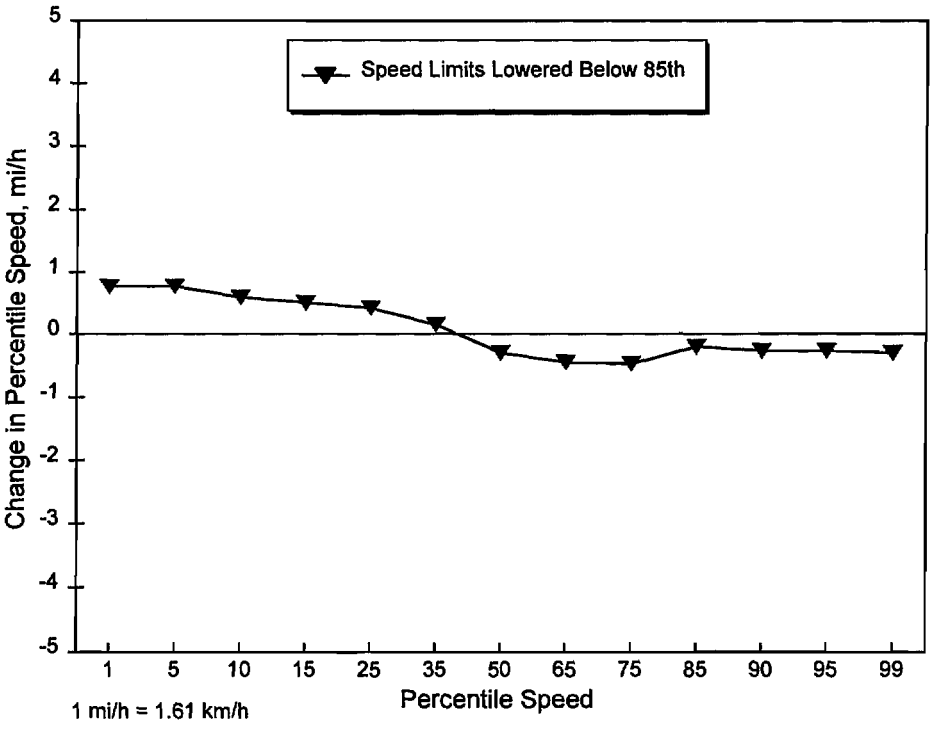


Figure 22. Mean change in percentile speeds at 34 sites where speed limits were lowered below the 85th percentile speed.

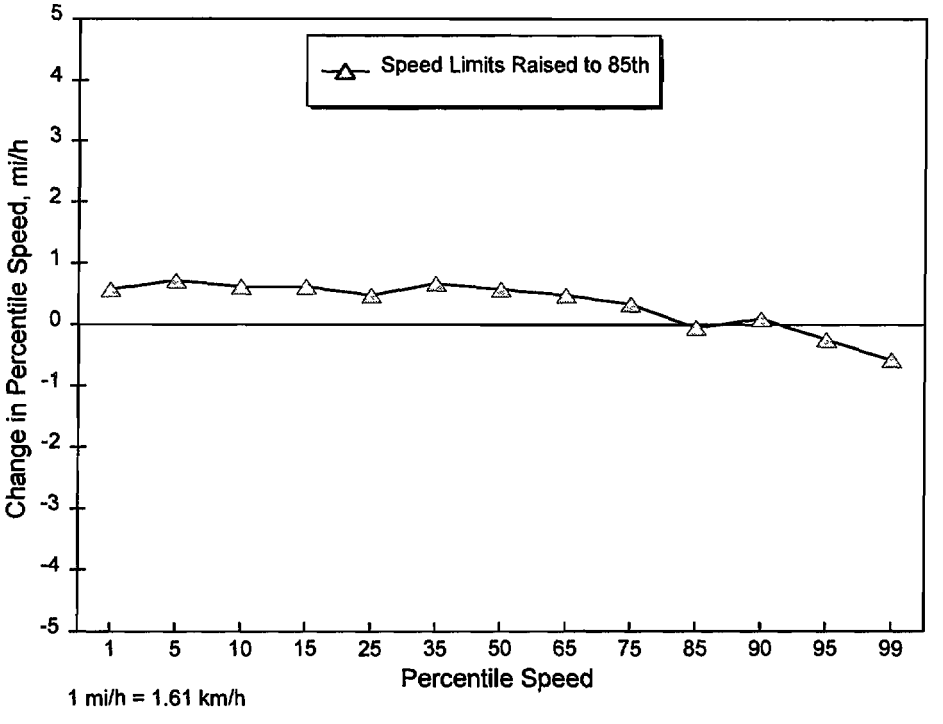


Figure 23. Mean change in percentile speeds at 21 sites where speed limits were raised to the 85th percentile speed.

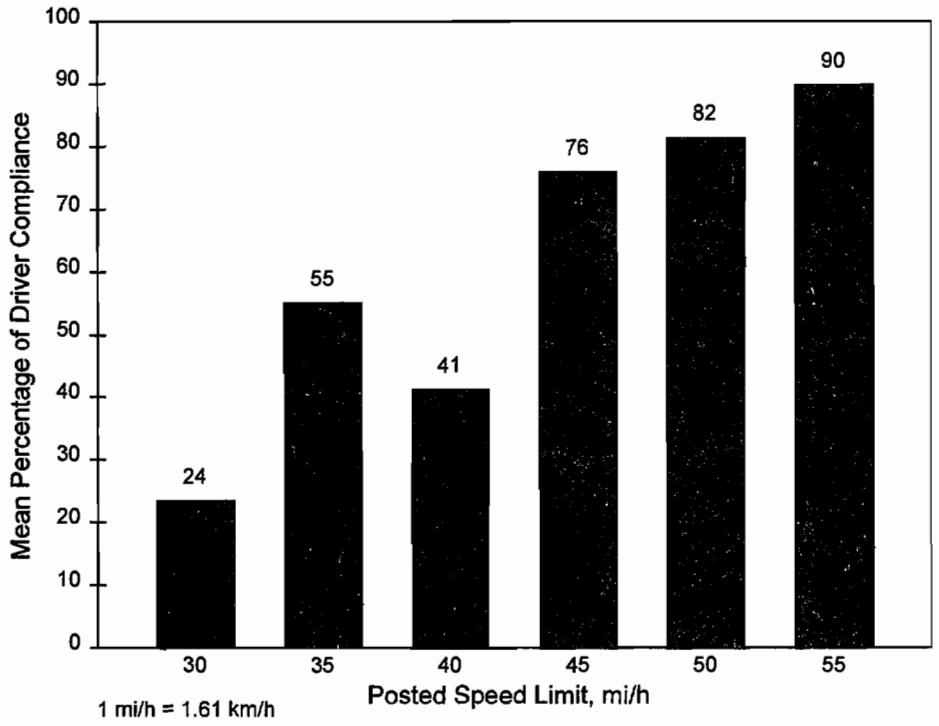


Figure 24. Average driver compliance at 57 experimental sites before the speed limits were lowered.

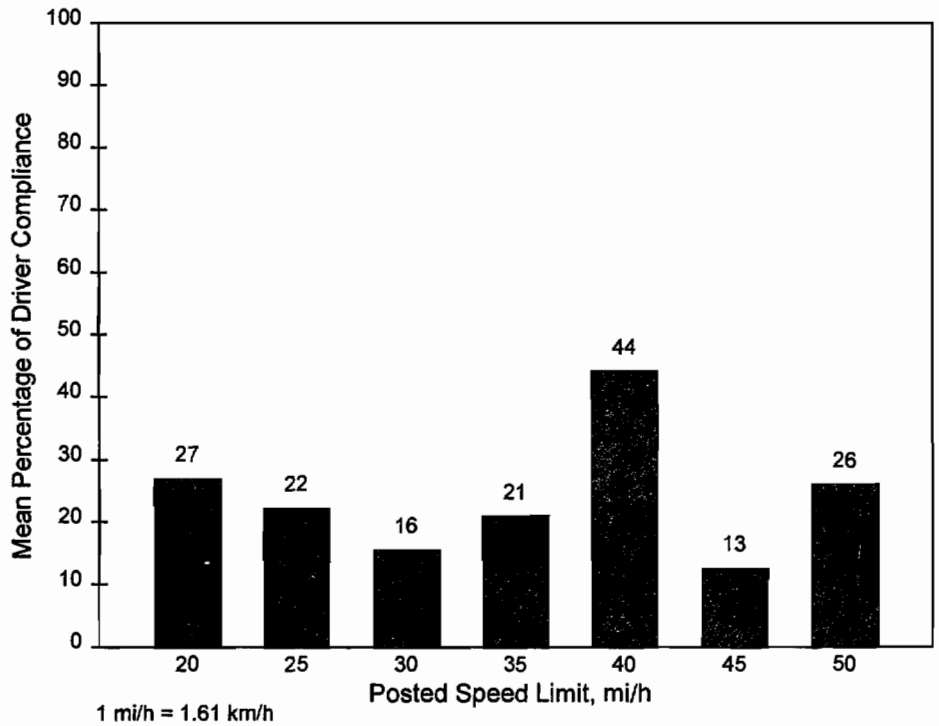


Figure 25. Average driver compliance at 41 experimental sites before the speed limits were raised.

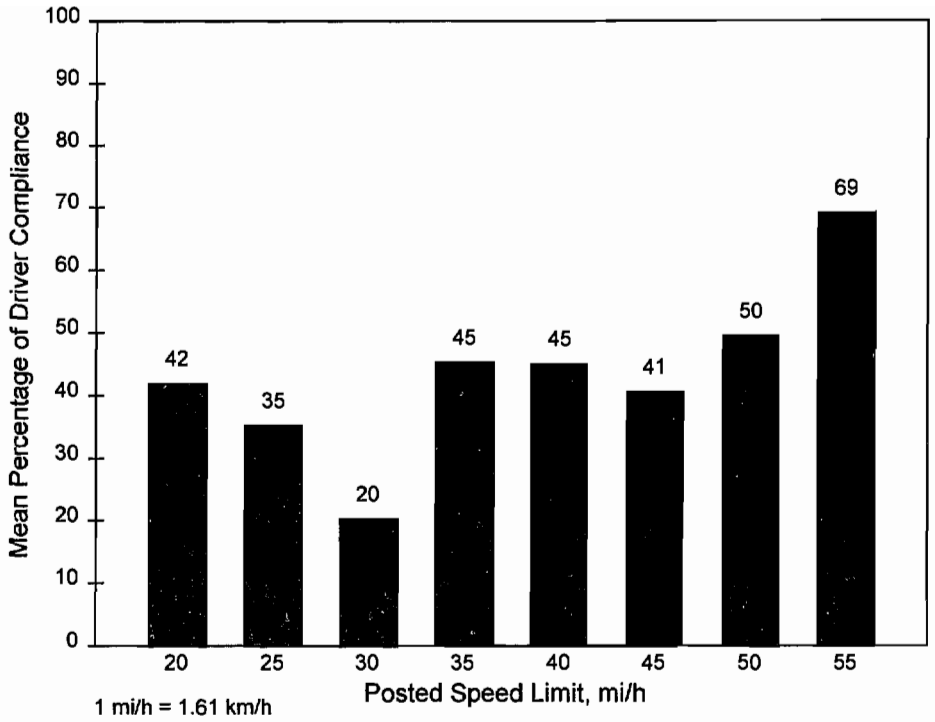


Figure 26. Average driver compliance at the comparison sites.

The mean change in driver compliance, after speed limit alterations were made at the experimental sites, is shown in figure 27 for the speed limit change groups. For the group of sites where the speed limits were lowered by 15 or 20 mi/h (24 or 32 km/h), average compliance decreased by two-thirds. At sites where speed limits were lowered by 10 mi/h (16 km/h), there was approximately a 50 percent reduction in compliance. The majority of drivers, for whatever reasons, apparently did not choose to comply with the new, lower speed limits at these sites.

Conversely, at the group of sites where speed limits were raised by 10 or 15 mi/h (16 or 24 km/h), there was a fourfold increase in driver compliance. Even at this level, however, only about two-thirds of the motorists drove at or below the posted speed limits. Again, it should be noted that these figures do not reflect a change in driver behavior to comply with the new limits, but a change in the standard used to measure compliance, i.e., the posted speed limit.

Noncompliance with a posted speed limit, as measured by the percentage of drivers who exceed the speed limit by various amounts, has also been used to describe driver behavior. Shown in table 11 is a summary of the mean percentage of drivers exceeding the speed limit by 0, 5, 10, 15, or 20 mi/h (0, 8, 16, 24, or 32 km/h) at the experimental sites for each speed limit change group.

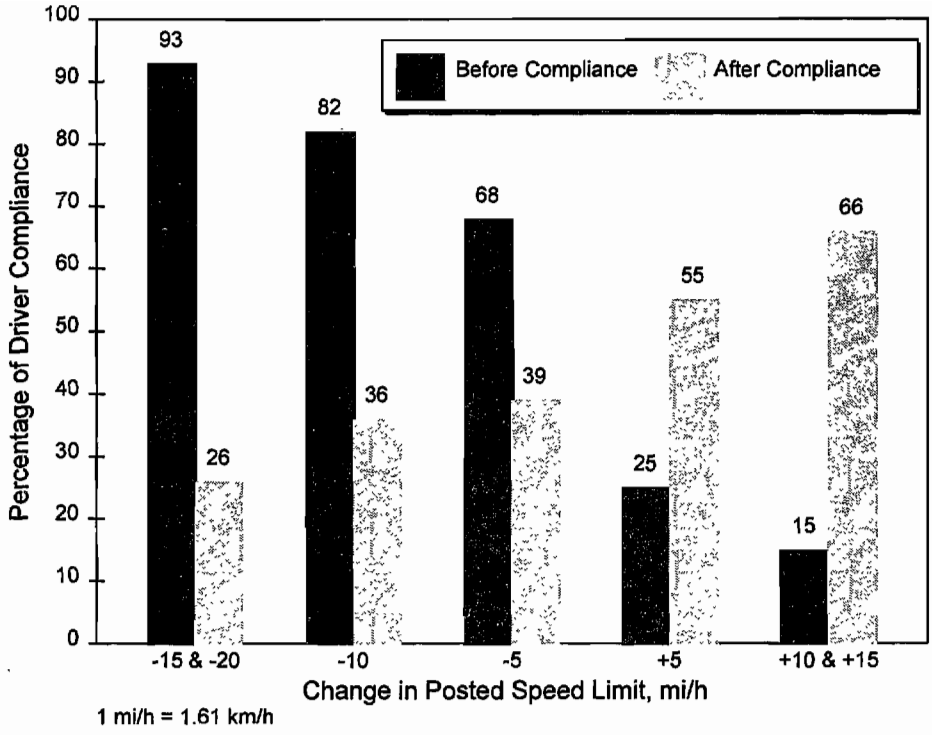


Figure 27. Driver compliance before and after speed limits were changed at the experimental sites.

As with driver compliance, when the limits were lowered, a greater percentage of drivers exceeded the new limits. When speed limits were raised, more drivers were in compliance with the speed limits. Again, these figures do not represent a shift in driver behavior, but a change in how noncompliance is measured, i.e., from the posted speed limit.

As shown in table 12, the mean change in driver compliance between the before and after periods for the comparison site groups where speed limits were not altered was less than 1.6 percent.

There was considerable variation in the percentages from site to site, depending upon the level of the speed limit change. Individual site data for the experimental and comparison sites are given in appendix C.

Overall, altering the speed limits at the experimental sites had a dramatic effect on driver compliance, but most of the effect was due to how compliance was measured, i.e., percentage of motorists driving at or below the posted speed limit. Changing the speed limit did not alter driver behavior. After the speed limits were lowered, driver compliance was typically less than 40 percent at the study sites. At sites where speed limits were raised, compliance was generally less than 60 percent.

Table 11. Percentage of drivers exceeding posted speed limits at the experimental sites.

Change in Posted Speed Limit		Before Percent Exceeding Posted Speed Limit					After Percent Exceeding Posted Speed Limit					Differences Percent Exceeding Posted Speed Limit				
		0	5	10	15	20	0	5	10	15	20	0	5	10	15	20
-15 & -20	9 sites	6.6	2.0	0.4	0.0	0.0	74.1	47.3	21.2	6.4	1.8	67.5	45.3	20.8	6.4	1.8
-10	34 sites	18.2	6.5	1.7	0.3	0.0	64.3	37.3	17.2	6.3	1.8	46.1	30.8	15.5	6.0	1.7
-5	14 sites	32.2	12.8	4.4	1.4	0.5	60.9	31.7	12.5	4.3	1.4	28.7	18.9	8.1	2.9	0.9
+5	26 sites	74.6	45.9	20.3	7.1	2.0	44.9	19.2	6.6	1.9	0.5	-29.7	-26.7	-13.7	-5.2	-1.5
-10 & +15	15 sites	84.9	60.6	34.5	16.0	5.7	33.8	12.9	3.6	0.7	0.2	-51 .1	-47.6	-31.0	-15.2	-5.5

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 12. Percentage of drivers exceeding posted speed limits at the comparison sites.

Change in Posted Speed Limit at Experimental Sites		Before Percent Exceeding Posted Speed Limit					After Percent Exceeding Posted Speed Limit					Differences Percent Exceeding Posted Speed Limit				
		0	5	10	15	20	0	5	10	15	20	0	5	10	15	20
-15 &-20	9 sites	34.9	17.6	7.1	3.0	1.0	34.8	16.6	6.6	2.2	0.6	-0.1	-1.0	-0.5	-0.8	-0.4
-10	32 sites	37.8	16.9	5.5	1.4	0.3	39.4	17.3	5.4	1.3	0.2	1.6	0.4	-0.1	-0.1	-0.1
-5	14 sites	52.2	25.4	8.8	2.4	0.5	53.4	26.0	8.7	2.1	0.3	1.2	0.7	-0.1	-0.3	-0.1
+5	25 sites	66.5	36.8	13.9	3.8	0.7	66.0	36.1	13.1	3.4	0.6	-0.5	-0.7	-0.8	-0.3	-0.1
+10 & +15	14 sites	71.0	40.2	17.0	6.2	1.6	71.4	39.7	17.2	6.1	1.6	0.3	-0.5	0.2	-0.1	-0.0

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

This study did not measure current enforcement levels or practices in the participating States and jurisdictions. In addition, the study scope did not address methods for achieving compliance with speed limits.

It is well known that the presence of police enforcement has a deterrent effect which tends to improve driver compliance with speed limits. In general, the magnitude of the speed change depends on the speed limit and the perceived deterrent effect. Vehicle speed decreases of 3 to 10 mi/h (5 to 16 km/h) have been observed.[9,17] Other measures, such as educational campaigns combined with police visibility, posting realistic speed limits, speed governors on vehicles, designing roadways for speed management, etc., are also effective in improving driver behavior and compliance with posted speed limits.[18]

Effects on Close Following Behavior

In conjunction with speed data collection, before and after vehicle headway data were collected for a 24-h period at each experimental and comparison site pair. The purpose of collecting these data was to determine if changes occurred in short vehicle headways, defined as headways less than 2 s.

Vehicle headways on a roadway are a function of traffic flow, i.e., the mean headway decreases with increasing volume. It is only appropriate to compare differences in headways when traffic volumes at the sites are similar. Prior to conducting the headway analysis, a comparison was made of the before and after 24-h traffic volumes recorded at each site. For the purpose of this analysis, it was decided to include experimental sections where traffic volumes had changed less than 10 percent during the before and after periods. Shown in table 13 are the 24-h traffic volumes and short headway data for sections where posted speed limits were lowered. Similar data are shown in table 14 for sites where posted speed limits were raised.

As shown in tables 13 and 14, the before and after differences in short headways were small for both the raised and lowered speed limit sites. Chi-square tests indicated no statistically significant differences in the proportion of short headways at these sites.

Shown in figures 28 and 29 are before and after headway distributions for a low-volume and a high-volume experimental site where the posted speed limits were lowered. Figures 30 and 31 show before and after headway distributions for a low-volume and a high-volume experimental site where the posted speed limits were raised. These figures illustrate that there was little change in short headways and in the distribution of headways of 10 s or less at these sites, irrespective of whether the speed limits were raised or lowered.

Table 13. Before and after short headway data for 28 experimental sites where posted speed limits were lowered.

Site Number	Before Speed Limit	After Speed Limit	Diff. Limit	Total Before Volume	Before <2 s Volume	Before <2 s Pct.	Total After Volume	After <2 s Volume	After <2 s Pct.
Two-Lane Sites - Lower Speed Limits									
DE02E	50	35	-15	507	13	2.56	529	11	2.08
MA01E	40	30	-10	318	1	0.31	319	4	1.25
ME02E	45	35	-10	405	4	0.99	380	5	1.32
DE04E	50	40	-10	433	4	0.92	413	6	1.45
OH08E	55	45	-10	626	6	0.96	697	5	0.72
OH06E	55	45	-10	1,138	22	1.93	1,051	17	1.62
VAO5E	55	45	-10	1,247	40	3.21	1,230	50	4.07
VA03E	55	45	-10	1,295	47	3.63	1,307	52	3.98
OH11E	50	40	-10	1,391	25	1.80	1,455	23	1.58
TX02E	55	45	-10	2,259	96	4.25	2,412	107	4.44
IN01E	55	45	-10	2,305	87	3.77	2,209	95	4.30
CA01E	35	25	-10	2,553	72	2.82	2,493	78	3.13
VA07E	55	45	-10	4,588	487	10.61	4,305	411	9.55
OK04E	45	35	-10	5,663	700	12.36	5,301	599	11.30
OK03E	35	25	-10	6,322	490	7.75	5,755	420	7.30
NJ02E	45	35	-10	7,328	854	11.65	7,584	994	13.11
OH07E	55	45	-10	7,715	1,026	13.30	8,280	1,084	13.09
VA01E	55	45	-10	8,456	1,227	14.51	8,651	1,325	15.32
DE03E	50	40	-10	9,039	1,835	20.30	9,092	1,839	20.23
OK02E	35	25	-10	11,512	1,000	8.69	11,019	1,063	9.65
ME01 E	45	40	-5	343	1	0.29	333	6	1.80
IN05E	45	40	-5	1,486	49	3.30	1,521	49	3.22
IN07E	50	45	-5	5,745	516	8.98	6,023	602	10.00
AZ01E	50	45	-5	7,979	1,577	19.76	8,083	1,686	20.86
ID02E	55	50	-5	8,155	1,388	17.02	8,270	1,333	16.12
IN06E	50	45	-5	8,563	1,320	15.42	8,770	1,386	15.80
IL02E	50	45	-5	9,542	1,611	16.88	10,420	1,909	18.32
NJ01 E	40	35	-5	12.853	2.777	21.61	12.485	2.921	23.40

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 14. Before and after short headway data for 18 experimental sites where posted speed limits were raised.

Site Number	Before Speed Limit	After Speed Limit	Diff. Limit	Total Before Volume	Before <2 s Volume	Before <2 s Pct.	Total After Volume	After <2 s Volume	After <2 s Pct.
Two-Lane Sites - Raise Speed Limits									
DE05E	35	40	5	476	3	0.63	510	7	1.37
AZ02E	25	30	5	1,344	27	2.01	1,367	28	2.05
TX06E	30	35	5	1,619	39	2.41	1,776	21	1.18
CT04E	30	35	5	1,798	87	4.84	1,906	99	5.19
MD07E	30	35	5	2,693	167	6.20	2,770	190	6.86
AZ03E	30	35	5	4,105	248	6.04	4,186	240	5.73
MS02E	30	35	5	7 791	1 065	13.67	7.901	962	12.18
ID04E	20	30	10	1,252	6	0.48	1,322	16	1.21
ID03E	20	30	10	1,490	43	2.89	1,372	26	1.90
CT03E	30	40	10	1,728	74	4.28	1,794	83	4.63
ME03E	35	45	10	1.774	124	6.99	1.819	144	7.92
IN04E	30	45	15	431	5	1.16	476	2	0.42
Four-Lane Divided Sections - Raise Speed Limits									
CA06E	45	50	5	13,003	1,741	13.39	13,049	1,819	13.94
CT01E	45	50	5	19,024	3,750	19.71	19,028	3,884	20.41
Two-lane One-Way Pairs - Raise Speed Limits									
IN02E	25	30	5	8,291	881	10.63	8,688	985	11.34
IN03E	25	30	5	8,768	1,355	15.45	9,229	1,442	15.62
ID06E	25	35	10	8,147	792	9.72	7,879	696	8.83
ID07E	25	35	10	8,124	461	5.67	8,032	391	4.87

1 mi/h = 1.61 km/h

Note: All speed limits are shown in mi/h.

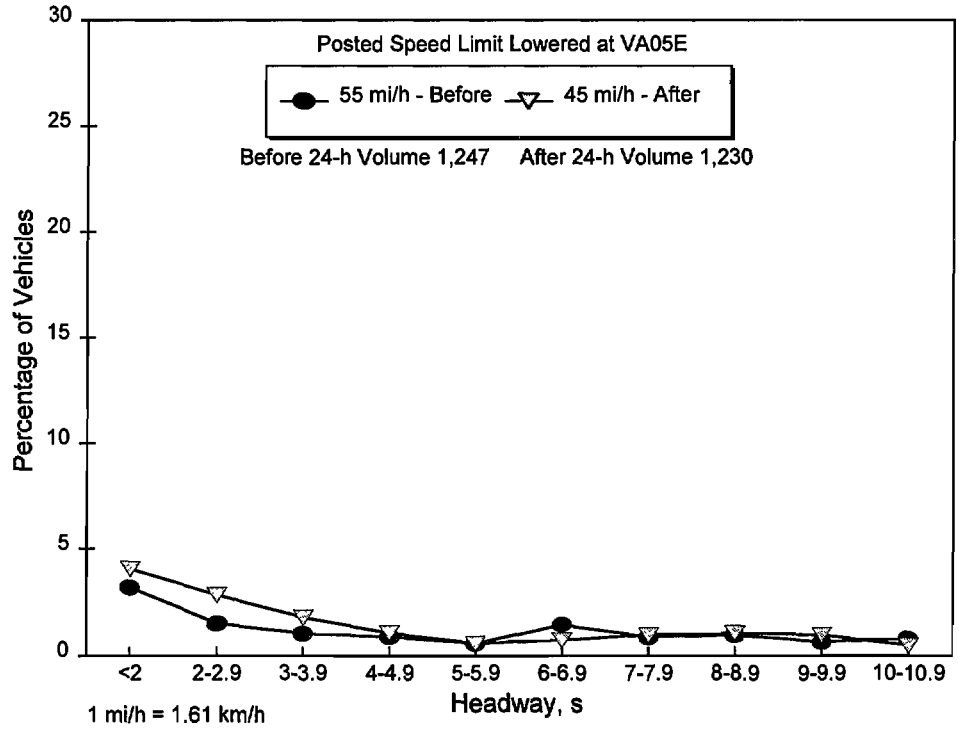


Figure 28. Before and after percent changes in headways at a low-volume experimental site where the speed limit was lowered.

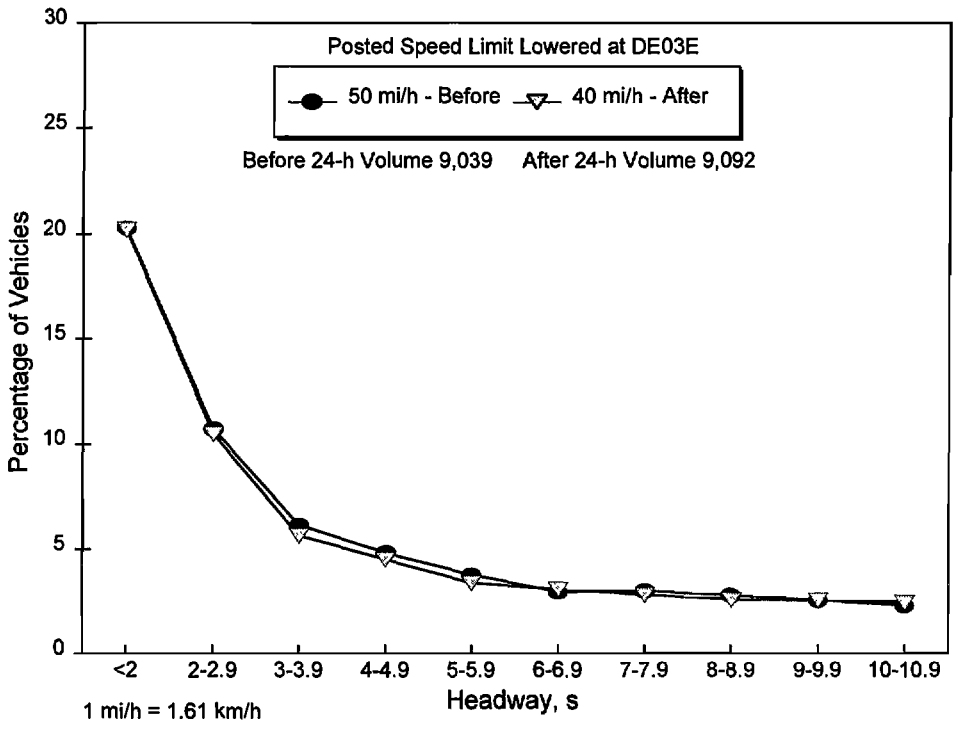


Figure 29. Before and after percent changes in headways at a high-volume experimental site where the speed limit was lowered.

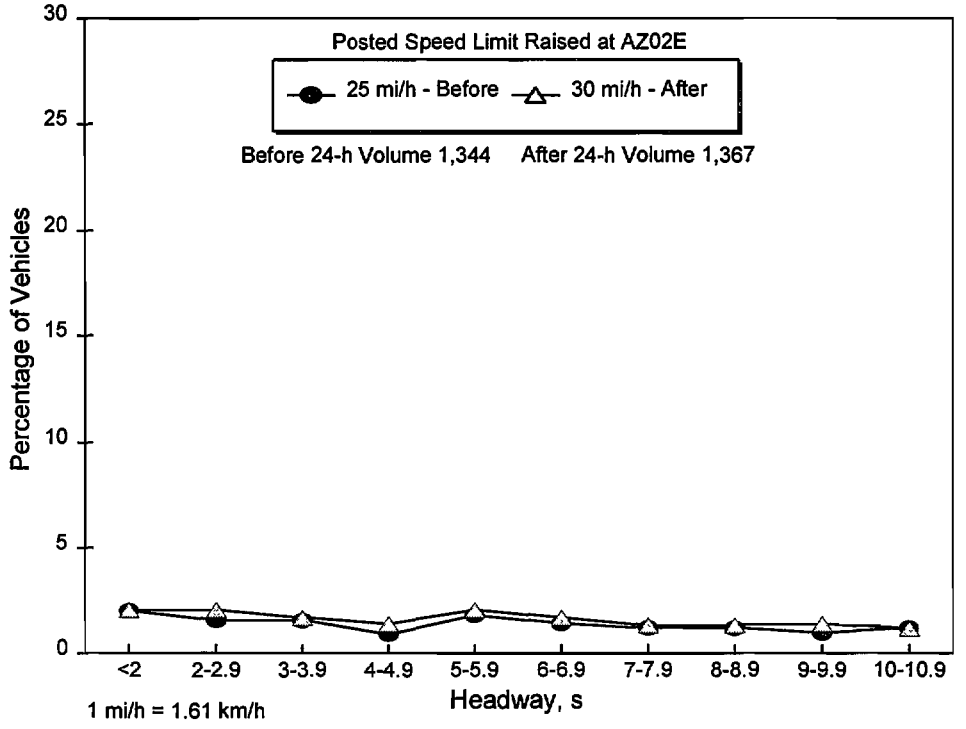


Figure 30. Before and after percent changes in headways at a low-volume experimental site where the speed limit was raised.

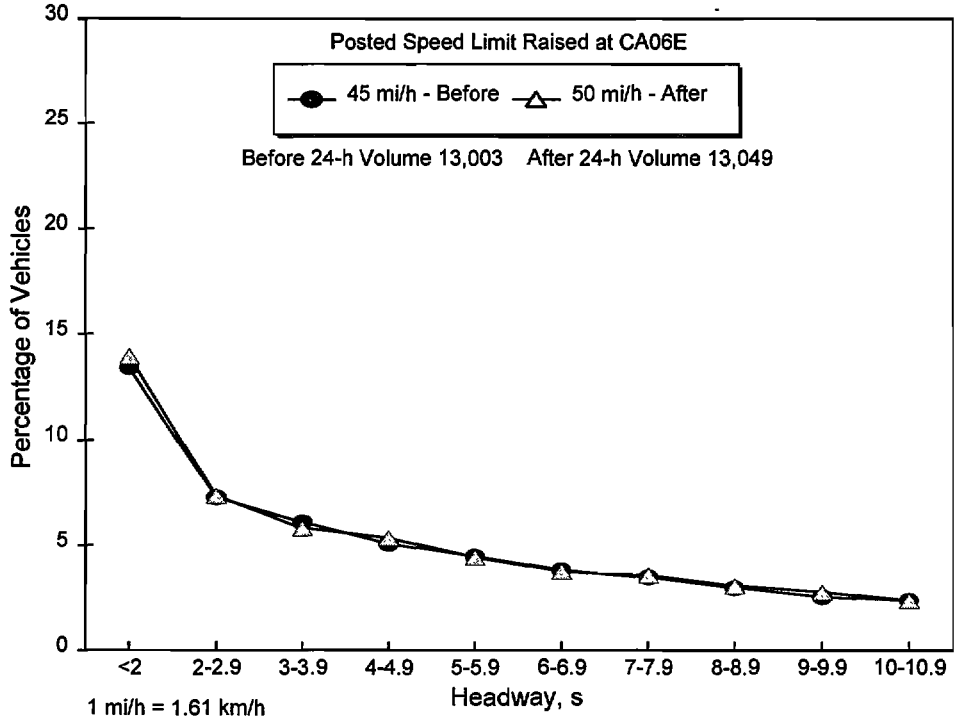


Figure 31. Before and after percent changes in headways at a high-volume experimental site where the speed limit was raised.

Repeated Measurements

The results of speed observations have shown that variations in spot speeds occur over time, even in the absence of speed limit changes or other alterations.[19-21] To obtain some information on the time effects of speed limit alterations, repeated speed measurements were made at 11 experimental and comparison sites.

Posted speed limits on the experimental sites were lowered at five locations and raised at six other sites. Speed data were collected before the speed limits were posted and again after the new limits were posted, at intervals ranging from 1 day to 2 years and 9 months. A summary of the 24-h mean and 85th percentile speeds for the 11 sites is shown in table 15. A detailed summary of the speed measurements for the sites is given in appendix D.

Of the five sites where speed limits were lowered, two locations, OH01E and OH05E, were on roadways passing through small rural communities. Two other locations, DE01E and VA05E, were two-lane facilities in rural communities. Site IN07E was a primary route in a small urban area.

As shown in table 15, at four sites where speed measurements were taken within 1 to 3 months after the speed limits were lowered, the 85th percentile speeds increased by 1 mi/h (1.6 km/h) at one site, decreased by 2 mi/h (3.2 km/h) at another site, and remained the same at two locations. One year after the speed limits were lowered, the 85th percentile speeds decreased by 1 mi/h (1.6 km/h) at one site, decreased by 2 mi/h (3.2 km/h) at one site, and remained the same at two sites. At three sites where measurements were taken 2 yr after the speed limits were lowered, 85th percentile speeds decreased by 1 mi/h (1.6 km/h) at two sites, and increased by 1 mi/h (1.6 km/h) at one site.

Of the six sites where speed limits were raised, two locations, MD06E and TX01E, were roadways passing through small rural communities. Sites ID03E and ID04E were urban streets in a city of less than 5,000 persons. The site in Virginia, VA02E, was a two-lane facility in a small urban area. Site MD01E was a rural two-lane roadway where the speed limit was raised from 50 to 55 mi/h (81 to 89 km/h).

At five sites where speed measurements were taken within 1 to 3 months after the speed limits were raised, the 85th percentile speeds increased by 1 mi/h (1.6 km/h) at three sites, increased by 2 mi/h (3.2 km/h) at one site, and remained the same at one site. One year after the speed limits were changed, the 85th percentile speeds increased by 1 mi/h (1.6 km/h) at two locations, increased by 2 mi/h (3.2 km/h) at two sites, and decreased by 3 mi/h (4.8 km/h) at one location. At three sites where measurements were made 2 yr after the speed limits were raised, the 85th percentile speeds increased by 2 mi/h (3.2 km/h) at one location, remained the same at one location, and decreased by 1 mi/h (1.6 km/h) at one location.

Table 15. Repeated speed measurements at 11 experimental sites.

Site Number	Posted Speed Limit mi/h Before	After	Before Period Collection Date	Mean mi/h	85th mi/h	Date Speed Limit Posted	After Period 1 to 3 months Collection Date	Mean mi/h	85th mi/h	1 yr Collection Date	Mean mi/h	85th mi/h	2 yr or more Collection Date	Mean mi/h	85th mi/h
Lower Speed Limit Sites															
DE01E	40	35	09-26-86	45.3	54	11-04-86	12-12-86	47.1	55				10-28-88	45.1	53
IN07E	50	45	12-17-86	44.1	51	12-29-86				04-18-88	44.8	51	08-09-88	44.7	52
OH01E	55	45	06-25-86	53.0	60	09-07-86	10-01-86	50.9	58	07-15-87	51.8	58	05-03-89	51.7	59
OH05E	45	35	10-19-86	38.7	46	12-10-86	01-25-87	39.1	46	11-10-87	38.8	46			
VA05E	55	45	07-30-86	44.8	54	09-09-87	11-19-87	45.0	54	06-28-88	45.0	53			
Raise Speed Limit Sites															
ID03E	20	30	04-15-87	24.2	29	06-01-88	06-02-88	25.3	30	10-03-88	25.0	30			
ID04E	20	30	04-I 5-87	23.1	29	06-01-88	06-02-88	23.1	29	10-03-88	24.1	30			
MD01E	50	55	08-03-86	54.8	61	09-23-86	01-11-87	55.8	62	02-25-88	56.8	63	06-26-88	56.4	63
MD06E	30	35	08-16-86	40.6	47	1 0-22-86	12-06-86	40.9	48				07-09-88	40.8	47
TX01E	40	55	09-19-86	47.3	57	10-17-86				03-06-87	43.6	54	12-16-88	45.8	56
VA02E	35	45	07-26-86	39.9	46	1 0-14-87	12-12-87	42.5	48	06-25-88	43.0	48			

1 mi/h = 1.61 km/h

Shown in figure 32 are the average changes in the before and after 85th percentile speeds for the group of five locations where speed limits were lowered, and the group of six locations where speed limits were raised.

Inspection of figure 32 reveals that for the group of five sites where speed limits were lowered, the average change in 85th percentile speeds was a decrease of less than 1 mi/h (1.6 km/h) for 1 and 2 yr following the speed limit change.

For the group of six sites where speed limits were raised, the average change in 85th percentile speeds was an increase of less than 1 mi/h (1.6 km/h) for 1 and 2 yr following the speed limit change.

The number of sites and the number of repeated measurements are too small to establish trends or permit drawing conclusions concerning the time effects of speed limit changes. The speed measurements taken at 11 selected sites over a 2-yr period after speed limits were altered revealed that small changes (i.e., 2 mi/h (3.2 km/h)) occur in the 24-h 85th percentile speeds of free-flow vehicles at any given site. Similar changes were also found in the mean speeds. For the group of sites where speed limits were lowered, the 85th percentile speeds decreased by less than 1 mi/h (1.6 km/h). At sites where posted speed limits were raised, the 85th percentile speeds increased by 1 mi/h (1.6 km/h) or less.

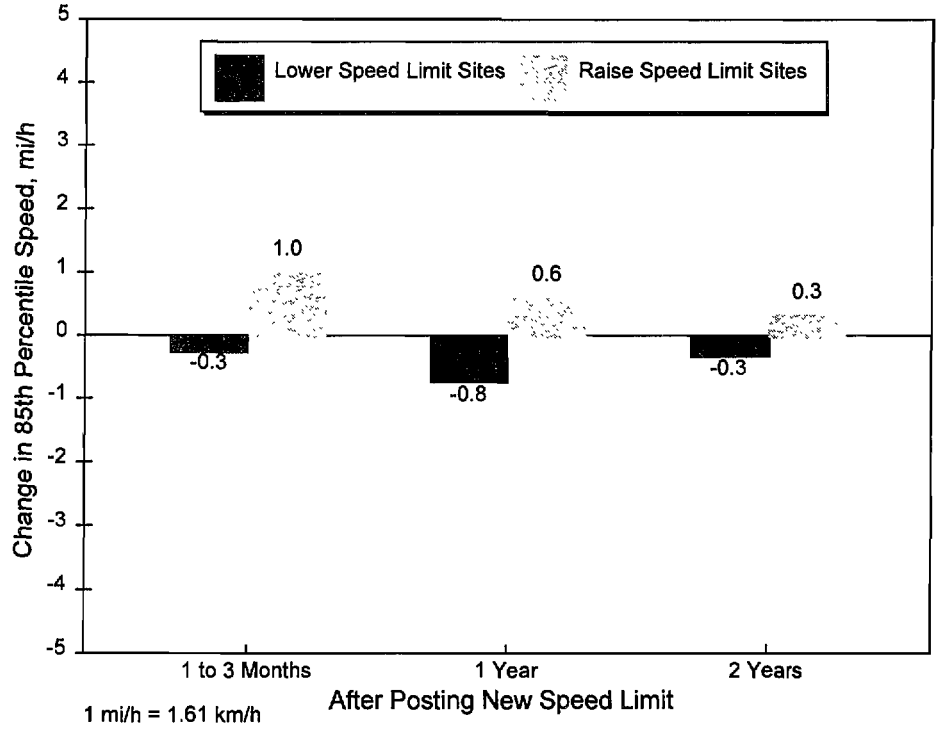


Figure 32. Mean changes in 85th percentile speeds at five sites where speed limits were lowered and at six sites where speed limits were raised.

Indirect Effects on Nearby Roads

Speed, headway, and crash data were collected for five selected highway sections that were contiguous to four experimental sites. The purpose of these measurements was to determine if speed limit changes on the experimental sections had an indirect effect on driver behavior on the contiguous sections. Selection of the contiguous sites was not random, but was dependent on the selection of the experimental sites provided by the participating jurisdictions. Due to cost constraints, the sample of sites studied was limited to five locations.

No speed limit or other alterations to the roadway were made on the contiguous sections during the study period. Posted speed limits on the adjacent experimental sections were lowered at two sites and raised at two other sites. All of the contiguous and experimental sites were two-lane facilities.

The general characteristics of the contiguous sites are shown in table 16. A summary of the before and after 24-h free-flow speed data, as well as the differences in speed characteristics, is given in tables 17 through 19. The percentage of drivers that exceeded the posted speed limits at these sites is shown in table 20. A summary of before and after police-reported crashes on the contiguous sections is shown in table 21. A discussion of the indirect effects at each of the contiguous sites is given below.

The first site listed in table 16, COO1 P, had a posted speed limit of 40 mi/h (64 km/h) and was contiguous to a 1.05-mi (1.69-km) rural experimental section, CO01E, where the speed limit was raised from 30 to 3 5 mi/h (48 to 56 km/h). The sections were located on the only major highway facility in the area. The general terrain of the area was mountainous, where horizontal and vertical alignment constraints frequently require motorists to reduce speed. Between the before and after data collection periods, there was a 10 percent increase in the 24-h traffic volume on the experimental section. As shown in table 19, there was a 1-mi/h (1.6-km/h) decrease in the percentile speeds on the contiguous section after the speed limit was raised on the experimental section.

Table 16. Contiguous site characteristics.

Parallel Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Speed Limit mi/h	Intersections Signalized Per Mile	Intersections No Signal Per Mile	Driveways Comm. Per Mile	Driveways Resid. Per Mile
COO1 P	Jefferson Count y	72	Rural	2.45	2	40	0.00	0.00	0.00	7.76
IN07P	Scott County	31 at Scottsburg	Small Urban	0.37	2	35	0.00	16.22	24.32	27.03
TX06P	City of Justin	FR 156	Rural	0.48	2	35	0.00	18.75	56.25	0.00
WV1 1 P	Kanawha Count y	62	Rural	0.20	2	45	0.00	5.00	30.00	5.00
WV12P	Kanawha Count y	62	Rural	1.12	2	45	0.00	11.61	14.29	38.39
5 Sites				4.62 Miles						

1 mi= 1.61 km
1milh = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 17. Before speed data for the contiguous sites.

Parallel Site Number	Posted Speed Limit	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	IO	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
CO01P	40	02/02/87	47.0	4.8	3,275	2,488	76.0	34	40	42	43	45	46	48	49	50	52	53	55	59	43	52	73.8	0.86
IN07P	35	12/17/86	42.3	6.4	8,468	6,634	78.3	24	32	35	37	39	41	43	45	47	49	50	53	57	39	48	62.5	1.00
TX06P	35	03/11/87	34.7	6.9	3,787	3,372	89.0	17	23	26	29	31	33	35	38	40	42	44	46	51	31	40	58.2	1.00
WV11P	45	06/19/86	47.1	8.4	3,720	3,191	85.8	25	33	37	40	43	45	48	51	53	55	58	61	67	43	52	49.3	0.92
WV12P	45	06/19/86	41.0	8.5	8.902	6.888	77.4	22	29	31	32	35	37	41	45	48	50	53	55	61	37	46	39.8	1.08

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 18. After speed data for the contiguous sites.

Parallel Site Number	Posted Speed Limit	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	IO	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
CO01P	40	05/16/88	46.5	4.9	3,592	2,642	73.6	33	39	41	42	44	46	47	49	50	51	53	54	58	43	52	74.5	0.92
IN07P	35	08/09/88	42.3	6.9	8,804	7,065	80.2	23	29	33	36	39	41	43	46	47	49	51	53	57	40	49	58.7	0.86
TX06P	35	03/31/88	35.3	6.5	3,853	3,529	91.6	17	25	28	29	32	34	36	38	40	42	44	46	51	32	41	59.5	0.95
WV11P	45	06/21/89	47.1	7.3	5,273	4,056	76.9	27	35	39	41	44	45	48	50	52	55	56	59	64	43	52	56.4	0.95
WV12P	45	06/21/89	41.1	8.4	9.193	7.018	76.3	25	29	31	32	35	38	42	45	48	50	52	55	62	39	48	41.1	1.00

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 19. Differences in speed characteristics for the contiguous sites.

Parallel Site Number	Posted Speed Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1 5 10 15 25 35 50 65 75 85 90 95 99	10-mi/h Pace Lower Limit	10-mi/h Pace Upper Limit	Pct. Pace	Skew. Index
CO01 P	40	-0.5	0.1	317	154	-2.4	-1 -1 -1 -1 -1 0 -1 0 0 -1 0 -1 -1	0	0	0.7	0.06
IN07P	35	0.0	0.5	336	431	1.9	-1 -3 -2 -1 0 0 0 1 0 0 1 0 0	1	1	-3.8	-0.14
TX06P	35	0.6	-0.4	66	157	2.6	0 2 2 0 1 1 1 0 0 0 0 0 0	1	1	1.3	-0.05
WV11P	45	0.0	-1.1	1,553	865	-8.9	2 2 2 1 1 0 0 -1 -1 0 -2 -2 -3	0	0	7.1	0.03
WV12P	45	0.1	-0.1	291	130	-1.1	3 0 0 0 0 1 1 0 0 O - I 0 1	2	2	1.3	-0.08

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 20. Percentage of drivers exceeding posted speed limits at the contiguous sites.

Parallel Site Number	Posted Speed Limit	Before Percent Exceeding Posted Speed Limit 0	5	10	15	20	After Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences Percent Exceeding Posted Speed Limit 0	5	10	15	20
CO01P	40	92.7	68.4	24.7	4.2	0.5	91.8	66.7	21.8	3.2	0.3	-0.9	-1.7	-2.9	-1.0	-0.2
IN07P	35	89.5	67.0	34.0	9.4	1.9	86.7	67.3	36.2	10.4	1.9	-2.0	0.3	2.2	1.0	0.0
TX06P	35	48.5	20.4	6.4	1.2	0 2	54.0	22.2	6.2	1.3	0.1	5.5	1.8	-0.2	0.1	-0.1
WV11P	45	62.2	36.1	14.8	5.3	1.4	63.8	33.2	12 1	3.5	0.7	1.6	-2.9	-2.7	-1.8	-0.7
WV12P	45	33.6	14.5	4.7	1.0	0.2	33 .9	14.7	4.6	1.3	0.3	0.3	0.2	-0 .1	0.3	0.1

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h

Table 21. Before and after crash data for the contiguous sites.

Parallel Site Number	Posted Speed Limit	Length, Miles	Before Volume	After Volume	Third Before Period Total	Third Before Period Injury	Third Before Period Month	Second Before Period Total	Second Before Period Injury	Second Before Period Month	First Before Period Total	First Before Period Injury	First Before Period Month	Total Before Total	Total Before Injury	Total Before Month	First After Period Total	First After Period Injury	First After Period Month	Second After Period Total	Second After Period Injury	Second After Period Month	Total After Total	Total After Injury	Total After Month
CO01P	40	2.45	3,275	3,592	17	7	12	12	7	12	6	3	12	35	17	36	8	4	12				8	4	12
IN07P	35	0.37	8,468	8,804	6	2	12	3	0	12	9	4	12	18	6	36	4	2	12	4	1	12	8	3	24
TX06P	35	0.48	3,787	3,853	3	0	12	3	2	12	4	2	12	10	4	36	2	1	12				2	1	12
WV11P	45	0.20	3,720	5,273	1	0	12	1	1	12	2	2	12	4	3	36	2	0	12	0	0	12	2	0	24
WV12P	4 5	1.12	8,902	9,193	11	1	12	10	2	12	17	8	12	38	11	36	11	6	12	14	8	12	25	14	24
5 Sites		4.62			38	10		29	12		38	19		105	41		27	13		18	9		45	22	

1 mi= 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

The Indiana site, IN07P, was on a major primary highway located in a small urban area. The speed limit on the section was 35 mi/h (56 km/h). The site was located between two experimental sites, IN06E and IN07E, where the speed limits were lowered from 50 to 45 mi/h (81 to 72 km/h). The 24-h traffic volume increased approximately 4 percent on the experimental sections between the before and after periods. As shown in table 19, there was no change in the mean speed, but there were small reductions in the percentile speeds below the 15th percentile, on the contiguous section, after the posted speed limits were lowered on the experimental sections.

The Texas site, TX06P, passed through a small rural community and was located adjacent to a 0.54-mi (0.87-km) experimental site where the speed limit was raised from 30 to 35 mi/h (48 to 56 km/h). The posted speed limit on TX06P was 35 mi/h (56 km/h). Drivers on the experimental section must turn onto and off of the adjacent section to continue their journey. The experimental and adjacent sections are the only major primary highways in the community. There was a minor change in the 24-h traffic volume on the experimental section during the study period. As shown in table 19, there was a 0.6-mi/h (0.97-km/h) increase in the mean speed, and there were small increases in the percentile speeds below the 50th percentile speed, on the adjacent section, after the posted speed limit was raised on the experimental section.

The two West Virginia contiguous sites, WV11P and WV12P, were located in a small city at each end of a 1.14-mi (1.84-km) experimental section where the speed limit was lowered from 45 to 35 mi/h (72 to 56 km/h). The speed limit posted on the contiguous sections was 45 mi/h (72 km/h). The 24-h traffic volume at site WV11P increased by 42 percent; however, the volume at site WV12P only increased by 3 percent during the study period. Based on a review of the area, the volume increase at site WV11P was due to development in the adjacent area, and was not due to drivers attempting to avoid the lower speed limit on the experimental section. There were no other major highways in the area that could be used by drivers to bypass the experimental section. As shown in table 19, changes in the mean speeds at the contiguous sites were minor; however, there was a small increase in the percentile speeds below the 50th percentile and a small decrease in the percentile speeds above the 50th percentile at site WV11P after the speed limit was lowered on the experimental site.

As can be seen by examining table 19, changes in the mean speeds, standard deviation of speeds, and 85th percentile speeds at the contiguous locations were generally less than 1 mi/h (1.6 km/h). As shown in table 20, there were minor changes in the percentage of drivers exceeding the posted speed limits at these sites. The number of before and after police-reported crashes on the contiguous sections, summarized in table 21, is too small to provide meaningful results.

Due to the small sample of sites examined in this study, it is not possible to draw conclusions concerning potential carryover effects of posted speed limit changes on a roadway section to nearby roadways where speed limits were not changed. Drivers on the five contiguous sections examined in this study did not appear to change their behavior, regardless of whether the speed limits were lowered or raised on the experimental sites.

Discussion of Speed Effects

The purpose of this study was to examine the effects of raising and lowering posted speed limits on driver behavior for urban and rural nonlimited access roadways. Although additional enforcement, education, and other engineering measures have been used to effectively manage vehicle speeds, this study only examined the effects of changing the posted speed limit on driver behavior.

Because the participating transportation officials would not permit random selection of sites for speed limit changes, experimental sections were selected from locations where the agencies planned to change posted speed limits as a result of routine traffic and engineering investigations. Comparison sites, where speed limits were not changed, were selected by the research team to control for extraneous factors such as weather conditions. During the time that data were collected, from June 1986 through July 1989, the maximum speed limit on nonlimited access highways was 55 mi/h (89 km/h). At that time, State and local transportation officials typically changed posted speed limits on short roadway segments, i.e., usually less than 2 mi (3.2 km) in length. The average length of sections selected for the study was 1.7 mi (2.7 km). Sixty-three percent of the sites were located in rural areas and small communities with a population of less than 5,000 persons.

Of the 98 sites selected for speed data collection in 22 States, posted speed limits were lowered at 57 sites and raised at 41 other locations. Changes in the posted speed limits ranged from lowering the speed limit by 5, 10, 15, or 20 mi/h (8, 16, 24, or 32 km/h) to raising the speed limit by 5, 10, or 1 5 mi/h (8, 16, or 24 km/h). During the study, only one change in the posted speed limit was made at each site. Before and after speeds of free-flow vehicles (vehicles with a headway of 4 s or more) were collected for a 24-h period simultaneously at each experimental and comparison site pair.

A review of the before and after speed data at each experimental site revealed that differences in the mean speeds, standard deviation of speeds, and 85th percentile speeds were generally less than 2 mi/h (3.2 km/h). When sites were grouped by amount of speed limit change, the differences in the percentile speeds for each group were less than 1.5 mi/h (2.4 km/h), irrespective of whether the posted speed limit was lowered or raised, or the amount that the limit was changed. While these differences are statistically significant due to the large speed samples collected, the overall change in speeds is small.

At 34 locations, existing speed limits were posted within 5 mi/h (8 km/h) of the 85th percentile speed. Speed limits at these sites were lowered more than 5 mi/h (8 km/h) below the 85th percentile speed. At 21 other locations, existing speed limits were posted more than 5 mi/h (8 km/h) below the 85th percentile speed, and the agencies raised the posted speed limit to within 5 mi/h (8 km/h) of the 85th percentile speed. Comparison of the before and after percentile speeds for both groups of sites revealed that the mean difference in percentile speeds was less than 1 mi/h (1.6 km/h).

Based on the speed data collected at the study sites, speed limits were typically set below the average speed of traffic.

By defining driver compliance as the number or percentage of drivers that travel at or below the posted speed limit, major changes in compliance occurred when speed limits were either raised or lowered. However, as reflected in small changes in vehicle speeds, driver behavior did not change; but the standard for measuring compliance, i.e., posted speed limit, changed.

Because the sites were not randomly selected from the population of nonlimited access highways, the findings apply only to the locations studied, and may apply to other locations where agencies alter speed limits for similar reasons. As noted below, the study findings are similar to the results reported by other researchers who examined driver behavior changes before and after speed limits were changed on nonlimited access highways.

A number of studies have been conducted on nonlimited access highways to examine the effects of changing posted speed limits on drive r behavior.[22-33] A summary of the data obtained from published reports is shown in table 22 for urban and rural nonlimited access highways. Table 23 provides a summary of operational studies. It should be noted that studies concerning the effects of posted speed limit changes on limited access high-speed highways are not included in the following discussion, nor are the effects of other speed management techniques, as this study only examined changes in posted speed limits on nonlimited access highways.

Avery conducted before and after studies on 11 arterial streets consisting of segments varying from 1 to 4.5 mi (1.6 to 7.3 km) in length.[22] Speed limits were raised from 30 to 35 mi/h (48 to 56 km/h) on some sections, and from 30 to 40 mi/h (48 to 64 km/h) on other sections. Avery found that the speed changes were small and not related to the amount that the limit was changed.

Ogawa et al. examined the effects of raising the speed limit by 5 mi/h (8 km/h) in two rural towns in Illinois.[24] No significant difference in speeds was found where speed limits were raised; however, a small, but statistically significant increase in speed occurred in one town where the speed limit was lowered.

Roberts found that raising the speed limit from 35 to 40 mi/h (56 to 64 km/h) on a 1.5-mi (2.4-km) four-lane urban street in Columbia, South Carolina, did not significantly change the mean, 85th percentile, or 10-mi/h (16-km/h) pace.[25]

Rowan and Keese conducted before and after studies at 186 locations to determine the effect of speed limit signs on traffic speeds.[29] Speed limits were changed from 60 to 30 mi/h (97 to 48 km/h) and from 30 to 55 mi/h (48 to 89 km/h) in 5-mi/h (8-km/h) increments. They found that speed limit signs had little influence on drivers' speeds; however, they detected a slight decrease in the dispersion of traffic speeds.

Table 22. Summary of research studies on the effects of raising and lowering speed limits.

Location	Author, Date, and Reference	Number of Sections	Speed Limit Before mi/h	Speed Limit After mi/h	Average 85th Percentile Speed, mi/h Before	After Posting Lower Limit	After Posting Higher Limit	Remarks
Urban								
St. Paul, Minnesota	Avery, 1960[22]	7	30	35	35.5		35.8	Compliance increased from 36 to 80 percent.
		4	30	40	39.4		40.8	Compliance increased from 19 to 82 percent.
West Lafayette, Indiana	Elmberg, 1960[23]	1	35	30	38.4	38.5		Percentage of vehicles exceeding the speed limit by 5 mi/h or more increased from 10 to 30 percent.
St. Joseph, Illinois	Ogawa, 1962[24]	1	30	35	30.6*		31.3*	Speed limit revisions based on 85th percentile speeds. The mean speed increase in Ogden is statistically significant.
Ogden, Illinois		1	40	35	32.2*	33.3"		
Fithian, Illinois		1	35	40	34.9*		35.3*	
Columbia, South Carolina	Roberts, 1967[25]	1	35	40	42.5		41.0	Compliance increased from 28 to 76 percent.
10 California Cities	Spitz, 1984[26]	40	NA	NA	39.9		40.3	The 85th percentile speed in the 27 comparison samples where no change in the limit was made increased from 40.1 to 40.8 mi/h.
		10	NA	NA	36.9	38.6		
3 Urban Fringe Areas in Texas	Dudek, 1986[27]	6	55	45	55.9	54.0		Lowering the speed limit had little effect on vehicle speeds and speed variance.

1mi/h = 1.61 km/h
NA = Not Available
* = Denotes mean speeds, not 85th percentile speeds
[ ] = Numbers in brackets refer to references

Table 22. Summary of research studies on the effects of raising and lowering speed limits (continued).

Location	Author, Date, and Reference	Number of Sections	Speed Limit Before mi/h	Speed Limit After mi/h	Average 85th Percentile Speed, mi/h Before	After Posting Lower Limit	After Posting Higher Limit	Remarks
Rural								
Illinois	Kessler, 1959[28]	30	30	40	38.9		38.4	Driver compliance increased from 39 to 85 percent.
iouston District, Texas	Rowan, 1962[29]	1	60	55	55.5	55.0		Speed limits were established in the after period based on the 85th percentile speeds. A slight increase in the dispersion of speeds was reported after the new limits were established.
		1	60	50	53.7	52.0		
		1	60	45	47.3	46.4		
		1	60	40	41.5	39.9		
		1	60	35	40.2	38.9		
		1	60	30	31.2	33.2		
Paris District, Texas	Rowan 1962[29]	1	60	55	55.2	51.2		
		1	60	50	51.5	50.9		
		1	60	45	47.6	43.9		
		1	60	40	40.4	38.6		
		1	30	55	53.2		50.5	
		1	30	50	52.6		51.3	
		1	30	45	45.4		45.2	
		1	30	40	40.3		42.0	
		1	30	35	36.8		38.4	

mi/h = 1.61 km/h
NA = Not Available
* = Denotes mean speeds, not 85th percentile speeds
[ ] = Numbers in brackets refer to references

Table 23. Summary of operational studies on the effects of raising and lowering speed limits.

Location	Author, Date, and Reference	Number of Sections	Speed Limit Before mi/h	Speed Limit After mi/h	Average 85th Percentile Speed, mi/h Before	After Posting Lower Limit	After Posting Higher Limit	Remarks
Massachusetts	Oct. 1 966[30]	19 Two-lane	30-45	20-35	47.5	48.3		After posting 10-mi/h lower and higher limits than existing zones, no differences in 85th percentile speeds were found.
			30-45	40-55	47.5		48.0	
		6 Dual-lane	50-55	40-45	60.7	60.3		
				60-65	60.7		61.0	
Minnesota	Jan. 1 979[31]	12 Two-lane	45	30	NA	43.6		
		4 Four-lane	40	30	42.0	40.3		
Washington	1981 -82[32]	3	25	30	34.7		34.3	
		1	50	55	57.0		59.0	
		1	50	35	43.0	42.0		
		3	40	35	45.0	43.7		
Michigan	1 982[33]	4	25	35	37.6		36.0	Compliance increased from 10 to 81 percent.
		4	55	50	56.8	54.8		Compliance decreased from 73 to 56 percent.
		4	55	50	57.8	56.0		Compliance decreased from 71 to 46 percent.
		5	45	35	49.2	47.0		Compliance decreased from 56 to 7 percent.

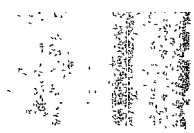
1 mi/h = 1.61 km/h
NA = Not Available
* = Denotes mean speeds, not 85th percentile speeds
[ ] = Numbers in brackets refer to references

Dudek and Ullman conducted before and after studies where speed limits were lowered from 55 to 45 mi/h (89 to 72 km/h) on six urban fringe highway sites in Texas.[27] Roadway section lengths ranged from 2 to 3.9 mi (3.2 to 6.3 km). No significant changes were found in speeds or the speed distributions.

Studies conducted by Avery and Elmberg revealed that there were few changes in the mean, standard deviation, and percentage of vehicles in the pace when speed limits were established on the basis of the 85th percentile speed.[22,23]

While much of the previous speed limit research on nonlimited access highways was limited in scope, several trends are worth noting. First, the magnitude of any change in speed due to a speed limit alteration was small, typically 1 mi/h (1.6 km/h), even in cases with large posted speed limit changes. Secondly, due to the speed limit change and the fact that driver compliance is measured as the number or percentage of motorists driving at or below the posted limit, there was a significant change in compliance.

The findings of the current study, as well as the results of previous research, indicate that changing the posted speed limit did not have a major effect on driver behavior on the urban and rural nonlimited access highway sections that were studied.



EFFECTS ON CRASHES

Prior to collecting before and after speed data for this study, the effects of posted speed limit changes on vehicle speeds for a large sample of jurisdictions were unknown. During the development of the experimental plan, it was assumed that posted speed limits would have an effect on driver speeds, and that the speed changes would be large enough to have an effect on crashes.[10] Accordingly, at that time, a decision was made to collect and analyze crash data.

As the results of the driver behavior analysis indicate, vehicle speed changes at individual study sites, although statistically significant, were small, i.e., generally less than 2 mi/h (3.2 km/h). As there were small differences in vehicle speeds, irrespective of whether posted speed limits were raised or lowered and the amount of the change, there is no reason to suspect that changing posted speed limits at the study sites had an effect on crashes. Thus, any changes in crashes at the study sites may be attributed to other factors beyond the scope of this study, and not to altering the posted speed limits.

As before and after crash data were collected at the experimental and comparison sites, the data were analyzed and the results are reported in this section.

As previously mentioned, the study sites were located in 22 States. In any crash evaluation, the quality of the data is always a major concern.[34] It is well known that crash reporting practices, reporting thresholds, level of detail, and other factors that affect the quality of crash data vary widely among States and jurisdictions. While attempts were made to obtain accurate crash data for the study sites, the overall quality of the data is unknown. Accordingly, the results of this or any other evaluation that uses multi-State data should be interpreted with caution.

Analysis Methodology

As the participating States and jurisdictions would not permit random selection and assignment of sites to experimental and control groups, experimental sites were selected from locations furnished by the jurisdictions where speed limit changes were made as part of a routine traffic and engineering investigation. By necessity, comparison sites were selected by the research team in the field during the review of the experimental sections. Although the team attempted to match comparison sites and experimental sites with similar safety and operational characteristics, i.e., number of

Because a crash at a site is rare compared to other events, such as traffic volume, free-flow vehicle speeds, etc., the minimum sample size requirements for the study were based on estimated crash counts. As sites were furnished by the participating agencies, attempts were made during the site selection process to ensure that the minimum sample size would be obtained. It was clear early in the site selection process that crash counts at the selected sites were less than originally estimated. As a result, additional sites beyond the 100 mi (161 km) originally estimated were selected until all of the available funding for data collection was depleted.

After speed limit changes were made on the experimental sections, police-reported crash data were obtained for each experimental and comparison site. The crash data were received from the participating agencies in a variety of formats, including computerized summaries, hard copies of the reports, and data formatted on computer diskette.

Before and after crash data were collected for 99 experimental sites and their corresponding comparison locations. As speed limits on the experimental sections were posted on different dates, every effort was made to collect as much crash data as possible to increase the sample size. For most locations, the crash data were collected for a 3-yr before period and a 2-yr after period. The final crash data base available for analysis contained 6,307 crashes.

Shown in appendix E are the before and after summaries of the total police-reported crashes and fatal and injury crashes for each experimental and comparison site.

Evaluation Design

The evaluation design selected to estimate the effectiveness of speed limit changes on crashes was the before-and-after design with a comparison group, and a check for comparability .[35] With this design, multiple before and after crash counts are taken at both the experimental and comparison locations. The purpose of the multiple measurements is to determine if the comparison locations are suitable comparisons for the experimental sites. The purpose of the comparison group is to account for changes in safety (such as weather conditions, driver characteristics, etc.) between the before and after periods, The primary benefit of this design is that the comparison group controls for extraneous factors, and as multiple measurements are made over a number of years, some relief from regression-to-the-mean bias is possible.

Numerous statistical methods have been used for analyzing categorical crash data. Each method contains strengths and weaknesses. For example, the simple before-and-after design may be biased due to nonrandom errors introduced by unaccounted for factors that unevenly affect crashes in the before or after period. On the other hand, the use of a comparison group with a small number of crashes can also bias the results. Due to the strengths and weaknesses of various analysis methods, four different techniques were used to estimate the safety effects of the speed limit changes.

The first method, reported by Griffin, uses multiple before and after analyses with paired comparison ratios to estimate the overall safety effects at multiple treatment locations.[36,37] The second method is the classical cross-product ratio or odds ratio that estimates safety effects based only on the total crash counts at the sites. Application of this method is also discussed by Griffin.[35]

Because regression-to-the-mean is an important factor that can often lead to erroneous conclusions in crash analyses, the third analysis method employed the use of a new empirical Bayes method, EBEST (Empirical Bayes Estimation of Safety and Transportation), which adjusts for regression-to-the-mean bias and provides a more realistic estimate of the safety effects.[38] The EBEST procedure requires a reference group and measurement of site exposure. Because the reference group available for use in this study was smaller than required for appropriate application of the method, the procedure was used primarily to approximate the amount of regression-to-the-mean bias in the dataset.

The fourth analysis method is the before-and-after design that uses the weighted average logit to produce an overall estimate of safety effects at multiple treatment locations.[39] This method does not use comparison sites to control for extraneous factors. The results obtained with the before-and-after design may contain nonrandom errors such as changes in traffic volumes, weather conditions, crash reporting thresholds, and other factors. Thus, the safety estimates produced by this method may be biased and invalid.

The before-and-after design with a comparison group and a check for comparability can be used to estimate the effects of a treatment on crashes at a single site or for a group of sites if the number of reported crashes is sufficiently large. In this study, the design was used to estimate safety effects for groups of sites. The design was not used to estimate the effect of posted speed limit changes on crashes at each individual experimental site due to the small number of crash counts at the experimental and comparison sites . In addition, the comparison group must have a sufficient number of crashes, otherwise, it is better not to use it.[40]

The comparison group was not used to estimate the safety effects when the comparability tests indicated that the crash histories either during the before period or during the after period at the experimental and comparison sites were not comparable. When the groups were not comparable, the before-and-after design, using the weighted average logit, was employed.[39]

The null hypothesis tested was that the observed crashes after treatment, i.e., installation of the new speed limit signs, were equal to the expected crashes after treatment. All statistical analyses were conducted at the 0.05 significance level (a). Rejection of the null hypothesis required a probability or p-value <0.05.

For each of the analysis methods, the expected crashes after treatment explicitly considered unequal before and after reporting periods and changes in traffic volumes at the sites.

Procedure

The analysis procedure included the following steps:

(1) Conduct a check for comparability.

(2) Estimate the treatment effects using multiple before and after analyses with paired comparison ratios. The comparison ratios adjust the expected number of crashes for unequal time periods and changes in traffic volumes.

(3) Estimate the treatment effects using the classical cross-product ratio or odds ratio based on the total number of crashes in the evaluation group.

(4) Use the empirical Bayes method to examine the amount o f regression-to-the-mean bias present in the sample.

(5) Estimate the safety effects using the before-and-after design that employs the weighted average logit.

Estimates of the effects of speed limit changes on total crashes were made for the following groups:

- The 58 experimental sites where posted speed limits were lowered using 49 corresponding comparison sites. In addition, the sites were further analyzed by level of posted speed limit change, i.e., reduced by 5, 10, or 15 and 20 mi/h (8, 16, or 24 and 32 km/h).

- The 41 experimental sites where posted speed limits were raised using 34 corresponding comparison sites. These sites were further subdivided into two groups, i.e., raised 5 mi/h (8 km/h) and raised 10 and 15 mi/h (16 and 24 km/h).

- The 21 sites where speed limits were posted within 5 mi/h (8 km/h) of the 85th percentile speed and the 34 sites where the speed limits were posted more than 5 mi/h (8 km/h) below the 85th percentile speed.

Estimates of the effects of speed limit changes on fatal and injury crashes were also made for the lowered and raised speed limit groups. Due to sample size limitations of these data, no analyses were conducted for the amount of speed limit change groups.

Although it is possible to subdivide the sites into other groups, this was not done as further subdivisions produced too small a sample size for analysis.

Details of the analysis procedure, along with an example of the paired comparison ratios method, are provided in appendix F.

Results

As previously mentioned, the statistical analyses were conducted for sites where speed limits were lowered and sites where speed limits were raised. A summary of the results by analysis method is provided in table 24. illustrated graphically in figure 33 are the 95 percent confidence limits, which are very large for both lowered and raised posted speed limit conditions.

As shown in table 24, the results of the statistical tests indicated that there is not sufficient evidence in this dataset to reject the hypothesis that total crashes or fatal and injury crashes changed when posted speed limits were either raised or lowered.

The EBEST analysis indicated that the average shrinkage in the dataset where speed limits were lowered was 0.15. The average shrinkage in the dataset where speed limits were raised was 0.10. Average shrinkage factors range from 0 (no regression-to-the-mean bias) to 1 .0, indicating substantial bias. The shrinkage factors mentioned above provide an indication that regression-to-the-mean may not be a major factor with this dataset.

The paired comparison ratios method indicated that there was a statistically significant increase in crashes at the 14 sites where speed limits were lowered by 5 mi/h (8 km/h). This result must be viewed with caution due to the small number of crashes in the sample.

The before-and-after method indicated that there was a significant decrease in crashes at the 41 sites where speed limits were raised. This result is contrary to the results of the other methods and may be due to the previously cited limitations of the before-and-after method.

Results at 85th Percentile Sites

Crash data were analyzed for the 34 experimental sites where posted speed limits were initially within 5 mi/h (8 km/h) of the 85th percentile speeds and posted speed limits were lowered at these sites more than 5 mi/h (8 km/h) below the 85th percentile speeds. An analysis was also conducted for the 21 sites where speed limits were initially set more than 5 mi/h (8 km/h) below the 85th percentile speeds, and the posted speed limits were raised to within 5 mi/h (8 km/h) of the 85th percentile speeds.

As shown in table 25, there is not sufficient evidence in this dataset to reject the hypothesis that crash experience changed when posted speed limits were either raised to within 5 mi/h (8 km/h) of the 85th percentile speeds or lowered more than 5 mi/h (8 km/h) below the 85th percentile speeds. The 95 percent confidence limits for these estimates, which are large, are shown in figure 34.

Table 24. Summary of statistical tests.

Group	Crash* Sample Size Before	After	Comparability G-Value 3 df	prob.	Analysis Method	Percent Change in Crashes	Z-Value	prob.	95 Percent Confidence Limits Lower	Upper	X^2 Homogeneity	Degrees of Freedom	prob.
Lower Speed Limit Sites													
58 Experimental	1,247	776	1.85	0.61	Paired Comp.	6.86	0.74	0.46	-10.42	27.47	48.36	57	0.78
49 Comparison	635	405			Odds Ratio	-2.43	-0.31	0.76	-16.32	13.76			
					EBEST	-1.45	-0.33	0.74	Reference group too small to provide reliable results.				
					Before-After	0.80	0.17	0.87	-8.09	10.55	56.05	57	0.51
Fatal and Injury Crashes													
58 Experimental	456	271	2.94	0.37	Paired Comp.	5.20	0.35	0.73	-20.59	39.38	38.37	57	0.97
49 Comparison	263	162			Before-After	1.50	0.19	0.85	-13.16	18.64	37.16	57	0.98
Lower Limit by 5 mi/h													
14 Experimental	291	214	0.69	0.87	Paired Comp.	44.44	2.29	0.02	5.38	97.98	12.23	13	0.51
12 Comparison	198	131			Before-After	17.29	1.71	0.09	-2.31	40.81	15.22	13	0.30
Lower Limit by 10 mi/h													
34 Experimental	735	441	3.56	0.32	Paired Comp.	-7.13	-0.62	0.54	-26.39	17.16	22.43	33	0.92
31 Comparison	351	227			Before-After	-3.91	-0.65	0.52	-14.87	8.45	30.99	33	0.57
Lower Limit by 15 or 20 mi/h													
10 Experimental	221	121	5.38	0.15	Paired Comp.	-4.72	-0.20	0.84	-41.34	54.76	8.64	9	0.48
9 Comparison	105	59			Before-After	-5.62	-0.50	0.62	-24.86	18.54	6.29	9	0.71
Raise Speed Limit Sites													
41 Experimental	1,169	683	7.33	0.07	Paired Comp.	-11.28	-1.37	0.18	-25.24	5.30	34.93	40	0.70
34 Comparison	861	534			Odds Ratio	-5.80	-0.82	0.41	-18.38	8.73			
					EBEST	-5.91	-1.27	0.20	Reference group too small to provide reliable results.				
					Before-After	-9.98	-2.10	0.04	-18.38	-0.72	42.46	40	0.37
Fatal and Injury Crashes													
41 Experimental	459	282	5.52	0.15	Paired Comp.	-6.78	-0.52	0.60	-28.28	21.18	28.92	40	0.90
34 Comparison	350	226			Before-After	-3.21	-0.42	0.67	-16.93	12.77	31.24	40	0.83
Raise Limit by 5 mi/h													
26 Experimental	816	537	18.30	>0.001	Before-After	-8.28	-1.51	0.14	-18.02	2.63	32.68	25	0.15
23 Comparison	599	431											
Raise Limit by 10 or 15 mi/h													
15 Experimental	353	146	12.61	0.008	Before-After	-15.21	-1.61	0.11	-30.61	3.61	9.33	14	0.80
12 Comparison	274	107											

1 mi/h = 1.61 km/h

* Crash counts are based on a 3-yr before and a 2-yr after period at most sites. See appendix E for crash counts at each site.

Table 25. Summary of crash results at 85th percentile sites.

Group	Crash* Sample Size Before	After	Comparability G-Value 3 df	prob.	Analysis Method	Percent Change in Crashes	Z-Value	prob.	95 Percent Confidence Limits Lower	Upper	X^2 Homogeneity	Degrees of Freedom	prob.
Sites where speed limits were within 5 mi/h of the 85th percentile steeds and speed limits were lowered more than 5 mi/h below the 85th Percentile speeds													
34 Experimental	854	501	4.40	0.22	Paired Comp.	13.90	1.24	0.22	-7.26	39.90	34.75	33	0.39
30 Comparison	478	291			Before-After	0.25	0.04	>0.90	-10.46	12.24	33.91	33	0.43
Sites where speed limits were more than 5 mi/h below the 85th oercentile speeds an d speed limits were raised to within 5 mi/h of the 85th oercentile speeds													
21 Experimental	693	407	29.38	>0.001	Before-After	-8.32	-1.34	0.18	-19.25	4.09	19.75	20	0.48
17 Comparison	409	202											

1 mi/h = 1.61 km/h

* Crash counts are based on a 3-yr before and a 2-yr after period at most sites.
See appendix E for crash counts at each site.

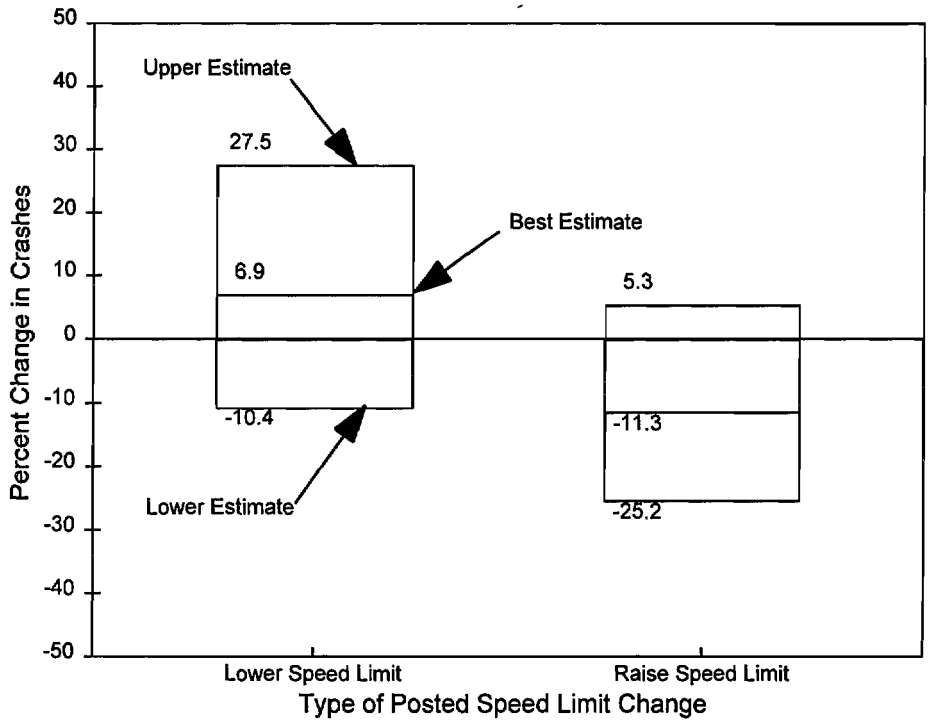


Figure 33. Summary of crash effects at sites where posted speed limits were altered.

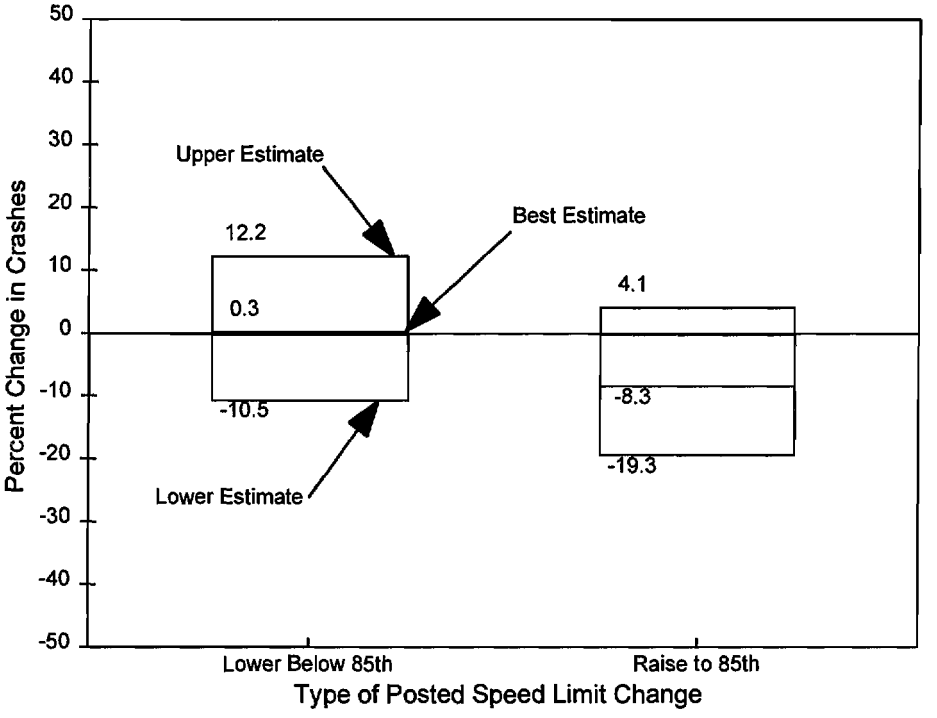


Figure 34. Summary of crash effects at sites where speed limits were lowered below or raised to the 85th percentile speeds.

Multiple-Vehicle vs. Single-Vehicle Crashes

Before-and-after crash data collected at the study sites provided information on crash severity, persons killed and injured, collision type, number of vehicles, lighting conditions, roadway surface conditions, intersection-relatedness, and estimated speeds of the vehicles involved in the crashes. Information on contributing circumstances was not available for all jurisdictions. While a breakdown of the crashes by each of these variables is possible, the resulting number of crashes is too small to provide meaningful results.

In order to provide an indication of the sample sizes for each speed limit change group, the crash data were summarized for multiple-vehicle and single-vehicle crashes for equal before and after time periods. The results are shown in table 26. If lowering the speed limit resulted in additional vehicle queues, one might expect an increase in multiple-vehicle crashes. On the other hand, if speed limits were raised, it is plausible that there could be an increase in single-vehicle crashes, assuming that all other factors remained the same.

As shown in table 26, there was a small percent increase in multiple-vehicle crashes for all speed limit groups. As traffic volumes increased by 4 to 12 percent during the study period for the group of sites, this result is most likely due to volume increases at the sites, as opposed to the posted speed limit change. In fact, the limited amount of short headway data collected during the study indicated that the proportion of vehicles traveling at short headways after the new speed limits were posted did not change at locations where traffic volumes did not change.

Table 26. Multiple-vehicle and single-vehicle crashes.

Speed Limit Change, mi/h	Multiple-Vehicle					Single-Vehicle				
	3-yr Before		2-yr After		Diff.	3-yr Before		2-yr After		Diff.
	No.	Pct.	No.	Pct.	Pct.	No.	Pct.	No.	Pct.	Pct.
-15 & -20	149	67.42	74	72.55	5.13	72	32.58	28	27.45	-5.13
-10	503	68.44	270	74.38	5.94	232	31.56	93	25.62	-5.94
- 5	205	74.01	177	83.10	9.09	72	25.99	36	16.90	-9.09
+ 5	548	69.28	393	74.86	5.58	243	30.72	132	25.14	-5.58
+10 & +15	275	77.90	115	79.31	1.41	78	22.10	30	20.69	-1.41

1 mi/h = 1.61 km/h

Crash-Speed Relationships

In an effort to examine if changes in the speed distributions produced corresponding changes in crashes at the study sites, scatter plots of selected variables were developed. No attempt was made to develop a mathematical model, as the primary interest was to examine before-and-after differences in the variables.

Selected parameters of the speed distributions were plotted against changes in crashes at the experimental sites. For example, the changes in crashes vs. the changes in 85th percentile speeds are shown in figure 35 for sites where speed limits were lowered. The data for sites where speed limits were raised are shown in figure 36. The changes in crashes vs. the changes in mean speeds are shown in figures 37 and 38 for the lowered and raised sites, respectively. The changes in crashes vs. the changes in coefficients of variation (the standard deviation divided by the mean) of speeds are shown in figures 39 and 40 for the lowered and raised sites, respectively.

As can be seen by examining figures 35 through 40, the scatter plots do not provide an indication of any relationship between changes in crashes and changes in the three speed parameters examined. It is important to note, however, that the changes in the speed distributions are quite small, perhaps too small to have an effect on crashes.

Changes in crashes with changes in other speed variables, including the 50th percentile speed, the upper limit of the pace, and the skewness index, were plotted. These plots also did not reveal any trends or relationships.

A scatter plot was also developed to determine if a relationship exists between the ratio of after-to-before 85th percentile speeds and the ratio of after-to-before crashes. For example, if the after-to-before speed ratio is greater than 1 .O, there has been an increase in the 85th percentile speed. One might expect that an increase in speed could increase the crash ratio. Similarly, when the speed ratio is less than 1 .O, one might expect a decrease in the crash ratio. Shown in figures 41 and 42 are plots of the crash-speed ratios for the lowered and raised speed limit sites, respectively. These plots also do not show a relationship between the crash-speed ratios.

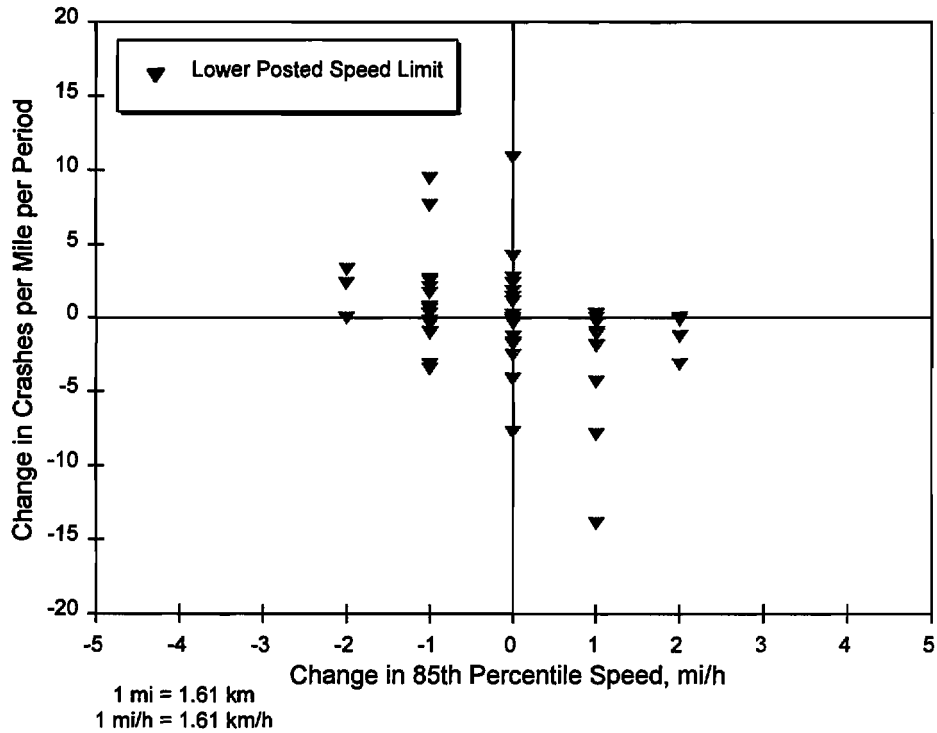


Figure 35. Before and after changes in crashes vs. changes in the 85th percentile speeds at sites where speed limits were lowered.

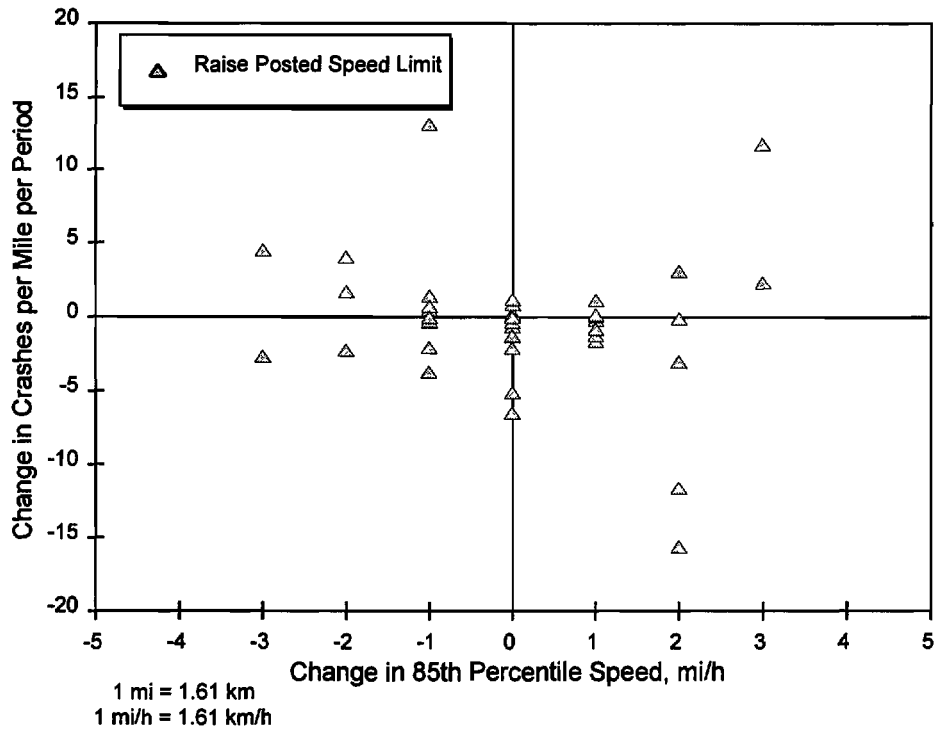


Figure 36. Before and after changes in crashes vs. changes in the 85th percentile speeds at sites where speed limits were raised.

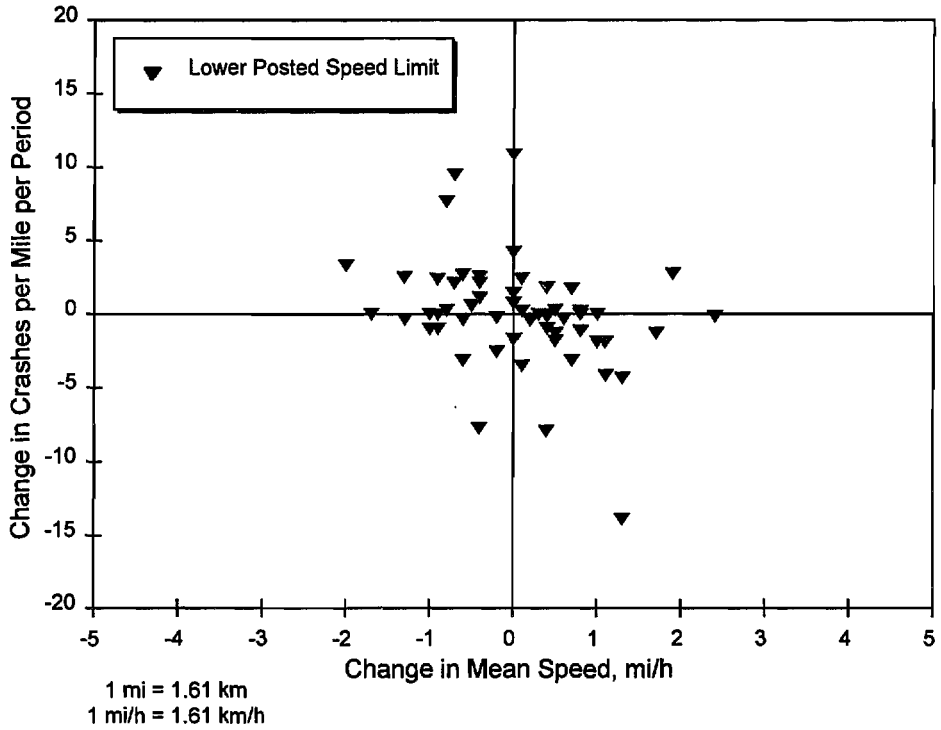


Figure 37. Before and after changes in crashes vs. changes in the mean speeds at sites where speed limits were lowered.

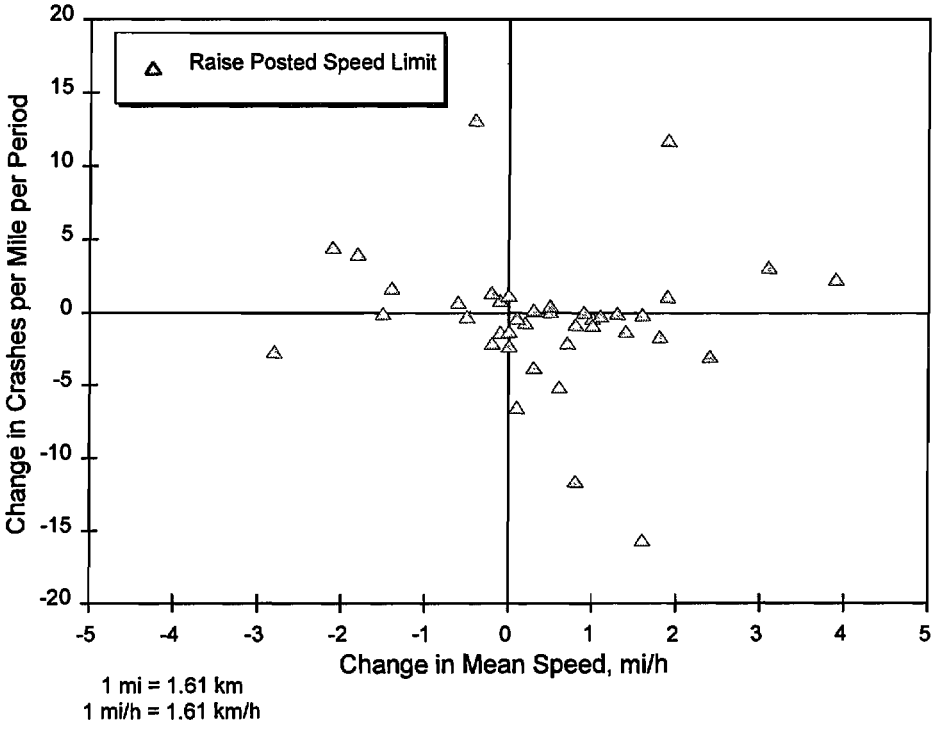


Figure 38. Before and after changes in crashes vs. changes in the mean speeds at sites where speed limits were raised.

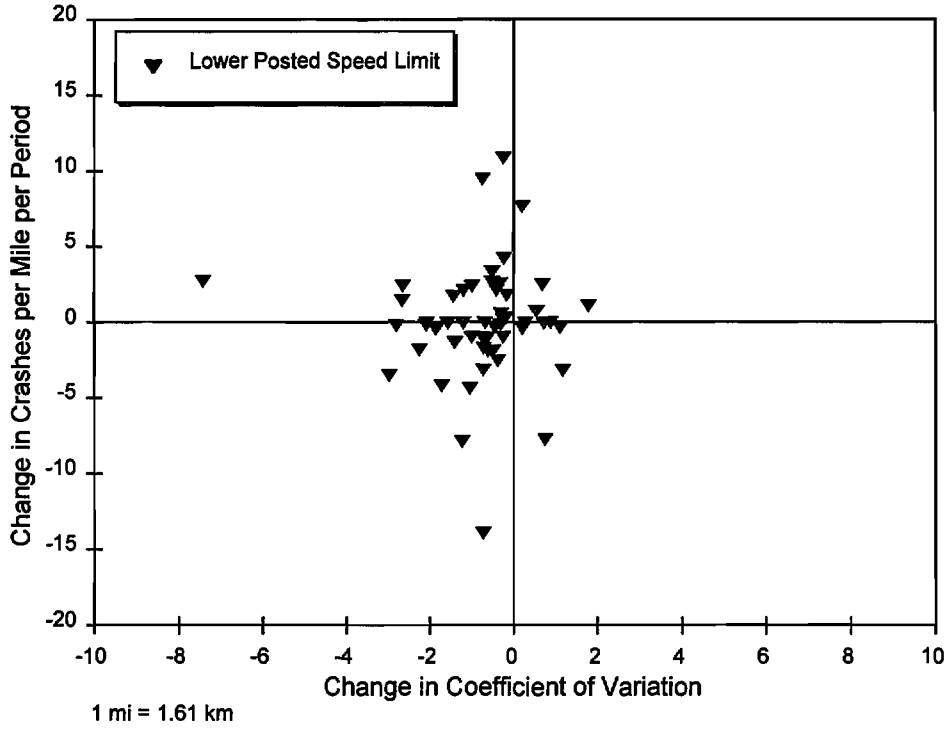


Figure 39. Before and after changes in crashes vs. changes in the coefficients of variation of speeds at sites where speed limits were lowered.

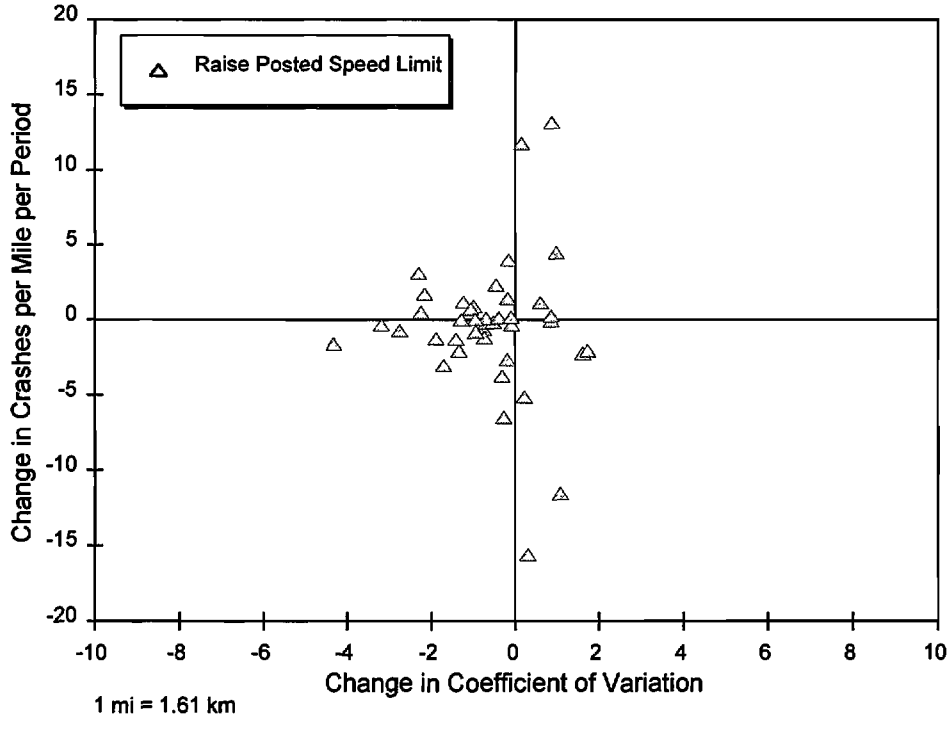


Figure 40. Before and after changes in crashes vs. changes in the coefficients of variation of speeds at sites where speed limits were raised.

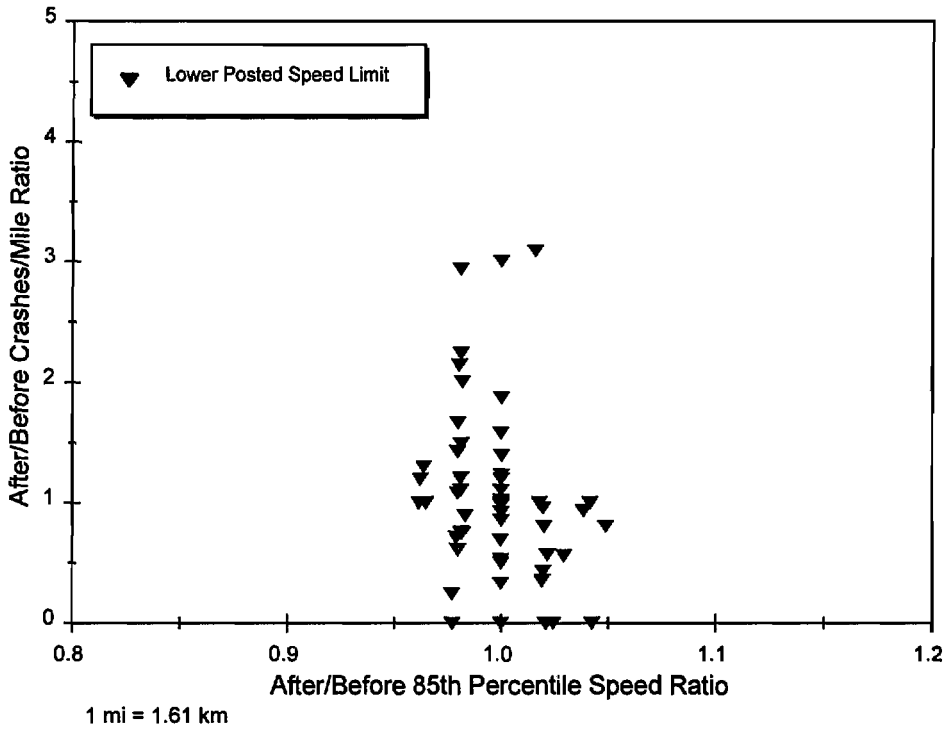


Figure 41. Ratio of the change in crashes vs. ratio of the change in 85th percentile speeds where speed limits were lowered.

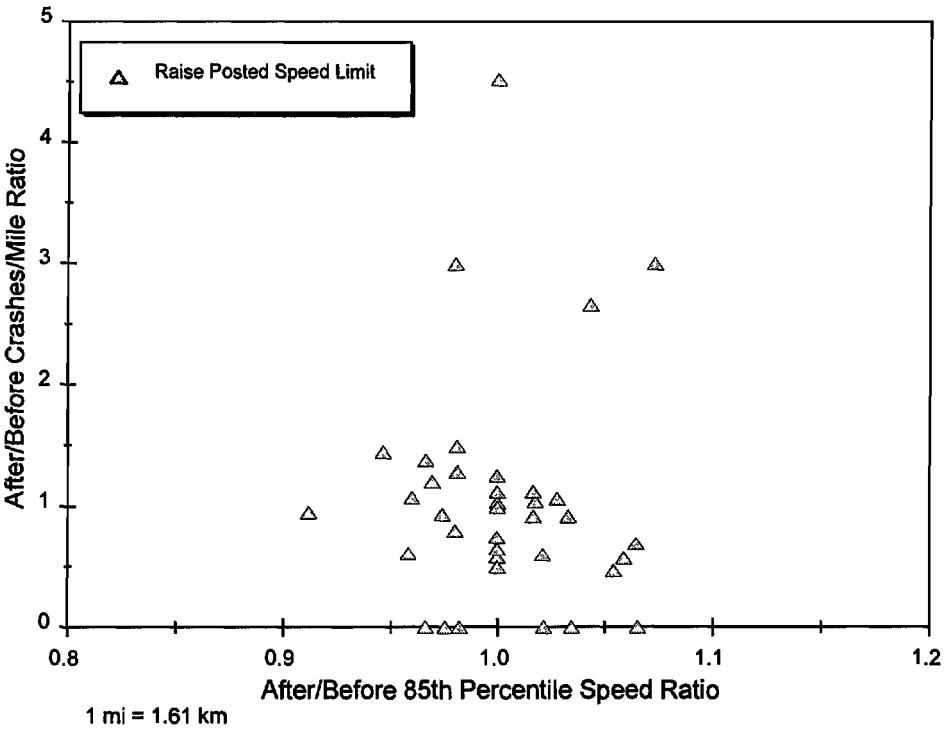


Figure 42. Ratio of the change in crashes vs. ratio of the change in 85th percentile speeds where speed limits were raised.

Discussion of Crash Effects

Before and after crash data were collected at the study locations because it was assumed that posted speed limits could have an effect on driver speeds, and that the speed changes would be large enough to have an effect on crashes. As the results of the before and after speed analyses indicate, vehicle speed changes at the study sites were small. Accordingly, it is not logical to assume that changing the posted speed limits at the study sites had an effect on crashes.

As before and after crash data were collected at the study sites, the data were analyzed using four crash evaluation analysis methods. Before and after crash data were analyzed for 99 experimental sites and their corresponding comparison locations.

The results of the statistical tests indicate that there is not sufficient evidence to reject the hypothesis that total crashes or fatal and injury crashes changed when posted speed limits were either raised or lowered.

Crash data were also analyzed for 34 experimental sites where posted speed limits were initially set within 5 mi/h (8 km/h) of the 85th percentile speeds and posted limits at these sites were lowered more than 5 mi/h (8 km/h) below the 85th percentile speeds. An analysis was also conducted for the 21 sites where speed limits were initially set more than 5 mi/h (8 km/h) below the 85th percentile speeds and the limits at these sites were raised to within 5 mi/h (8 km/h) of the 85th percentile speeds. The results of these analyses indicate that there is not sufficient evidence to reject the hypothesis that crash experience changed when posted speed limits were either lowered more than 5 mi/h (8 km/h) below the 85th percentile speeds or raised to within 5 mi/h (8 km/h) of the 85th percentile speeds.

Because random selection and assignment of roadway sections to experimental groups for posted speed limit changes and to control groups were not possible, these findings apply only to the study locations and cannot be generalized.

Although many transportation engineers and the public consider posted speed limits to be associated with safety, very few investigators have studied the effect of changing speed limits on crashes on nonlimited access highways. Most of the recent studies have dealt with the effects of 55- and 65-mi/h (89- and 105-km/h) speed limits on crashes on high-speed limited access highways. As the scope of this study only included nonlimited access facilities, the following discussion only pertains to studies on nonlimited access highways.

Kessler found that when speed limits were raised at 30 locations in Illinois, the 85th percentile speeds did not change; however, the number of crashes decreased from 62 to 40.[28]

Wenger examined crash experiences at 25 locations in St. Paul, Minnesota, and found that raising speed limits from 30 to 35 or 40 mi/h (48 to 56 or 64 km/h) adversely affected crashes.[41]

Dudek and Ullman examined the impacts of posting speed limits below the 85th percentile speeds at six locations in Texas and found no conclusive effect on either travel speeds or crashes.[27]

McCoy et al. collected crash, speed, and other data at 38 nonlimited access sites in Nebraska.[42] The sections examined ranged from 0.2 to 1.2 mi (0.3 to 1.9 km) in length, and average daily traffic volumes ranged from 500 to 20,000 vehicles. The results of their analyses indicated that sites with reasonable speed limits set by the Nebraska Department of Roads' method of speed zoning were safer than zones with posted speed limits that were set 5 or 10 mi/h (8 or 16 km/h) below the reasonable limits.

One problem with the previous research, including the current study, is the small number of crashes used to estimate the safety effects.

The study with the largest crash sample size conducted to date was completed by Parker in Michigan .[21] The study included experimental sites where posted speed limits were changed, and corresponding comparison sites where no changes were made. Before and after crash data were collected for 68 nonlimited access highway sections and 86 comparison sections. At the experimental sites, 11,120 crashes were available for analysis. At the 86 comparison sites, 26,617 crashes were analyzed.

Analysis of the data indicated that there was not sufficient evidence to reject the hypothesis that crash experience changed when posted speed limits were either raised or lowered. The same finding was reported for sites where the speed limit was set at the 85th percentile speed and at sites where the speed limit was posted more than 5 mi/h (8 km/h) below the 85th percentile speed. Although the Michigan crash data base was much larger than the crash data base used in the current study, the results were the same.

Based on the best information available to date, there is no evidence to suggest that lowering or raising posted speed limits on nonlimited access roadways has an effect on crashes. Reducing the posted speed limit without utilizing other enforcement, educational, and engineering measures does not appear to be an effective safety treatment.

SUMMARY, FINDINGS, AND CONCLUSIONS

SUMMARY

This research was conducted to examine the effects of raising and lowering posted speed limits on driver behavior for urban and rural nonlimited access roadways. The scope of the study was limited to examining changes in driver behavior when the only change was an alteration in the posted speed limit.

Due to legislative requirements, tort liability issues, and public confidence concerns, the participating States and jurisdictions would not permit the research team to randomly select and assign roadway sections for speed limit changes. Because the original study design could not be implemented, experimental sections were selected from locations where transportation agencies planned to change posted speed limits as a result of routine traffic and engineering investigations. Based on safety and operational characteristics, comparison sites were selected by the research team during a field review of the experimental locations.

The study was conducted from October 1985 to September 1992, when the maximum speed limit was 55 mi/h (89 km/h) on nonlimited access highways. During this period, the States and localities lowered and raised posted speed limits on short roadway segments, typically less than 2 mi (3.2 km) in length. The general types of sites included in the study were:

1. A roadway section in a small rural town or community where the speed limit on the adjoining roadway sections was 55 mi/h (89 km/h). The length of these sections varied between 0.5 and 1 mi (0.8 and 1.6 km).

2. A roadway section in an urban. suburban. or rural area where public or political requests or increases or decreases in the adjacent land use and corresponding traffic volumes dictated the need for a change in the speed limit. These sections were typically 1 mi (1.6 km) in length.

3. A two- or four-lane nonlimited access roadway section in a rural area where the speed limit was raised to 55 mi/h (89 km/h). These sections were between 2 and 12 mi (3.2 and 19.3 km) in length.

Posted speed limits were changed for the following reasons:

- As a result of a request from the public, political leaders, or enforcement officials.
- To ensure that speed limits were appropriate for roadway and traffic conditions.
- As a result of a high incidence of traffic crashes.
- To comply with local laws or ordinances.
- In response to changing traffic volume and land-use patterns.

The study included the collection of driver behavior and crash data in 22 States. The data were collected at 100 sites on nonlimited access highways, consisting of 172 mi (277 km) where speed limits were either lowered or raised, and at 83 comparison sites, consisting of 132 mi (213 km), where no changes in the posted speed limits were made. Sixty-three percent of the sites selected were in rural areas and small communities with a population of less than 5,000 persons. Ninety-four percent of the sections were two-lane highways. Traffic volumes on the sections ranged from 300 to 17,000 vehicles/day.

Of the 100 study sites, posted speed limits were lowered at 59 sites and raised at 41 other locations. Changes in the posted speed limits ranged from lowering the speed limit by 5, IO, 15, or 20 mi/h (8, 16, 24, or 32 km/h) to raising the speed limit by 5, 10, or 15 mi/h (8, 16, or 24 km/h). Only one change in the posted speed limit was made at each site during the study.

Speed limits on the experimental sections were changed between July 1986 and May 1989. The before speed data were collected between June 1986 and June 1988. The after speed data were collected between August 1987 and July 1989. Collection of the before data ranged from several days to 2 years prior to the speed limit change. Collection of the after data ranged from several days to as much as 2 years following the speed limit change.

The examination of driver behavior data, collected at 98 experimental sections, included the speed distribution (percentile speeds), mean speeds, speed variance, percentage of drivers exceeding the posted speed limit, and close following behavior. Before and after speeds of free-flow vehicles (vehicles with a headway of 4 s or more) were collected for a 24-h period simultaneously at each experimental and comparison site pair.

The crash data collected included police-reported crashes, crashes involving injury or death, and multiple-vehicle and single-vehicle crashes. Before and after crash data were collected at 99 experimental sections and their corresponding comparison sections. For most sections, crash data were available for a 3-yr period before the speed limit was changed and for a 2-yr after period. A total of 6,307 police-reported crashes were used in the analysis.

Analyses were conducted to examine before-and-after differences in driver behavior at each site. The sites were divided into lowered posted speed limit and raised posted speed limit groups. The sites were further subdivided into groups based on the amount of posted speed limit change. Group means and other statistics were calculated for each of the speed variables collected.

Four evaluation methods were used to analyze the crash data. The methods included multiple before and after analyses with paired comparison ratios, the classical cross-product ratio, the new empirical Bayes method, and the before-and-after design using a weighted average logit to produce an overall estimate of safety effects.

FINDINGS

Sites for this study were selected from locations where the participating agencies planned to make speed limit changes. Nonrandom selection of sites can produce biased results and limits the findings and conclusions to the locations studied. The findings may apply to similar sites where the speed limits are changed for similar reasons. Generalizations to other roadways are not appropriate.

This study, conducted to examine the effects of lowering and raising posted speed limits on nonlimited access rural and urban highways, produced the following findings:

- A review of the before and after speed data at each site revealed that differences in mean speeds, standard deviations of speeds, 85th percentile speeds, and other percentile speeds were generally less than 2 mi/h (3.2 km/h) and were not related to the amount the posted speed limit was changed.

- When sites were grouped by amount of speed limit change, the differences in percentile speeds for each group were less than 1.5 mi/h (2.4 km/h), irrespective of whether the speed limit was lowered or raised or the amount that the limit was changed. As shown in figure 43, the average change in percentile speeds at sites where speed limits were lowered and at sites where speed limits were raised was less than 1 mi/h (1.6 km/h).

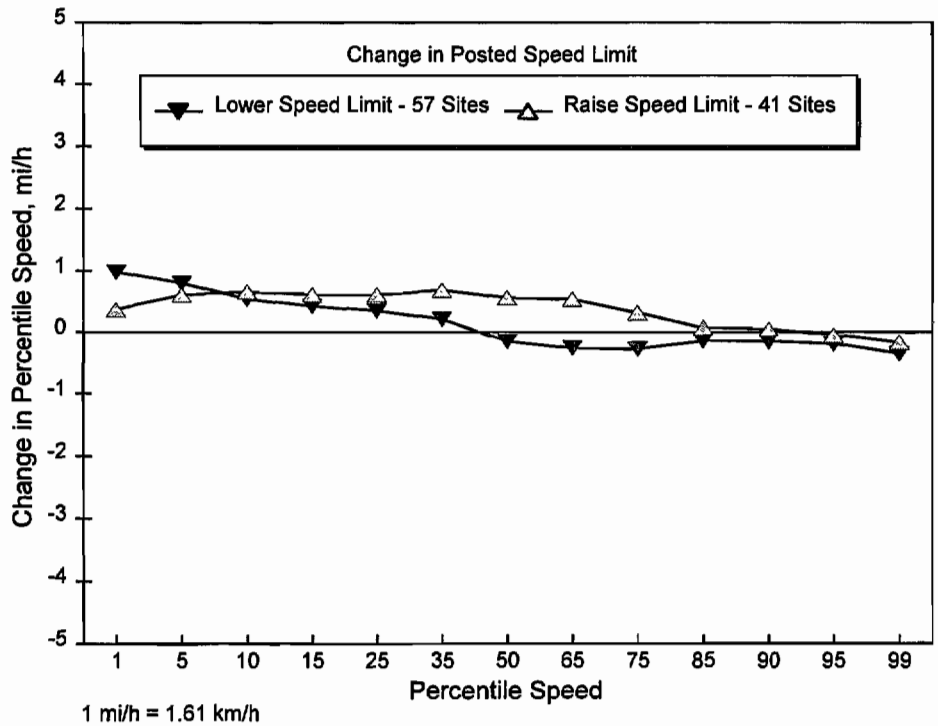


Figure 43. Mean changes in percentile speeds after speed limits were lowered at 57 sites and raised at 41 sites.

- The small differences in before and after speeds, as shown in figure 43, were statistically significant due primarily to the large sample size collected.

- At 34 locations, existing speed limits were posted within 5 mi/h (8 km/h) of the 85th percentile speeds. When speed limits at these sites were lowered more than 5 mi/h (8 km/h) below the 85th percentile speeds, the mean difference in percentile speeds was less than 1 mi/h (1.6 km/h).

- At 21 other locations, existing speed limits were posted more than 5 mi/h (8 km/h) below the 85th percentile speeds. When the agencies raised the limits to within 5 mi/h (8 km/h) of the 85th percentile speeds at these sites, the mean difference in percentile speeds was less than 1 mi/h (I .6 km/h).

- By defining driver compliance as the number or percentage of drivers that travel at or below the posted speed limit, major changes in compliance occurred when speed limits were raised or lowered. However, as reflected in small changes in vehicle speeds, driver behavior did not change, but the standard for measuring compliance, i.e., posted speed limit, changed.

- Based on the free-flow speed data collected for a 24-h period at the experimental and comparison sites in 22 States, posted speed limits were set, on average, at the 45th percentile speed or below the average speed of traffic.

- Only minor changes in vehicles following at headways of less than 2 s were found at the experimental sites with similar before and after traffic volumes.

- The indirect effects of speed limit changes on a sample of five contiguous and adjacent roadways were found to be small and insignificant.

- There is not sufficient evidence, in this dataset, to reject the hypothesis that total crashes or fatal and injury crashes changed when posted speed limits were either lowered or raised.

- There is not sufficient evidence, in this dataset, to reject the hypothesis that total crashes changed when posted speed limits were lowered more than 5 mi/h (8 km/h) below the 85th percentile speeds.

- There is not sufficient evidence, in this dataset, to reject the hypothesis that total crashes changed when posted speed limits were raised to within 5 mi/h (8 km/h) of the 85th percentile speeds.

- In April 1987, when Congress permitted States to raise speed limits to 65 mi/h (105 km/h) on selected limited access highways, speed and crash data were collected for a sample of four limited access Interstate segments. The findings concerning speed and crashes, which are different than those found on the nonlimited access roadway sites studied, are discussed in appendix G.

CONCLUSIONS

The general conclusions of this study are:

- There is statistically sufficient evidence in this dataset to reject the hypothesis that driver speeds do not change when posted speed limits are either raised or lowered. However, the differences in speeds are not sufficiently large to be of practical significance, and are due primarily to large sample sizes.

- Although the changes in vehicle speeds were small, driver violations of the speed limits increased when posted speed limits were lowered. Conversely, violations decreased when speed limits were raised. This does not reflect a change in driver behavior, but a change in how compliance is measured, i.e., from the posted speed limit.

- The majority of motorists did not drive 5 to 10 mi/h (8 to 16 km/h) above the posted speed limit when speed limits were raised, nor did they reduce their speed by 5 to 10 mi/h (8 to 16 km/h) when speed limits were lowered.

- Based on the sites selected for this study, it appears that highway agencies have a tendency to set speed limits slightly below the average speed of traffic.

- Changing posted speed limits alone, without additional enforcement, educational programs, or other engineering measures, has only a minor effect on driver behavior.

- There is not sufficient evidence in this dataset to reject the hypothesis that crash experience changed when posted speed limits were either lowered or raised.

SUGGESTIONS FOR FUTURE RESEARCH

Based on the results of this research, the following areas are suggested for further investigation:

- There is an immediate need to examine the State policies and practices used to set posted speed limits on nonlimited access facilities. In particular, attention should be given to identifying factors or a method that leads to establishing uniform speed limits for similar roadway and traffic conditions.

- The use of automated equipment and other alternative economical means of collecting unbiased speed data used to set speed limits should be explored as an alternative to the conventional use of radar.

- Actual prevailing speed data for a variety of roadway geometrics and highway systems should be summarized and provided to design engineers for use as a guideline when setting the design speed on a proposed roadway project.

- The implications of setting speed limits based on samples obtained by using an hourly or minimum vehicle requirement should be reexamined. Based on the 2-h data collection increments from the current study, as well as recent research conducted in Michigan, wide variations in the 85th percentile speeds occurred throughout the 24-h recording periods.[21] In addition, the hourly variations were not consistent from site to site. This suggests that speed samples should be taken throughout the day to obtain a representative sample of the 85th percentile speed, as opposed to collecting a sample over a short time period such as 2 h.

Table 27. Experimental site characteristics.

Experimental Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Before Speed Limit	After Speed Limit	Date New Limit Posted	Intersections Signalized	Intersections No Signal Per Mile	Driveways Comm. Per Mile	Driveways Resid. Per Mile
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites												
NJ04E	Burlington County	Oxmead Road	Rural	1.03	2	50	30	02/28/89	0.00	3.88	0.00	11.65
TX03E	City of Rockwall	I-30 N. Frontage Road	Small Urban	0.80	2	55	35	05/01/87	0.00	7.50	11.25	0.00
VA06E	Scott County	72 West of Rte. 65	Rural	8.42	2	55	35	10/27/86		Data Not Available		
DE02E	New Castle County	428 N. of Odessa	Rural	2.11	2	50	35	11/06/86	0.00	2.84	2.84	18.96
NM01E	Dona Ana County	A-17	Rural	0.58	2	55	40	04/01/87	0.00	3.45	3.45	1.72
NM03E	Valencia County	Marquez Road	Rural	1.04	2	55	40	03/01/87	0.00	5.77	0.00	19.23
NM04E	Valencia County	Romero Road	Rural	1.39	2	55	40	03/01/87	0.00	5.76	0.72	26.62
OH02E	Lawrence County	243	Rural	2.74	2	55	40	07/13/86	0.00	2.92	5.11	21.53
OH13E	Portage County	43 at Suffield	Rural	1.00	2	55	40	06/30/87	2.00	7.00	19.00	35.00
TX05E	Highland Village & Flower Mound	FM 407	Rural	1.17	2	55	40	05/30/89	2.56	5.13	7.69	0.85
10 Sites				20.28								
Speed Limit Lowered by 10 mi/h at Experimental Sites												
CA01E	City of Modesto	Conant Avenue	Urban	0.61	2	35	25	03/05/87	0.00	16.39	9.84	19.67
DE03E	Sussex County	24 E. of Millsboro	Rural	0.77	2	50	40	12/12/86	0.00	0.00	24.68	6.49
DE04E	Kent County	166 near Kenton	Rural	1.38	2	50	40	12/15/86	0.00	1.45	1.45	28.99
IL01E	Lake County	Butterfield Road	Small Urban	0.89	2	50	40	01/19/88	2.25	13.48	4.49	0.00
IN01E	Hancock County	109 at Warrington	Rural	0.40	2	55	45	09/23/86	0.00	5.00	0.00	17.50
MA01E	Town of Boxford	Barehill Road	Rural	1.00	2	40	30	10/31/86	0.00	2.00	0.00	18.00
ME02E	City of Rockland	West Meadow Road	Small Urban	1.40	2	45	35	05/01/87	0.00	2.14	0.00	29.29
MI09E	Jackson County	106 at Munith	Rural	0.56	2	55	45	06/13/88	0.00	8.93	10.71	12.50
NE01E	Cass County	50 at Louisville	Rural	0.66	2	55	45	05/29/87	0.00	4.55	3.03	3.03
NJ02E	City of Millville	667	Small Urban	0.56	2	45	35	02/05/87	0.00	7.14	5.36	35.71
NJ03E	City of Millville	667	Small Urban	0.63	2	45	35	02/05/87	1.59	4.76	12.70	0.00
OH01E	Fulton County	20 at Oakshade	Rural	0.52	2	55	45	09/07/86	0.00	3.85	3.85	28.85
OH03E	Delaware County	315	Rural	7.26	2	55	45	01/16/87	0.14	1.79	0.83	11.85
OH04E	Athens County	33 at Shade	Rural	0.47	2	55	45	11/18/86	0.00	4.26	8.51	19.15
OH05E	Meigs County	7 at Tuppers Plains	Rural	0.83	2	45	35	12/10/86	0.00	6.02	18.07	66.27
OH06E	Wayne County	604 at Canaan	Rural	0.75	2	55	45	12/22/86	0.00	2.67	5.33	33.33

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 27. Experimental site characteristics (continued).

Experimental Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Before Speed Limit	After Speed Limit	Date New Limit Posted	Intersections Signalized Per Mile	Intersections No Signal Per Mile	Driveways Comm. Per Mile	Driveways Resid. Per Mile
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)												
OH07E	Butler County	129	Urban	0.64	2	55	45	11/26/86	0.00	4.69	7.81	42.19
OH08E	Madison County	38 at Plumwood	Rural	0.74	2	55	45	02/10/87	0.00	10.81	8.11	20.27
OH09E	Mahoning County	45 at Ellsworth	Rural	1.10	2	55	45	04/29/87	0.91	1.82	10.91	30.00
OH10E	**Mahoning County**	224 at Elisworth	Rural	0.70	2	55	45	05/12/87	1.43	4.29	30.00	28.57
OH11E	Washington County	124	Rural	0.73	2	50	40	03/23/87	0.00	8.22	20.55	15.07
OH12E	Trumbull County	7 at Burghill	Rural	1.33	2	55	45	10/15/87	0.00	2.26	18.05	45.86
OK01E	City of Muskogee	62 & 64 & 16	Small Urban	0.69	4	45	35	09/15/86	0.00	17.39	44.93	33.33
OK02E	City of Sallisaw	59	Small Urban	0.74	2	35	25	09/15/86	1.35	18.92	58.11	6.76
OK03E	City of Sallisaw	59	Small Urban	0.30	2	35	25	09/15/86	3.33	23.33	20.00	10.00
OK04E	City of Pryor	20	Small Urban	0.30	2	45	35	04/06/87	0.00	6.67	43.33	6.67
TX02E	City of Rockwall	I-30 N. Frontage Road	Small Urban	1.75	2	55	45	05/01/87	0.00	6.29	10.29	0.00
TX04E	City of McKinney	FR 3038	Small Urban	0.46	2	55	45	06/23/87	0.00	13.04	17.39	0.00
VA01E	**Chesterfield County**	144 S. of Chester	Small Urban	1.47	2	55	45	08/25/86	0.00	7.48	0.68	21.09
VA03E	Powhatan County	677	Rural	1.19	2	55	45	06/16/87	0.00	2.52	0.84	9.24
VA04E	**Powhatan County**	678	Rural	1.63	2	55	45	10/28/86	0.00	3.68	1.23	28.83
VA05E	**Powhatan County**	610	Rural	1.67	2	55	45	09/09/87	0.00	1.80	0.00	16.17
VA07E	**Smyth County**	16 S. of Marion	Rural	2.25	2	55	45	10/17/87	0.00	2.22	11.11	32.44
WV01E	**Kanawha County**	62 at Cross Lanes	Rural	1.14	2	45	35	08/04/86	0.88	11.40	35.96	20.18
WV03E	Mingo County	**49 at Matewan**	Rural	1.96	2	45	35	09/15/86	0.00	0.51	11.73	32.14
35	Sites			39.48								
Speed Limit Lowered by 5 mi/h at Experimental Sites												
AZ01E	City of Phoenix	Beardsley Road	Urban	1.00	2	50	45	04/28/87	1.00	5.00	3.00	1.00
CT02E	Cheshire County	10 South of Milldale	Small Urban	1.01	2	45	40	10/23/86	3.96	6.93	4.95	20.79
CT05E	Ellington County	83 South of Ellington	Rural	1.09	2	45	40	03/26/87	0.00	0.00	7.34	16.51
DE01E	**Sussex County**	357 near Ocean View	Rural	0.80	2	40	35	11/04/86	0.00	5.00	2.50	18.75
ID01E	**Ada County**	55 near Eagle	Rural	2.68	2	55	50	10/01/88	0.00	4.10	3.73	17.16
ID02E	**Ada County**	20	Rural	3.50	2	55	50	10/01/88	0.29	3.43	5.43	12.57

1 mi= 1.61 km
1 mi/h = 1.61 kmlh
Note: All speed limits are shown in mi/h.

Table 27. Experimental site characteristics (continued).

Experimental Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Speed Limit Before	Speed Limit After	Date New Limit Posted	Intersections Signalized	Intersections No Signal	Driveways Comm. Per Mile	Driveways Resid. Per Mile
Speed Limit Lowered by 5 mi/h at Experimental Sites (continued)												
IL02E	Lake County	45	Small Urban	1.04	2	50	45	10/08/86	0.96	5.77	9.62	26.92
IN05E	Spencer County	245 at Santa Claus	Rural	0.80	2	45	40	12/04/86	0.00	6.25	7.50	10.00
IN06E	Scott County	31 at N. Scottsburg	Small Urban	1.02	2	50	45	12/29/86	0.00	3.92	20.59	5.88
IN07E	Scott County	31 at S. Scottsburg	Small Urban	1.12	2	50	45	12/29/86	0.00	7.14	18.75	33.04
MA03E	Town of Boxford	Barehill Road	Rural	0.68	2	30	25	10/31/86	0.00	2.94	0.00	32.35
ME01	E City of Rockland	West Meadow Road	Small Urban	1.30	2	45	40	05/01/87	0.00	0.00	4.62	29.23
NJ01	E Mercer County	Klockner Road	Urban	0.88	2	40	35	02/09/87	2.27	9.09	3.41	51.14
NM02E	Dona Ana County	A-17	Rural	2.97	2	55	50	04/01/87	0.00	0.34	1.35	3.37
14	Sites			19.89								
Speed Limit Raised by 5 mi/h at Experimental Sites												
AZ02R	City of Phoenix	Grovers Avenue	Urban	1.00	2	25	30	07/22/87	0.00	15.00	4.00	73.00
AZ03E	City of Phoenix	29th Avenue	Urban	1.00	2	30	35	04/04/88	2.00	10.00	10.00	30.00
CA06E	City of Mission Viejo	Trabuco Road	Urban	0.89	4	45	50	04/30/87	2.25	7.87	4.49	0.00
CA07E	City of Mission Viejo	Marguerite Parkway	Urban	2.73	4	45	50	05/07/87	1.47	6.96	1.47	0.00
CO01E	Jefferson County	72	Rural	1.05	2	30	35	11/04/87	0.00	0.95	0.95	3.81
CO03E	Boulder & Gilpin Cos.	72	Rural	4.23	2	40	45	11/04/87	0.00	0.95	0.71	3.78
CT01E	Windsor & S. Windsor	291	Urban	1.77	4	45	50	12/11/86	0.00	0.00	0.00	0.00
CT04E	Sharon County	41 South of Sharon	Rural	0.47	2	30	35	10/24/86	0.00	4.26	4.26	29.79
DE05E	Kent County	105 near Star Hill	Rural	1.87	2	35	40	12/16/86	0.00	4.28	5.35	20.86
IN02E	City of Lafayette	3rd Street (Rt. 231)	Urban	0.38	2	25	30	10/06/86	7.89	36.84	63.16	0.00
IN03E	**City** of Lafayette	4th Street (Rt. 231)	Urban	0.38	2	25	30	10/06/86	7.89	36.84	34.21	0.00
MD01	E Carroll County	194	Rural	4.72	2	50	55	09/23/86	0.00	1.69	1.27	11.23
MD02E	Carroll County	27	Rural	7.33	2	50	55	11/19/86	0.00	3.68	0.68	5.32
MD03E	Carroll County	75	Rural	4.00	2	50	55	11/28/86	0.00	3.00	0.50	3.25
MD04E	Frederick County	75	Rural	5.83	2	50	55	11/17/86	0.00	2.23	0.17	8.06
MD05E	Frederick & Carroll Cos.	26	Rural	12.60	2	50	55	10/02/86	0.00	2.78	1.19	7.46
MD06E	Frederick County	194 at New Midway	Rural	0.80	2	30	35	10/22/86	0.00	5.00	10.00	27.50
MD07E	Carroll County	194 at Keymar	Rural	0.63	2	30	35	09/30/86	0.00	3.17	20.63	42.86

1 mi= 1.61 km
1 mi/h = 1.61 kmlh
Note: All speed limits are shown in milh.

Table 27. **Experimental site characteristics (continued).**

Ixperimental Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Before Speed Limit	After Speed Limit	Date New Posted	Intersections Signalized	Intersections No Signal	Driveways Comm. Per Mile	Driveways Resid. Per Mile
Speed Limit Raised by 5 mi/h at Experimental Sites (continued)												
MD08E	Frederick County	26 at Mt. Pleasant	Rural	0.95	2	30	35	02/25/87	0.00	5.26	16.84	47.37
MD09E	Frederick County	550 at Thurmont	Rural	0.57	2	30	35	01/09/87	0.00	17.54	5.26	31.58
MD10E	Howard County	32	Rural	12.49	2	50	55	10/24/87	0.00	2.64	0.08	5.04
MS02E	City of Brandon	18	Small **Urban**	0.68	2	30	35	02/18/87	0.00	8.82	1.47	30.88
TN01 E	Shelby County	Route 204	Rural	6.16	4	50	55	10/30/86	0.00	1.46	0.49	2.11
TX06E	City of Justin	FR 407	**Rural**	0.54	2	30	35	06/01/87	0.00	27.78	11.11	50.00
TX07E	City of Paris	L 469	Small Urban	0.67	2	40	45	08/20/87	0.00	28.36	11.94	65.67
TX08E	City of Paris	L 469	Small Urban	0.86	2	30	35	08/20/87	1.16	19.77	54.65	53.49
26 Sites				74.60								
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites												
CO02E	Jefferson & Boulder Cos.	72	Rural	3.91	2	30	40	11 /04/87	0.00	2.05	7.16	9.72
CT03E	Sharon County	41 South of Sharon	Rural	0.65	2	30	40	10/24/86	0.00	6.15	0.00	18.46
ID03E	City of American Falls	Fort Hall Avenue	Rural	1.79	2	20	30	06/01/88	0.00	12.85	15.64	12.85
ID04E	City of American Falls	Falls Avenue	**Rural**	0.82	2	20	30	06/01 /88	0.00	37.80	4.88	46.34
ID05E	City of American Falls	Bennett Avenue	Rural	0.49	2	20	30	06/01/88	0.00	40.82	4.08	46.94
ID06E	City of Pocatello	4th Avenue	Urban	0.94	2	25	35	09/22/88	3.19	27.66	32.98	27.66
ID07E	City of Pocatello	5th Avenue	Urban	0.96	2	25	35	09/22/88	3.13	27.08	46.88	3.13
ID08E	City of Pocatello	South 2nd Avenue	Urban	1.11	2	35	45	09/16/88	0.00	0.00	4.50	1.80
MA02E	Town of Boxford	Pond Street	**Rural**	0.40	2	30	40	10/31/86	0.00	5.00	0.00	22.50
ME03E	Town of Raymond	121	**Rural**	1.80	2	35	45	05/26/87	0.00	4.44	2.78	29.44
MS01 E	City of Brandon	18	Small Urban	0.43	2	35	45	02/18/87	0.00	6.98	0.00	44.19
VA02E	Chesterfield County	651	Small **Urban**	1.60	2	35	45	10/14/87	0.63	3.75	4.38	21.88
CA04E	City of Irvine	Campus Drive	Urban	1.74	4	30	45	03/12/87	2.30	9.20	2.87	0.00
IN04E	Lawrence County	58 E. of Heltonville	Rural	0.62	2	30	45	11/20/86	0.00	3.23	1.61	22.58
TX01 E	City of Anna	FM 455	Rural	0.50	2	40	55	10/17/86	0.00	0.00	0.00	32.00
15 Sites				17.76								
Total	100 Sites			172 01 Miles								

1 mi= 1.61 km
1 mi/h = 1.61 kmlh
Note: All speed limits are shown in milh.

Table 28. Comparison site characteristics.

Comparison Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Posted Speed Limit	Intersections Signalized (Per Mile)	Intersections No Signal (Per Mile)	Driveways Comm. (Per Mile)	Driveways Resid. (Per Mile)
Speed Limit Lowered by 15 or 2 0 mi/h at Experimental Sites										
NJ04C	Burlington County	Oxmead Road	Rural	1.66	2	50	0.00	3.61	0.00	9.04
TX03C	Rockwall County	I-30 N. Frontage Road	Small Urban	2.39	2	55	0.00	2.93	4.18	0.00
VA06C	Scott County	65	Rural	2.85	2	55	0.00	0.70	1.40	11.23
DE02C	New Castle County	4291428	Rural	2.62	2	50	0.00	1.91	1.53	3.44
NM01C	Dona Ana County	273	Rural	3.31	2	55	0.00	2.72	1.81	3.93
NM03C	Valencia County	263	Rural	1.70	2	40	0.00	5.29	4.71	41.76
NM04C	Valencia County	263	Rural	1.70	2	40	0.00	5.29	4.71	41.76
OH02C	Lawrence County	243	Rural	3.00	2	55	0.00	1.33	2.00	14.00
OH13C	Portage County	43	Rural	1 .00	2	55	0.00	8.00	9.00	51 .oo
TX05C	Denton County	FM 407	Rural	1.17	2	55	0.00	4.27	0.00	5.98
Speed Limit Lowered by 10 mi/h at Experimental Sites										
CA01C	City of Modesto	West Rumble Road	Urban	0.48	2	30	0.00	20.83	10.42	37.50
DE03C	Sussex County	24 near Mission	Rural	1.58	2	50	0.00	3.16	1.90	10.76
DE04C	**Sussex** County	24 near Mission	Rural	1.58	2	50	0.00	3.16	1.90	10.76
IL01C	McHenry County	176	Rural	1.15	2	45	0.87	10.43	3.48	11.30
IN01C	Hancock County	109 N. of Warrington	Rural	0.45	2	55	0.00	4.44	0.00	13.33
MA01C	Town of Boxford	Depot Road	Rural	0.99	2	30	0.00	6.06	0.00	33.33
ME01 C	Town of Waldoboro	Old Route 1	Rural	2.15	2	45	0.00	0.00	0.00	19.53
MI09C	Jackson County	106	Rural	0.82	2	55	0.00	7.32	3.66	9.76
NE01C	Cass County	1	Rural	0.62	2	55	0.00	3.23	0.00	8.06
NJ02C	Cumberland County	553 near Gouldtown	Rural	0.78	2	50	0.00	7.69	2.56	39.74
NJ03C	Cumberland County	553 near Gouldtown	Rural	0.78	2	50	0.00	7.69	2.56	39.74
OH01C	Fulton County	20	Rural	0.59	2	55	0.00	3.39	1.69	5.08
OH03C	Delaware County	257 (Riverside Dr.)	Rural	6.37	2	55	0.00	1.88	0.47	18.84
OH04C	Athens County	33 at Pratts Fork	Rural	0.37	2	55	0.00	0.00	0.00	32.43
OH05C	Meigs County	7	Rural	1.12	2	55	0.00	2.68	1.79	11.61
OH06C	Wayne County	604 at West Canaan	Rural	0.96	2	55	0.00	4.17	0.00	10.42

1 mi= 1.61 km
1 mi/h = 1.61 kmlh
Note: All speed limits are shown i n mi/h

Table 28. Comparison site characteristics (continued).

Comparison Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Posted Speed Limit	Intersections Signalized (Per Mile)	Intersections No Signal (Per Mile)	Driveways Comm. (Per Mile)	Driveways Resid. (Per Mile)
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)										
OH07C	Butler County	129	Urban	0.74	2	55	0.00	6.76	8.11	41.89
OH08C	Madison County	38	Rural	1.16	2	55	0.00	3.45	0.00	9.48
OH09C	Mahoning County	45 near N. Jackson	Rural	1.04	2	55	0.00	2.88	0.00	15.38
OH10C	Mahoning County	45 near N. Jackson	Rural	1.04	2	55	0.00	2.88	0.00	15.38
OH11C	Washington County	555	Rural	0.83	2	50	0.00	8.43	4.82	33.73
OH12C	Trumbull County	88	Rural	1.58	2	55	0.00	2.53	6.96	11.39
OK01C	City of Muskogee	62 & 64 & 16	Small Urban	0.76	4	45	0.00	3.95	11.84	32.89
OK04C	City of Pryor	20	Small Urban	0.50	2	35	2.00	30.00	80.00	10.00
TX02C	Rockwall County	I-30 N. Frontage Road	Small Urban	2.39	2	55	0.00	2.93	4.18	0.00
TX04C	City of McKinney	FR 3038	Small Urban	0.55	2	55	0.00	1.82	0.00	3.64
VA01C	Chesterfield County	144	Small Urban	1.55	2	55	0.65	7.74	6.45	25.16
VA03C	Powhatan County	628	Rural	1.72	2	55	0.00	2.33	1.74	20.93
VA04C	Powhatan County	628	Rural	1.72	2	55	0.00	2.33	1.74	20.93
VA05C	Powhatan County	628	Rural	1.72	2	55	0.00	2.33	1.74	20.93
VA07C	Smyth County	16	Rural	2.04	2	55	0.00	1.47	3.43	16.18
WV03C	Mingo County	49	Rural	2.55	2	45	0.00	0.39	7.06	15.69
Ppeed Limit Lowered by 5 mi/h at Experimental Sites										
AZ01C	Phoenix & Maricopa Co.	32nd Street	Urban	0.87	2	45	0.00	6.90	5.75	0.00
CT02C	Cheshire County	70 North of Cheshire	Rural	2.24	2	45	0.45	5.36	4.91	21.43
CT05C	Stafford County	30 S. of W. Stafford	Rural	1.67	2	45	0.00	2.99	0.00	8.38
DE01C	Sussex County	357 near Ocean View	Rural	0.22	2	40	0.00	22.73	4.55	13.64
ID01C	Ada County	55 N. of Rte. 44	Rural	2.75	2	55	0.00	1.82	0.73	6.91
ID02C	Ada County .	55 N. of Rte. 44	Rural	2.75	2	55	0.00	1.82	0.73	6.91
ILO2C	McHenry County	176	Rural	1.15	2	45	0.87	10.43	3.48	11.30
IN05C	Spencer County	245 N. of Santa Claus	Rural	1.02	2	45	0.00	2.94	2.94	10.78
IN06C	Scott County	56 at W. Scottsburg	Small Urban	0.72	2	50	0.00	4.17	2.78	11.11
IN07C	Scott County	56 at W. Scottsburg	Small Urban	0.72	2	50	0.00	4.17	2.78	11.11

1 mi= 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in milh.

Table 28. Comparison site characteristics (continued).

Comparison Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Posted Speed Limit	Intersections Signalized per Mile	Intersections No Signal per Mile	Driveways Comm. per Mile	Driveways Resid. per Mile
Speed Limit Lowered by 5 mi/h at Experimental Sites (continued)										
MA03C	Town of Boxford	Depot Road	Rural	0.99	2	30	0.00	6.06	0.00	33.33
ME01C	Town of Waldoboro	Old Route 1	Rural	2.15	2	45	0.00	0.00	0.00	19.53
NJ01C	Mercer County	Crosswicks-Ham. Sq . Rd.	Urban	0.96	2	40	0.00	5.21	2.08	38.54
NM02C	Dona Ana County	273	Rural	3.31	2	55	0.00	2.72	1.81	3.93
Speed Limit Raised by 5 mi/h at Experimental Sites										
AZ02C	City of Phoenix	Grovers Avenue	Urban	0.97	2	30	1.03	15.46	7.22	21.65
AZ03C	City of Phoenix	Holmes Blvd. & 27th Ave.	Urban	1.11	2	30	0.90	11.71	10.81	0.00
CA06C	City of Mission Viejo	Trabuco Road	Urban	1.01	4	45	2.97	10.89	2.97	0.00
CA07C	City of Mission Viejo	Trabuco Road	Urban	1.01	4	45	2.97	10.89	2.97	0.00
CO01C	Boulder & Gilpin Cos.	72	Rural	3.98	2	30	0.00	0.50	0.00	7.04
CO03C	Boulder & Gilpin Cos.	72	Rural	3.98	2	30	0.00	0.50	0.00	7.04
CT01C	East Hartford	5	Urban	1.41	4	45	1.42	9.22	21.99	26.24
DE05C	Kent County	105	Rural	0.51	2	35	0.00	5.88	5.88	54.90
IN02C	City of Lafayette	Union Street	Urban	0.46	2	25	2.17	21.74	2.17	17.39
IN03C	City of Lafayette	Union Street	Urban	0.46	2	25	2.17	21.74	2.17	17.39
MD01C	Carroll County	194	Rural	4.43	2	50	0.00	1.35	0.00	10.38
MD02C	Carroll County	496	Rural	7.23	2	50	0.00	1.94	1.24	11.89
MD03C	Carroll County	27	Rural	3.73	2	50	0.00	2.95	0.80	17.16
MD04C	Frederick & Carroll Cos.	75	Rural	3.63	2	50	0.00	1.93	3.31	8.26
MD05C	Carroll County	27	Rural	7.28	2	50	0.00	2.75	0.41	21.02
MD06C	Frederick County	Frederick Street	Rural	1.07	2	30	0.00	11.21	23.36	37.38
MD07C	Frederick County	Frederick Street	Rural	1.07	2	30	0.00	11.21	23.36	37.38
MD08C	Frederick County	Frederick Street	Rural	1.07	2	30	0.00	11.21	23.36	37.38
MD09C	Frederick County	550 at Creagerstown	Rural	0.66	2	30	0.00	7.58	4.55	39.39
MD10C	Carroll County	32	Rural	1.58	2	50	0.00	1.27	0.00	6.33
MS02C	City of Brandon	468	Small Urban	0.81	2	30	1.23	9.88	14.81	33.33

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 28. Comparison site characteristics (continued).

Comparison Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Posted Speed Limit	Intersections Signalized (per mile)	Intersections No Signal (per mile)	Driveways Comm. (per mile)	Driveways Resid. (per mile)
Speed Limit Raised by 5 mi/h at Experimental Sites (continued)										
TN01C	Shelby County	385	Rural	2.95	4	55	0.00	2.71	0.00	0.00
TX06C	City of Justin	FR 407	Rural	0.26	2	30	0.00	26.92	26.92	26.92
TX07C	City of Paris	FM 79	Small Urban	0.60	2	35	1.67	21.67	23.33	41.67
TX06C	City of Paris	FM 79	Small Urban	0.60	2	35	1.67	21.67	23.33	41.67
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites										
CO02C	Boulder & Gilpin Cos.	72	Rural	3.98	2	30	0.00	0.50	0.00	7.04
IDO3C	City of American Falls	Polk Street	Rural	0.63	2	20	0.00	50.79	3.17	57.14
ID04C	City of American Falls	Polk Street	Rural	0.63	2	20	0.00	50.79	3.17	57.14
ID05C	City of American Falls	Polk Street	Rural	0.63	2	20	0.00	50.79	3.17	57.14
ID06C	City of Pocatello	Arthur Avenue	Urban	0.95	2	25	4.21	29.47	32.63	17.89
ID07C	City of Pocatello	Arthur Avenue	Urban	0.95	2	25	4.21	29.47	32.63	17.89
ID08C	City of Pocatello	South Grant Ave.	Urban	1.30	2	35	0.00	3.85	2.31	19.23
MA02C	Town of Boxford	Depot Road	Rural	0.99	2	30	0.00	6.06	0.00	33.33
ME03C	Oxford County	121 at Otisfield	Rural	0.61	2	35	0.00	3.28	13.11	31.15
MS01C	City of Brandon	80	Small Urban	0.35	2	35	0.00	11.43	0.00	25.71
VA02C	Chesterfield County	643	Small Urban	1.83	2	35	0.55	4.92	1.64	44.81
CA04C	City of Irvine	Harvard Avenue	Urban	1.04	4	30	2.88	8.65	0.00	1.92
IN04C	Lawrence County	58 at Heltonville	Rural	0.63	2	30	0.00	7.94	3.17	31.75
TX01C	City of Anna	FM 455	Rural	0.45	2	40	0.00	13.33	0.00	33.33

1 mi= 1.61 km
1mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 29. Before speed data for the experimental sites.

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Limit Posted	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds															10-mi/h Pace Lower Limit	10-mi/h Pace Upper Limit	Pct. Pace	Skew. Index
											1	5	10	15	25	35	50	65	75	85	90	95	99				
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																													
NJ04E	50	30	-20	02/28/89	01/17/87	37.7	6.6	408	394	96.6	18	27	29	32	34	36	38	41	43	44	46	48	55	35	44	59.6	0.95
TX03E	55	35	-20	05/01/87	03/02/87	36.2	5.0	1,173	1,081	92.2	21	28	31	32	34	35	37	39	40	41	43	44	48	32	41	73.8	1.00
DE02E	50	35	-15	11/06/86	09/29/86	45.7	6.8	468	449	95.9	28	35	38	39	41	43	46	49	51	53	55	57	62	42	51	53.7	1.00
NM01E	55	40	-15	04/01/87	02/23/87	44.5	9.5	571	551	96.5	24	28	31	33	38	42	46	50	52	55	57	58	64	46	55	42.8	0.79
NM03E	55	40	-15	03/01/87	02/26/87	42.0	7.6	473	444	93.9	25	30	33	35	37	39	42	46	48	50	52	55	61	39	48	48.4	1.05
NM04E	55	40	-15	03/01/87	02/26/87	40.4	7.5	620	560	90.3	23	28	32	34	36	38	41	44	46	48	50	53	61	37	46	53.6	1.00
OH02E	55	40	-15	07/13/86	06/28/86	42.6	6.3	1,453	1,354	93.2	27	33	36	37	39	41	43	45	47	49	51	53	59	38	47	61.4	1.00
OH13E	55	40	-15	06/30/87	03/28/87	41.9	5.7	4,201	3,197	76.1	25	34	36	37	39	41	42	44	46	48	49	51	56	38	47	67.6	1.07
TX05E	55	40	-15	05/30/89	03/08/87	47.9	5.5	10,752	6,852	63.7	33	39	42	43	45	47	48	50	52	54	55	57	61	44	53	68.1	1.07
Speed Limit Lowered by 10 mi/h at Experimental Sites																													
CA01E	35	25	-10	03/05/87	02/09/87	34.3	6.9	2,552	2,388	93.6	18	22	26	28	31	32	35	37	39	42	44	46	51	30	39	55.3	0.95
DE03E	50	40	-10	12/12/86	11/12/86	45.0	6.9	8,986	6,198	69.0	26	33	37	39	42	43	46	48	50	52	54	56	60	41	50	57.9	0.90
DE04E	50	40	-10	12/15/86	11/12/86	48.7	7.9	393	384	97.7	27	35	39	42	45	46	49	52	55	57	59	61	66	45	54	51.3	0.96
IL01E	50	40	-10	01/19/88	09/13/86	43.6	5.1	8,457	6,321	74.7	32	36	38	39	41	42	44	46	47	49	50	52	56	40	49	70.5	1.00
IN01E	55	45	-10	09/23/86	09/07/86	46.9	5.8	2,279	2,151	94.4	33	37	40	41	44	45	48	50	51	53	54	56	61	43	52	63.2	0.82
MA01E	40	30	-10	11/01/86	10/29/86	41.9	5.8	303	297	98.0	27	32	35	37	39	40	43	45	46	48	49	52	54	38	47	63.3	0.89
ME02E	45	35	-10	05/01/87	10/15/86	33.0	7.2	375	364	97.1	18	21	23	26	29	31	34	36	38	41	42	46	51	31	40	53.3	0.91
MI09E	55	45	-10	06/13/88	10/12/87	49.7	8.8	2,544	2,340	92.0	25	33	38	41	45	48	51	54	57	58	60	62	68	49	58	48.5	0.80
NE01E	55	45	-10	05/29/87	04/20/87	44.2	7.5	3,847	3,190	82.9	25	31	35	37	40	43	46	48	50	52	54	55	59	43	52	51.1	0.82
NJ02E	45	35	-10	02/05/87	12/15/86	37.7	8.0	7,295	5,669	77.7	19	24	28	30	33	35	38	41	44	46	48	51	56	34	43	46.1	1.00
NJ03E	45	35	-10	02/05/87	12/18/86	41.0	6.8	7,594	5,972	78.6	23	29	33	35	38	40	42	44	46	48	50	52	57	38	47	59.2	0.90
OH01E	55	45	-10	09/07/86	06/25/86	53.0	7.0	3,948	3,380	85.6	34	42	45	47	50	51	54	56	58	60	62	64	70	50	59	57.9	0.90
OH03E	55	45	-10	01/16/87	06/30/86	48.2	6.3	3,835	3,020	78.7	32	38	41	43	45	47	49	51	53	55	57	59	62	45	54	59.2	0.95
OH04E	55	45	-10	11/18/86	10/17/86	45.8	7.6	3,464	2,572	74.2	25	33	37	39	42	44	47	49	51	54	55	58	63	43	52	52.4	0.91
OH05E	45	35	-10	12/10/86	10/19/86	38.7	7.6	3,909	3,452	88.3	14	25	31	33	35	37	40	42	44	46	47	50	55	36	45	57.0	0.86
OH06E	55	45	-10	12/22/86	10/26/86	44.1	9.0	1,113	1,074	96.5	21	29	32	35	39	42	46	49	51	53	55	58	63	44	53	44.6	0.81
OH07E	55	45	-10	11/26/86	10/29/86	43.3	6.4	7,695	5,877	76.4	26	32	36	38	40	42	44	46	48	50	51	54	58	39	48	62.5	0.95
OH08E	55	45	-10	02/10/87	11/23/86	39.1	7.5	596	575	96.5	20	25	29	32	35	37	40	43	45	47	48	50	54	36	45	51.0	0.86

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 29. Before speed data for the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Limit Posted	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 10 milh at Experimental Sites (continued)																											
OH09E	55	45	-10	04/29/87	01/16/87	42.7	6.8	3,261	2,916	89.4	20	32	35	37	40	41	43	46	47	49	51	53	58	40	49	60.8	1.00
OH10E	55	45	-10	05/12/87	01/16/87	46.7	6.3	4,152	3,306	79.6	30	36	40	41	43	45	47	50	51	53	54	57	62	43	52	63.3	1.00
OH11E	50	40	-10	03123187	01126187	35.5	12.6	1,350	1,292	95.7	10	15	17	19	24	33	39	43	46	48	50	53	58	38	47	37.5	0.72
OH12E	55	45	-10	1 0/15/87	03/26/87	45.6	7.3	2,608	2,295	88.0	22	34	37	39	42	44	47	49	51	53	55	57	61	43	52	54.9	0.86
OK01 E	45	35	-10	09/15/86	08/21/86	36.4	6.3	9,691	8,825	91.1	18	26	29	31	33	35	37	40	41	43	44	46	50	34	43	61.1	0.89
OK02E	35	25	-10	09/15/86	08/26/86	29.5	4.8	11,472	8,288	72.2	15	22	25	26	27	29	30	32	33	34	36	37	41	26	35	75.7	0.92
OK03E	35	25	-10	09/15/86	08/26/86	39.3	6.0	6,283	5,125	81.6	24	29	32	34	36	38	40	42	43	46	47	49	54	35	44	63.0	0.94
OK04E	45	35	-10	04/06/87	03/16/87	42.7	5.7	5,625	4,337	77.1	27	34	36	38	40	41	43	46	47	49	50	52	56	39	48	65.5	1.00
TXO2E	55	45	-10	05/01/87	03/02/87	48.4	6.5	2,233	2,054	92.0	32	38	41	43	45	47	49	51	53	55	57	59	64	45	54	60.2	1.00
TXO4E	55	45	-10	06/23/87	03/05/87	40.4	7.2	2,991	2,619	87.6	24	30	32	34	36	38	40	43	46	48	50	53	61	35	44	52.5	1.10
VA01 E	55	45	-10	08/25/86	07/1 1/86	47.4	7.2	8,425	6,410	76.1	29	34	38	41	44	46	49	51	53	55	56	58	63	45	54	57.0	0.73
VA03E	55	45	-10	06/16/87	07/28/86	44.0	6.4	1,303	1,238	95.0	28	33	36	38	41	42	45	47	49	51	53	55	60	40	49	59.8	0.90
VA04E	55	45	-10	10/28/86	07/30/86	40.2	6.9	533	514	96.4	23	28	32	34	36	38	41	43	45	47	49	52	57	36	45	57.6	0.95
VA05E	55	45	-10	09/09/87	07/30/86	44.8	8.5	927	869	93.7	23	28	35	38	40	42	46	49	51	54	56	58	62	40	49	45.8	0.88
VA07E	55	45	-10	10/17/87	08/27/86	44.4	7.0	4,551	3,674	80.7	24	33	36	38	41	43	45	48	50	52	53	55	60	41	50	57.2	0.90
WV03E	45	35	-10	09/15/86	08/29/86	44.0	7.1	2,170	1,914	88.2	28	32	35	37	40	42	45	47	49	52	53	56	61	41	50	53.1	0.91
Speed Limit Lowered by 5 mi /h at Experimental Sites																											
AZ01E	50	45	-5	04/28/87	03/27/87	44.8	5.5	7,830	5,438	69.5	31	37	39	40	42	43	45	47	49	51	52	54	60	41	50	67.7	1.07
CT02E	45	40	-5	10/23/86	10/08/86	39.9	5.7	13,646	7,608	55.8	25	31	33	35	37	39	41	43	44	46	47	49	53	36	45	65.3	0.88
CT05E	45	40	-5	03/26/87	10/25/86	44.4	5.4	9,658	6,305	65.3	30	36	38	40	42	43	45	47	48	50	51	53	59	41	50	69.3	0.92
DE01E	40	35	-5	11/04/86	09/26/86	45.3	a.4	986	946	95.9	27	33	35	37	40	42	46	48	51	54	57	62	67	40	49	48.8	1.04
ID01E	55	50	-5	10/10/88	04/12/87	49.6	6.9	4,357	3,705	85.0	31	38	41	43	46	48	50	53	55	57	58	61	65	46	55	58.7	1.00
ID02E	55	50	-5	10/01/88	04/12/87	50.3	5.8	8,064	5,816	72.1	34	41	44	45	48	49	51	53	54	56	58	60	64	46	55	66.5	0.88
IL02E	50	45	-5	10/08/86	09113/86	44.8	5.2	9,481	6,761	71.3	31	37	39	40	42	44	46	47	48	50	51	53	57	41	50	71.1	0.86
IN05E	45	40	-5	12/04/86	11/12/86	41.7	7.1	1,455	1,381	94.9	25	30	33	35	37	39	42	45	47	50	51	53	57	37	46	50.3	0.95
IN06E	50	45	-5	12/29/86	12/17/86	45.4	7.2	8,528	6,259	73.4	24	32	37	39	43	44	47	49	50	53	54	56	60	43	52	60.0	0.76
IN07E	50	45	-5	12/29/86	12/17/86	44.1	7.4	5,743	4,750	82.7	20	29	35	38	41	43	46	48	49	51	52	55	58	42	51	61.7	0.73

1 mi/h = 1.61 km/h

Note: All speed limits and vehicle speeds are shown in mi/h.

Table 29. Before speed data for the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Limit Posted	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 5 milh at Experimental Sites (continued)																											
MA03E	30	25	-5	11/01/86	10/31/86	33.9	6.1	371	361	97.3	19	24	26	28	31	32	34	37	39	41	42	44	47	31	40	60.1	0.95
ME01E	45	40	-5	05/01/87	10/15/86	36.1	7.0	306	303	99.0	21	24	27	29	32	34	36	39	41	44	46	49	53	33	42	53.5	1.09
NJ01E	40	35	-5	02/09/87	11/18/86	38.3	5.7	12,669	7,744	61.1	23	30	32	34	36	37	39	41	42	44	45	48	53	34	43	68.9	1.00
NM02E	55	50	-5	04/01/87	02/23/87	53.8	8.8	484	466	96.3	33	38	43	46	49	52	55	57	60	63	65	69	74	50	59	47.0	0.92
Speed Limit Raised by 5 mi/h at Experimental Sites																											
AZ02E	25	30	5	07/22/87	03/30/87	31.8	5.6	1,296	1,252	96.6	20	24	25	27	26	30	32	34	36	38	40	42	46	27	36	62.5	1.00
AZ03E	30	35	5	04/04/88	04/01/87	32.6	5.4	4,005	3,521	87.9	21	25	27	28	30	31	33	35	36	39	40	42	47	28	37	67.0	1.07
CA06E	45	50	5	04/30/87	03/13/87	48.9	6.4	12,917	10,201	79.0	34	39	41	43	45	47	49	52	53	56	58	60	65	45	54	58.1	1.05
CA07E	45	50	5	05/07/87	03/22/87	53.1	5.9	14,132	9,789	69.3	40	44	46	48	50	51	54	56	57	60	61	63.69		49	58	62.0	0.94
CO01E	30	35	5	11/04/87	04/04/87	38.9	4.8	2,975	2,375	79.8	28	32	33	35	36	38	39	41	42	44	45	47	52	35	44	73.0	1.08
CO03E	40	45	5	11/04/87	02/02/87	43.3	7.1	491	478	97.4	28	32	35	37	39	41	43	46	48	51	53	57	62	39	48	55.9	1.14
CT01E	45	50	5	12/11/86	10/05/86	56.4	7.0	17,040	11,932	70.0	41	46	46	50	52	54	57	59	61	64	66	69	75	52	61	55.3	1.00
CT04E	30	35	5	10/24/86	10/11/86	43.2	7.2	1,762	1,619	91.9	25	31	35	37	39	41	44	47	48	51	53	55	60	40	49	54.3	0.95
DE05E	35	40	5	12/16/86	11/15/86	37.6	8.2	428	419	97.9	17	24	27	29	33	35	38	41	44	48	49	51	55	34	43	48.4	1.00
IN02E	25	30	5	10/06/86	09/10/86	27.6	5.9	8,170	6,095	74.6	11	17	20	22	25	27	29	30	32	34	35	37	41	24	33	66.3	0.82
IN03E	25	30	5	10/06/86	09/10/86	26.9	5.6	8,698	5,592	64.3	12	16	21	22	25	26	28	30	31	33	34	36	39	24	33	69.2	0.82
MD01E	50	55	5	09/23/86	08/03/86	54.8	6.3	2,898	2,498	86.2	38	46	48	49	52	53	55	57	59	61	63	65	71	51	60	63.3	1.06
MD02E	50	55	5	11/19/86	08/06/86	51.2	5.4	6,046	4,493	74.3	38	43	45	47	48	50	52	54	55	57	58	61	65	47	56	68.4	1.00
MD03E	50	55	5	11/28/86	08/07/86	51.2	6.9	2,509	2,241	89.3	33	39	42	45	48	50	52	54	56	58	60	62	68	48	57	60.4	0.86
MD04E	50	55	5	11/17/86	08/10/86	53.3	6.3	2,794	2,434	87.1	38	43	46	48	50	52	54	56	58	60	62	63	69	50	59	61.0	0.94
MD05E	50	55	5	10/02/86	08/12/86	53.8	6.1	2,908	2,432	63.6	36	45	47	49	51	52	54	57	58	60	62	64	69	50	59	62.9	1.06
MD06E	30	35	5	10/22/86	08/16/86	40.6	6.0	3,666	3,086	84.2	27	31	33	35	37	39	41	43	45	47	49	51	56	36	45	59.4	1.00
MD07E	30	35	5	09/30/86	08116186	35.7	6.0	2,688	2,351	87.5	22	27	29	30	32	34	36	38	40	42	44	46	50	32	41	61.6	1.06
MD08E	30	35	5	02/25/87	08/16/86	30.7	5.9	7,562	5,599	74.0	17	20	23	25	28	29	31	33	35	37	38	40	45	27	36	63.8	1.00
MD09E	30	35	5	01/09/87	08/18/86	35.2	5.0	4,586	3,700	80.7	22	27	29	31	33	34	36	37	39	41	42	44	48	32	41	70.5	0.93
MD10E	50	55	5	10/08/86	08/20/86	53.7	5.0	9,429	5,680	60.2	40	46	48	50	51	53	54	56	57	59	60	62	67	50	59	73.5	1.00
MS02E	30	35	5	02/18/87	09/25/86	34.0	6.9	7,755	5,801	74.8	17	23	25	27	30	33	35	37	39	41	43	45	50	31	40	56.6	0.90

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 29. Before speed data for the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Posted	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	10-mi/h Pace Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 5 milh at Experimental Sites (continued)																											
TN01E	50	55	5	10/30/86	09/03/86	56.8	6.2	6,313	5,312	84.1	42	48	50	51	53	55	57	59	61	63	65	67	74	52	61	63.0	1.06
TX06E	30	35	5	06/01/87	03/11/87	33.0	7.1	1,562	1,482	94.9	17	21	24	26	29	31	34	36	38	41	43	45	49	29	38	53.4	0.91
TX07E	40	45	5	08/20/87	03/13/87	35.1	5.9	6,807	5,674	83.4	15	25	29	31	33	34	36	38	39	41	42	44	48	32	41	69.7	0.88
TX08E	30	35	5	08/20/87	03/13/87	30.6	4.8	9,217	6,698	72.7	18	23	25	27	28	29	31	33	34	36	37	39	43	27	36	74.3	1.00
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																											
CO02E	30	40	10	11/04/87	04/04/87	40.9	5.6	2,098	1,853	88.3	28	32	34	36	38	39	41	43	45	47	48	51	55	37	46	65.2	1.06
CT03E	30	40	10	10/24/86	10/11/86	44.9	7.1	1,711	1,523	89.0	27	34	37	39	41	43	45	48	50	53	55	57	62	40	49	53.1	1.05
ID03E	20	30	10	06/01/88	04/15/87	24.2	4.8	1,414	1,351	95.5	14	17	18	20	22	23	25	27	28	29	30	32	36	20	29	71.1	0.93
ID04E	20	30	10	06/01/88	04/15/87	23.1	6.0	1,161	1,126	97.0	8	11	15	18	21	22	24	26	28	29	30	32	37	21	30	66.3	0.78
ID05E	20	30	10	06/01188	04/17/87	21.7	7.6	538	532	98.9	8	10	12	13	16	19	23	25	28	30	31	33	40	21	30	51.3	0.86
ID06E	25	35	10	09/22/88	04/17/87	29.0	4.9	8,019	6,172	77.0	16	19	24	26	27	28	30	31	32	34	35	36	41	26	35	77.6	0.80
ID07E	25	35	10	09/22/88	06/04/88	27.1	4.0	8,010	6,757	84.4	17	21	23	24	25	26	28	29	30	31	32	34	37	23	32	81.8	0.91
ID08E	35	45	10	09/16/88	06/04/88	39.2	5.8	2,075	1,880	90.6	27	31	33	34	36	37	39	41	43	46	47	50	54	34	43	65.6	1.18
MA02E	30	40	10	11/01/86	10/29/86	41.9	6.1	1,394	1,340	96.1	25	32	35	37	39	40	43	45	46	48	50	52	57	38	47	65.0	0.89
ME03E	35	45	10	05/26/87	10121 /86	46.7	7.0	1,720	1,517	88.2	29	36	39	41	43	45	47	50	52	54	56	59	64	42	51	55.4	1.05
MSOIE	35	45	10	02/18/87	09/23/86	38.9	6.8	5,345	3,989	74.6	22	29	32	33	35	37	39	41	44	46	48	51	57	34	43	58.1	1.05
VA02E	35	45	10	10/14/87	07/26/86	39.9	5.2	2,231	1,990	89.2	27	32	34	35	37	38	40	42	44	46	47	49	53	36	45	69.1	1.07
CA04E	30	45	15	03/12/87	02/28/87	43.6	5.7	11,480	6,950	78.0	32	35	37	39	40	42	44	46	46	50	51	54	60	39	48	65.2	1.06
IN04E	30	45	15	11/20/86	11/10/86	41.8	7.3	405	390	96.3	26	30	32	34	38	40	42	45	48	50	52	55	58	40	49	50.5	1.04
TX01E	40	55	15	10/17/86	09/19/86	47.3	10.0	745	702	94.2	18	29	36	39	43	45	48	52	54	57	58	62	71	46	55	45.7	0.93

1 milh = 1.61 kmlh
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 30. After speed data for the experimental sites.

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Limit Posted	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																											
NJ04E	50	30	-20	02/28/89	04/02/89	37.8	5.5	633	603	95.3	23	29	31	33	35	37	38	40	42	43	45	47	51	34	43	67.3	1.00
TX03E	55	35	-20	05/01/87	03/29/88	37.9	4.7	1,378	1,281	93.0	27	31	33	34	35	37	38	40	41	43	44	46	50	34	43	73.6	1.00
DE02E	50	35	-15	11/06/86	10/24/88	44.9	6.6	486	476	97.9	30	34	37	39	41	43	45	48	49	52	54	57	60	40	49	60.1	1.00
NM01E	55	40	-15	04/01/87	04/06/88	45.2	9.0	867	831	95.8	24	30	33	36	40	43	46	49	51	54	57	60	67	43	52	47.2	0.92
NM03E	55	40	-15	03/01/87	04/15/88	41.1	7.8	263	256	97.3	24	28	31	33	36	39	41	44	47	50	52	54	59	38	47	49.2	1.04
NM04E	55	40	-15	03/01/87	04/15/88	41.4	7.8	374	363	97.1	23	29	31	34	37	39	41	45	47	50	52	55	60	38	47	48.5	1.04
OH02E	55	40	-15	07/13/86	09/25/87	42.1	6.1	1,803	1,659	92.0	25	32	35	37	39	41	43	45	46	48	50	52	57	38	47	64.0	0.94
OH13E	55	40	-15	06/30/87	03/12/88	41.9	5.4	3,749	3,029	80.8	28	34	36	37	39	40	42	44	46	48	49	51	55	38	47	69.3	1.07
TX05E	55	40	-15	05/30/89	07/08/89	47.5	5.3	13,035	7,706	59.1	34	40	42	43	45	46	48	50	51	53	54	57	60	43	52	68.4	1.00
Speed Limit Lowered by 10 mi/h at Experimental Sites																											
CA01E	35	25	-10	03/05/87	05/26/88	33.8	6.7	2,458	2,309	93.9	19	23	25	27	30	32	35	37	39	41	42	45	51	30	39	57.8	0.90
DE03E	50	40	-10	12/12/86	02/29/88	45.1	6.8	9,042	6,226	68.9	26	33	37	40	42	44	46	48	50	52	54	56	60	41	50	59.0	0.90
DE04E	50	40	-10	12/15/86	02/29/88	48.1	7.9	375	367	97.9	30	35	39	41	44	46	48	51	54	57	59	62	66	43	52	51.0	1.04
IL01E	50	40	-10	01/19/88	09/17/88	42.9	4.7	10,006	7,104	71.0	31	36	38	39	41	42	43	45	46	48	49	51	54	39	48	75.2	1.08
IN01E	55	45	-10	09/23/86	08/11/88	46.7	5.6	2,168	2,027	93.5	33	38	40	41	44	45	47	49	51	53	54	56	61	43	52	64.6	0.94
MA01E	40	30	-10	11/01/86	12/07/88	40.9	5.4	289	283	97.9	28	33	35	36	37	39	41	44	45	47	48	50	54	37	46	64.0	1.07
ME02E	45	35	-10	05/01/87	12/01/88	33.4	7.2	345	336	97.4	19	22	24	26	29	31	34	37	39	42	44	47	51	29	38	49.4	0.95
MI09E	55	45	-10	06/13/88	06/08/89	50.5	7.9	2,975	2,674	89.9	27	36	41	44	47	49	51	54	56	58	60	62	67	48	57	53.6	0.92
NE01E	55	45	-10	05/29/87	05/12/88	42.5	6.7	4,666	3,821	81.9	27	32	34	36	39	41	43	46	48	50	51	54	58	39	48	55.9	1.00
NJ02E	45	35	-10	02/05/87	05/01/88	37.7	7.0	7,526	5,760	76.5	21	26	29	31	34	36	38	41	43	46	47	50	54	34	43	52.9	1.00
NJ03E	45	35	-10	02/05/87	05/01/88	41.5	6.3	10,268	6,735	65.6	17	33	36	37	39	40	42	44	46	48	49	51	56	38	47	67.6	1.00
OH01E	55	45	-10	09/07/86	05/03/89	51.7	7.4	3,192	2,836	88.8	32	40	43	45	48	50	52	55	57	59	61	64	70	48	57	54.1	1.05
OH03E	55	45	-10	01/16/87	09/23/87	48.6	6.2	4,278	3,308	77.3	33	39	41	43	45	47	49	51	53	55	57	58	64	45	54	62.4	0.94
OH04E	55	45	-10	11/18/86	11/07/87	45.1	7.3	2,559	2,147	83.9	26	33	37	39	41	43	46	48	50	53	55	58	63	41	50	55.0	1.00
OH05E	45	35	-10	12/10/86	11/10/87	38.8	6.6	3,458	3,047	88.1	20	28	31	34	36	37	39	41	43	46	47	50	55	35	44	62.3	1.05
OH06E	55	45	-10	12/22/86	11/01/87	44.6	8.1	1,022	977	95.6	26	31	34	36	40	42	46	48	50	53	56	58	62	42	51	48.1	0.88

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 30. After speed data for the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Limit Posted	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																											
OH07E	55	45	-10	11/26/86	11/04/87	44.4	5.8	8,256	6,332	76.7	28	35	38	40	41	43	45	47	48	50	52	54	58	40	49	65.9	1.00
OH08E	55	45	-10	02/10/87	11/04/87	39.8	8.1	675	653	96.7	21	26	29	31	35	38	41	44	46	49	50	52	56	39	48	47.3	0.83
OH09E	55	45	-10	04/29/87	03/11/88	42.7	6.7	3,920	3,254	83.0	22	31	35	37	40	42	44	46	47	49	51	53	58	39	48	62.8	0.84
OH10E	55	45	-10	05/12/87	03/11/88	44.7	5.8	5,083	3,819	75.1	30	35	38	40	42	43	45	47	49	51	52	54	59	41	50	66.5	1.00
OH11E	50	40	-10	03/23/87	11/10/87	37.4	10.5	1,417	1,334	94.1	12	18	21	24	33	36	40	43	45	48	50	52	57	37	46	44.7	0.69
OH12E	55	45	-10	10/15/87	05/03/88	44.3	7.4	3,227	2,784	86.3	24	33	36	38	40	42	45	48	49	52	53	57	62	41	50	55.0	0.95
OK01E	45	35	-10	09/15/86	07/09/89	36.0	6.5	11,051	9,970	90.2	17	24	29	31	33	35	37	39	40	43	44	46	51	32	41	63.3	0.84
OK02E	35	25	-10	09/15/86	07/11/89	29.9	4.5	10,985	7,715	70.2	17	23	25	26	28	29	30	32	33	35	36	37	41	26	35	77.4	1.08
OK03E	35	25	-10	09/15/86	07/11/89	40.6	5.9	5,734	4,776	83.3	26	31	34	35	38	39	41	43	45	47	48	50	55	37	46	62.1	1.00
OK04E	45	35	-10	04/06/87	03/27/88	42.3	6.4	5,302	4,184	78.9	24	32	35	37	39	41	43	46	47	49	50	52	57	39	48	62.2	0.89
TX02E	55	45	-10	05/01/87	03/29/88	47.5	5.9	2,343	2,134	91.1	34	38	41	42	44	46	48	50	52	54	55	58	63	43	52	64.1	1.06
TX04E	55	45	-10	06/23/87	04/04/88	41.7	7.0	3,433	2,977	86.7	24	31	33	35	38	40	42	45	47	49	51	53	58	39	48	53.6	1.00
VA01E	55	45	-10	08/25/86	08/07/87	46.5	6.6	8,605	6,411	74.5	30	35	38	41	43	45	48	50	51	53	55	57	62	43	52	61.1	0.80
VA03E	55	45	-10	06/16/87	11/16/87	44.8	6.2	1,292	1,209	93.6	29	34	37	39	42	43	45	47	49	52	53	55	59	41	50	61.5	1.05
VA04E	55	45	-10	10/28/86	11/19/87	40.7	6.9	498	485	97.4	24	29	32	34	37	39	42	44	46	48	50	52	56	38	47	53.6	0.90
VA05E	55	45	-10	09/09/87	06/26/88	45.0	7.7	1,066	1,022	95.9	24	32	36	38	41	43	46	49	51	53	55	57	62	43	52	50.6	0.96
VA07E	55	45	-10	10/17/87	10/27/87	46.8	6.4	4,266	3,550	83.2	28	36	40	41	44	45	48	50	51	54	55	57	61	43	52	61.5	0.89
WV03E	45	35	-10	09/15/86	11/07/87	45.1	7.0	1,219	1,122	92.0	29	34	37	38	41	43	46	48	50	53	55	58	62	40	49	52.2	0.95
Speed Limit Lowered by 5 mi/h at Experimental Sites																											
AZ01E	50	45	-5	04/28/87	04/09/88	44.2	5.2	8,028	5,469	68.1	32	37	39	40	41	43	44	46	48	50	51	53	58	40	49	70.6	1.14
CT02E	45	40	-5	10/23/86	12/06/88	39.9	5.6	12,183	7,073	58.1	25	31	34	35	37	39	41	43	44	46	47	49	53	36	45	67.2	0.88
CT05E	45	40	-5	03/26/87	12/03/88	45.4	5.3	11,966	7,570	63.3	31	37	40	41	43	44	46	48	49	51	52	54	60	41	50	70.5	0.93
DE01E	40	35	-5	11/04/86	10/28/88	45.1	7.1	775	742	95.7	30	34	37	39	41	43	45	47	50	53	55	58	65	41	50	56.2	1.14
ID01E	55	50	-5	10/01/88	10/04/88	48.6	6.0	5,120	4,176	81.6	32	39	42	44	46	47	49	51	53	55	56	58	62	45	54	65.5	0.94
ID02E	55	50	-5	10/01/88	10/04/88	50.7	5.5	8,200	5,850	71.3	35	42	45	46	48	50	52	53	55	57	57	59	63	48	57	69.6	0.80
IL02E	50	45	-5	10/08/86	09/17/88	44.0	5.2	10,380	7,043	67.9	30	36	38	40	42	43	45	46	48	49	51	53	57	40	49	70.9	0.93
IN05E	45	40	-5	12/04/86	03/24/88	41.1	6.7	1,500	1,404	93.6	26	30	33	35	37	39	41	44	46	49	50	52	56	38	47	53.1	1.10
IN06E	50	45	-5	12/29/86	08/09/88	45.0	6.6	8,721	6,465	74.1	24	33	38	40	42	44	46	48	50	52	53	55	59	42	51	63.3	0.84

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 30. After speed data for the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Limit Posted	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 5 mi/h at Experimental Sites (continued)																											
IN07E	50	45	-5	12/29/86	08/09/88	44.7	7.3	5,954	4,947	83.1	21	30	36	39	42	44	46	48	50	52	53	55	60	42	51	62.7	0.76
MA03E	30	25	-5	11/01/86	12/08/88	34.2	6.4	314	306	97.5	20	23	27	28	31	32	35	37	39	41	43	45	50	31	40	58.2	0.95
ME01E	45	40	-5	05/01/87	12/01/88	36.1	7.2	315	307	97.5	19	24	27	29	32	34	37	39	42	43	46	49	53	33	42	53.4	0.91
NJ01E	40	35	-5	02/09/87	04/03/89	38.7	5.7	12,450	7,557	60.7	23	30	33	34	36	37	39	41	43	44	46	48	53	34	43	69.1	1.00
NM02E	55	50	-5	04/01/87	04/06/88	54.6	8.8	712	684	96.1	32	41	44	47	50	52	55	58	61	64	66	70	75	49	58	47.5	1.00
Speed Limit Raised by 5 mi/h at Experimental Sites																											
AZ02E	25	30	5	07/22/87	04/11/88	31.9	5.4	1,332	1,284	96.4	19	24	26	27	29	30	32	34	36	38	39	41	45	27	36	66.7	1.07
AZ03E	30	35	5	04/04/88	04/12/88	33.6	4.5	4,156	3,704	89.1	24	27	29	30	31	32	34	36	37	38	40	42	46	29	38	76.6	1.08
CA06E	45	50	5	04/30/87	05/23/88	46.8	6.2	13,017	10,044	77.2	33	37	40	41	43	45	47	50	51	53	55	57	63	43	52	60.3	1.00
CA07E	45	50	5	05/07/87	05/24/88	51.3	6.2	17,054	11,449	67.1	36	42	44	46	48	50	52	54	56	58	59	62	67	48	57	61.5	1.00
CO01E	30	35	5	11/04/87	05/14/88	38.8	4.5	3,528	2,734	77.5	29	32	34	35	36	38	39	41	42	44	45	47	51	35	44	76.9	1.08
CO03E	40	45	5	11/04/87	05/16/88	42.8	6.8	602	585	97.2	29	32	34	36	38	41	43	46	48	50	51	54	62	41	50	53.2	0.95
CT01E	45	50	5	12/11/86	12/04/88	57.0	6.9	18,923	12,696	67.1	41	47	49	51	53	55	57	60	62	64	66	69	76	53	62	57.4	1.05
CT04E	30	35	5	10/24/86	12/09/88	43.0	7.1	1,884	1,731	91.9	24	31	34	36	39	41	44	46	48	50	52	54	60	40	49	54.8	0.90
DE05E	35	40	5	12/16/86	02/27/88	37.6	7.7	453	440	97.1	18	25	28	31	34	35	38	41	43	46	48	50	55	34	43	52.3	1.04
IN02E	25	30	5	10/06/86	09/06/88	24.8	5.7	8,608	6,276	72.9	11	16	18	20	22	23	25	27	29	31	32	34	39	21	30	64.2	1.00
IN03E	25	30	5	10/06/86	09/06/88	26.5	5.6	9,162	5,876	64.1	11	15	20	22	24	26	28	29	31	32	33	35	38	23	32	69.6	0.75
MD01E	50	55	5	09/23/86	06/28/88	56.4	6.1	3,284	2,754	83.9	41	47	50	51	53	55	57	59	60	63	64	67	73	53	62	65.0	1.00
MD02E	50	55	5	11/19/86	07/11/88	52.1	5.3	6,681	4,782	71.6	39	44	46	48	49	51	53	55	56	58	59	61	66	48	57	70.8	0.93
MD03E	50	55	5	11/28/86	06/28/88	51.1	7.2	2,769	2,454	88.6	32	38	41	45	48	50	52	54	56	58	60	62	68	48	57	59.8	0.82
MD04E	50	55	5	11/17/86	08/31/88	53.6	6.8	3,854	3,144	81.6	34	42	46	48	50	52	54	57	58	61	62	64	69	50	59	60.3	0.95
MD05E	50	55	5	10/02/86	06/29/88	54.9	6.7	3,176	2,635	83.0	38	45	48	50	52	53	55	57	59	61	63	66	73	50	59	65.1	1.06
MD06E	30	35	5	10/22/86	07/09/88	40.8	6.0	4,114	3,389	82.4	27	32	34	35	37	39	41	43	45	47	49	52	57	36	45	61.6	1.06
MD07E	30	35	5	09/30/86	07/09/88	36.0	5.7	2,728	2,390	87.6	23	27	30	31	33	34	36	38	40	42	43	46	52	32	41	64.5	1.06
MD08E	30	35	5	02/25/87	07/10/88	33.1	6.3	8,594	6,175	71.9	17	21	25	28	30	32	34	36	37	39	41	43	48	30	39	65.0	0.84
MD09E	30	35	5	01/09/87	07/11/88	35.9	4.6	5,299	4,029	76.0	24	29	31	32	34	35	36	38	39	41	42	44	47	32	41	75.6	1.08
MD10E	50	55	5	10/08/86	07/12/88	54.2	5.0	10,828	6,178	57.1	41	46	49	50	52	53	55	57	58	59	61	62	67	50	59	73.3	1.00
MS02E	30	35	5	02/18/87	12/20/88	35.9	7.6	7,874	6,034	76.6	19	22	25	27	32	35	38	40	41	44	45	47	52	34	43	54.7	0.70

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 30. After speed data for the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Limit Posted	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds															10-mi/h Pace			
											1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 5 mi/h at Experimental Sites (continued)																													
TN01E	50	55	5	10/30/86	07/12/89	56.8	6.1	7,498	6,192	82.6	43	48	50	52	54	55	57	59	61	63	65	67	74	53	62	64.1	1.06
TX06E	30	35	5	06/01/87	03/31/88	33.3	6.6	1,749	1,679	96.0	18	22	26	27	30	32	34	36	38	40	42	45	49	29	38	58.9	1.00
TX07E	40	45	5	08/20/87	04/02/88	35.2	6.0	7,964	6,269	78.7	14	26	29	31	33	34	36	38	39	41	43	44	48	32	41	67.8	0.88
TX08E	30	35	5	08/20/87	04/02/88	32.5	4.7	10,623	6,954	65.5	19	25	28	29	30	31	33	35	36	37	39	40	44	29	38	76.2	1.00
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																													
CO02E	30	40	10	11/04/87	05/14/88	42.3	5.4	2,398	2,067	86.2	28	34	36	38	39	41	43	45	46	48	49	51	55	38	47	67.8	0.93
CT03E	30	40	10	10/24/86	12/09/88	45.4	6.7	1,766	1,600	90.6	29	35	37	39	42	44	46	49	50	52	54	56	62	42	51	57.6	0.95
ID03E	20	30	10	06/01/88	10/03/88	25.0	4.4	1,343	1,299	96.7	15	18	20	21	23	24	26	27	29	30	31	33	36	21	30	74.4	0.92
ID04E	20	30	10	06/01/88	10/03/88	24.1	5.6	1,202	1,165	96.9	9	13	17	20	22	23	25	27	28	30	31	33	36	21	30	69.6	0.82
ID05E	20	30	10	06/01/88	10/02/88	21.5	6.6	643	625	97.2	9	11	12	14	17	20	23	25	27	29	30	32	36	20	29	54.7	0.80
ID06E	25	35	10	09/22/88	09/30/88	30.6	5.5	7,869	6,195	78.7	16	19	23	27	29	30	32	34	35	36	37	38	41	28	37	75.4	0.67
ID07E	25	35	10	09/22/88	09/30/88	27.9	4.6	7,945	6,763	85.1	16	20	22	24	26	27	29	30	31	33	34	35	38	24	33	74.7	0.86
ID08E	35	45	10	09/16/88	10/01/88	41.0	5.3	1,714	1,571	91.7	28	33	35	36	38	40	42	43	45	47	48	50	55	37	46	69.6	0.93
MA02E	30	40	10	11/01/86	12/07/88	41.9	5.8	1,611	1,507	93.5	25	33	36	37	39	40	43	45	46	48	50	52	56	38	47	65.2	0.94
ME03E	35	45	10	05/26/87	11/30/88	46.1	6.7	1,791	1,595	89.1	30	35	38	40	43	45	47	49	51	53	54	57	62	43	52	57.8	0.90
MS01E	35	45	10	02/18/87	12/19/88	42.8	6.5	6,072	4,473	73.7	20	33	36	38	40	42	43	46	47	49	51	53	58	39	48	64.8	1.06
VA02E	35	45	10	10/14/87	06/25/88	43.0	5.2	3,222	2,845	88.3	29	36	37	39	40	42	43	45	47	48	50	52	58	39	48	71.0	1.07
CA04E	30	45	15	03/12/87	05/21/88	42.2	5.3	12,683	9,618	75.8	30	35	36	37	39	41	42	44	46	48	49	52	57	38	47	68.3	1.13
IN04E	30	45	15	11/20/86	04/18/88	43.1	6.6	437	426	97.5	28	32	35	36	39	41	44	47	48	50	51	53	56	41	50	55.9	0.90
TX01E	40	55	15	10/17/86	12/16/88	45.8	9.1	582	572	98.3	20	31	35	37	41	44	47	50	52	56	57	60	63	44	53	45.8	0.85

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 31. Differences in speed characteristics for the experimental sites.

Experimental Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																							
NJ04E	-20	0.1	-1.1	225	209	-1.3	5	2	2	1	1	1	0	-1	-1	-1	-1	-1	-4	-1	-1	7.7	0.05
TX03E	-20	1.7	-0.3	205	200	0.8	6	3	2	2	1	2	1	1	1	2	1	2	2	2	2	-0.2	0.00
DE02E	-15	-0.8	-0.2	18	27	2.0	2	-1	-1	0	0	0	-1	-1	-2	-1	-1	0	-2	-2	-2	6.4	0.00
NM01E	-15	0.7	-0.5	296	280	-0.7	0	2	2	3	2	1	0	-1	-1	-1	0	2	3	-3	-3	4.4	0.13
NM03E	-15	-0.9	0.2	-210	-188	3.4	-1	-2	-2	-2	-1	0	-1	-2	-1	0	0	-1	-2	-1	-1	0.8	-0.01
NM04E	-15	1.0	0.3	-246	-197	6.8	0	1	-1	0	1	1	0	1	1	2	2	2	-1	1	1	-5.1	0.04
OH02E	-15	-0.5	-0.2	350	305	-1.2	-2	-1	-1	0	0	0	0	0	-1	-1	-1	-1	-2	0	0	2.6	-0.06
OH13E	-15	0.0	-0.3	-452	-168	4.7	3	0	0	0	0	-1	0	0	0	0	0	0	-1	0	0	1.7	0.00
TX05E	-15	-0.4	-0.2	2,283	854	-4.6	1	1	0	0	0	-1	0	0	-1	-1	-1	0	-1	-1	-1	0.3	-0.07
Speed Limit Lowered by 10 mi/h at Experimental Sites																							
CA01E	-10	-0.5	-0.2	-94	-79	0.3	1	1	-1	-1	-1	0	0	0	0	-1	-2	-1	0	0	0	2.5	-0.05
DE03E	-10	0.1	-0.1	56	28	-0.1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1.1	0.00
DE04E	-10	-0.6	0.0	-18	-17	0.2	3	0	0	-1	-1	0	-1	-1	-1	0	0	1	0	-2	-2	-0.3	0.08
IL01E	-10	-0.7	-0.4	1,549	783	-3.7	-1	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-2	-1	-1	4.7	0.08
IN01E	-10	-0.2	-0.2	-111	-124	-0.9	0	1	0	0	0	0	-1	-1	0	0	0	0	0	0	0	1.4	0.12
MA01E	-10	-1.0	-0.4	-14	-14	-0.1	1	1	0	-1	-2	-1	-2	-1	-1	-1	-1	-2	0	-1	-1	0.7	0.18
ME02E	-10	0.4	0.0	-30	-28	0.3	1	1	1	0	0	0	0	1	1	1	2	1	0	-2	-2	-3.9	0.04
MI09E	-10	0.8	-0.9	431	334	-2.1	2	3	3	3	2	1	0	0	-1	0	0	0	-1	-1	-1	5.1	0.12
NE01E	-10	-1.7	-0.8	819	631	-1.0	2	1	-1	-1	-1	-2	-3	-2	-2	-2	-3	-1	-1	-4	-4	4.8	0.18
NJ02E	-10	0.0	-1.0	231	91	-1.2	2	2	1	1	1	1	0	0	-1	0	-1	-1	-2	0	0	6.8	0.00
NJ03E	-10	0.5	-0.5	2,674	763	-13.0	-6	4	3	2	1	0	0	0	0	0	-1	-1	-1	0	0	8.4	0.10
OH01E	-10	-1.3	0.4	-756	-544	3.2	-2	-2	-2	-2	-2	-1	-2	-1	-1	-1	-1	0	0	-2	-2	-3.8	0.15
OH03E	-10	0.4	-0.1	443	288	-1.4	1	1	0	0	0	0	0	0	0	0	0	-1	2	0	0	3.2	-0.01
OH04E	-10	-0.7	-0.3	-905	-425	9.7	1	0	0	0	-1	-1	-1	-1	-1	-1	0	0	0	-2	-2	2.6	0.09
OH05E	-10	0.1	-1.0	-451	-405	-0.2	6	3	0	1	1	0	-1	-1	-1	0	0	0	0	-1	-1	5.3	0.19
OH06E	-10	0.5	-0.9	-91	-97	-0.9	5	2	2	1	1	0	0	-1	-1	0	1	0	-1	-2	-2	3.5	0.07
OH07E	-10	1.1	-0.6	561	455	0.3	2	3	2	2	1	1	1	1	0	0	1	0	0	1	1	3.4	0.05
OH08E	-10	0.7	0.6	79	78	0.2	1	1	0	-1	0	1	1	1	1	2	2	2	2	3	3	-3.7	-0.03
OH09E	-10	0.0	-0.1	659	338	-6.4	2	-1	0	0	0	1	1	0	0	0	0	0	0	-1	-1	2.0	-0.16

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 31. Differences in speed characteristics for the experimental sites (continued).

Experimental Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																							
OH10E	-10	-2.0	-0.5	931	513	-4.5	0	-1	-2	-1	-1	-2	-2	-3	-2	-2	-2	-3	-3	-2	-2	3.2	0.00
OH11E	-10	1.9	-2.1	67	42	-1.6	2	3	4	5	9	3	1	0	-1	0	0	-1	-1	-1	-1	7.2	-0.03
OH12E	-10	-1.3	0.1	619	489	-1.7	2	-1	-1	-1	-2	-2	-2	-1	-2	-1	-2	0	1	-2	-2	0.1	0.09
OK01E	-10	-0.4	0.2	1,360	1,145	-0.9	-1	-2	0	0	0	0	0	-1	-1	0	0	0	1	-2	-2	2.2	-0.05
OK02E	-10	0.4	-0.3	-487	-573	-2.0	2	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1.7	0.16
OK03E	-10	1.3	-0.1	-549	-349	1.7	2	2	2	1	2	1	1	1	2	1	1	1	1	2	2	-0.9	0.06
OK04E	-10	-0.4	0.7	-323	-153	1.8	-3	-2	-1	-1	-1	0	0	0	0	0	0	0	1	0	0	-3.3	-0.11
TX02E	-10	-0.9	-0.6	110	80	-0.9	2	0	0	-1	-1	-1	-1	-1	-1	-1	-2	-1	-1	-2	-2	3.9	0.06
TX04E	-10	1.3	-0.2	442	358	-0.9	0	1	1	1	2	2	2	2	1	1	1	0	-3	4	4	1.1	-0.10
VA01E	-10	-0.9	-0.6	180	1	-1.6	1	1	0	0	-1	-1	-1	-1	-2	-2	-1	-1	-1	-2	-2	4.1	0.07
VA03E	-10	0.8	-0.2	-11	-29	-1.4	1	1	1	1	1	1	0	0	0	1	0	0	-1	1	1	1.7	0.15
VA04E	-10	0.5	0.0	-35	-29	1.0	1	1	0	0	1	1	1	1	1	1	1	0	-1	2	2	-4.0	-0.05
VA05E	-10	0.2	-0.8	139	153	2.2	1	4	1	0	1	1	0	0	0	-1	-1	-1	0	3	3	4.8	0.08
VA07E	-10	2.4	-0.6	-285	-124	2.5	4	3	4	3	3	2	3	2	1	2	2	2	1	2	2	4.3	-0.01
WV03E	-10	1.1	-0.1	-951	-792	3.8	1	2	2	1	1	1	1	1	1	1	2	2	1	-1	-1	-0.9	0.04
Speed Limit Lowered by 5 mi/h at Experimental Sites																							
AZ01E	-5	-0.6	-0.3	198	31	-1.4	1	0	0	0	-1	0	-1	-1	-1	-1	-1	-1	-2	-1	-1	2.9	0.07
CT02E	-5	0.0	-0.1	-1,463	-535	2.3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1.9	0.00
CT05E	-5	1.0	-0.1	2,308	1,265	-2.0	1	1	2	1	1	1	1	1	1	1	1	1	1	0	0	1.2	0.00
DE01E	-5	-0.2	-1.3	-211	-204	-0.2	3	1	2	2	1	1	-1	-1	-1	-1	-2	-4	-2	1	1	7.4	0.10
ID01E	-5	-1.0	-0.9	763	471	-3.4	1	1	1	1	0	-1	-1	-2	-2	-2	-2	-3	-3	-1	-1	6.8	-0.06
ID02E	-5	0.4	-0.3	136	34	-0.8	1	1	1	1	0	1	1	0	1	1	-1	-1	-1	2	2	3.1	-0.08
IL02E	-5	-0.8	0.0	899	282	-3.4	-1	-1	-1	0	0	-1	-1	-1	0	-1	0	0	0	-1	-1	-0.2	0.07
IN05E	-5	-0.6	-0.4	45	23	-1.3	1	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1	1	1	2.8	0.15
IN06E	-5	-0.4	-0.6	193	206	0.7	0	1	1	1	-1	0	-1	-1	0	-1	-1	-1	-1	-1	-1	3.3	0.08
IN07E	-5	0.6	-0.1	211	197	0.4	1	1	1	1	1	1	0	0	1	1	1	0	2	0	0	1.0	0.03
MA03E	-5	0.3	0.3	-57	-55	0.2	1	-1	1	0	0	0	1	0	0	0	1	1	3	0	0	-1.9	0.00
ME01E	-5	0.0	0.2	9	4	-1.5	-2	0	0	0	0	0	1	0	1	-1	0	0	0	0	0	-0.1	-0.18
NJ01E	-5	0.4	0.0	-219	-187	-0.4	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0.2	0.00
NM02E	-5	0.8	0.0	228	218	-0.2	-1	3	1	1	1	0	0	1	1	1	1	1	1	-1	-1	0.5	0.08

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 31. Differences in speed characteristics for the experimental sites (continued).

Experimental Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 5 mi/h at Experimental Sites																							
AZ02E	5	0.1	-0.2	36	32	-0.2	-1	0	1	0	1	0	0	0	0	0	-1	-1	-1	0	0	4.2	0.07
AZ03E	5	1.0	-0.9	151	183	1.2	3	2	2	2	1	1	1	1	1	-1	0	0	-1	1	1	9.6	0.01
CA06E	5	-2.1	-0.2	100	-157	-1.8	-1	-2	-1	-2	-2	-2	-2	-2	-2	-3	-3	-3	-2	-2	-2	2.2	-0.05
CA07E	5	-1.8	0.3	2,922	1,660	-2.2	-4	-2	-2	-2	-2	-1	-2	-2	-1	-2	-2	-1	-2	-1	-1	-0.5	0.06
CO01E	5	-0.1	-0.3	553	359	-2.3	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	0	3.9	0.00
CO03E	5	-0.5	-0.3	111	107	-0.2	1	0	-1	-1	-1	0	0	0	0	-1	-2	-3	0	2	2	-2.7	-0.19
CT01E	5	0.6	-0.1	1,883	764	-2.9	0	1	1	1	1	1	0	1	1	0	0	0	1	1	1	2.1	0.05
CT04E	5	-0.2	-0.1	122	112	0.0	-1	0	-1	-1	0	0	0	-1	0	-1	-1	-1	0	0	0	0.5	-0.05
DE05E	5	0.0	-0.5	25	21	-0.8	1	1	1	2	1	0	0	0	-1	-2	-1	-1	0	0	0	3.9	0.04
IN02E	5	-2.8	-0.2	438	181	-1.7	0	-1	-2	-2	-3	-4	-4	-3	-3	-3	-3	-3	-2	-3	-3	-2.1	0.18
IN03E	5	-0.4	0.0	464	284	-0.2	-1	-1	-1	0	-1	0	0	-1	0	-1	-1	-1	-1	-1	-1	0.4	-0.07
MD01E	5	1.6	-0.2	386	256	-2.3	3	1	2	2	1	2	2	2	1	2	1	2	2	2	2	1.7	-0.06
MD02E	5	0.9	-0.1	635	289	-2.7	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	2.4	-0.07
MD03E	5	-0.1	0.3	260	213	-0.7	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-0.04
MD04E	5	0.3	0.5	1,060	710	-5.5	-4	-1	0	0	0	0	0	1	0	1	0	1	0	0	0	-0.7	0.01
MD05E	5	1.1	0.6	268	203	-0.6	2	0	1	1	1	1	1	0	1	1	1	2	4	0	0	2.2	0.00
MD06E	5	0.2	0.0	448	303	-1.8	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	2.2	0.06
MD07E	5	0.3	-0.3	40	39	0.1	1	0	1	1	1	0	0	0	0	0	-1	0	2	0	0	2.9	0.00
MD08E	5	2.4	0.4	1,032	576	-2.1	0	1	2	3	2	3	3	3	2	2	3	3	3	3	3	1.2	-0.16
MD09E	5	0.7	-0.4	713	329	-4.7	2	2	2	1	1	1	0	1	0	0	0	0	-1	0	0	5.1	0.15
MD10E	5	0.5	0.0	1,399	498	-3.1	1	0	1	0	1	0	1	1	1	0	1	0	0	0	0	-0.2	0.00
MS02E	5	1.9	0.7	119	233	1.8	2	-1	0	0	2	2	3	3	2	3	2	2	2	3	3	-1.9	-0.20
TN01E	5	0.0	-0.1	1,185	880	-1.5	1	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1.1	0.00
TX06E	5	0.3	-0.5	187	197	1.1	1	1	2	1	1	1	0	0	0	-1	-1	0	0	0	0	5.5	0.09
TX07E	5	0.1	0.1	1,157	595	-4.7	-1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	-1.9	0.00
TX08E	5	1.9	-0.1	1,406	256	-7.2	1	2	3	2	2	2	2	2	2	1	2	1	1	2	2	1.9	0.00

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 31. Differences in speed characteristics for the experimental sites (continued).

Experimental Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																							
CO02E	10	1.4	-0.2	300	214	-2.1	0	2	2	2	1	2	2	2	1	1	1	0	0	1	1	2.6	-0.13
CT03E	10	0.5	-0.4	55	77	1.6	2	1	0	0	1	1	1	1	0	-1	-1	-1	0	2	2	4.5	-0.10
ID03E	10	0.8	-0.4	-71	-52	1.2	1	1	2	1	1	1	1	0	1	1	1	1	0	1	1	3.3	-0.01
ID04E	10	1.0	-0.4	41	39	-0.1	1	2	2	2	1	1	1	1	0	1	1	1	-1	0	0	3.3	0.04
ID05E	10	-0.2	-1.0	105	93	-1.7	1	1	0	1	1	1	0	0	-1	-1	-1	-1	-4	-1	-1	3.4	-0.06
ID06E	10	1.6	0.6	-150	23	1.7	0	0	-1	1	2	2	2	3	3	2	2	2	0	2	2	-2.2	-0.13
ID07E	10	0.8	0.6	-65	6	0.7	-1	-1	-1	0	1	1	1	1	1	2	2	1	1	1	1	-7.1	-0.05
ID08E	10	1.8	-0.5	-361	-309	1.1	1	2	2	2	2	3	3	2	2	1	1	0	1	3	3	4.0	-0.25
MA02E	10	0.0	-0.3	217	167	-2.6	0	1	1	0	0	0	0	0	0	0	0	0	-1	0	0	0.2	0.05
ME03E	10	-0.6	-0.3	71	78	0.9	1	-1	-1	-1	0	0	0	-1	-1	-1	-2	-2	-2	1	1	2.4	-0.15
MS01E	10	3.9	-0.3	727	484	-0.9	-2	4	4	5	5	5	4	5	3	3	3	2	1	5	5	6.7	0.01
VA02E	10	3.1	0.0	991	855	-0.9	2	4	3	4	3	4	3	3	3	2	3	3	5	3	3	1.9	0.00
CA04E	15	-1.4	-0.4	1,203	668	-2.2	-2	0	-1	-2	-1	-1	-2	-2	-2	-2	-2	-2	-3	-1	-1	3.1	0.07
IN04E	15	1.3	-0.7	32	36	1.2	2	2	3	2	1	1	2	2	0	0	-1	-2	-2	1	1	5.4	-0.14
TX01E	15	-1.5	-0.9	-163	-130	4.1	2	2	-1	-2	-2	-1	-1	-2	-2	-1	-1	-2	-8	-2	-2	0.1	-0.08

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 32. Average changes in speed characteristics for the experimental site groups.

Speed Limit Change Group	Factor	24-h Volume	Pct. Free Flow	Mean Speed	Std. Dev. Speeds	Percentile Speeds													10-mi/h Pace				
						1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew Index	Coeff. Var.
-15 & -20	Before	2,235	88.7	42.1	6.7	24.9	31.3	34.2	35.8	38.1	40.2	42.6	45.3	47.2	49.1	50.9	52.9	58.6	39.0	48.0	58.8	1.0	16.0
	After	2,510	89.8	42.2	6.5	26.4	31.9	34.3	36.2	38.6	40.6	42.4	45.0	46.7	49.0	50.8	53.2	57.7	38.4	47.4	60.8	1.0	15.3
	Mean Diff.	274	1.1	0.1	-0.3	1.6	0.6	0.1	0.4	0.4	0.3	-0.1	-0.3	-0.6	-0.1	-0.1	0.3	-0.9	-0.6	-0.6	2.1	0.0	-0.7
	Std. Dev.	802	3.5	0.9	0.4	2.7	1.7	1.5	1.4	0.9	1.0	0.6	1.0	1.0	1.3	1.1	1.3	2.1	1.5	1.5	3.8	0.1	1.1
	No. Sites	9																					
-10	Before	4,022	86.4	42.7	7.1	24.2	30.6	34.1	36.2	38.9	40.9	43.6	46.0	47.9	50.0	51.6	53.9	58.6	39.6	48.6	56.7	0.9	16.8
	After	4,206	85.8	42.7	6.7	25.2	31.6	34.6	36.5	39.3	41.1	43.4	45.8	47.5	49.9	51.4	53.7	58.3	39.2	48.2	58.8	1.0	16.0
	Mean Diff.	184	-0.6	0.1	-0.3	1.1	1.0	0.6	0.4	0.4	0.2	-0.2	-0.2	-0.4	-0.1	-0.1	-0.2	-0.3	-0.4	-0.4	2.0	0.0	-0.9
	Std. Dev.	715	3.5	1.0	0.5	2.1	1.6	1.5	1.4	2.0	1.1	1.2	1.1	1.0	1.0	1.3	1.1	1.2	1.8	1.8	3.3	0.1	1.6
	No. Sites	34																					
-5	Before	5,970	80.0	43.7	6.6	26.7	32.9	35.9	37.8	40.4	42.1	44.5	46.7	48.4	50.7	52.1	54.7	59.1	40.1	49.1	60.6	0.9	15.2
	After	6,187	79.2	43.7	6.3	27.1	33.4	36.6	38.4	40.6	42.2	44.4	46.4	48.4	50.4	51.9	54.1	58.9	40.0	49.0	62.7	1.0	14.6
	Mean Diff.	217	-0.8	-0.0	-0.3	0.4	0.5	0.8	0.6	0.1	0.1	-0.1	-0.4	0.1	-0.3	-0.2	-0.6	-0.2	-0.1	-0.1	2.1	0.0	-0.5
	Std. Dev.	808	1.6	0.6	0.4	1.2	1.0	0.8	0.6	0.7	0.7	0.9	0.8	1.0	1.0	1.1	1.5	1.6	0.9	0.9	2.6	0.1	0.9
	No. Sites	14																					
+5	Before	5,717	81.8	41.9	6.1	26.8	32.2	34.7	36.5	38.7	40.3	42.5	44.6	46.2	48.5	50.1	52.2	57.0	38.1	47.1	62.8	1.0	15.3
	After	6,375	80.0	42.2	6.1	27.1	32.4	35.2	36.9	39.0	40.7	42.7	44.8	46.4	48.4	49.9	52.1	57.3	38.5	47.5	64.5	1.0	15.0
	Mean Diff.	658	-1.7	0.2	-0.1	0.3	0.2	0.5	0.4	0.3	0.3	0.2	0.3	0.2	-0.2	-0.2	-0.1	0.2	0.3	0.3	1.6	-0.0	-0.3
	Std. Dev.	691	2.1	1.2	0.4	1.7	1.1	1.3	1.3	1.3	1.3	1.5	1.4	1.1	1.4	1.5	1.5	1.5	1.4	1.4	2.8	0.1	1.0
	No. Sites	26																					
+10 & +15	Before	3,223	89.2	36.7	6.3	21.6	26.5	29.4	31.2	33.4	34.9	37.2	39.4	41.3	43.3	44.7	47.1	52.1	33.1	42.1	62.7	1.0	17.9
	After	3,419	89.3	37.5	6.0	22.1	27.9	30.3	32.2	34.5	36.3	38.3	40.4	41.9	43.8	45.1	47.1	51.3	34.2	43.2	64.8	0.9	16.7
	Mean Diff.	195	0.1	0.8	-0.3	0.5	1.3	0.9	1.0	1.1	1.3	1.1	1.0	0.5	0.5	0.4	0.0	-0.9	1.1	1.1	2.1	-0.1	-1.2
	Std. Dev.	442	1.8	1.5	0.4	1.4	1.5	1.8	2.0	1.6	1.7	1.6	1.9	1.7	1.5	1.7	1.6	2.9	1.8	1.8	3.4	0.1	1.5
	No. Sites	15																					

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 33. Before speed data for the comparison sites.

Comparison Site Number	Posted Speed Limit	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																								
NJ04C	50	01/17/87	47.6	5.5	1,440	1,279	88.8	33	39	42	43	45	46	48	50	51	54	55	57	61	43	52	68.2	1.07
TX03C	55	03/02/87	49.6	10.4	459	447	97.4	19	28	38	41	45	48	51	55	57	59	62	64	71	48	57	44.5	0.86
DE02C	50	09/29/86	44.5	6.9	213	210	98.6	25	32	36	39	42	43	45	47	49	51	53	56	59	42	51	61.4	0.91
NM01C	55	02/23/87	52.2	7.7	1,496	1,407	94.1	33	40	43	45	48	50	52	55	57	60	62	65	74	48	57	54.1	1.04
NM03C	40	02/26/87	44.2	9.8	577	559	96.9	20	25	31	35	40	42	46	49	51	54	57	60	67	41	50	46.3	0.77
NM04C	40	02/26/87	44.2	9.8	577	559	96.9	20	25	31	35	40	42	46	49	51	54	57	60	67	41	50	46.3	0.77
OH02C	55	06/28/86	46.6	7.2	668	642	96.1	29	35	38	40	43	45	47	50	52	55	57	59	63	43	52	52.5	1.00
OH13C	55	03/28/87	47.5	6.2	6,517	4,834	74.2	30	38	41	42	45	46	48	50	52	54	55	58	63	43	52	64.9	0.94
TX05C	55	03/08/87	52.6	6.4	4,281	3,527	82.4	33	43	46	47	50	51	53	56	57	59	61	63	68	49	58	63.3	1.00
Speed Limit Lowered by 10 mi/h at Experimental Sites																								
CA01C	30	02/09/87	34.0	5.6	8,689	6,780	78.0	21	25	27	29	31	32	34	36	38	40	42	44	49	30	39	64.7	1.06
DE03C	50	11/12/86	49.5	8.6	3,005	2,632	87.6	28	35	38	40	45	48	51	54	56	58	60	62	69	49	58	47.9	0.80
DE04C	50	11/12/86	49.3	8.7	3,005	2,624	87.3	27	34	38	40	44	47	51	54	56	58	60	62	69	49	58	47.3	0.80
IL01C	45	09/13/86	43.6	5.6	9,208	6,298	68.4	27	33	37	39	41	43	44	46	48	49	51	52	56	40	49	69.1	0.88
IN01C	55	09/07/86	52.9	6.6	1,993	1,861	93.4	34	42	45	47	50	51	54	56	58	60	61	63	69	50	59	59.8	0.89
MA01C	30	10/29/86	37.9	6.3	581	563	96.9	23	27	30	32	34	36	39	41	42	45	46	49	53	33	42	59.7	0.95
ME02C	45	10/15/86	46.5	7.5	364	356	97.8	29	33	36	39	42	45	48	50	52	54	56	59	62	45	54	53.1	0.78
MI09C	55	10/12/87	56.7	7.2	3,180	2,819	88.6	37	45	48	50	53	55	58	60	62	64	65	69	74	53	62	58.3	0.86
NE01C	55	04/20/87	52.1	8.3	821	784	95.5	26	37	42	45	49	51	54	56	57	59	62	64	68	49	58	59.2	0.67
NJ02C	50	12/15/86	50.6	7.9	2,161	2,014	93.2	28	37	41	44	47	49	52	54	56	59	60	63	69	46	55	51.9	0.87
NJ03C	50	12/18/86	50.2	7.7	2,045	1,914	93.6	28	38	41	43	46	48	51	54	56	58	60	62	69	47	56	52.6	0.91
OH01C	55	06/25/86	51.6	9.4	3,720	3,252	87.4	26	35	38	41	47	50	54	57	58	61	62	65	72	52	61	49.6	0.71
OH03C	55	06/30/86	52.9	7.7	1,491	1,359	91.1	29	40	44	47	50	52	54	56	58	61	62	65	70	49	58	57.2	0.95
OH04C	55	10/17/86	46.8	5.9	2,826	2,166	76.6	32	37	40	41	44	46	48	49	51	53	54	57	63	43	52	65.2	0.82
OH05C	55	10/19/86	50.0	11.1	2,771	2,412	87.0	20	27	31	37	47	50	54	56	58	59	61	64	70	50	59	53.4	0.48
OH06C	55	10/26/86	52.7	7.4	854	823	96.4	34	40	43	46	48	50	53	56	58	61	62	65	69	50	59	51.3	0.96
OH07C	55	10/29/86	43.8	8.4	6,534	5,347	81.8	23	29	32	35	39	42	46	48	50	52	54	56	62	43	52	50.1	0.72
OH08C	55	11/23/86	56.4	8.5	554	525	94.8	30	38	46	50	53	56	58	60	62	65	66	68	72	54	63	55.4	0.75

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 33. Before speed data for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																								
OH09C	55	01/16/87	54.4	6.4	2,957	2,624	88.7	37	44	47	49	52	53	55	57	58	61	62	65	71	50	59	65.3	1.00
OH10C	55	01/16/87	54.4	6.4	2,957	2,624	88.7	37	44	47	49	52	53	55	57	58	61	62	65	71	50	59	65.3	1.00
OH11C	50	01/26/87	41.6	6.4	1,327	1,258	94.8	23	33	35	36	38	40	42	45	46	48	50	52	57	38	47	61.1	1.06
OH12C	55	03/26/87	53.3	7.4	1,835	1,714	93.4	32	42	45	47	50	52	54	57	58	61	62	65	71	50	59	57.6	1.00
OK01C	45	08/21/86	46.6	7.0	6,456	5,962	92.3	24	36	39	41	43	45	47	50	51	54	55	58	63	43	52	60.1	1.05
OK04C	35	03/16/87	32.0	5.5	7,258	5,543	76.4	17	23	26	27	29	31	33	35	36	38	39	41	45	29	38	69.1	0.88
TX02C	55	03/02/87	49.6	10.4	459	447	97.4	19	28	38	41	45	48	51	55	57	59	62	64	71	48	57	44.5	0.86
TX04C	55	03/05/87	50.5	8.6	603	575	95.4	32	37	40	43	45	48	51	54	56	59	62	65	73	46	55	46.8	1.04
VA01C	55	07/11/86	44.7	6.1	7,973	5,892	73.9	27	35	38	39	42	43	46	48	49	51	53	54	58	41	50	63.0	0.94
VA03C	55	07/28/86	45.2	6.7	967	916	94.7	28	34	37	39	41	43	46	48	50	53	54	57	61	41	50	55.2	0.95
VA04C	55	07/28/86	45.2	6.7	967	916	94.7	28	34	37	39	41	43	46	48	50	53	54	57	61	41	50	55.2	0.95
VA05C	55	07/28/86	45.2	6.7	967	916	94.7	28	34	37	39	41	43	46	48	50	53	54	57	61	41	50	55.2	0.95
VA07C	55	08/27/86	49.4	8.1	2,144	1,925	89.8	26	36	39	42	45	48	51	53	55	57	59	62	67	46	55	50.6	0.78
WV03C	45	08/29/86	39.0	7.8	1,035	966	93.3	20	25	29	31	35	37	40	43	45	47	49	52	57	36	45	50.9	0.92
Speed Limit Lowered by 5 mi/h at Experimental Sites																								
AZ01C	45	03/27/87	46.9	6.5	1,757	1,637	93.2	30	37	39	41	44	45	48	50	51	54	55	58	63	43	52	60.4	0.95
CT02C	45	10/08/86	40.7	8.8	4,761	3,894	81.8	18	22	29	32	37	40	43	46	47	49	51	53	58	40	49	51.7	0.67
CT05C	45	10/25/86	48.3	5.6	3,462	2,858	82.6	36	41	42	43	45	47	48	50	52	54	56	58	64	43	52	68.1	1.13
DE01C	40	09/26/86	33.2	6.2	605	573	94.7	17	23	26	28	30	32	34	36	38	40	41	44	47	28	37	60.2	0.89
ID01C	55	04/12/87	51.5	6.6	2,508	2,220	88.5	34	41	44	46	48	50	52	54	56	58	60	62	69	48	57	61.3	1.00
ID02C	55	04/12/87	51.5	6.6	2,508	2,220	88.5	34	41	44	46	48	50	52	54	56	58	60	62	69	48	57	61.3	1.00
IL02C	45	09/13/86	43.6	5.6	9,208	6,298	68.4	27	33	37	39	41	43	44	46	48	49	51	52	56	40	49	69.1	0.88
IN05C	45	11/12/86	48.0	6.6	1,321	1,235	93.5	30	37	40	42	44	47	49	51	53	55	56	59	62	44	53	58.5	0.90
IN06C	50	12/17/86	51.0	6.6	4,593	3,887	84.6	33	40	43	45	48	50	52	54	56	58	59	62	65	48	57	59.3	0.90
IN07C	50	12/17/86	51.0	6.6	4,593	3,887	84.6	33	40	43	45	48	50	52	54	56	58	59	62	65	48	57	59.3	0.90
MA03C	30	10/31/86	37.6	6.8	632	620	98.1	21	26	29	31	34	36	38	41	42	45	46	50	53	34	43	56.9	0.95
ME01C	45	10/15/86	46.5	7.5	364	356	97.8	29	33	36	39	42	45	48	50	52	54	56	59	62	45	54	53.1	0.78
NJ01C	40	11/18/86	44.4	6.3	2,747	2,357	85.8	25	35	37	39	41	43	45	47	49	51	52	55	60	40	49	63.4	1.00
NM02C	55	02/23/87	52.2	7.7	1,496	1,407	94.1	33	40	43	45	48	50	52	55	57	60	62	65	74	48	57	54.1	1.04

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 33. Before speed data for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 5 mi/h at Experimental Sites																								
AZ02C	30	03/30/87	31.0	5.7	2,100	1,946	92.7	18	22	25	26	28	29	31	33	35	38	39	41	46	27	36	64.2	1.06
AZ03C	30	04/01/87	32.1	6.9	2,715	2,483	91.5	14	19	24	26	29	31	33	35	37	39	41	43	48	29	38	61.2	0.86
CA06C	45	03/13/87	49.9	6.9	21,723	13,741	63.3	29	39	42	44	46	48	51	53	55	57	59	61	66	46	55	57.4	0.95
CA07C	45	03/13/87	49.9	6.9	21,723	13,741	63.3	29	39	42	44	46	48	51	53	55	57	59	61	66	46	55	57.4	0.95
CO01C	30	04/04/87	32.0	4.7	754	708	93.9	22	25	27	28	29	31	32	34	35	37	38	40	46	28	37	74.3	1.08
CO03C	30	02/02/87	37.4	5.6	572	552	96.5	24	29	31	32	34	36	38	40	42	43	45	47	52	33	42	65.4	1.00
CT01C	45	10/05/86	49.2	6.6	18,424	12,193	66.2	26	39	42	44	46	48	50	52	54	56	57	59	64	46	55	61.8	0.94
DE05C	35	11/15/86	34.0	7.7	938	910	97.0	16	22	25	27	30	32	34	37	39	42	44	48	53	29	38	51.0	1.04
IN02C	25	09/10/86	25.2	5.7	6,505	4,981	76.6	12	16	19	20	22	24	26	28	29	31	33	35	41	21	30	64.4	0.94
IN03C	25	09/10/86	25.2	5.7	6,505	4,981	76.6	12	16	19	20	22	24	26	28	29	31	33	35	41	21	30	64.4	0.94
MD01C	50	08/03/86	54.5	6.6	2,943	2,508	85.2	35	43	47	49	51	53	56	57	59	61	63	65	70	51	60	61.7	0.84
MD02C	50	08/06/86	52.5	6.5	1,565	1,410	90.1	37	43	46	47	49	51	53	55	57	59	61	64	70	48	57	61.1	1.00
MD03C	50	08/07/86	53.0	5.7	6,123	4,335	70.8	41	45	47	48	50	51	53	55	57	58	60	63	71	48	57	68.9	1.13
MD04C	50	08/10/86	44.7	6.9	1,251	1,187	94.9	27	34	37	39	41	42	45	48	50	52	54	57	60	40	49	56.2	1.10
MD05C	50	08/12/86	53.8	5.9	6,527	4,685	71.8	37	45	48	49	51	52	54	56	58	60	61	63	68	50	59	66.5	1.00
MD06C	30	08/16/86	34.9	7.2	1,730	1,650	95.4	18	22	25	28	31	33	36	38	40	42	44	46	51	33	42	55.5	0.82
MD07C	30	08/16/86	34.9	7.2	1,730	1,650	95.4	18	22	25	28	31	33	36	38	40	42	44	46	51	33	42	55.5	0.82
MD08C	30	08/16/86	34.9	7.2	1,730	1,650	95.4	18	22	25	28	31	33	36	38	40	42	44	46	51	33	42	55.5	0.82
MD09C	30	08/18/86	37.2	6.0	3,080	2,726	88.5	23	28	30	32	34	35	38	40	42	44	45	48	52	33	42	60.5	1.00
MD10C	50	08/19/86	50.1	5.2	8,562	5,288	61.8	36	42	44	46	48	49	51	52	54	55	57	58	62	46	55	71.9	0.86
MS02C	30	09/25/86	34.4	5.2	6,429	5,197	80.8	22	27	29	30	32	33	35	37	38	40	41	43	48	30	39	69.6	1.00
TN01C	55	09/03/86	59.2	6.1	1,705	1,605	94.1	44	50	52	54	56	57	60	62	63	66	67	70	75	55	64	62.2	1.00
TX06C	30	03/11/87	36.5	7.2	1,734	1,566	90.3	17	24	28	30	33	35	37	40	42	44	46	48	52	33	42	53.9	0.95
TX07C	35	03/13/87	33.0	5.3	6,045	5,159	85.3	20	25	27	28	30	32	33	36	37	39	40	42	47	29	38	68.2	1.07
TX08C	35	03/13/87	33.0	5.3	6,045	5,159	85.3	20	25	27	28	30	32	33	36	37	39	40	42	47	29	38	68.2	1.07

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 33. Before speed data for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																								
CO02C	30	04/04/87	32.0	4.7	754	708	93.9	22	25	27	28	29	31	32	34	35	37	38	40	46	28	37	74.3	1.08
ID03C	20	04/15/87	21.3	5.3	434	431	99.3	10	13	15	17	18	20	22	24	25	28	29	30	36	17	26	67.3	0.93
ID04C	20	04/15/87	21.3	5.3	434	431	99.3	10	13	15	17	18	20	22	24	25	28	29	30	36	17	26	67.3	0.93
ID05C	20	04/15/87	21.3	5.3	434	431	99.3	10	13	15	17	18	20	22	24	25	28	29	30	36	17	26	67.3	0.93
ID06C	25	04/17/87	27.3	4.2	7,840	6,298	80.3	15	21	23	24	26	27	28	29	30	32	33	34	38	24	33	82.2	0.91
ID07C	25	06/04/88	28.0	4.2	7,041	5,844	83.0	16	22	24	25	26	27	29	30	31	32	33	35	39	24	33	81.5	0.91
ID08C	35	06/04/88	32.8	6.2	578	559	96.7	17	23	26	27	30	31	33	36	37	40	41	43	48	28	37	61.7	1.00
MA02C	30	10/29/86	37.9	6.3	581	563	96.9	23	27	30	32	34	36	39	41	42	45	46	49	53	33	42	59.7	0.95
ME03C	35	10/21/86	42.2	7.5	661	640	96.8	23	29	33	35	39	40	43	45	47	50	52	55	62	39	48	56.7	0.91
MS01C	35	09/23/86	43.7	7.8	2,882	2,613	90.7	22	30	34	37	40	42	45	47	49	52	53	56	61	41	50	51.9	0.82
VA02C	35	07/26/86	40.3	5.3	4,060	3,447	84.9	27	32	34	36	38	39	41	43	44	46	47	49	54	36	45	70.2	0.93
CA04C	30	02/28/87	40.1	6.7	4,080	3,912	95.9	25	30	32	34	36	38	41	43	45	47	49	51	57	37	46	55.8	0.95
IN04C	30	11/10/86	34.7	7.6	521	507	97.3	13	18	24	29	32	34	36	38	40	42	44	46	51	32	41	60.9	0.75
TX01C	40	09/19/86	38.0	7.6	1,000	936	93.6	20	26	29	31	33	35	38	41	43	46	48	51	58	35	44	51.3	1.09

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 34. After speed data for the comparison sites.

Comparison Site Number	Posted Speed Limit	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds															10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																										
NJ04C	50	04/02/89	46.6	6.0	1,810	1,625	89.8	32	38	40	41	44	45	47	49	51	53	54	57	65	43	52	65.3	1.00
TX03C	55	03/29/88	52.3	7.8	418	406	97.1	27	39	43	45	48	51	53	55	57	60	62	65	69	48	57	55.2	0.91
DE02C	50	10/24/88	44.9	7.5	245	241	98.4	24	31	36	38	41	44	45	47	50	53	55	58	62	41	50	55.6	0.96
NM01C	55	04/06/88	52.2	7.9	1,779	1,659	93.3	34	40	43	45	48	50	53	55	57	60	62	65	73	49	58	51.3	0.96
NM03C	40	04/15/88	43.6	8.5	744	722	97.0	22	28	33	36	39	42	45	47	50	53	54	57	62	38	47	48.3	0.85
NM04C	40	04/15/88	43.6	8.5	744	722	97.0	22	28	33	36	39	42	45	47	50	53	54	57	62	38	47	48.3	0.85
OH02C	55	09/25/87	45.9	7.0	894	833	93.2	28	34	37	40	42	44	46	49	51	54	55	57	62	42	51	55.6	0.95
OH13C	55	03/12/88	47.6	6.7	5,198	4,045	77.8	28	36	40	42	45	47	49	51	52	54	56	58	64	45	54	62.2	0.84
TX05C	55	07/08/89	53.0	6.0	5,242	4,270	81.5	38	44	46	48	50	51	54	56	57	59	61	63	67	49	58	65.0	0.94
Speed Limit Lowered by 10 mi/h at Experimental Sites																										
CA01C	30	05/26/88	33.5	5.4	9,559	7,348	76.9	20	25	28	29	31	32	34	36	37	39	40	43	48	29	38	68.6	1.00
DE03C	50	02/29/88	49.6	8.7	2,892	2,522	87.2	28	35	38	40	45	48	51	54	56	58	60	63	69	49	58	48.5	0.85
DE04C	50	02/29/88	49.5	8.8	2,919	2,542	87.1	27	34	38	40	44	48	51	54	56	58	60	63	69	49	58	48.3	0.85
IL01C	45	09/17/88	43.3	4.9	11,059	7,080	64.0	30	35	38	39	41	42	44	46	47	48	50	51	55	40	49	74.0	0.92
IN01C	55	08/11/88	53.4	6.7	2,071	1,931	93.2	33	43	46	48	50	52	54	57	58	60	62	64	69	50	59	61.9	0.95
MA01C	30	12/07/88	38.0	5.7	598	583	97.5	24	29	31	33	35	37	38	40	42	44	46	48	52	34	43	65.0	1.06
ME02C	45	12/01/88	47.7	6.9	440	426	96.8	29	36	39	42	44	46	48	51	53	55	57	59	62	43	52	55.2	0.95
MI09C	55	06/08/89	57.0	6.8	3,775	3,249	86.1	37	47	49	51	54	55	58	60	62	64	66	68	74	53	62	59.7	0.95
NE01C	55	05/12/88	52.6	7.8	1,018	969	95.2	28	38	44	47	50	52	54	56	58	60	62	64	71	49	58	59.4	0.82
NJ02C	50	05/01/88	50.5	7.0	2,260	2,089	92.4	29	39	43	45	47	49	51	54	55	57	59	61	68	47	56	60.0	0.90
NJ03C	50	05/01/88	50.5	7.0	2,277	2,101	92.3	29	39	43	45	47	49	51	54	55	58	59	61	68	48	57	59.4	0.95
OH01C	55	05/03/89	50.9	9.5	2,949	2,666	90.4	26	34	38	40	45	49	53	56	58	60	62	65	71	52	61	46.7	0.74
OH03C	55	09/23/87	52.9	7.6	1,807	1,613	89.3	28	40	45	47	49	51	54	56	58	61	62	65	70	49	58	57.1	0.95
OH04C	55	11/07/87	47.5	5.9	1,996	1,711	85.7	31	38	41	43	45	46	48	50	52	54	55	57	62	44	53	65.2	1.00
OH05C	55	11/10/87	50.2	10.5	2,419	2,093	86.5	21	27	33	40	47	50	53	56	57	60	61	64	68	49	58	51.4	0.61
OH06C	55	11/01/87	53.2	7.9	889	857	96.4	26	40	44	46	50	52	55	57	59	61	63	65	69	51	60	55.8	0.82
OH07C	55	11/04/87	43.6	7.2	7,816	6,170	78.9	25	30	34	37	40	42	45	47	49	51	53	55	59	41	50	56.5	0.82
OH08C	55	11/04/87	56.8	9.0	562	545	97.0	30	40	46	49	53	55	58	61	63	66	67	71	75	55	64	50.6	0.81
OH09C	55	03/11/88	54.7	6.0	4,233	3,431	81.1	38	45	48	50	52	53	55	57	59	61	62	65	70	51	60	65.0	0.94

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 34. After speed data for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																								
OH10C	55	03/11/88	54.7	6.0	4,233	3,431	81.1	38	45	48	50	52	53	55	57	59	61	62	65	70	51	60	65.0	0.94
OH11C	50	11/10/87	41.6	6.2	1,513	1,431	94.6	24	31	35	36	38	40	42	44	46	48	50	52	56	38	47	63.2	1.00
OH12C	55	05/03/88	52.3	6.8	2,153	1,970	91.5	33	41	45	46	49	51	53	55	57	59	61	63	69	50	59	59.3	0.95
OK01C	45	07/09/89	47.6	6.4	6,794	6,309	92.9	27	37	41	43	45	46	48	50	52	54	55	58	62	44	53	64.1	1.00
OK04C	35	03/27/88	31.7	5.6	6,937	5,524	79.6	18	22	25	27	29	30	32	34	36	38	39	41	46	28	37	67.2	1.00
TX02C	55	03/29/88	52.3	7.8	418	406	97.1	27	39	43	45	48	51	53	55	57	60	62	65	69	48	57	55.2	0.91
TX04C	55	04/04/88	51.3	7.3	1,526	1,420	93.1	33	40	43	45	47	49	52	55	57	59	61	63	69	48	57	53.5	0.95
VA01C	55	08/07/87	46.0	5.9	9,407	6,547	69.6	30	37	40	41	43	45	47	49	50	52	53	56	60	42	51	65.0	0.88
VA03C	55	11/16/87	45.8	8.4	1,154	1,073	93.0	21	30	35	38	42	44	48	50	52	54	56	58	62	45	54	50.9	0.72
VA04C	55	11/16/87	45.8	8.4	1,154	1,073	93.0	21	30	35	38	42	44	48	50	52	54	56	58	62	45	54	50.9	0.72
VA05C	55	06/26/88	46.8	8.1	1,111	1,052	94.7	20	33	37	40	43	45	48	51	53	55	56	59	62	46	55	50.8	0.87
VA07C	55	10/27/87	50.2	8.3	2,150	1,940	90.2	29	37	40	42	45	48	51	54	57	59	61	64	67	47	56	45.7	0.92
WV03C	45	11/07/87	38.7	8.9	707	648	91.7	18	23	26	29	34	37	40	43	46	48	50	52	57	38	47	46.1	0.81
Speed Limit Lowered by 5 mi/h at Experimental Sites																								
AZ01C	45	04/09/88	46.7	6.3	1,735	1,614	93.0	29	37	40	41	43	45	47	50	51	53	55	57	62	43	52	62.5	1.00
CT02C	45	12/06/88	40.3	9.0	5,050	4,072	80.6	21	24	26	29	35	39	43	45	47	49	51	53	58	41	50	49.7	0.67
CT05C	45	12/03/88	49.4	5.6	3,885	3,210	82.6	36	41	43	45	46	48	50	52	53	55	57	59	65	45	54	67.0	1.07
DE01C	40	10/28/88	34.1	7.4	531	502	94.5	18	22	24	27	30	32	35	37	40	42	44	47	52	29	38	51.4	0.96
ID01C	55	10/04/88	51.6	5.7	3,550	2,765	77.9	37	43	46	47	49	50	52	54	56	57	59	61	66	48	57	67.8	1.00
ID02C	55	10/04/88	51.6	5.7	3,550	2,765	77.9	37	43	46	47	49	50	52	54	56	57	59	61	66	48	57	67.8	1.00
IL02C	45	09/17/88	43.3	4.9	11,059	7,080	64.0	30	35	38	39	41	42	44	46	47	48	50	51	55	40	49	74.0	0.92
IN05C	45	03/24/88	48.1	6.1	1,311	1,197	91.3	32	38	41	43	45	47	49	51	53	54	56	58	62	45	54	62.9	0.89
IN06C	50	08/09/88	51.2	6.5	5,351	4,495	84.0	33	40	44	45	48	50	52	54	56	58	59	62	66	48	57	59.5	0.95
IN07C	50	08/09/88	51.2	6.5	5,351	4,495	84.0	33	40	44	45	48	50	52	54	56	58	59	62	66	48	57	59.5	0.95
MA03C	30	12/08/88	37.6	6.5	638	615	96.4	21	27	30	32	34	36	39	40	42	44	46	49	52	34	43	60.3	0.90
ME01C	45	12/01/88	47.7	6.9	440	426	96.8	29	36	39	42	44	46	48	51	53	55	57	59	62	43	52	55.2	0.95
NJ01C	40	04/03/89	44.0	6.0	2,594	2,248	86.7	24	35	38	39	41	43	45	47	48	50	51	54	58	40	49	66.1	0.94
NM02C	55	04/06/88	52.2	7.9	1,779	1,659	93.3	34	40	43	45	48	50	53	55	57	60	62	65	73	49	58	51.3	0.96

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 34. After speed data for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 5 mi/h at Experimental Sites																								
AZ02C	30	04/11/88	30.6	5.6	2,120	1,987	93.7	17	22	25	26	27	29	31	33	34	37	38	40	47	27	36	65.9	1.00
AZ03C	30	04/12/88	32.6	7.1	3,165	2,902	91.7	15	19	23	26	29	31	34	36	38	40	41	44	48	29	38	58.5	0.78
CA06C	45	05/23/88	48.4	6.8	23,692	14,041	59.3	31	37	40	42	45	47	49	52	53	55	57	59	64	46	55	59.0	0.90
CA07C	45	05/24/88	48.0	6.6	24,388	14,553	59.7	31	37	40	42	45	47	49	51	53	55	56	59	64	45	54	60.8	0.90
CO01C	30	05/14/88	32.0	4.8	1,106	981	88.7	20	25	27	28	30	31	32	34	35	37	38	41	46	28	37	74.3	1.08
CO03C	30	05/16/88	36.6	5.4	666	631	94.7	23	28	30	32	34	35	37	39	40	42	44	46	52	32	41	66.9	1.00
CT01C	45	12/04/88	49.3	6.8	21,688	13,569	62.6	30	39	42	44	46	48	50	52	54	56	58	60	65	46	55	60.2	0.95
DE05C	35	02/27/88	33.5	7.4	951	918	96.5	16	21	25	27	29	31	34	37	39	42	44	46	51	29	38	52.3	1.00
IN02C	25	09/06/88	24.2	5.8	6,924	5,239	75.7	10	15	18	19	21	23	25	27	28	30	32	34	40	20	29	63.4	0.94
IN03C	25	09/06/88	24.2	5.8	6,924	5,239	75.7	10	15	18	19	21	23	25	27	28	30	32	34	40	20	29	63.4	0.94
MD01C	50	06/28/88	55.0	6.5	3,126	2,619	83.8	39	45	48	50	52	53	55	58	59	62	63	66	72	51	60	62.5	1.11
MD02C	50	07/11/88	52.0	6.7	1,657	1,505	90.8	33	41	45	46	49	50	53	55	56	58	61	63	69	48	57	62.1	0.95
MD03C	50	06/28/88	53.9	5.6	6,400	4,341	67.8	41	46	48	49	51	52	54	56	58	60	61	64	70	49	58	67.0	1.07
MD04C	50	08/31/88	46.1	7.0	1,433	1,342	93.6	26	34	38	40	42	45	47	49	51	54	55	57	62	42	51	56.6	0.90
MD05C	50	06/29/88	55.2	5.4	7,404	5,123	69.2	43	48	50	51	52	54	55	57	59	61	62	64	70	51	60	69.8	1.14
MD06C	30	07/10/88	34.6	6.9	1,886	1,809	95.9	19	23	25	28	31	33	36	38	40	42	44	46	50	31	40	55.1	0.86
MD07C	30	07/10/88	34.6	6.9	1,886	1,809	95.9	19	23	25	28	31	33	36	38	40	42	44	46	50	31	40	55.1	0.86
MD08C	30	07/10/88	34.6	6.9	1,886	1,809	95.9	19	23	25	28	31	33	36	38	40	42	44	46	50	31	40	55.1	0.86
MD09C	30	07/11/88	37.7	5.5	3,093	2,740	88.6	25	30	32	33	35	36	38	40	42	44	45	48	52	33	42	65.4	1.13
MD10C	50	07/12/88	50.3	5.1	8,264	5,174	62.6	37	42	45	46	48	49	51	53	54	55	57	59	63	46	55	73.2	1.00
MS02C	30	12/20/88	34.5	4.9	6,676	5,456	81.7	23	27	29	30	32	33	35	37	38	40	41	43	47	31	40	72.9	1.00
TN01C	55	07/12/89	58.8	6.1	2,203	2,027	92.0	45	50	52	53	55	57	59	62	63	65	67	70	74	54	63	62.9	1.11
TX06C	30	03/31/88	37.9	6.9	1,716	1,589	92.6	19	26	30	32	35	36	39	41	43	45	47	49	52	35	44	58.1	0.90
TX07C	35	04/02/88	32.4	5.0	6,009	5,093	84.8	21	25	27	28	29	31	33	35	36	38	39	41	45	28	37	70.3	1.00
TX08C	35	04/02/88	32.4	5.0	6,009	5,093	84.8	21	25	27	28	29	31	33	35	36	38	39	41	45	28	37	70.3	1.00

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 34. After speed data for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
								1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																								
CO02C	30	05/14/88	32.0	4.8	1,106	981	88.7	20	25	27	28	30	31	32	34	35	37	38	41	46	28	37	74.3	1.08
ID03C	20	10/03/88	21.3	4.8	401	390	97.3	10	13	15	17	19	20	22	24	25	26	27	28	35	18	27	73.6	0.86
ID04C	20	10/03/88	21.3	4.8	401	390	97.3	10	13	15	17	19	20	22	24	25	26	27	28	35	18	27	73.6	0.86
ID05C	20	10/03/88	21.3	4.8	401	390	97.3	10	13	15	17	19	20	22	24	25	26	27	28	35	18	27	73.6	0.86
ID06C	25	09/30/88	27.2	4.3	8,091	6,287	77.7	15	20	23	24	25	26	28	29	30	32	33	34	38	23	32	80.1	0.92
ID07C	25	09/30/88	27.2	4.3	8,091	6,287	77.7	15	20	23	24	25	26	28	29	30	32	33	34	38	23	32	80.1	0.92
ID08C	35	10/01/88	32.6	5.8	489	465	95.1	19	22	26	27	30	31	33	35	37	38	40	43	47	29	38	64.9	0.89
MA02C	30	12/07/88	38.0	5.7	598	583	97.5	24	29	31	33	35	37	38	40	42	44	46	48	52	34	43	65.0	1.06
ME03C	35	11/30/88	42.8	7.6	705	674	95.6	21	30	34	36	39	41	44	46	48	50	53	55	60	40	49	55.0	0.91
MS01C	35	12/19/88	45.1	7.6	3,378	3,025	89.6	26	32	36	38	41	43	46	48	51	53	55	57	64	42	51	53.1	0.91
VA02C	35	06/25/88	40.6	5.3	3,725	3,127	83.9	27	33	35	36	38	39	41	43	44	46	48	50	55	37	46	69.7	1.07
CA04C	30	05/21/88	38.8	7.1	5,066	4,722	93.2	23	26	29	32	35	37	40	42	44	46	48	50	55	36	45	56.4	0.82
IN04C	30	04/18/88	35.8	7.4	593	574	96.8	15	20	28	30	33	35	37	39	40	43	45	47	51	31	40	59.2	0.82
TX01C	40	12/16/88	36.8	7.3	906	889	98.1	22	25	28	30	32	34	37	40	42	44	46	49	57	32	41	53.0	1.00

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 35. Differences in speed characteristics for the comparison sites.

Comparison Site Number	Posted Speed Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																							
NJ04C	50	-1.0	0.5	370	346	1.0	-1	-1	-2	-2	-1	-1	-1	-1	0	-1	-1	0	4	0	0	-2.9	-0.07
TX03C	55	2.7	-2.6	-41	-41	-0.3	8	11	5	4	3	3	2	0	0	1	0	1	-2	0	0	10.7	0.05
DE02C	50	0.4	0.6	32	31	-0.2	-1	-1	0	-1	-1	1	0	0	1	2	2	2	3	-1	-1	-5.8	0.05
NM01C	55	0.0	0.2	283	252	-0.8	1	0	0	0	0	0	1	0	0	0	0	0	-1	1	1	-2.8	-0.08
NM03C	40	-0.6	-1.3	167	163	0.1	2	3	2	1	-1	0	-1	-2	-1	-1	-3	-3	-5	-3	-3	2.0	0.08
NM04C	40	-0.6	-1.3	167	163	0.1	2	3	2	1	-1	0	-1	-2	-1	-1	-3	-3	-5	-3	-3	2.0	0.08
OH02C	55	-0.7	-0.2	226	191	-2.9	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-2	-2	-1	-1	-1	3.1	-0.05
OH13C	55	0.1	0.5	-1,319	-789	3.6	-2	-2	-1	0	0	1	1	1	0	0	1	0	1	2	2	-2.7	-0.10
TX05C	55	0.4	-0.4	961	743	-0.9	5	1	0	1	0	0	1	0	0	0	0	0	-1	0	0	1.7	-0.06
Speed Limit Lowered by 10 mi/h at Experimental Sites																							
CA01C	30	-0.5	-0.2	870	568	-1.1	-1	0	1	0	0	0	0	0	-1	-1	-2	-1	-1	-1	-1	3.9	-0.06
DE03C	50	0.1	0.1	-113	-110	-0.4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.6	0.05
DE04C	50	0.2	0.1	-86	-82	-0.2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1.0	0.05
IL01C	45	-0.3	-0.7	1,851	782	-4.4	3	2	1	0	0	-1	0	0	-1	-1	-1	-1	-1	0	0	4.9	0.04
IN01C	55	0.5	0.1	78	70	-0.2	-1	1	1	1	0	1	0	1	0	0	1	1	0	0	0	2.1	0.06
MA01C	30	0.1	-0.6	17	20	0.6	1	2	1	1	1	1	-1	-1	0	-1	0	-1	-1	1	1	5.3	0.11
ME02C	45	1.2	-0.6	76	70	-1.0	0	3	3	3	2	1	0	1	1	1	1	0	0	-2	-2	2.1	0.17
MI09C	55	0.3	-0.4	595	430	-2.5	0	2	1	1	1	0	0	0	0	0	1	-1	0	0	0	1.4	0.09
NE01C	55	0.5	-0.5	197	185	-0.3	2	1	2	2	1	1	0	0	1	1	0	0	3	0	0	0.2	0.15
NJ02C	50	-0.1	-0.9	99	75	-0.8	1	2	2	1	0	0	-1	0	-1	-2	-1	-2	-1	1	1	8.1	0.03
NJ03C	50	0.3	-0.7	232	187	-1.3	1	1	2	2	1	1	0	0	-1	0	-1	-1	-1	1	1	6.8	0.04
OH01C	55	-0.7	0.1	-771	-586	3.0	0	-1	0	-1	-2	-1	-1	-1	0	-1	0	0	-1	0	0	-2.9	0.03
OH03C	55	0.0	-0.1	316	254	-1.8	-1	0	1	0	-1	-1	0	0	0	0	0	0	0	0	0	-0.1	0.00
OH04C	55	0.7	0.0	-830	-455	9.1	-1	1	1	2	1	0	0	1	1	1	1	0	-1	1	1	0.0	0.18
OH05C	55	0.2	-0.6	-352	-319	-0.5	1	0	2	3	0	0	-1	0	-1	1	0	0	-2	-1	-1	-2.0	0.13
OH06C	55	0.5	0.5	35	34	0.0	-8	0	1	0	2	2	2	1	1	0	1	0	0	1	1	4.5	-0.14
OH07C	55	-0.2	-1.2	1,282	823	-2.9	2	1	2	2	1	0	-1	-1	-1	-1	-1	-1	-3	-2	-2	6.4	0.10
OH08C	55	0.4	0.5	8	20	2.2	0	2	0	-1	0	-1	0	1	1	1	1	3	3	1	1	-4.8	0.06
OH09C	55	0.3	-0.4	1,276	807	-7.6	1	1	1	1	0	0	0	0	1	0	0	0	-1	1	1	-0.3	-0.06
OH10C	55	0.3	-0.4	1,276	807	-7.6	1	1	1	1	0	0	0	0	1	0	0	0	-1	1	1	-0.3	-0.06

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 35. Differences in speed characteristics for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																							
OH11C	50	0.0	-0.2	186	173	-0.2	1	-2	0	0	0	0	0	-1	0	0	0	0	-1	0	0	2.1	-0.06
OH12C	55	-1.0	-0.6	318	256	-1.9	1	-1	0	-1	-1	-1	-1	-2	-1	-2	-1	-2	-2	0	0	1.7	-0.05
OK01C	45	1.0	-0.6	338	347	0.6	3	1	2	2	2	1	1	0	1	0	0	0	-1	1	1	4.0	-0.05
OK04C	35	-0.3	0.1	-321	-19	3.2	1	-1	-1	0	0	-1	-1	-1	0	0	0	0	1	-1	-1	-1.9	0.12
TX02C	55	2.7	-2.6	-41	-41	-0.3	8	11	5	4	3	3	2	0	0	1	0	1	-2	0	0	10.7	0.05
TX04C	55	0.8	-1.3	923	845	-2.3	1	3	3	2	2	1	1	1	1	0	-1	-2	-4	2	2	6.7	-0.09
VA01C	55	1.3	-0.2	1,434	655	-4.3	3	2	2	2	1	2	1	1	1	1	0	2	2	1	1	2.0	-0.06
VA03C	55	0.6	1.7	187	157	-1.7	-7	-4	-2	-1	1	1	2	2	2	1	2	1	1	4	4	-4.3	-0.23
VA04C	55	0.6	1.7	187	157	-1.7	-7	-4	-2	-1	1	1	2	2	2	1	2	1	1	4	4	-4.3	-0.23
VA05C	55	1.6	1.4	144	136	0.0	-8	-1	0	1	2	2	2	3	3	2	2	2	1	5	5	-4.4	-0.08
VA07C	55	0.8	0.2	6	15	0.4	3	1	1	0	0	0	0	1	2	2	2	2	0	1	1	-4.9	0.14
WV03C	45	-0.3	1.1	-328	-318	-1.6	-2	-2	-3	-2	-1	0	0	0	1	1	1	0	0	2	2	-4.8	-0.11
Speed Limit Lowered by 5 mi/h at Experimental Sites																							
AZ01C	45	-0.2	-0.2	-22	-23	-0.2	-1	0	1	0	-1	0	-1	0	0	-1	0	-1	-1	0	0	2.1	0.05
CT02C	45	-0.4	0.2	289	178	-1.2	3	2	-3	-3	-2	-1	0	-1	0	0	0	0	0	1	1	-2.0	0.00
CT05C	45	1.1	0.0	423	352	0.0	0	0	1	2	1	1	2	2	1	1	1	1	1	2	2	-1.1	-0.06
DE01C	40	0.9	1.2	-74	-71	-0.2	1	-1	-2	-1	0	0	1	1	2	2	3	3	5	1	1	-8.8	0.07
ID01C	55	0.1	-0.9	1,042	545	-10.6	3	2	2	1	1	0	0	0	0	-1	-1	-1	-3	0	0	6.5	0.00
ID02C	55	0.1	-0.9	1,042	545	-10.6	3	2	2	1	1	0	0	0	0	-1	-1	-1	-3	0	0	6.5	0.00
IL02C	45	-0.3	-0.7	1,851	782	-4.4	3	2	1	0	0	-1	0	0	-1	-1	-1	-1	-1	0	0	4.9	0.04
IN05C	45	0.1	-0.5	-10	-38	-2.2	2	1	1	1	1	0	0	0	0	-1	0	-1	0	1	1	4.4	-0.01
IN06C	50	0.2	-0.1	758	608	-0.6	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0.2	0.05
IN07C	50	0.2	-0.1	758	608	-0.6	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0.2	0.05
MA03C	30	0.0	-0.3	6	-5	-1.7	0	1	1	1	0	0	1	-1	0	-1	0	-1	-1	0	0	3.4	-0.05
ME01C	45	1.2	-0.6	76	70	-1.0	0	3	3	3	2	1	0	1	1	1	1	0	0	-2	-2	2.1	0.17
NJ01C	40	-0.4	-0.3	-153	-109	0.9	-1	0	1	0	0	0	0	0	-1	-1	-1	-1	-2	0	0	2.7	-0.06
NM02C	55	0.0	0.2	283	252	-0.8	1	0	0	0	0	0	1	0	0	0	0	0	-1	1	1	-2.8	-0.08

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 35. Differences in speed characteristics for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds												10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 5 mi/h at Experimental Sites																							
AZ02C	30	-0.4	-0.1	20	41	1.0	-1	0	0	0	-1	0	0	0	-1	-1	-1	-1	1	0	0	1.7	-0.06
AZ03C	30	0.5	0.2	450	419	0.2	1	0	-1	0	0	0	1	1	1	1	0	1	0	0	0	-2.7	-0.08
CA06C	45	-1.5	-0.1	1,969	300	-4.0	2	-2	-2	-2	-1	-1	-2	-1	-2	-2	-2	-2	-2	0	0	1.6	-0.05
CA07C	45	-1.9	-0.3	2,665	812	-3.6	2	-2	-2	-2	-1	-1	-2	-2	-2	-2	-3	-2	-2	-1	-1	3.4	-0.05
CO01C	30	0.0	0.1	352	273	-5.2	-2	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0.0	0.00
CO03C	30	-0.8	-0.2	94	79	-1.8	-1	-1	-1	0	0	-1	-1	-1	-2	-1	-1	-1	0	-1	-1	1.5	0.00
CT01C	45	0.1	0.2	3,264	1,376	-3.6	4	0	0	0	0	0	0	0	0	0	1	1	1	0	0	-1.6	0.01
DE05C	35	-0.5	-0.3	13	8	-0.5	0	-1	0	0	-1	-1	0	0	0	0	0	-2	-2	0	0	1.3	-0.04
IN02C	25	-1.0	0.1	419	258	-0.9	-2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1.0	0.00
IN03C	25	-1.0	0.1	419	258	-0.9	-2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1.0	0.00
MD01C	50	0.5	-0.1	183	111	-1.4	4	2	1	1	1	0	-1	1	0	1	0	1	2	0	0	0.8	0.27
MD02C	50	-0.5	0.2	92	95	0.7	-4	-2	-1	-1	0	-1	0	0	-1	-1	0	-1	-1	0	0	1.0	-0.05
MD03C	50	0.9	-0.1	277	6	-3.0	0	1	1	1	1	1	1	1	1	2	1	1	-1	1	1	-1.9	-0.06
MD04C	50	1.4	0.1	182	155	-1.3	-1	0	1	1	1	3	2	1	1	2	1	0	2	2	2	0.4	-0.20
MD05C	50	1.4	-0.5	877	438	-2.6	6	3	2	2	1	2	1	1	1	1	1	1	2	1	1	3.3	0.14
MD06C	30	-0.3	-0.3	156	159	0.5	1	1	0	0	0	0	0	0	0	0	0	0	-1	-2	-2	-0.4	0.04
MD07C	30	-0.3	-0.3	156	159	0.5	1	1	0	0	0	0	0	0	0	0	0	0	-1	-2	-2	-0.4	0.04
MD08C	30	-0.3	-0.3	156	159	0.5	1	1	0	0	0	0	0	0	0	0	0	0	-1	-2	-2	-0.4	0.04
MD09C	30	0.5	-0.5	13	14	0.1	2	2	2	1	1	1	0	0	0	0	0	0	0	0	0	4.9	0.13
MD10C	50	0.2	-0.1	-298	-114	0.8	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1.3	0.14
MS02C	30	0.1	-0.3	247	259	0.9	1	0	0	0	0	0	0	0	0	0	0	0	-1	1	1	3.3	0.00
TN01C	55	-0.4	0.0	498	422	-2.1	1	0	0	-1	-1	0	-1	0	0	-1	0	0	-1	-1	-1	0.7	0.11
TX06C	30	1.4	-0.3	-18	23	2.3	2	2	2	2	2	1	2	1	1	1	1	1	0	2	2	4.2	-0.05
TX07C	35	-0.6	-0.3	-36	-66	-0.5	1	0	0	0	-1	-1	0	-1	-1	-1	-1	-1	-2	-1	-1	2.1	-0.07
TX08C	35	-0.6	-0.3	-36	-66	-0.5	1	0	0	0	-1	-1	0	-1	-1	-1	-1	-1	-2	-1	-1	2.1	-0.07
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																							
CO02C	30	0.0	0.1	352	273	-5.2	-2	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0.0	0.00
ID03C	20	0.0	-0.5	-33	-41	-2.0	0	0	0	0	1	0	0	0	0	-2	-2	-2	-1	1	1	6.3	-0.07
ID04C	20	0.0	-0.5	-33	-41	-2.0	0	0	0	0	1	0	0	0	0	-2	-2	-2	-1	1	1	6.3	-0.07
ID05C	20	0.0	-0.5	-33	-41	-2.0	0	0	0	0	1	0	0	0	0	-2	-2	-2	-1	1	1	6.3	-0.07

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 35. Differences in speed characteristics for the comparison sites (continued).

Comparison Site Number	Posted Speed Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													10-mi/h Pace			
							1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites (continued)																							
ID06C	25	-0.1	0.1	251	-11	-2.6	0	-1	0	0	-1	-1	0	0	0	0	0	0	0	-1	-1	-2.1	0.01
ID07C	25	-0.8	0.1	1,050	443	-5.3	-1	-2	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1	-1	-1	-1.4	0.01
ID08C	35	-0.2	-0.4	-89	-94	-1.6	2	-1	0	0	0	0	0	-1	0	-2	-1	0	-1	1	1	3.2	-0.11
MA02C	30	0.1	-0.6	17	20	0.6	1	2	1	1	1	1	-1	-1	0	-1	0	-1	-1	1	1	5.3	0.11
ME03C	35	0.6	0.1	44	34	-1.2	-2	1	1	1	0	1	1	1	1	0	1	0	-2	1	1	-1.7	0.00
MS01C	35	1.4	-0.2	496	412	-1.1	4	2	2	1	1	1	1	1	2	1	2	1	3	1	1	1.2	0.09
VA02C	35	0.3	0.0	-335	-320	-1.0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	1	-0.5	0.14
CA04C	30	-1.3	0.4	986	810	-2.7	-2	-4	-3	-2	-1	-1	-1	-1	-1	-1	-1	-1	-2	-1	-1	0.6	-0.13
IN04C	30	1.1	-0.2	72	67	-0.5	2	2	4	1	1	1	1	1	0	1	1	1	0	-1	-1	-1.7	0.07
TX01C	40	-1.2	-0.3	-94	-47	4.5	2	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2	-2	-1	-3	-3	1.7	-0.09

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 36. Average changes in speed characteristics for the comparison site groups.

Speed Limit Change Group	Factor	24-h Volume	Pct. Free Flow	Mean Speed	Std. Dev. Speeds	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew Index	Coeff. Var.
-15 & -20	Before	1,803	91.7	47.7	7.8	26.9	33.9	38.4	40.8	44.2	45.9	48.4	51.2	53.0	55.6	57.7	60.2	65.9	44.2	53.2	55.7	0.9	16.4
	After	1,897	91.7	47.7	7.3	28.3	35.3	39.0	41.2	44.0	46.2	48.6	50.7	52.8	55.4	57.0	59.7	65.1	43.7	52.7	56.3	0.9	15.5
	Mean Diff.	94	-0.0	0.1	-0.4	1.4	1.4	0.6	0.4	-0.2	0.3	0.1	-0.6	-0.2	-0.1	-0.7	-0.6	-0.8	-0.6	-0.6	0.6	-0.0	-0.9
	Std. Dev.	603	1.7	1.1	1.1	3.3	4.0	2.1	1.7	1.3	1.2	1.2	1.0	0.7	1.1	1.7	1.7	3.1	1.7	1.7	4.9	0.1	2.5
	No. Sites	9																					
-10	Before	2,866	89.5	47.8	7.5	27.5	34.9	38.5	40.8	44.0	46.2	48.9	51.3	53.0	55.3	56.9	59.5	64.8	44.8	53.8	56.4	0.9	15.7
	After	3,150	88.6	48.1	7.3	27.4	35.6	39.3	41.6	44.6	46.6	49.1	51.5	53.4	55.5	57.1	59.6	64.4	45.4	54.4	57.7	0.9	15.3
	Mean Diff.	284	-0.9	0.4	-0.2	-0.1	0.7	0.9	0.8	0.5	0.4	0.2	0.3	0.4	0.2	0.2	0.1	-0.4	0.7	0.7	1.2	0.0	-0.4
	Std. Dev.	621	3.0	0.7	0.9	3.4	2.5	1.6	1.4	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.5	1.5	1.5	4.1	0.1	1.9
	No. Sites	32																					
-5	Before	2,897	88.3	46.2	6.7	28.6	34.9	38.0	40.1	42.7	44.9	46.9	49.1	50.9	53.1	54.6	57.2	61.9	42.6	51.6	59.8	0.9	14.8
	After	3,345	85.9	46.4	6.5	29.6	35.8	38.7	40.4	42.9	44.9	47.2	49.3	51.1	52.9	54.6	57.0	61.6	42.9	51.9	61.1	0.9	14.3
	Mean Diff.	448	-2.4	0.2	-0.2	1.0	0.9	0.7	0.4	0.2	0.0	0.3	0.1	0.1	-0.2	0.1	-0.2	-0.3	0.3	0.3	1.3	0.0	-0.4
	Std. Dev.	576	3.7	0.5	0.5	1.5	1.2	1.5	1.4	1.0	0.6	0.7	0.8	0.8	1.0	1.1	1.1	2.0	0.9	0.9	4.1	0.1	1.3
	No. Sites	14																					
+5	Before	5,566	84.1	40.5	6.2	24.6	30.5	33.3	35.0	37.2	38.9	41.1	43.2	45.0	47.0	48.6	50.8	55.9	36.7	45.7	62.3	1.0	16.2
	After	6,051	83.1	40.4	6.1	25.3	30.6	33.4	35.0	37.2	38.8	41.0	43.2	44.7	46.8	48.4	50.6	55.5	36.4	45.4	63.2	1.0	16.0
	Mean Diff.	485	-1.0	-0.1	-0.1	0.7	0.1	0.0	0.0	-0.0	-0.0	-0.1	-0.0	-0.3	-0.2	-0.2	-0.2	-0.4	-0.2	-0.2	1.0	0.0	-0.2
	Std. Dev.	862	1.9	0.9	0.2	2.2	1.3	1.1	1.0	0.9	1.0	1.0	0.8	0.9	1.1	1.0	1.0	1.3	1.1	1.1	1.9	0.1	0.7
	No. Sites	25																					
+10 & +15	Before	2,236	93.4	32.9	6.0	18.1	23.0	25.8	27.8	29.8	31.4	33.6	35.6	37.0	39.5	40.8	42.8	48.2	29.1	38.1	64.9	0.9	18.8
	After	2,425	91.8	32.9	5.8	18.4	22.9	26.1	27.8	30.0	31.4	33.6	35.5	37.0	38.8	40.4	42.3	47.7	29.2	38.2	66.5	0.9	18.1
	Mean Diff.	189	-1.6	-0.0	-0.2	0.3	-0.1	0.3	0.0	0.2	0.0	-0.1	-0.1	0.0	-0.7	-0.4	-0.5	-0.5	0.1	0.1	1.7	-0.0	-0.7
	Std. Dev.	406	2.4	0.8	0.3	1.8	1.7	1.6	0.9	0.9	0.8	0.7	0.8	0.8	1.1	1.3	1.2	1.3	1.3	1.3	3.2	0.1	1.3
	No. Sites	14																					

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 37. Percentage of drivers exceeding posted speed limits at the experimental sites.

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before Percent Exceeding Posted Speed Limit 0	5	10	15	20	After Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																		
NJ04E	50	30	-20	2.0	0.8	0.3	0.0	0.0	92.7	73.0	33.5	8.1	1.5	90.7	72.2	33.2	8.1	1.5
TX03E	55	35	-20	0.1	0.0	0.0	0.0	0.0	74.8	30.0	6.7	0.8	0.0	74.7	30.0	6.7	0.8	0.0
DE02E	50	35	-15	26.3	8.7	1.6	0.0	0.0	92.4	78.8	49.8	19.5	6.9	66.1	70.1	48.2	19.5	6.9
NM01E	55	40	-15	11.4	3.6	0.7	0.0	0.0	72.6	53.4	28.5	11.9	4.9	61.2	49.8	27.8	11.9	4.9
NM03E	55	40	-15	4.3	1.1	0.5	0.0	0.0	55.5	30.9	12.5	3.9	0.8	51.2	29.8	12.0	3.9	0.8
NM04E	55	40	-15	2.9	1.4	0.4	0.0	0.0	54.8	32.5	13.8	4.1	0.8	51.9	31.1	13.4	4.1	0.8
OH02E	55	40	-15	3.2	0.5	0 0	0.0	0.0	66.9	30.1	9.5	1.6	0.1	63.7	29.6	9.5	1.6	0.1
OH13E	55	40	-15	1.4	0.3	0 1	0.0	0.0	64.3	26.2	6.2	0.9	0.2	62.9	25.9	6.1	0.9	0.2
TX05E	55	40	-15	8.0	1.3	0.1	0.0	0.0	93.3	70.7	30.1	6.9	1.0	85.3	69.4	30.0	6.9	1.0
Average for the 9 sites in this group				6.6	2.0	0.4	0.0	0.0	74.1	47.3	21.2	6.4	1.8	67.5	45.3	20.8	6.4	1.8
Speed Limit Lowered by 10 mi/h at Experimental Sites																		
CA01E	35	25	-10	45.6	20.3	5.9	1.4	0.0	89.7	73.2	43.6	15.8	4.7	44.1	52.9	37.7	14.4	4.7
DE03E	50	40	-10	22.2	5.8	0.9	0.0	0.0	80.9	54.5	21.9	5.5	0.9	58.7	48.7	21.0	5.5	0.9
DE04E	50	40	-10	44.5	21.4	6.0	1.3	0.3	85.8	67.0	38.4	19.9	7.4	41.3	45.6	32.4	18.6	7.1
IL01E	50	40	-10	9.0	1.4	0.3	0 0	0.0	75.1	31.0	5.7	0.6	0.1	66.1	29.6	5.4	0.6	0.1
IN01E	55	45	-10	6.8	1.2	0.0	0.0	0.0	64.2	26 4	6.0	1.0	0.0	57.4	25.2	6.0	1.0	0.0
MA01E	40	30	-10	65.0	28.6	7.7	0.3	0.0	97.9	85.9	55.5	23.7	3.9	32.9	57.3	47.8	23.4	3.9
ME02E	45	35	-10	5.5	1.4	0.0	0.0	0.0	41.7	18.5	5 4	1.2	0.0	36.2	17.1	5.4	1.2	0.0
MI09E	55	45	-10	28.9	9.4	1.8	0.2	0.0	80.9	56.9	28.6	9.1	1.8	52.0	47.5	26.8	8.9	1.8
NE01E	55	45	-10	5.0	0.6	0.1	0.0	0.0	36.2	11.4	2.6	0.4	0.0	31.2	10.8	2.5	0.4	0.0
NJ02E	45	35	-10	18.1	5.5	1.0	0.2	0.1	65.0	36.3	15.1	3.2	0.5	46 9	30.8	14.1	3.0	0.4
NJ03E	45	35	-10	26.5	7.7	1.9	0.3	0.1	90.3	63.3	26.3	6.1	1.1	63.8	55.6	24.4	5.8	1.0
OH01E	55	45	-10	37.9	13.8	3.5	0.9	0.4	83.7	59.0	32.4	11.1	3.4	45.8	45.2	28.9	10.2	3.0
OH03E	55	45	-10	13.3	2.8	0.3	0.0	0.0	74.3	40.6	13.1	3.2	0.8	61.0	37.8	12.8	3.2	0.8
OH04E	55	45	-10	9.7	2.7	0.5	0.1	0.0	50.8	23.7	8.2	2.3	0.3	41.1	21.0	7.7	2.2	0.3
OH05E	45	35	-10	17.3	3.7	1.0	0.1	0.0	76.2	41.2	15.2	4.7	1.0	58.9	37.5	14.2	4.6	1.0
OH06E	55	45	-10	9.2	2.5	0.3	0.1	0.0	50.7	24.4	10.7	1.8	0.1	41.5	21.9	10.4	1.7	0.1
OH07E	55	45	-10	2.4	0.4	0.1	0.0	0.0	46.8	14.7	3.1	0.5	0.1	44.4	14.3	3.0	0.5	0.1
OH08E	55	45	-10	0.7	0.0	0.0	0.0	0.0	28.6	8.3	1.5	0.0	0.0	27.9	8.3	1.5	0.0	0.0
OH09E	55	45	-10	2.5	0.5	0.1	0.0	0.0	37.7	10.5	2.2	0.5	0.0	35.2	10.0	2.1	0.5	0.0
OH10E	55	45	-10	7.3	2.0	0.3	0.1	0.0	47.8	15.7	3.4	0.5	0.1	40.5	13.7	3.1	0.4	0.1
OH11E	50	40	-10	9.4	1.9	0.7	0 2	0.0	46.6	24.2	8.0	1.8	0.3	37.2	22.3	7.3	1.6	0.3

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 37. Percentage of drivers exceeding posted speed limits at the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before: Percent Exceeding Posted Speed Limit 0	5	10	15	20	After: Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences: Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																		
OH12E	55	45	-10	7.2	1.7	0 0	0.0	0.0	47.7	19.7	6.7	2.0	0.3	40.5	18.0	6.7	2.0	0.3
OK01E	45	35	-10	6.7	1.0	0.1	0.0	0.0	60.7	24.8	5.9	1.0	0.2	54.0	23.8	5.8	1.0	0.2
OK02E	35	25	-10	10.4	1 0	0 2	0.1	0.0	88.6	49.0	11.3	1.4	0.2	78.2	48.0	11.1	1.3	0.2
OK03E	35	25	-10	78.4	45.1	16.2	3.1	0.5	99.3	95.8	84.3	55.3	22.3	20.9	50.7	68.1	52.2	21.8
OK04E	45	35	-10	35.2	8.0	1.2	0.2	0.0.	89.5	67.5	35.1	8.6	1.5	54.3	59.5	33.9	8.4	1.5
TX02E	55	45	-10	13.9	3.2	0 8	0.2	0.0	66.5	30.0	9.7	2.0	0.5	52.6	26.8	8.9	1.8	0.5
TX04E	55	45	-10	3.1	1.1	0 3	0.0	0.0	32.9	10.9	2.2	0.6	0.1	29.8	9.8	1.9	0.6	0.1
VA01E	55	45	-10	12.1	2.6	0.5	0.1	0.0	64.3	28.2	8.1	1.4	0.2	52.2	25.6	7.6	1.3	0.2
VA03E	55	45	-10	3.8	0.8	0.1	0.0	0.0	48.6	18.4	4.9	0.4	0.0	44.8	17.6	4.8	0.4	0.0
VA04E	55	45	-10	1.6	0.2	0.0	0.0	0.0	27.8	7.2	1.4	0.0	0.0	26.2	7.0	1.4	0.0	0.0
VA05E	55	45	-10	10.6	2.3	0.0	0.0	0.0	51.9	25.4	9.0	1.9	0.0	41.3	23.1	9.0	1.9	0.0
VA07E	55	45	-10	5.0	0.7	0 1	0.0	0.0	64.7	29.2	8.6	1.4	0.0	59.7	28.5	8.5	1.4	0.0
WV03E	45	35	-10	43.6	19.2	6.0	1.3	0.0	93.0	75.8	50.9	24.3	8.4	49.4	56.6	44.9	23.0	8.4
Average for the 34 sites in this group				18 2	6.5	1.7	0.3	0.0	64.3	37.3	17.2	6.3	1.8	46.1	30.8	15.5	6.0	1.7
Speed Limit Lowered by 5 mi/h at Experimental Sites																		
AZ01E	50	45	-5	15.1	3.5	0.8	0.2	0.0	42.0	11.3	2.4	0.6	0.2	26.9	7.8	1.6	0.4	0.2
CT02E	45	40	-5	17.7	2.8	0.4	0.0	0.0	50.7	16.9	2.5	0.3	0.0	33.0	14.1	2.1	0.3	0.0
CT05E	45	40	-5	47.8	12.1	2.5	0.6	0.1	86.7	54.4	16.2	3.4	0.7	38.9	42.3	13.7	2.8	0.6
DE01E	40	35	-5	74.1	50.8	25.7	12.3	5.7	93.7	78.2	47.0	22.0	9.0	19.6	27.4	21.3	9.7	3.3
ID01E	55	50	-5	19.4	5.5	1.0	0.4	0.2	40.6	11.8	2.3	0.4	0.1	21.2	6.3	1.3	0.0	-0.1
ID02E	55	50	-5	18.3	3.5	0.5	0.1	0.1	57.9	19.0	3.2	0.4	0.1	39.6	15.5	2.7	0.3	0.0
IL02E	50	45	-5	13.2	2.1	0.2	0.0	0.0	42.8	10.5	1.9	0.3	0.0	29.6	8.4	1.7	0.3	0.0
IN05E	45	40	-5	33.6	12.5	2.0	0.0	0.0	56.0	29.1	9.5	1.4	0.2	22.4	16.6	7.5	1.4	0.2
IN06E	50	45	-5	25.0	6.0	0.6	0.0	0.0	54.3	20.2	3.9	0.4	0.0	29.3	14.2	3.3	0.4	0.0
IN07E	50	45	-5	17.8	3.7	0.3	0.0	0.0	55.7	20.2	4.0	0.7	0.0	37.9	16.5	3.7	0.7	0.0
MA03E	30	25	-5	76.5	41.3	16.3	3.3	0.0	92.8	75.5	43.1	17.3	4.9	16.3	34.2	26.8	14.0	4.9
ME01E	45	40	-5	11.2	2.0	0.3	0.0	0.0	30.6	10.7	1.6	0.3	0.0	19.4	8.7	1.3	0.3	0.0
NJ01E	40	35	-5	37.2	10.0	2.2	0.5	0.1	77.8	38.4	11.3	2.6	0.6	40.6	28.4	9.1	2.1	0.5
NM02E	55	50	-5	44.4	24.0	9.0	2.8	0.9	70.8	48.0	25.7	10.4	4.4	26.4	24.0	16.7	7.6	3.5
Average for the 14 sites in this group				32.2	12.8	4.4	1.4	0.5	60.9	31.7	12.5	4.3	1.4	28.7	18.9	8.1	2.9	0.9

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 37. Percentage of drivers exceeding posted speed limits at the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before: Percent Exceeding Posted Speed Limit 0	5	10	15	20	After: Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences: Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Raised by 5 mi/h at Experimental Sites																		
AZ02E	25	30	5	89.3	61.0	28.8	7.0	1.4	63.8	27.3	6.6	1.0	0.5	-25.5	-33.7	-22.2	-6.0	-0.9
AZ03E	30	35	5	68.2	30.9	9.0	1.7	0.3	35.3	7.1	1.2	0.2	0.0	-32.9	-23.8	-7.8	-1.5	-0.3
CA06E	45	50	5	73.8	42.3	15.9	4.4	0.8	29.0	8.4	2.0	0.4	0.0	-44.8	-33.9	-13.9	-4.0	-0.8
CA07E	45	50	5	92.6	70.7	36.1	11.5	3.0	58.9	25.5	7.2	1.7	0.3	-33.7	-45.2	-28.9	-9.8	-2.7
CO01E	30	35	5	97.1	81.2	38.1	9.7	1.7	8.3	1.1	0.2	0 0	0.0	-88.8	-80.1	-37.9	-9.7	-1.7
CO03E	40	45	5	68.8	36.4	15.9	6.3	2.3	39.0	12.8	2.6	1.4	0.2	-29.8	-23.6	-13.3	-4.9	-2.1
CT01E	45	50	5	95.5	82.9	57.6	27.8	10.3	86.3	60.7	31.0	11.0	3.5	-9.2	-22.2	-26.6	-16.8	-6.8
CT04E	30	35	5	95.4	87.8	69.1	41.2	16.2	87.8	69.4	40.4	14.7	3.4	-7.6	-18.4	-28.7	-26.5	-12.8
DE05E	35	40	5	64.0	37.2	19.1	6.7	1.0	37.7	15.9	4.8	0 9	0.0	-26.3	-21.3	-14.3	-5.8	-1.0
IN02E	25	30	5	71.9	34.8	7.8	1.1	0.1	16.8	3.2	0.4	0.1	0.0	-55.1	-31.6	-7.4	-1.0	-0.1
IN03E	25	30	5	68.9	28.3	5.3	0.7	0.0	25.7	4.4	0.4	0.0	0.0	-43.2	-23.9	-4.9	-0.7	0.0
MD01E	50	55	5	80.5	49.7	17.2	4.6	1.2	60.6	24.9	7.1	2.0	0.4	-19.9	-24.8	-10.1	-2.6	-0.8
MD02E	50	55	5	59.0	22.5	5.1	0.9	0.3	27.3	5.9	1.1	0.3	0.0	-31.7	-16.6	-4.0	-0.6	-0.3
MD03E	50	55	5	60.9	27.1	7.6	1.9	0.5	26.7	8.4	2.2	0.7	0.2	-34.2	-18.7	-5.4	-1.2	-0.3
MD04E	50	55	5	71.9	40.3	13.0	2.7	0.7	42.6	15.3	3.4	0.6	0.1	-29.3	-25.0	-9.6	-2.1	-0.6
MD05E	50	55	5	75.3	41.6	14.0	3.1	0.6	47.8	18.2	5.0	1 6	0.5	-27.5	-23.4	-9.0	-1.5	-0.1
MD06E	30	35	5	96.4	82.5	54.1	23.1	6.0	84.4	53.8	22.8	6.7	1.7	-12.0	-28.7	-31.3	-16.4	-4.3
MD07E	30	35	5	83.9	55.1	22.6	6.6	1.0	57.1	21.8	5.7	1.4	0.2	-26.8	-33.3	-16.9	-5.2	-0.8
MD08E	30	35	5	56.5	22.0	4.8	0.9	0.2	38.3	10.4	2.3	0.3	0.0	-18.2	-11.6	-2.5	-0.6	-0.2
MD09E	30	35	5	85.9	53.3	15.4	2.6	0.2	59.0	16.8	2.5	0.1	0.0	-26.9	-36.5	-12.9	-2.5	-0.2
MD10E	50	55	5	80.6	39.2	9.1	1.6	0.2	42.6	10.6	1.7	0 4	0.0	-38.0	-28.6	-7.4	-1.2	-0.2
MS02E	30	35	5	74.2	45.5	17.7	4.8	1.0	61.2	30.8	8.8	1.6	0.4	-13.0	-14.7	-8.9	-3.2	-0.6
TN01E	50	55	5	88.6	61.0	27.2	8.4	2.3	61.2	27.2	7.8	2.1	0.6	-27.4	-33.8	-19.4	-6.3	-1.7
TX06E	30	35	5	67.5	40.7	15.6	4.1	0.5	39.4	13.6	4.7	0.5	0.0	-28.1	-27.1	-10.9	-3.6	-0.5
TX07E	40	45	5	17.3	2.6	0.3	0.1	0.0	2.9	0.4	0.0	0.0	0.0	-14.4	-2.2	-0.3	-0.1	0.0
TX08E	30	35	5	55.5	15.9	2.4	0.4	0.0	27.5	4.7	0.5	0.0	0.0	-28.0	-11.2	-1.9	-0.4	0.0
Average for the 26 sites in this group				74.6	45.9	20.3	7.1	2.0	44.9	19.2	6.6	1.9	0.5	-29.7	-26.7	-13.7	-5.2	-1.5

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 37. Percentage of drivers exceeding posted speed limits at the experimental sites (continued).

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before: Percent Exceeding Posted Speed Limit 0	5	10	15	20	After: Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences: Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																		
CO02E	30	40	10	97.3	86.2	55.4	22.3	5.5	68.3	30.0	6.6	1.0	0.1	-29.0	-56.2	-48.8	-21.3	-5.4
CT03E	30	40	10	98.0	91.9	75.7	49.2	23.1	80.1	54.1	23.0	6.1	1.8	-17.9	-37.8	-52.7	-43.1	-21.3
ID03E	20	30	10	80.1	44.9	10.0	1.2	0.2	12.5	1.3	0.0	0.0	0.0	-67.6	-43.6	-10.0	-1.2	-0.2
ID04E	20	30	10	75.8	40.4	9.5	1.6	0.2	12.7	1.2	0.0	0.0	0.0	-63.1	-39.2	-9.5	-1.6	-0.2
ID05E	20	30	10	62.8	34.8	11.5	2.8	0.4	8.8	1.6	0.2	0.0	0.0	-54.0	-33.2	-11.3	-2.8	-0.4
ID06E	25	35	10	85.4	43.2	7.8	1.0	0.2	18.3	1.5	0.1	0.0	0.0	-67.1	-41.7	-7.7	-1.0	-0.2
ID07E	25	35	10	72.6	20.9	2.3	0.2	0.0	4.7	0.3	0.0	0.0	0.0	-67.9	-20.6	-2.3	-0.2	0.0
ID08E	35	45	10	76.9	40.4	15.5	4.3	0.7	21.4	4.5	1.0	0.0	0.0	-55.5	-35.9	-14.5	-4.3	-0.7
MA02E	30	40	10	96.3	89.9	64.0	29.3	7.7	63.6	29.3	7.0	1.1	0.1	-32.7	-60.6	-57.0	-28.2	-7.6
ME03E	35	45	10	95.3	85.4	59.3	30.7	11.6	61.6	26.1	7.5	1.7	0.3	-33.7	-59.3	-51.8	-29.0	-11.3
MS01E	35	45	10	73.6	40.4	17.7	5.3	1.2	36.1	10.3	2.2	0.4	0.0	-37.5	-30.1	-15.5	-4.9	-1.2
VA02E	35	45	10	84.8	48.4	15.7	2.8	0.4	32.9	7.7	1.5	0.6	0.0	-51.9	-40.7	-14.2	-2.2	-0.4
CA04E	30	45	15	99.4	94.8	72.6	37.2	12.2	27.9	7.0	1.5	0.3	0.0	-71.5	-87.8	-71.1	-36.9	-12.2
IN04E	30	45	15	93.8	82.1	61.5	32.6	13.8	42.5	14.3	2.3	0.0	0.0	-51.3	-67.8	-59.2	-32.6	-13.8
TX01E	40	55	15	80.9	64.7	39.3	18.9	7.8	15.2	4.9	0.5	0.0	0.0	-65.7	-59.8	-38.8	-18.9	-7.8
Average for the 15 sites in this group				84.9	60.6	34.5	16.0	5.7	33.8	12.9	3.6	0.7	0.2	-51.1	-47.6	-31.0	-15.2	-5.5

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 38. Percentage of drivers exceeding posted speed limits at the comparison sites.

Comparison Site Number	Posted Limit	Before Percent Exceeding Posted Speed Limit 0	5	10	15	20	After Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																
NJ04C	50	29.6	9.2	1.3	0.0	0.0	25.1	6.9	2.0	0.9	0 1	-4.5	-2.3	0.7	0.9	0.1
TX03C	55	30.0	12.5	3.6	1.3	0.4	35.0	15.0	4.9	0.7	0.0	5.0	2.5	1.3	-0.6	-0.4
DE02C	50	20.0	6.2	0.0	0.0	0.0	23.7	9.1	1.7	0.0	0.0	3.7	2.9	1.7	0.0	0.0
NM01C	55	32.3	13.7	4.8	1.8	0.6	34.4	14.4	5.0	1.7	0.6	2.1	0.7	0.2	-0.1	0.0
NM03C	40	72.3	50.4	25.9	11.6	4.1	69.8	44.9	21.6	8.0	2.4	-2.5	-5.5	-4.3	-3.6	-1.7
NM04C	40	72.3	50.4	25.9	11.6	4.1	69.8	44.9	21.6	8.0	2.4	-2.5	-5.5	-4.3	-3.6	-1.7
OH02C	55	14.0	3.0	0.0	0.0	0.0	8.5	2.0	0.1	0.0	0.0	-5.5	-1.0	0.1	0.0	0.0
OH13C	55	8.4	2.4	0.5	0.2	0.0	10.3	2.4	0.6	0.0	0.0	1.9	0.0	0.1	-0.2	0.0
TX05C	55	35.1	10.5	2.2	0.3	0.1	36.6	10.0	1.8	0 5	0.0	1.5	-0.5	-0.4	0.2	-0.1
Average for the 9 sites		34.9	17.6	7.1	3.0	1.0	34.8	16.6	6.6	2.2	0.6	-0.1	-1.0	-0.5	-0.8	-0.4
Speed Limit Lowered by 10 mi/h at Experimental Sites																
CA01C	30	77.4	41.5	13.7	3.0	0.4	76.4	38.5	9.8	2.0	0.5	-1.0	-3.0	-3.9	-1.0	0.1
DE03C	50	52.0	26.2	8.6	2.2	0.5	53.3	27.0	9.2	2.6	0.7	1.3	0.8	0.6	0.4	0.2
DE04C	50	51.4	26.2	8 6	2.2	0.5	52.6	26.5	9.1	2 6	0.7	1.2	0.3	0.5	0.4	0.2
IL01C	45	41.7	10.3	1.3	0.0	0.0	36.6	6.5	0.8	0.1	0.0	-5.1	-3.8	-0.5	0.1	0.0
IN01C	55	38.2	12.6	2.0	0.5	0.0	40.9	13.6	3.2	0.7	0.2	2.7	1.0	1.2	0.2	0.2
MA01C	30	89.3	68.9	36.8	12.3	3.0	91.6	73.4	34.0	10.5	1 4	2.3	4.5	-2.8	-1.8	-1.6
ME02C	45	62.9	32.6	11 2	3.1	0.0	68.1	37.1	14.8	3.3	0.0	5.2	4.5	3.6	0.2	0.0
MI09C	55	62.6	33.7	9.3	2.6	0.5	63.2	32.1	10.6	2.5	0.8	0.6	-1.6	1.3	-0.1	0.3
NE01C	55	36.9	12.5	2.9	0.8	0.4	37.8	12.6	3.2	1.3	0.1	0.9	0.1	0.3	0.5	-0.3
NJ02C	50	55.8	27.5	9.6	2 7	0.6	56.2	23.6	6 2	1 6	0.3	0.4	-3.9	-3.4	-1.1	-0 3
NJ03C	50	53.0	25.8	8.5	2.0	0.6	56.4	24.2	6.2	1.7	0.3	3.4	-1.6	-2.3	-0.3	-0.3
OH01C	55	41.2	15.1	4.3	1.3	0.3	37.3	15.0	4.1	1.1	0.2	-3.9	-0.1	-0.2	-0.2	-0.1
OH03C	55	39.0	15.6	4 9	0.7	0.0	37.8	15.2	4.2	0.7	0.0	-1.2	-0.4	-0.7	0.0	0.0
OH04C	55	6.8	1.6	0.4	0.0	0.0	8.9	1.9	0.1	0.0	0 0	2.1	0.3	-0.3	0.0	0.0
OH05C	55	36.9	12.0	3.0	0.9	0.1	36.3	12.7	2.5	0.3	0.0	-0.6	0.7	-0.5	-0.6	-0.1
OH06C	55	38.6	16.8	4.4	0.5	0.0	44.5	16.5	4.9	0.5	0.0	5.9	-0.3	0.5	0.0	0.0
OH07C	55	5.9	1.5	0.2	0.1	0.0	3.5	0.6	0.0	0.0	0.0	-2.4	-0.9	-0.2	-0.1	0.0
OH08C	55	66.1	34.5	11.8	2.1	0.0	64.4	37.8	16.3	5.1	0.9	-1.7	3 3	4.5	3.0	0.9
OH09C	55	45.0	15.4	4.1	1.1	0.5	48.1	16.6	3.8	0.8	0.0	3.1	1.2	-0.3	-0.3	-0.5
OH10C	55	45.0	15 4	4.1	1.1	0.5	48.1	16.6	3.8	0.8	0.0	3.1	1.2	-0.3	-0.3	-0.5
OH11C	50	8.3	1.5	0.1	0.0	0.0	7.5	1.3	0.0	0.0	0.0	-0.8	-0.2	-0.1	0.0	0.0

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 38. Percentage of drivers exceeding posted speed limits at the comparison sites (continued).

Comparison Site Number	Posted Limit	Before Percent Exceeding Posted Speed Limit 0	5	10	15	20	After Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																
OH12C	55	39.5	15.3	4.7	1.3	0.5	35.0	10.9	2.5	0.4	0.0	-4.5	-4.4	-2.2	-0.9	-0.5
OK01C	45	62.8	29.8	9.3	2.1	0.3	71.4	34.0	9.9	1.6	0.2	8.6	4.2	0.6	-0.5	-0.1
OK04C	35	28.0	5.3	0.9	0.1	0.0	26.1	6.3	1.1	0.1	0.0	-1.9	1.0	0.2	0.0	0.0
TX02C	55	30.0	12.5	3.6	1.3	0.4	35.0	15.0	4.9	0.7	0.0	5.0	2.5	1.3	-0.6	-0.4
TX04C	55	28.2	12.7	5.0	1.6	0.9	30.0	11.1	2.8	0.7	0.1	1.8	-1.6	-2.2	-0.9	-0.8
VA01C	55	3.3	0.5	0.1	0.0	0.0	5.1	0 7	0.1	0.0	0.0	1.8	0.2	0.0	0.0	0.0
VA03C	55	6.3	1.1	0.0	0.0	0.0	10 3	2.4	0.0	0.0	0.0	4.0	1.3	0.0	0.0	0.0
VA04C	55	6.3	1.1	0.0	0.0	0.0	10.3	2.4	0.0	0.0	0.0	4.0	1.3	0.0	0.0	0.0
VA05C	55	6.3	1.1	0.0	0.0	0.0	12.9	2.5	0.0	0.0	0.0	6.6	1.4	0.0	0.0	0.0
VA07C	55	23.6	6.5	1.7	0.5	0.1	29.2	11.7	2.1	0.2	0.0	5.6	5.2	0.4	-0.3	-0.1
WV03C	45	21.1	7.5	1.7	0.2	0.0	25.5	7.9	1.9	0.5	0.0	4.4	0.4	0.2	0.3	0.0
Average for the 32 sites		37.8	16.9	5.5	1.4	0.3	39.4	17.3	5.4	1.3	0.2	1.6	0.4	-0.1	-0.1	-0.1
Speed Limit Lowered by 5 mi/h at Experimental Sites																
AZ01C	45	63.2	29.5	9.6	2.4	0.4	62.5	28.2	8.4	1.5	0.4	-0.7	-1.3	-1.2	-0.9	0.0
CT02C	45	35.1	10.6	2.1	0.3	0.0	34.7	10.3	2.3	0.4	0.1	-0.4	-0.3	0.2	0.1	0.1
CT05C	45	72.9	33.8	10.6	2.9	0.5	80.6	43.3	14.0	4.0	0.8	7.7	9.5	3.4	1.1	0.3
DE01C	40	12.9	2.4	0.2	0.0	0.0	20.7	7.2	1.8	0.2	0.0	7.8	4.8	1 6	0.2	0.0
ID01C	55	28.0	7.5	2.0	0.8	0.2	25.1	5.9	1.3	0.3	0.0	-2.9	-1.6	-0.7	-0.5	-0.2
ID02C	55	28.0	7.5	2.0	0.8	0.2	25.1	5.9	1.3	0.3	0.0	-2.9	-1.6	-0.7	-0.5	-0.2
IL02C	45	41.7	10.3	1.3	0.0	0.0	36.6	6.5	0.8	0.1	0.0	-5.1	-3.8	-0.5	0.1	0.0
IN05C	45	70.0	39.8	12.2	2.6	0.1	72.9	38.2	10.6	1.7	0.2	2.9	-1.6	-1.6	-0.9	0.1
IN06C	50	58.7	26.6	7.5	1.0	0.0	60.0	26.9	7.3	1.2	0.0	1.3	0.3	-0.2	0.2	0.0
IN07C	50	58.7	26.6	7.5	1.0	0.0	60.0	26.9	7.3	1.2	0.0	1.3	0.3	-0.2	0.2	0.0
MA03C	30	87.4	66.5	36.1	12.9	4.0	87.8	68.3	34.5	10.6	2.6	0.4	1.8	-1.6	-2.3	-1.4
ME01C	45	62.9	32.6	11.2	3.1	0.0	68.1	37.1	14.8	3.3	0.0	5.2	4.5	3.6	0.2	0.0
NJ01C	40	79.2	47.5	16.0	4.2	0.8	78.7	45.2	12.8	2.5	0.1	-0.5	-2.3	-3.2	-1.7	-0.7
NM02C	55	32.3	13.7	4.8	1.8	0.6	34.4	14.4	5.0	1.7	0.6	2.1	0.7	0.2	-0.1	0.0
Average for the 14 sites		52.2	25.4	8.8	2.4	0.5	53.4	26.0	8.7	2.1	0.3	1.2	0.7	-0.1	-0.3	-0.1

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 38. Percentage of drivers exceeding posted speed limits at the comparison sites (continued).

Comparison Site Number	Posted Limit	Before Percent Exceeding Posted Speed Limit 0	5	10	15	20	After Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Raised by 5 mi/h at Experimental Sites																
AZ02C	30	56.5	23.1	5.9	1.1	0 1	53.9	20.3	4.8	1.3	0.2	-2.6	-2.8	-1.1	0.2	0.1
AZ03C	30	67.4	32.6	10.9	2.7	0.3	70.1	38.2	12.5	2.5	0.3	2.7	5.6	1.6	-0.2	0.0
CA06C	45	79.0	50.9	21.6	6.2	1.2	73.3	41.8	14.4	3.6	0.5	-5.7	-9.1	-7.2	-2.6	-0.7
CA07C	45	79.0	50.9	21.6	6.2	1.2	71.8	38.4	12.1	3.1	0.6	-7 2	-12.5	-9.5	-3.1	-0.6
CO01C	30	66.4	23.7	4.1	1.1	0.3	68.8	23.8	5.1	1.3	0.0	2 4	0.1	1.0	0.2	-0.3
CO03C	30	90.6	67.0	32.1	7.4	1.6	89.4	61.0	24.1	5.5	1.3	-1 2	-6.0	-8.0	-1.9	-0.3
CT01C	45	77.9	46.2	16.1	3.9	0.6	77.8	47.2	17.5	4.3	0.7	-0.1	1.0	1.4	0.4	0.1
DE05C	35	44.0	20.7	7.3	2.6	0.5	41.5	19.0	5.8	1.2	0.2	-2.5	-1.7	-1.5	-1.4	-0.3
IN02C	25	50.2	18.8	4.5	1.0	0.0	44.0	14.6	3.6	0.8	0.1	-6.2	-4.2	-0.9	-0.2	0.1
IN03C	25	50.2	18.8	4 5	1.0	0.0	44.0	14.6	3.6	0.8	0.1	-6.2	-4.2	-0.9	-0.2	0.1
MD01C	50	79.4	50.4	17.7	4.9	0.6	81.6	49.5	19.0	6.3	1.5	2.2	-0.9	1.3	1.4	0.9
MD02C	50	66.0	32.8	12.2	3.5	0.8	64.8	29.2	10.7	2.9	0.7	-1.2	-3.6	-1.5	-0.6	-0.1
MD03C	50	70.2	30.8	9.7	3.1	1 1	76.2	39.9	12.3	3.2	0.8	6.0	9.1	2.6	0.1	-0.3
MD04C	50	21.8	7.2	1.0	0.3	0.0	27.5	9.1	1.5	0.1	0.0	5.7	1.9	0.5	-0.2	0.0
MD05C	50	77.2	41.7	11.9	2.7	0.6	86.1	49.1	16.3	3.8	1.0	8.9	7.4	4.4	1.1	0.4
MD06C	30	77.4	52.9	23.5	6.3	1.4	76.1	50.9	21.0	5.5	0.8	-1.3	-2.0	-2.5	-0.8	-0.6
MD07C	30	77.4	52.9	23.5	6.3	1.4	76.1	50.9	21.0	5.5	0.8	-1.3	-2.0	-2.5	-0.8	-0.6
MD08C	30	77.4	52.9	23.5	6.3	1.4	76.1	50.9	21.0	5.5	0.8	-1.3	-2.0	-2.5	-0.8	-0.6
MD09C	30	89.8	63.8	31.6	9.8	2.0	93.4	68.6	32.0	9.6	1.6	3.6	4.8	0.4	-0.2	-0.4
MD10C	50	53.4	14.7	2.2	0.2	0.0	52.7	14.7	2.7	0.3	0.0	-0.7	0.0	0.5	0.1	0.0
MS02C	30	81.6	45.3	12.8	2.3	0.5	84.5	45.3	11.7	1.9	0.2	2 9	0.0	-1.1	-0.4	-0.3
TN01C	55	76.4	44.4	15.8	4.4	0.9	74.6	41.8	14.1	3.6	0.6	-1.8	-2.6	-1.7	-0.8	-0.3
TX06C	30	84.1	60.9	31.3	10.9	2.0	88.5	69.8	39.4	13.4	2.5	4.4	8.9	8.1	2.5	0.5
TX07C	35	35 1	8.1	1.5	0.3	0.0	28.7	6.6	0.9	0.1	0.0	-6.4	-1.5	-0.6	-0.2	0.0
TX08C	35	35.1	8.1	1.5	0.3	0.0	28.7	6.6	0.9	0.1	0.0	-6 4	-1.5	-0.6	-0.2	0.0
Average for the 25 sites		66.5	36.8	13.9	3.8	0.7	66.0	36.1	13.1	3.4	0.6	-0.5	-0.7	-0.8	-0.3	-0.1

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 38. Percentage of drivers exceeding posted speed limits at the comparison sites (continued).

Comparison Site Number	Posted Limit	Before Percent Exceeding Posted Speed Limit 0	5	10	15	20	After Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																
CO02C	30	66.4	23.7	4.1	1.1	0.3	68.8	23.8	5.1	1.3	0.0	2.4	0.1	1.0	0.2	-0.3
ID03C	20	58.0	23.0	4.6	1.4	0.0	63.1	19.7	3.1	0.5	0.0	5.1	-3.3	-1.5	-0.9	0.0
ID04C	20	58.0	23.0	4.6	1.4	0.0	63.1	19.7	3.1	0.5	0.0	5.1	-3.3	-1.5	-0.9	0.0
ID05C	20	58.0	23.0	4.6	1.4	0.0	63.1	19.7	3.1	0.5	0.0	5.1	-3.3	-1.5	-0.9	0.0
ID06C	25	76.4	22.7	3.0	0.3	0.0	74.6	22.7	2.9	0.3	0.0	-1.8	0.0	-0.1	0.0	0.0
ID07C	25	81.3	29.0	4.0	0.5	0.1	74.6	22.7	2.9	0.3	0.0	-6.7	-6.3	-1.1	-0.2	-0.1
ID08C	35	35.4	11.6	2.3	0.7	0.4	32.7	7.7	2.4	0.6	0.0	-2.7	-3.9	0.1	-0.1	-0.4
MA02C	30	89.3	68.9	36.8	12.3	3.0	91.6	73.4	34.0	10.5	1.4	2.3	4.5	-2.8	-1.8	-1.6
ME03C	35	84.8	63.8	32.3	13.3	4.7	87.2	68.1	38.3	13.5	4.6	2.4	4.3	6.0	0.2	-0.1
MS01C	35	87.9	72.1	46 7	20 2	5.1	90.2	77.7	52.5	25.1	7.8	2.3	5.6	5.8	4.9	2.7
VA02C	35	86.5	53.2	16.3	3.5	0.5	87.9	54.4	18.8	3.8	0.9	1.4	1.2	2.5	0.3	0.4
CA04C	30	93.7	78.4	50.3	22.6	6.3	87.2	74.5	45.5	18.1	4.6	-6.5	-3.9	-4.8	-4.5	-1.7
IN04C	30	80.9	53.1	22.7	6.1	1.4	84.1	60.3	24 9	8.0	1.7	3.2	7.2	2.2	1.9	0.3
TX01C	40	37.6	16.9	5.7	1.8	0.4	30.9	11.5	3.6	1.8	0.7	-6.7	-5.4	-2.1	0.0	0.3
Average for the 14 sites		71.0	40.2	17.0	6.2	1.6	71.4	39.7	17.2	6.1	1.6	0.3	-0.5	0.2	-0.1	-0.0

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 39. Repeated speed measurements for the experimental sites where speed limits were lowered.

Site Number	Before Limit	After Limit	Date Limit Posted	Period	Data Collection Date	Mean Speed	Std. Dev. Speeds	24-h Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds															10-mi/h Pace			
											1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Lower Speed Limit Sites																													
DE01E	40	35	11/04/86	Before	09/26/86	45.3	8.4	986	946	95.9	27	33	35	37	40	42	46	48	51	54	57	62	67	40	49	48.8	1.04
DE01E				After 1	12/12/86	47.1	7.6	565	553	97.9	31	36	38	40	43	45	47	50	52	55	58	61	66	43	52	51.9	1.13
DE01E				After	10/28/88	45.1	7.1	775	742	95.7	30	34	37	39	41	43	45	47	50	53	55	58	65	41	50	56.2	1.14
IN07E	50	45	12/29/86	Before	12/17/86	44.1	7.4	5,743	4,750	82.7	20	29	35	38	41	43	46	48	49	51	52	55	58	42	51	61.7	0.73
IN07E				After 1	04/18/88	44.8	6.9	5,893	4,800	81.5	22	33	38	40	42	44	46	48	50	51	53	55	59	41	50	62.7	0.84
IN07E				After	08/09/88	44.7	7.3	5,954	4,947	83.1	21	30	36	39	42	44	46	48	50	52	53	55	60	42	51	62.7	0.76
OH01E	55	45	09/07/86	Before	06/25/86	53.0	7.0	3,948	3,380	85.6	34	42	45	47	50	51	54	56	58	60	62	64	70	50	59	57.9	0.90
OH01E				After 1	10/01/86	50.9	7.0	3,386	2,903	85.7	31	40	44	46	48	49	51	54	56	58	60	63	69	47	56	60.6	1.05
OH01E				After 2	07/15/87	51.8	6.4	4,045	3,468	85.7	35	42	45	46	48	50	52	55	56	58	60	63	67	49	58	60.4	1.00
OH01E				After	05/03/89	51.7	7.4	3,192	2,836	88.8	32	40	43	45	48	50	52	55	57	59	61	64	70	48	57	54.1	1.05
OH05E	45	35	12/10/86	Before	10/19/86	38.7	7.6	3,909	3,452	88.3	14	25	31	33	35	37	40	42	44	46	47	50	55	36	45	57.0	0.86
OH05E				After 1	01/25/87	39.1	6.5	3,391	3,044	89.8	23	28	31	33	36	37	40	42	44	46	48	50	55	36	45	60.3	0.95
OH05E				After	11/10/87	38.8	6.6	3,458	3,047	88.1	20	28	31	34	36	37	39	41	43	46	47	50	55	35	44	62.3	1.05
VA05E	55	45	09/09/87	Before	07/30/86	44.8	8.5	927	869	93.7	23	28	35	38	40	42	46	49	51	54	56	58	62	40	49	45.8	0.88
VA05E				After 1	11/19/87	45.0	8.2	978	917	93.8	19	32	36	37	40	43	46	49	51	54	56	58	62	42	51	47.2	0.96
VA05E				After	06/26/88	45.0	7.7	1,066	1,022	95.9	24	32	36	38	41	43	46	49	51	53	55	57	62	43	52	50.6	0.96

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 40. Repeated speed measurements for the experimental sites where speed limits were raised.

Site Number	Before Limit	After Limit	Date Limit Posted	Period	Data Collection Date	Mean Speed	Std. Dev. Speeds	24-h Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds															10-mi/h Pace			
											1	5	10	15	25	35	50	65	75	85	90	95	99	Lower Limit	Upper Limit	Pct. Pace	Skew. Index
Raise Speed Limit Sites																													
ID03E	20	30	06/01/88	Before	04/15/87	24.2	4.8	1,414	1,351	95.5	14	17	18	20	22	23	25	27	28	29	30	32	36	20	29	71.1	0.93
ID03E				After 1	06/02/88	25.3	4.8	1,787	1,699	95.1	14	17	20	21	23	24	26	28	29	30	32	33	37	21	30	72.7	1.00
ID03E				After	10/03/88	25.0	4.4	1,343	1,299	96.7	15	18	20	21	23	24	26	27	29	30	31	33	36	21	30	74.4	0.92
ID04E	20	30	06/01/88	Before	04/15/87	23.1	6.0	1,161	1,126	97.0	8	11	15	18	21	22	24	26	28	29	30	32	37	21	30	66.3	0.78
ID04E				After 1	06/02/88	23.1	5.8	1,692	1,605	94.9	9	12	16	18	21	22	24	26	27	29	30	32	36	20	29	66.5	0.78
ID04E				After	10/03/88	24.1	5.6	1,202	1,165	96.9	9	13	17	20	22	23	25	27	28	30	31	33	36	21	30	69.6	0.82
MD01E	50	55	09/23/86	Before	08/03/86	54.8	6.3	2,898	2,498	86.2	38	46	48	49	52	53	55	57	59	61	63	65	71	51	60	63.3	1.06
MD01E				After 1	01/11/87	55.8	6.3	3,112	2,712	87.1	39	46	49	50	53	54	56	58	60	62	64	67	72	52	61	62.1	1.06
MD01E				After 2	02/25/88	56.8	5.9	3,025	2,603	86.0	43	48	50	52	54	55	57	59	61	63	64	67	73	53	62	65.7	1.06
MD01E				After	06/28/88	56.4	6.1	3,284	2,754	83.9	41	47	50	51	53	55	57	59	60	63	64	67	73	53	62	65.0	1.00
MD06E	30	35	10/22/86	Before	08/16/86	40.6	6.0	3,666	3,086	84.2	27	31	33	35	37	39	41	43	45	47	49	51	56	36	45	59.4	1.00
MD06E				After 1	12/06/86	40.9	6.1	3,605	2,990	82.9	27	32	34	35	37	39	41	44	45	48	49	52	56	37	46	59.9	1.11
MD06E				After	07/09/88	40.8	6.0	4,114	3,389	82.4	27	32	34	35	37	39	41	43	45	47	49	52	57	36	45	61.6	1.06
TX01E	40	55	10/17/86	Before	09/19/86	47.3	10.0	745	702	94.2	18	29	36	39	43	45	48	52	54	57	58	62	71	46	55	45.7	0.93
TX01E				After 1	03/06/87	43.6	10.2	658	647	98.3	18	25	30	33	38	41	46	48	50	54	56	60	68	41	50	44.5	0.77
TX01E				After	12/16/88	45.8	9.1	582	572	98.3	20	31	35	37	41	44	47	50	52	56	57	60	63	44	53	45.8	0.85
VA02E	35	45	10/14/87	Before	07/26/86	39.9	5.2	2,231	1,990	89.2	27	32	34	35	37	38	40	42	44	46	47	49	53	36	45	69.1	1.07
VA02E				After 1	12/12/87	42.5	5.3	2,965	2,598	87.6	29	35	37	38	40	41	43	45	46	48	49	51	56	38	47	69.7	1.07
VA02E				After	06/25/88	43.0	5.2	3,222	2,845	88.3	29	36	37	39	40	42	43	45	47	48	50	52	58	39	48	71.0	1.07

1 mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 41. Crash data for the experimental sites.

Experimental Site Number	Diff. Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	B3 Injury	B3 Month	Second Before Period B2 Total	B2 Injury	B2 Month	First Before Period B1 Total	B1 Injury	B1 Month	Total Before B Total	B Injury	B Month	First After Period A1 Total	A1 Injury	A1 Month	Second After Period A2 Total	A2 Injury	A2 Month	Total After A Total	A Injury	A Month
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																									
NJ04E	-20	1.03	408	633	2	1	10	5	4	10	5	3	10	12	8	30	1	1	10				1	1	10
TX03E	-20	0.80	1,173	1,378	4	1	12	3	0	12	8	1	12	15	2	36	4	1	12	11	4	11	15	5	23
VA06E	-20	8.42	1,660	1,805				7	3	12	6	4	12	13	7	24	6	1	12	4	1	12	10	2	24
DE02E	-15	2.11	468	486	0	0	12	1	1	12	0	0	12	1	1	36	1	0	12	1	0	12	2	0	24
NM01E	-15	0.58	571	867	1	1	12	0	0	12	2	0	12	3	1	36	2	1	12	1	0	8	3	1	20
NM03E	-15	1.04	473	263	0	0	12	0	0	12	0	0	12	0	0	36	0	0	12	0	0	9	0	0	21
NM04E	-15	1.39	620	374	0	0	12	0	0	12	3	1	12	3	1	36	1	1	12	1	0	9	2	1	21
OH02E	-15	2.74	1,453	1,803	17	6	12	21	10	12	20	10	12	58	26	36	17	7	12	25	8	12	42	15	24
OH13E	-15	1.00	4,201	3,749	15	10	12	11	5	12	9	5	12	35	20	36	10	5	12	6	2	6	16	7	18
TX05E	-15	1.17	10,752	13,035	33	13	12	27	6	12	21	10	12	81	29	36	30	13	12				30	13	12
10 Sites		20.28			72	32		75	29		74	34		221	95		72	30		49	15		121	45	
Speed Limit Lowered by 10 mi/h at Experimental Sites																									
DE03E	-10	0.77	8,986	9,042	3	1	12	6	3	12	13	3	12	22	7	36	13	8	12	2	2	12	15	10	24
DE04E	-10	1.38	393	375	2	0	12	0	0	12	1	0	12	3	0	36	0	0	12	1	0	12	1	0	24
IL01E	-10	0.89	8,457	10,006	15	4	9	13	3	9	16	7	9	44	14	27	21	4	9				21	4	9
IN01E	-10	0.40	2,279	2,168				1	0	12	2	1	12	3	1	24	0	0	12	1	0	12	1	0	24
MA01E	-10	1.00	303	289				3	0	12	4	1	12	7	1	24	2	0	12	3	0	12	5	0	24
ME02E	-10	1.40	375	345	1	1	12	1	0	12	2	1	12	4	2	36	0	0	12	1	1	7	1	1	19
MI09E	-10	0.56	2,544	2,975	2	2	12	4	1	12	0	0	12	6	3	36	2	1	12	0	0	6	2	1	18
NE01E	-10	0.66	3,847	4,666	3	1	12	0	0	12	3	2	12	6	3	36	2	1	12	1	0	8	3	1	20
NJ02E	-10	0.56	7,295	7,526	3	1	10	10	4	10	6	3	10	19	8	30	7	2	10				7	2	10
NJ03E	-10	0.63	7,594	10,268	9	5	10	5	2	10	12	5	10	26	12	30	8	0	10				8	0	10
OH01E	-10	0.52	3,948	3,192	1	1	12	1	0	12	3	1	12	5	2	36	2	0	12	1	1	12	3	1	24
OH03E	-10	7.26	3,835	4,278	63	21	12	58	26	12	44	15	12	165	62	36	54	13	12	58	21	11	112	34	23
OH04E	-10	0.47	3,464	2,559	0	0	12	3	2	12	3	2	12	6	4	36	4	0	12	2	0	12	6	0	24
OH05E	-10	0.83	3,909	3,458	6	1	12	3	1	12	6	5	12	15	7	36	6	1	12	8	1	12	14	2	24
OH06E	-10	0.75	1,113	1,022	0	0	12	1	1	12	3	1	12	4	2	36	0	0	12	0	0	12	0	0	24
OH07E	-10	0.64	7,695	8,256	7	2	12	5	0	12	5	2	12	17	4	36	3	2	12	3	2	12	6	4	24

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 41. Crash data for the experimental sites (continued).

Experimental Site Number	Diff. Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	B3 Injury	B3 Month	Second Before Period B2 Total	B2 Injury	B2 Month	First Before Period B1 Total	B1 Injury	B1 Month	Total Before B Total	B Injury	B Month	First After Period A1 Total	A1 Injury	A1 Month	Second After Period A2 Total	A2 Injury	A2 Month	Total After A Total	A Injury	A Month
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																									
OH08E	-10	0.74	596	675	2	0	12	2	0	12	3	0	12	7	0	36	0	0	12	0	0	10	0	0	22
OH09E	-10	1.10	3,261	3,920	8	4	12	5	0	12	3	2	12	16	6	36	10	4	12	1	1	8	11	5	20
OH10E	-10	0.70	4,152	5,083	12	4	12	13	6	12	10	5	12	35	15	36	14	5	12	5	3	7	19	8	19
OH11E	-10	0.73	1,350	1,417	1	1	12	0	0	12	2	2	12	3	3	36	3	1	12	1	0	9	4	1	21
OH12E	-10	1.33	2,608	3,227	3	3	12	3	1	12	2	0	12	8	4	36	6	2	12				6	2	12
OK01E	-10	0.69	9,691	11,051	24	7	12	19	3	12	9	1	12	52	11	36	9	2	12	15	7	12	24	9	24
OK02E	-10	0.74	11,472	10,985	12	1	12	16	3	12	12	4	12	40	8	36	9	0	12	6	1	12	15	1	24
OK03E	-10	0.30	6,283	5,734	12	2	12	7	1	12	10	2	12	29	5	36	5	3	12	6	3	12	11	6	24
OK04E	-10	0.30	5,625	5,302	3	1	12	0	0	12	2	0	12	5	1	36	2	1	12	2	1	12	4	2	24
TX02E	-10	1.75	2,233	2,343	6	2	12	7	2	12	7	3	12	20	7	36	5	1	12	8	4	11	13	5	23
TX04E	-10	0.46	2,991	3,433	3	1	12	1	0	12	2	2	12	6	3	36	0	0	12	2	2	10	2	2	22
VA01E	-10	1.47	8,425	8,605				14	5	12	9	6	12	23	11	24	15	8	12	15	8	12	30	16	24
VA03E	-10	1.19	1,303	1,292	4	2	12	1	1	12	2	2	12	7	5	36	1	0	12	1	1	9	2	1	21
VA04E	-10	1.63	533	498				0	0	12	0	0	12	0	0	24	1	0	12	0	0	12	1	0	24
VA05E	-10	1.67	927	1,066	2	0	12	3	1	12	3	2	12	8	3	36	2	1	12				2	1	12
VA07E	-10	2.25	4,551	4,266	9	4	12	3	1	12	4	2	12	16	7	36	5	3	12				5	3	12
WV01E	-10	1.14	8,902	9,193	28	8	12	31	6	12	32	12	12	91	26	36	33	10	12	50	14	12	83	24	24
WV03E	-10	1.96	2,170	1,219	2	1	12	7	1	12	8	3	12	17	5	36	0	0	12	4	3	12	4	3	24
34 Sites		38.87			246	81		246	74		243	97		735	252		244	73		197	76		441	149	
Speed Limit Lowered by 5 mi/h at Experimental Sites																									
AZ01E	-5	1.00	7,830	8,028	1	1	12	4	2	12	2	0	12	7	3	36	4	2	12	6	3	12	10	5	24
CT02E	-5	1.01	13,646	12,183	16	4	12	18	6	12	23	9	12	57	19	36	34	9	12	26	10	12	60	19	24
CT05E	-5	1.09	9,658	11,966	13	4	12	12	6	12	5	2	12	30	12	36	11	1	12	5	3	12	16	4	24
DE01E	-5	0.80	986	775	1	1	12	0	0	12	1	1	12	2	2	36	1	1	12	0	0	12	1	1	24
ID01E	-5	2.68	4,357	5,120	9	6	9	4	2	9	8	3	9	21	11	27	7	3	9				7	3	9
ID02E	-5	3.50	8,064	8,200	26	10	9	16	5	9	18	8	9	60	23	27	20	8	9				20	8	9
IL02E	-5	1.04	9,481	10,380				14	6	9	12	1	12	26	7	21	16	4	12	24	9	12	40	13	24

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 41. Crash data for the experimental sites (continued).

Experimental Site Number	Diff. Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	B3 Injury	B3 Month	Second Before Period B2 Total	B2 Injury	B2 Month	First Before Period B1 Total	B1 Injury	B1 Month	Total Before B Total	B Injury	B Month	First After Period A1 Total	A1 Injury	A1 Month	Second After Period A2 Total	A2 Injury	A2 Month	Total After A Total	A Injury	A Month
Speed Limit Lowered by 5 mi/h at Experimental Sites (continued)																									
IN05E	-5	0.80	1,455	1,500				7	0	12	6	1	12	13	1	24	5	1	12	3	0	12	8	1	24
IN06E	-5	1.02	8,528	8,721	9	6	12	14	7	12	8	4	12	31	17	36	10	6	12	15	7	12	25	13	24
IN07E	-5	1.12	5,743	5,954	8	3	12	10	3	12	7	2	12	25	8	36	6	3	12	10	5	12	16	8	24
MA03E	-5	0.68	371	314				1	0	12	0	0	12	1	0	24	1	0	12	0	0	12	1	0	24
ME01E	-5	1.30	306	315	0	0	12	0	0	12	0	0	12	0	0	36	1	1	12	1	0	7	2	1	19
NJ01E	-5	0.88	12,669	12,450	8	1	10	3	1	10	6	4	10	17	6	30	7	1	10				7	1	10
NM02E	-5	2.97	484	712	0	0	12	1	0	12	0	0	12	1	0	36	1	0	12	0	0	8	1	0	20
14 Sites		19.89			91	36		104	38		96	35		291	109		124	40		90	37		214	77	
Speed Limit Raised by 5 mi/h at Experimental Sites																									
AZ02E	5	1.00	1,296	1,332	1	1	12	2	1	12	1	0	12	4	2	36	1	0	12	1	0	9	2	0	21
AZ03E	5	1.00	4,005	4,156	4	2	12	5	0	12	7	1	12	16	3	36	5	2	12				5	2	12
CA06E	5	0.89	12,917	13,017	4	0	12	13	5	12	10	6	12	27	11	36	13	9	12				13	9	12
CA07E	5	2.73	14,132	17,054	25	8	12	31	13	12	31	17	12	87	38	36	40	13	12				40	13	12
CO01E	5	1.05	2,975	3,528	4	3	12	6	4	12	6	5	12	16	12	36	4	3	12				4	3	12
CO03E	5	4.23	491	602	4	3	12	5	1	12	6	4	12	15	8	36	4	2	12				4	2	12
CT01E	5	1.77	17,040	18,923							26	8	12	26	8	12	15	1	12	19	6	12	34	7	24
CT04E	5	0.47	1,762	1,884	0	0	12	0	0	12	1	0	12	1	0	36	1	1	12	1	0	12	2	1	24
DE05E	5	1.87	428	453	12	5	12	9	4	12	11	8	12	32	17	36	6	3	12	7	5	12	13	8	24
IN02E	5	0.38	8,170	8,608				22	4	12	24	6	12	46	10	24	18	4	12	26	4	12	44	8	24
IN03E	5	0.38	8,698	9,162				16	3	12	33	4	12	49	7	24	28	4	12	31	8	12	59	12	24
MD01E	5	4.72	2,898	3,284	2	1	12	4	3	12	7	5	12	13	9	36	4	2	12	4	2	12	8	4	24
MD02E	5	7.33	6,046	6,681	15	7	12	8	6	12	23	13	12	46	26	36	15	8	12	17	13	12	32	21	24
MD03E	5	4.00	2,509	2,769	1	0	12	0	0	12	2	1	12	3	1	36	5	4	12	4	2	12	9	6	24
MD04E	5	5.83	2,794	3,854	6	3	12	7	3	12	15	10	12	28	16	36	7	5	12	14	7	12	21	12	24
MD05E	5	12.60	2,908	3,176	26	21	12	19	7	12	33	16	12	78	44	36	25	17	12	23	17	12	48	34	24
MD06E	5	0.80	3,666	4,114	1	0	12	2	0	12	3	3	12	6	3	36	1	1	12	2	1	12	3	2	24

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 41. Crash data for the experimental sites (continued).

Experimental Site Number	Diff. Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	B3 Injury	B3 Month	Second Before Period B2 Total	B2 Injury	B2 Month	First Before Period B1 Total	B1 Injury	B1 Month	Total Before B Total	B Injury	B Month	First After Period A1 Total	A1 Injury	A1 Month	Second After Period A2 Total	A2 Injury	A2 Month	Total After A Total	A Injury	A Month
Speed Limit Raised by 5 mi/h at Experimental Sites (continued)																									
MD07E	5	0.63	2,688	2,728	2	2	12	1	1	12	1	1	12	4	4	36	2	2	12	1	1	12	3	3	24
MD08E	5	0.95	7,562	8,594	6	5	12	6	3	12	4	4	12	16	12	36	4	2	12	1	1	12	5	3	24
MD09E	5	0.57	4,586	5,299	2	2	12	7	1	12	5	1	12	14	4	36	3	2	12	4	1	12	7	3	24
MD10E	5	12.49	9,429	10,828	38	23	12	26	16	12	63	30	12	127	69	36	38	20	12	50	22	12	88	42	24
MS02E	5	0.68	7,755	7,874				5	2	12	3	0	12	8	2	24	14	1	12	10	2	12	24	3	24
TN01E	5	6.16	11,962	14,996	16	6	9	24	4	12	35	14	12	75	24	33	37	16	12				37	16	12
TX06E	5	0.54	1,562	1,749	1	1	12	3	1	12	2	2	12	6	4	36	0	0	12	1	1	10	1	1	22
TX07E	5	0.67	6,807	7,964	4	2	12	18	9	12	9	2	12	31	13	36	6	1	12	5	4	8	11	5	20
TX08E	5	0.86	9,217	10,623	11	2	12	12	4	12	19	6	12	42	12	36	15	4	12	5	2	8	20	6	20
26 Sites		74.60			185	97		251	95		380	167		816	359		311	127		226	99		537	226	
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																									
CO02E	10	3.91	2,098	2,398	11	4	12	11	5	12	13	7	12	35	16	36	7	5	12				7	5	12
CT03E	10	0.65	1,711	1,766	0	0	12	1	1	12	1	0	12	2	1	36	1	1	12	1	1	12	2	2	24
ID03E	10	1.79	1,414	1,343	1	1	12	0	0	12	3	2	12	4	3	36	0	0	12				0	0	12
ID04E	10	0.82	1,161	1,202	0	0	12	0	0	12	2	0	12	2	0	36	0	0	12				0	0	12
ID05E	10	0.49	538	643	0	0	12	1	0	12	2	1	12	3	1	36	0	0	12				0	0	12
ID06E	10	0.94	8,019	7,869	40	8	9	17	2	9	21	3	9	78	13	27	15	5	9				15	5	9
ID07E	10	0.96	8,010	7,945	40	7	9	26	9	9	16	5	9	82	21	27	19	2	9				19	2	9
ID08E	10	1.11	2,075	1,714	2	1	9	1	1	9	1	1	9	4	3	27	0	0	9				0	0	9
MA02E	10	0.40	1,394	1,611				0	0	12	2	0	12	2	0	24	1	0	12	0	0	12	1	0	24
ME03E	10	1.80	1,720	1,791	3	1	12	4	2	12	7	2	12	14	5	36	6	3	12	1	0	7	7	3	19
MS01E	10	0.43	5,345	6,072				0	0	12	0	0	12	0	0	24	1	0	12	1	1	12	2	1	24
VA02E	10	1.60	2,231	3,222	3	0	12	3	0	12	3	1	12	9	1	36	8	1	12				8	1	12
CA04E	15	1.74	11,480	12,683	39	8	12	30	12	12	48	16	12	117	36	36	38	17	12	46	19	12	84	36	24
IN04E	15	0.62	405	437				1	0	12	0	0	12	1	0	24	0	0	12	1	1	12	1	1	24
TX01E	15	0.50	745	582	0	0	12	0	0	12	0	0	12	0	0	36	0	0	12	0	0	12	0	0	24
15 Sites		17.76			139	30		95	32		119	38		353	100		96	34		50	22		146	56	

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 42. Crash data for the comparison sites.

Comparison Site Number	Posted Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	Third Before Period B3 Injury	Third Before Period B3 Month	Second Before Period B2 Total	Second Before Period B2 Injury	Second Before Period B2 Month	First Before Period B1 Total	First Before Period B1 Injury	First Before Period B1 Month	Total Before B Total	Total Before B Injury	Total Before B Month	First After Period A1 Total	First After Period A1 Injury	First After Period A1 Month	Second After Period A2 Total	Second After Period A2 Injury	Second After Period A2 Month	Total After A Total	Total After A Injury	Total After A Month
Speed Limit Lowered by 15 or 20 mi/h at Experimental Sites																									
NJ04C	50	1.66	1,440	1,810	2	2	10	0	0	10	0	0	10	2	2	30	0	0	10				0	0	10
TX03C	55	2.39	459	418	3	2	12	3	1	12	2	1	12	8	4	36	1	0	12	6	2	11	7	2	23
VA06C	55	2.85	983	1,220				2	1	12	0	0	12	2	1	24	3	1	12	5	2	12	8	3	24
DE02C	50	2.62	213	245	3	2	12	1	0	12	0	0	12	4	2	36	1	0	12	0	0	12	1	0	24
NM01C	55	3.31	1,496	1,779	2	0	12	3	1	12	4	0	12	9	1	36	4	3	12	1	1	8	5	4	20
NM03C	40	1.70	577	744	3	0	12	7	1	12	12	5	12	22	6	36	6	5	12	7	3	9	13	8	21
OH02C	55	3.00	668	894	7	2	12	5	1	12	2	0	12	14	3	36	5	2	12	8	3	12	13	5	24
OH13C	55	1.00	6,517	5,198	7	2	12	13	9	12	9	5	12	29	16	36	5	0	12	7	4	6	12	4	18
TX05C	55	1.17	4,281	5,242	7	3	12	6	4	12	2	1	12	15	8	36	0	0	12				0	0	12
9 Sites		19.70			34	13		40	18		31	12		105	43		25	11		34	15		59	26	
Speed Limit Lowered by 10 mi/h at Experimental Sites																									
DE03C	50	1.58	3,005	2,892	5	3	12	4	0	12	8	2	12	17	5	36	3	2	12	4	1	12	7	3	24
DE04C	50	1.58	3,005	2,919	5	3	12	4	0	12	8	2	12	17	5	36	3	2	12	4	1	12	7	3	24
IL01C	45	1.15	9,208	11,059	14	5	9	7	4	9	13	6	9	34	15	27	11	3	9				11	3	9
IN01C	55	0.45	1,993	2,071				0	0	12	0	0	12	0	0	24	1	0	12	2	0	12	3	0	24
MA01C	30	0.99	581	598				0	0	12	1	0	12	1	0	24	2	1	12	0	0	12	2	1	24
ME02C	45	2.15	364	440	1	0	12	0	0	12	1	0	12	2	0	36	0	0	12	0	0	7	0	0	19
MI09C	55	0.82	3,180	3,775	1	0	12	4	2	12	6	2	12	11	4	36	0	0	12	0	0	6	0	0	18
NE01C	55	0.62	821	1,018	2	1	12	0	0	12	0	0	12	2	1	36	1	1	12	0	0	8	1	1	20
NJ02C	50	0.78	2,161	2,260	2	1	10	3	2	10	0	0	10	5	3	30	2	2	10				2	2	10
NJ03C	50	0.78	2,045	2,277	2	1	10	3	2	10	0	0	10	5	3	30	2	2	10				2	2	10
OH01C	55	0.59	3,720	2,949	2	1	12	1	0	12	3	1	12	6	2	36	2	0	12	0	0	12	2	0	24
OH03C	55	6.37	1,491	1,807	24	14	12	22	9	12	36	16	12	82	39	36	39	20	12	38	17	11	77	37	23
OH04C	55	0.37	2,826	1,996	3	1	12	3	1	12	0	0	12	6	2	36	1	1	12	0	0	12	1	1	24

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 42. Crash data for the comparison sites (continued).

Comparison Site Number	Posted Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	B3 Injury	B3 Month	Second Before Period B2 Total	B2 Injury	B2 Month	First Before Period B1 Total	B1 Injury	B1 Month	Total Before B Total	B Injury	B Month	First After Period A1 Total	A1 Injury	A1 Month	Second After Period A2 Total	A2 Injury	A2 Month	Total After A Total	A Injury	A Month
Speed Limit Lowered by 10 mi/h at Experimental Sites (continued)																									
OH05C	55	1.12	2,771	2,419	4	1	12	3	0	12	5	3	12	12	4	36	4	0	12	1	0	12	5	0	24
OH06C	55	0.96	854	889	0	0	12	1	0	12	0	0	12	1	0	36	1	1	12	0	0	12	1	1	24
OH07C	55	0.74	6,534	7,816	6	4	12	2	1	12	6	4	12	14	9	36	5	0	12	2	1	12	7	1	24
OH08C	55	1.16	554	562	0	0	12	4	1	12	2	1	12	6	2	36	1	0	12	1	1	10	2	1	22
OH09C	55	1.04	2,957	4,233	4	2	12	2	1	12	1	0	12	7	3	36	8	6	12	2	1	8	10	7	20
OH10C	55	1.04	2,957	4,233	4	2	12	2	1	12	1	0	12	7	3	36	8	6	12	1	1	7	9	7	19
OH11C	50	0.83	1,327	1,513	0	0	12	2	1	12	1	0	12	3	1	36	6	2	12	0	0	9	6	2	21
OH12C	55	1.58	1,835	2,153	1	1	12	2	1	12	1	0	12	4	2	36	3	1	12				3	1	12
OK01C	45	0.76	6,456	6,794	6	3	12	4	2	12	6	2	12	16	7	36	5	4	12	6	2	12	11	6	24
OK04C	35	0.50	7,258	6,937	7	3	12	12	6	12	10	6	12	29	15	36	8	0	12	11	4	12	19	4	24
TX02C	55	2.39	459	418	3	2	12	3	1	12	2	1	12	8	4	36	1	0	12	6	2	11	7	2	23
TX04C	55	0.55	603	1,526	1	0	12	4	0	12	1	0	12	6	0	36	0	0	12	0	0	10	0	0	22
VA01C	55	1.55	7,973	9,407				13	9	12	9	6	12	22	15	24	7	5	12	11	6	12	18	11	24
VA03C	55	1.72	967	1,154	0	0	12	0	0	12	3	1	12	3	1	36	0	0	12	0	0	9	0	0	21
VA04C	55	1.72	967	1,154				0	0	12	0	0	12	0	0	24	3	1	12	0	0	12	3	1	24
VA05C	55	1.72	967	1,111	0	0	12	0	0	12	3	1	12	3	1	36	0	0	12				0	0	12
VA07C	55	2.04	2,144	2,150	3	2	12	5	4	12	0	0	12	8	6	36	2	1	12				2	1	12
WV03C	45	2.55	1,035	707	3	0	12	7	3	12	4	0	12	14	3	36	6	2	12	3	1	12	9	3	24
31 Sites		42.20			103	50		117	51		131	54		351	155		135	63		92	38		227	101	

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 42. Crash data for the comparison sites (continued).

Comparison Site Number	Posted Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	B3 Injury	B3 Month	Second Before Period B2 Total	B2 Injury	B2 Month	First Before Period B1 Total	B1 Injury	B1 Month	Total Before B Total	B Injury	B Month	First After Period A1 Total	A1 Injury	A1 Month	Second After Period A2 Total	A2 Injury	A2 Month	Total After A Total	A Injury	A Month
Speed Limit Lowered by 5 mi/h at Experimental Sites																									
AZ01C	45	0.87	1,757	1,735	0	0	12	2	0	12	1	0	12	3	0	36	0	0	12	4	3	12	4	3	24
CT02C	45	2.24	4,761	5,050	30	15	12	25	8	12	19	6	12	74	29	36	23	6	12	19	6	12	42	12	24
CT05C	45	1.67	3,462	3,885	11	3	12	6	1	12	7	1	12	24	5	36	14	0	12	8	1	12	22	1	24
DE01C	40	0.22	605	531	0	0	12	0	0	12	0	0	12	0	0	36	0	0	12	0	0	12	0	0	24
ID01C	55	2.75	2,508	3,550	2	1	9	6	4	9	4	1	9	12	6	27	2	1	9				2	1	9
IL02C	45	1.15	9,208	11,059				15	6	9	10	4	12	25	10	21	18	8	12	14	4	12	32	12	24
IN05C	45	1.02	1,321	1,311				2	0	12	0	0	12	2	0	24	0	0	12	0	0	12	0	0	24
IN06C	50	0.72	4,593	5,351	4	1	12	10	5	12	11	5	12	25	11	36	10	4	12	10	3	12	20	7	24
MA03C	30	0.99	632	638				0	0	12	1	0	12	1	0	24	2	1	12	0	0	12	2	1	24
ME01C	45	2.15	364	440	1	0	12	0	0	12	1	0	12	2	0	36	0	0	12	0	0	7	0	0	19
NJ01C	40	0.96	2,747	2,594	8	4	10	9	1	10	4	3	10	21	8	30	2	0	10				2	0	10
NM02C	55	3.31	1,496	1,779	2	0	12	3	1	12	4	0	12	9	1	36	4	3	12	1	1	8	5	4	20
12 Sites		18.05			58	24		78	26		62	20		198	70		75	23		56	18		131	41	
Speed Limit Raised by 5 mi/h at Experimental Sites																									
AZ02C	30	0.97	2,100	2,120	3	1	12	3	1	12	6	5	12	12	7	36	5	2	12	2	1	9	7	3	21
AZ03C	30	1.11	2,715	3,165							1	0	12	1	0	12	4	2	12				4	2	12
CA06C	45	1.01	21,723	23,692	19	13	12	14	8	12	22	12	12	55	33	36	20	13	12				20	13	12
CA07C	45	1.01	21,723	24,388	19	13	12	14	8	12	22	12	12	55	33	36	20	13	12				20	13	12
CO01C	30	3.98	754	1,106	9	3	12	1	0	12	2	0	12	12	3	36	4	2	12				4	2	12
CO03C	30	3.98	572	666	9	3	12	1	0	12	2	0	12	12	3	36	4	2	12				4	2	12
CT01C	45	1.41	18,424	21,688	61	22	12	52	16	12	58	22	12	171	60	36	59	20	12	73	21	12	132	41	24
DE05C	35	0.51	938	951	2	0	12	4	3	12	6	5	12	12	8	36	3	1	12	6	2	12	9	3	24
IN02C	25	0.46	6,505	6,924				13	2	12	15	0	12	28	2	24	15	3	12	10	1	12	25	4	24
MD01C	50	4.43	2,943	3,126	4	3	12	6	5	12	7	2	12	17	10	36	9	6	12	6	5	12	15	11	24
MD02C	50	7.23	1,565	1,657	3	0	12	5	3	12	9	4	12	17	7	36	10	6	12	3	3	12	13	9	24
MD03C	50	3.73	6,123	6,400	11	5	12	11	6	12	10	4	12	32	15	36	13	10	12	13	8	12	26	18	24
MD04C	50	3.63	1,251	1,433	3	2	12	3	2	12	12	7	12	18	11	36	4	3	12	7	4	12	11	7	24
MD05C	50	7.28	6,527	7,404	21	14	12	22	15	12	31	17	12	74	46	36	23	13	12	32	20	12	55	33	24

1 mi = 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 42. Crash data for the comparison sites (continued).

Comparison Site Number	Posted Limit	Length, Miles	Before Volume	After Volume	Third Before Period B3 Total	B3 Injury	B3 Month	Second Before Period B2 Total	B2 Injury	B2 Month	First Before Period B1 Total	B1 Injury	B1 Month	Total Before B Total	B Injury	B Month	First After Period A1 Total	A1 Injury	A1 Month	Second After Period A2 Total	A2 Injury	A2 Month	Total After A Total	A Injury	A Month
Speed Limit Raised by 5 mi/h at Experimental Sites (continued)																									
MD06C	30	1.07	1,730	1,886	0	0	12	0	0	12	0	0	12	0	0	36	4	1	12	1	0	12	5	1	24
MD07C	30	1.07	1,730	1,886	0	0	12	0	0	12	0	0	12	0	0	36	3	1	12	2	0	12	5	1	24
MD08C	30	1.07	1,730	1,886	0	0	12	0	0	12	1	0	12	1	0	36	3	1	12	1	0	12	4	1	24
MD09C	30	0.66	3,080	3,093	3	1	12	0	0	12	1	1	12	4	2	36	4	2	12	4	3	12	8	5	24
MD10C	50	1.58	8,562	8,264	4	3	12	7	3	12	2	2	12	13	8	36	6	4	12	5	3	12	11	7	24
MS02C	30	0.81	6,429	6,676				3	1	12	3	0	12	6	1	24	13	5	12	13	3	12	26	8	24
TN01C	55	2.95	3,410	4,406	2	1	9	10	5	12	6	2	12	18	8	33	11	5	12				11	5	12
TX06C	30	0.26	1,734	1,716	0	0	12	0	0	12	0	0	12	0	0	36	0	0	12	0	0	10	0	0	22
TX07C	35	0.60	6,045	6,009	21	6	12	8	2	12	12	3	12	41	11	36	6	1	12	10	4	8	16	5	20
23 Sites		50.81			194	90		177	80		228	98		599	268		243	116		188	78		431	194	
Speed Limit Raised by 10 or 15 mi/h at Experimental Sites																									
CO02C	30	3.98	754	1,106	9	3	12	1	0	12	2	0	12	12	3	36	4	2	12				4	2	12
ID03C	20	0.63	434	401	1	0	12	1	0	12	1	0	12	3	0	36	4	0	12				4	0	12
ID06C	25	0.95	7,840	8,091	29	5	9	19	6	9	21	3	9	69	14	27	20	5	9				20	5	9
ID07C	25	0.95	7,041	8,091	29	5	9	19	6	9	21	3	9	69	14	27	20	5	9				20	5	9
ID08C	35	1.30	578	489	2	0	9	3	0	9	2	0	9	7	0	27	2	1	9				2	1	9
MA02C	30	0.99	581	598				0	0	12	1	0	12	1	0	24	2	1	12	0	0	12	2	1	24
ME03C	35	0.61	661	705	2	1	12	1	0	12	1	0	12	4	1	36	0	0	12	0	0	7	0	0	19
MS01C	35	0.35	2,882	3,378				4	2	12	3	2	12	7	4	24	4	0	12	2	1	12	6	1	24
VA02C	35	1.83	4,060	3,725	10	4	12	13	5	12	9	3	12	32	12	36	10	3	12				10	3	12
CA04C	30	1.04	4,080	5,066	13	5	12	15	10	12	34	19	12	62	34	36	24	9	12	11	6	12	35	15	24
IN04C	30	0.63	521	593				3	0	12	1	0	12	4	0	24	0	0	12	3	1	12	3	1	24
TX01C	40	0.45	1,000	906	0	0	12	1	0	12	3	3	12	4	3	36	0	0	12	1	0	12	1	0	24
12 Sites		13.71			95	23		80	29		99	33		274	85		90	26		17	8		107	34	

1 mi=1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

APPENDIX F. CRASH ANALYSIS PROCEDURE

An example of the procedure used to analyze the crash data is provided in this appendix. For purposes of illustration, the analysis described below is for total crashes that were reported by the police on 41 experimental sites where speed limits were raised and on their corresponding comparison sites.

The four methods used to estimate safety effects were the multiple before and after analyses with paired comparison ratios, cross-product ratio, EBEST, and before and after analyses using the weighted average logit. The null hypothesis tested was that the observed crashes after treatment, i.e., installation of the new speed limit signs, were equal to the expected crashes after treatment. All statistical analyses were conducted at the 0.05 significance level (α). Rejection of the null hypothesis required a probability or p-value < 0.05.

Procedure

The first step in the analysis was to determine if the crash history for the comparison group was comparable to the crash history for the experimental group during the before period and during the after period. As an excellent discussion of the comparability procedure is provided by Griffin, only a brief summary is included below.[35]

To address the comparability question, the goodness-of-fit test was applied using the likelihood ratio chi-square (G) test as shown below:

$$G = -2 \sum_i \sum_j x_{ij} \ln \frac{\hat{m}_{ij}}{x_{ij}}$$

where:

x_{ij} = observed crash frequency in cell ij, row (i) and column (j)

$$\hat{m}_{ij} = \frac{x_{i+} x_{+j}}{x_{++}}$$

Shown in table 43 are total crashes listed by year for the before and after periods for the raised speed limit experimental and comparison sites. It should be noted that at most sites, the before data covered a 3-yr period and the after data were for a 2-yr period. As crash data were not available for all of the sites for all years, direct comparison of the before and after totals is misleading and inappropriate.

Applying the above formula to the three before periods and to the two after periods shown in table 43 produces the following results:

$$G_{before} = 6.82$$
$$G_{After} = \underline{0.51}$$
$$G_{comparability} = 7.33$$

Table 43. Crash summary by year for the sites where speed limits were raised.

Year	Number of Total Crashes Experimental	Comparison
Before Period		
B3 - Third	324	280
B2 - Second	346	256
B1 - First	499	325
Treatment Period (New Speed Limits Posted)		
After Period		
AI - First	407	329
A2 - Second	276	205

As a G-value of 7.33 with three degrees of freedom is not statistically significant (G = 7.82, a = 0.05) there is little reason to doubt the comparability of the comparison group. In other words, during the 3-yr before period and, again, during the 2-yr after period, crashes at the comparison and experimental sites changed at a similar rate.

It should be noted, however, that the rate of change in crashes from B1 (the year before the speed limit change) to AI (the year after the change) is less for the experimental sites than it is for the comparison sites (4071499 = 0.82 compared to 3291325 = 1 .01). This suggests that crashes at the experimental sites may have decreased following implementation of the higher posted speed limits.

As crash histories during the multiple before and after periods at the experimental and comparison sites were comparable, the next step in the analysis was to estimate the change in crashes following implementation of the new speed limits. The paired comparison ratios method described by Griffin, and the classical cross-product ratio were used to estimate the safety effects.

In cases where the crash histories at the comparison sites were not comparable with the crash histories at the experimental sites, i.e., the G-value is statistically significant, only a before-and-after analysis was conducted. When the crash histories are not comparable, it is not appropriate to use the comparison sites to estimate safety effects.

The paired comparison ratios method estimates the overall effect of the speed limit changes on crashes using a weighted average log odds ratio based upon the individual log odds ratios of the crash counts at each treatment location. In this study, the comparison ratios included the crash counts, traffic volumes, and crash repotting

periods. It was assumed that the crash reporting periods were known without error. It was also assumed that the crash counts and traffic volumes were known with error. Accordingly, the weighting coefficient was calculated using the reciprocals of the before and after crashes, and before and after traffic volumes for the experimental and comparison sites. In addition, a chi-square test of homogeneity was used to determine if the treatment effects were consistent among the locations studied. The test of homogeneity is applied only when statistically significant treatment effects are found.

Shown in table 44 is the application of the method for the sites where speed limits were raised. The data presented in table 44 contain all of the raised speed limit sites and corresponding comparison sites. In a few cases, when two experimental sites were in close proximity and two suitable comparison locations were not available, speed and crash data were collected at one comparison site. In the crash analyses, duplicate comparison sites were not used.

Several of the experimental and comparison sites had zero crashes in either the before and/or after periods. Because the natural logarithm of zero is undefined, a value of 0.5 was substituted for zero so the analysis could proceed. In cases where the experimental site did not have a corresponding comparison site, the comparison ratios and corresponding odds ratios were calculated using only the crash counts, traffic volumes, and time periods for the experimental sites.

Excellent summaries of the paired comparison ratios method with examples are given by Griffin .[36,37] Both Griffin and Pendleton provide good examples of the cross-product ratio .[35,38] The EBEST methodology is not presented in this report as an excellent discussion is provided by Pendleton.[38]

The results of the paired comparison ratios analyses, shown in table 44, indicated that there was no significant difference in total crashes after speed limits were raised at the 41 experimental sites, Z = -1.37. The cross-product or odds ratio method and the EBEST estimate also indicated that there was no significant difference in total crashes. In this report, the safety estimate (in percent), the Z-value, and the level of significance are presented along with the 95 percent confidence limits.

As the reference group size required by EBEST could not be obtained for this analysis, the EBEST estimates are not valid. The EBEST method was employed in this analysis to obtain an indication of regression-to-the-mean bias present in the dataset, because the paired comparison ratios method does not specifically account for regression-to-the-mean bias.

For the crash dataset, the EBEST method indicated that the average shrinkage was 0.10, which suggests little regression-to-the-mean bias. Average shrinkage factors range from 0 (no regression-to-the-mean bias) to 1.0, indicating substantial bias. A factor of 0.10 suggests that the posted speed limit increases made in this study were not conducted primarily at high-crash locations, or perhaps using multiple years of data in the analysis minimized the effect. Due to the low shrinkage factor, it was felt that regression-to-the-mean bias had little effect on the safety estimates obtained.

Table 44. Example of paired comparison ratios method using raised speed limit sites.

Site Number	Experimental Crashes Before	After	Comparison Crashes Before	After	Comp. Ratios C	B*	Percent Change	Z	L	w	wL	$(L-Lt)^2$	$w(L-Lt)^2$	wL^2
AZ02E	4	2	12	7	0.59	2.38	-15.8	-0.17	-0.1721	1.0218	-0.1758	0.0027	0.0028	0.0303
AZ03E	16	5	1	4	1.19	18.99	-73.7	-1.08	-1.3345	0.6606	-0.8816	1.4759	0.9750	1.1765
CA06E	27	13	55	20	0.34	9.07	43.3	0.84	0.3598	5.4829	1.9726	0.2298	1.2601	0.7097
CA07E	87	40	55	20	0.39	34.01	17.6	0.50	0.1623	9.5336	1.5478	0.0795	0.7581	0.2513
CO01E	16	4	12	4	0.27	4.31	-7.2	-0.09	-0.0751	1.5416	-0.1157	0.0020	0.0031	0.0087
CO03E	15	4	12	4	0.35	5.27	-24.0	-0.34	-0.2748	1.5222	-0.4183	0.0241	0.0367	0.1150
CT01E	26	34	171	132	2.18	56.80	-40.1	-1.80	-0.5132	12.2686	-6.2962	0.1549	1.9003	3.2312
CT04E	1	2	0.5	0.5	0.71	0.71	180.6	0.44	1.0317	0.1818	0.1875	1.3255	0.2410	0.1935
DE05E	32	13	12	9	0.78	25.05	-48.1	-1.18	-0.6561	3.2333	-2.1214	0.2878	0.9306	1.3919
IN02E	46	44	28	25	0.88	40.65	8.2	0.23	0.0791	8.2838	0.6551	0.0395	0.3271	0.0518
IN03E	49	59	0.5	0.5	1.05	51.61	14.3	0.07	0.1337	0.2477	0.0331	0.0642	0.0159	0.0044
MD01E	13	8	17	15	0.94	12.24	-34.6	-0.74	-0.4251	3.0421	-1.2931	0.0933	0.2838	0.5496
MDO2E	46	32	17	13	0.80	36.71	-12.8	-0.31	-0.1374	5.2550	-0.7220	0.0003	0.0017	0.0992
MD03E	3	9	32	26	0.86	2.57	249.7	1.74	1.2519	1.9409	2.4298	1.8811	3.6509	3.0418
MD04E	28	21	18	11	0.74	20.61	1.9	0.04	0.0190	4.3120	0.0819	0.0192	0.0829	0.0016
MD05E	78	48	74	55	0.72	55.82	-14.0	-0.59	-0.1509	15.0838	-2.2755	0.0010	0.0147	0.3433
MD06E	6	3	0.5	5	10.29	61.76	-95.1	-1.84	-3.0247	0.3701	-1.1196	8.4393	3.1238	3.3864
MDO7E	4	3	0.5	5	9.31	37.24	-91.9	-1.51	-2.5187	0.3590	-0.9043	5.7555	2.0665	2.2777
MD08E	16	5	1	4	4.17	66.72	-92.5	-2.11	-2.5910	0.6606	-1.7115	6.1078	4.0346	4.4347
MD09E	14	7	4	8	2.30	32.22	-78.3	-1.99	-1.5266	1.6939	-2.5860	1.9795	3.3532	3.9477
MD10E	127	88	13	11	1.01	127.86	-31.2	-0.86	-0.3736	5.3332	-1.9923	0.0645	0.3439	0.7443
MS02E	8	24	6	26	4.24	33.90	-29.2	-0.57	-0.3453	2.6856	-0.9272	0.0509	0.1367	0.3201
TN01E	75	37	18	11	0.59	44.47	-16.8	-0.42	-0.1839	5.3335	-0.9808	0.0041	0.0220	0.1803
TX06E	6	1	0.5	0.5	1.13	6.79	-85.3	-0.84	-1.9153	0.1935	-0.3705	3.2243	0.6238	0.7097
TX07E	31	11	41	16	0.46	14.24	-22.7	-0.56	-0.2581	4.7469	-1.2250	0.0192	0.0910	0.3161
TX08E	42	20	0.5	0.5	0.64	26.89	-25.6	-0.15	-0.2961	0.2455	-0.0727	0.0311	0.0076	0.0215
CO02E	35	7	0.5	0.5	0.38	13.33	-47.5	-0.32	-0.6445	0.2397	-0.1545	0.2755	0.0660	0.0995
CT03E	2	2	0.5	0.5	0.69	1.38	45.3	0.17	0.3738	0.2000	0.0747	0.2435	0.0487	0.0279

Table 44. Example of paired comparison ratios method using raised speed limit sites (continued).

Site Number	Experimental Crashes Before	Experimental Crashes After	Comparison Crashes Before	Comparison Crashes After	Comp. Ratios C	B*	Percent Change	Z	L	w	wL	(L-Lt)²	w(L-Lt)²	wL²
ID03E	4	0.5	3	4	1.37	5.48	-90.9	-1.42	-2.3947	0.3522	-0.8433	5.1759	1.8228	2.0195
ID04E	2	0.5	0.5	0.5	0.35	0.69	-27.6	-0.13	-0.3224	0.1538	-0.0496	0.0411	0.0063	0.0160
ID05E	3	0.5	0.5	0.5	0.40	1.20	-58.2	-0.35	-0.8714	0.1578	-0.1375	0.5652	0.0892	0.1198
ID06E	78	15	69	20	0.28	21.50	-30.2	-0.95	-0.3599	6.9212	-2.4909	0.0577	0.3995	0.8964
ID07E	82	19	69	20	0.25	20.52	-7.4	-0.21	-0.0768	7.7020	-0.5912	0.0018	0.0142	0.0454
ID08E	4	0.5	7	2	0.28	1.12	-55.2	-0.47	-0.8028	0.3451	-0.2770	0.4667	0.1610	0.2224
MA02E	2	1	1	2	2.25	4.49	-77.7	-0.87	-1.5021	0.3328	-0.4999	1.9113	0.6361	0.7509
ME03E	14	7	4	0.5	0.12	1.71	309.7	0.90	1.4103	0.4051	0.5713	2.3407	0.9483	0.8058
MS01E	0.5	2	7	6	0.83	0.42	381.5	0.94	1.5717	0.3558	0.5592	2.8607	1.0178	0.8789
VA02E	9	8	32	10	0.49	4.43	80.7	0.97	0.5917	2.7127	1.6051	0.5060	1.3726	0.9497
CA04E	117	84	62	35	0.50	58.77	42.9	1.39	0.3572	15.2067	5.4322	0.2274	3.4580	1.9405
IN04E	1	1	4	3	0.71	0.71	40.6	0.21	0.3411	0.3858	0.1316	0.2123	0.0819	0.0449
TX01E	0.5	0.5	4	1	0.22	0.11	363.9	0.67	1.5345	0.1903	0.2920	2.7361	0.5207	0.4481
Total	1,170.0	685.5	866.0	538.5		964.72				130.8945	-15.6595		34.9306	36.8040

Comparison Ratios = Ratio of comparison site after crashes to before crashes, and ratio of before and after time periods and ratio of before and after traffic volumes at the comparison and experimental sites.
B* = Experimental site before crashes multiplied by the comparison ratios.
Change = Percent change in experimental site crashes from before to after.
L = Log Odds Ratio = ln(after experimental site crashes divided by the before experimental site crashes multiplied by the comparison ratios).
w = Weighting Coefficient = 1 divided by the reciprocals of the before and after crashes and traffic volumes for the experimental and comparison sites.
Lt = Weighted average log odds ratio = $\Sigma wL \div \Sigma w = -0.1196$
Lse = Standard error of the weighted average Log Odds Ratio = $1 \div \sqrt{\Sigma w} = 0.0874$
Et = Apparent change in crashes at the experimental sites in percent = -11.28
Z = Standard Normal Z-test = Lt/Lse = -1.37
Lower Limit = 95% Lower confidence limit in percent = -25.24
Upper Limit = 95% Upper confidence limit in percent = 5.30

Chi-square summary to assess the homogeneity of treatment effect:

Source	X^2	Degrees of Freedom
Treatment	$Lt^2(\Sigma w) = 1.87$	1
Homogeneity	$\Sigma w(L-Lt)^2 = 34.93$	40
Total	$\Sigma wL^2 = 36.80$	41

When the comparability tests indicated the experimental and comparison sites were not comparable, the before-and-after design employing the weighted average logit was used to estimate the safety effect. The calculations for this procedure were similar to the ones illustrated in table 44; however, the comparison site data were not used in the analysis.

When the treatment effect is significant, the paired comparison ratios method and the before-and-after weighted average logit method permit the analyst to estimate the consistency of the treatment effect across all sites. The question posed is-Were the changes in crashes consistent or similar for all treatment sites? As reflected in table 44, a chi-square test of homogeneity is used to determine the consistency of the treatment effect. In the analyses conducted in this study, the treatment effects were not significant and the chi-square tests were not significant.

APPENDIX G. EFFECTS ON A SAMPLE OF INTERSTATE SECTIONS

When this research was initiated in October 1985, the maximum speed limit on limited access highways was 55 mi/h (89 km/h). Consequently, the initial experimental design for the study did not include these special high-speed facilities.[10] In April 1987, near the end of the site-selection phase of the study, Congress permitted States to raise the speed limit on selected limited access facilities to 65 mi/h (105 km/h). After enactment of the legislation, four Interstate experimental sites where the speed limits were raised and three comparison sites and three nearby sites where the speed limits were not changed were selected for study. Available funding and time constraints did not permit the random selection of a representative sample of Interstate sites nor the intensive collection of speed and crash data that would be required to draw conclusions concerning the effects of raising speed limits on driver behavior and the effects on crashes on these facilities.

Before and after speed and crash data were collected to obtain an indication of the effects of raising the speed limit at the study sites. A summary of the effects of raising the speed limit on vehicle speeds and crashes for this limited number of sites is given in this appendix.

Site Characteristics

Shown in table 45 are the general characteristics of the experimental sites. The characteristics of the comparison and nearby sites are shown in table 46. Site selection for the experimental locations was limited to States that were planning to raise speed limits on Interstate facilities, and to locations where existing inductive loops, buried in the pavement, could be used to collect before and after speed data. Four experimental sites, representing 94 mi (151 km), were selected in California, Michigan, and Virginia. Comparison sites were selected in California and Michigan. A comparison site for the Virginia experimental sites was selected in Maryland, a State that retained the 55-mi/h (89-km/h) speed limit.

The experimental four-lane sites were located in rural areas and carried 24-h traffic volumes ranging from 14,000 to 34,000 vehicles. As shown in table 45, the 65-mi/h (105-km/h) speed limits on these sections were posted between June 1987 and July 1988. The speed limit for trucks remained at 55 mi/h (89 km/h) on these sections.

Vehicle Speed Results

Before and after 24-h free-flow vehicle (a vehicle with a headway of 4 s or more) speed data, as well as the differences in the speed characteristics for the experimental sites, are shown in tables 47 through 49. Speed data for the comparison and nearby sites are given in tables 50 through 52. The data were collected between April 1987 and August 1989. The volume and speed data for the Michigan sites include vehicles for both directions of travel; however, because inductive loops were only installed in one direction of travel, the data for the other Interstate sites are for one direction of travel.

Table 45. Interstate experimental site characteristics.

Interstate Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Before Speed Limit	After Speed Limit	Date New Limit Posted	Intersections Signalized	Intersections No Signal	Driveways Comm. Per Mile	Driveways Resid. Per Mile
CA08E	Colusa County	I-5 near Williams	Rural	24.76	4	55	65	06103187	Not Applicable			
MI08E	Livingston & lngham Cos.	I-96 near Fowlerville	Rural	15.83	4	55	65	11129187	Not Applicable			
VA08E	Fauquier County	I-66 E. of Marshall	Rural	21.93	4	55	65	07/01/88	Not Applicable			
VA09E	Rockbridge County	I-81 S. of Lexington	Rural	31.73	4	55	65	07/01/88	Not Applicable			
4 Sites				94.27 Miles								

1 mi= 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 46. Interstate comparison and nearby site characteristics.

Comparison Site Number	Jurisdiction	Route	Area	Length, Miles	No. Lanes	Posted Speed Limit	Intersections Signalized	Intersections No Signal	Driveways Comm. Per Mile	Driveways Resid. Per Mile
CA08C	Sacramento County	99 at Grant Line Road	Rural	19.61	4	55	Not Applicable			
MI08C	Genesee County	I-69 near Flint	Urban	19.91	4	55	Not Applicable			
MD70C	Frederick & Washington Cos.	I-70 W. of Frederick	Rural	28.31	4	55	Not Applicable			
CA08P	Sacramento County	I-5 in Sacramento	Urban	21.72	8	55	Not Applicable			
MI81P	lngham County	52 S. of I-96	Rural	13.12	2	55	0.00	2.59	0.15	11.13
MI82P	Washtenaw County	Rt. 52 S. of I-94	Rural	9.18	2	55	0.00	1.31	1.85	10.35

1 mi= 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 47. Before speed data for the Interstate experimental sites.

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Posted	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
CA08E	55	65	10	06/03/87	04/28/87	64.7	6.6	6,839	5,674	83.0	45	54	58	60	62	64	66	67	69	71	72	74	81	61	70	65.5	0.82
MI08E	55	65	10	11/29/87	10/08/87	64.8	6.3	34,399	20,392	59.3	51	56	58	59	61	63	65	67	69	71	73	76	82	60	69	61.0	1.11
VA08E	55	65	10	07/01/88	06/29/88	62.2	6.2	11,133	7,720	69.3	50	54	56	57	59	60	62	64	66	68	70	73	81	58	67	64.7	1.18
VA09E	55	65	10	07/01/88	06/29/88	66.2	5.3	12,092	8,109	67.1	55	59	60	62	63	64	66	68	70	72	73	76	81	62	71	69.7	1.20

1 mi/h = I.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 48. After speed data for the Interstate experimental sites.

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Date Posted	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds I	5	10	15	25	35	50	65	75	85	90	95	99	I 0-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
CA08E	55	65	IO	06/03/87	06/06/88	65.2	6.8	8,662	7,132	82.3	46	54	57	59	62	64	66	68	70	72	74	76	81	62	71	58.0	0.95
MI08E	55	65	IO	11/29/87	10/1 3/88	65.9	5.9	37,365	21,676	58.0	52	56	59	61	63	65	67	69	70	72	73	76	81	62	71	63.8	0.89
VA08E	55	65	IO	07/01/88	08/02/89	64.5	5.3	11,521	8,141	70.7	51	56	58	60	62	63	65	67	68	70	71	73	79	61	70	68.9	0.93
VA09E	55	65	IO	07/01/88	08/02/89	66.4	5.2	12,197	8,703	71.4	55	58	60	62	64	65	67	69	70	72	73	75	81	62	71	70.2	0.93

I mi/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Table 49. Differences in speed characteristics for the Interstate experimental sites.

Site Number	Diff. Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	1 0-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
CA08E	IO	0.5	0.2	1,823	1,458	-0.7	I	0	-1	-I	0	0	0	I	1	1	2	2	0	I	1	-7.5	0.13
MI08E	IO	I.1	-0.4	2,966	1,284	-1.3	1	0	1	2	2	2	2	2	1	1	0	0	-	1	2	2	2.8	-0.22
VA08E	10	2.3	-0.9	388	421	I.4	1	2	2	3	3	3	3	3	2	2	1	0	-	2	3	3	4.2	-0.25
VA09E	IO	0.2	-0.1	105	594	4.3	0	-1	0	0	I	1	I	I	0	0	0	-1	0	0	0	0.5	-0.27

1 ml/h = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in ml/h.

Table 50. Before speed data for the Interstate comparison and nearby sites.

Comparison Site Number	Posted Speed Limit	Before Data Collection Date	Mean Speed	Std. Dev. Speeds	Before Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pet. Pace	Skew. Index
CA08C	55	04/28/87	61.6	4.9	13,346	9,007	67.5	51	55	56	58	59	60	62	64	65	67	68	70	75	57	66	74.6	1.08
MI08C	55	1 0/08/87	65.5	6.7	39,713	24,413	61.5	51	56	58	59	62	63	66	68	70	72	74	77	84	62	71	58.1	1.05
MD70C	55	06/29/88	65.3	5.5	14,490	7,795	53.8	53	58	59	61	62	64	66	67	69	71	72	75	80	60	69	68.0	1.00
CA08P	55	*04/29/87*	62.5	5.7	41,214	21,040	51.1	51	55	57	58	59	61	83	65	66	69	70	73	79	58	67	66.4	1.13
MI81 P	55	*10/08/87*	60.6	7.9	3,057	2,662	87.1	39	47	51	54	57	59	62	64	66	68	70	73	79	57	66	57.6	0.82
MI82P	55	*10/08/87*	56.6	6.4	4,369	3,498	80.1	41	47	50	51	53	55	57	59	61	63	65	67	73	53			62	60.2	1 .oo

1 milh = 1.61 kmlh
Note: All speed limits and vehicle speeds are shown in milh.

Table 51. After speed data for the Interstate comparison and nearby sites.

Comparison Site Number	Posted Speed Limit	After Data Collection Date	Mean Speed	Std. Dev. Speeds	After Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds 1	5	10	15	25	35	50	65	75	85	90	95	99	10-mi/h Pace Lower Limit	Upper Limit	Pct. Pace	Skew. Index
CA08C	55	*06/06/88*	61.3	4.8	14,717	9,943	67.6	50	54	56	57	59	60	62	63	65	66	68	70	75	57	66	74.5	1 .oo
MI08C	55	*10/13/88*	65.8	6.4	33,281	20,181	60.6	51	56	58	60	62	64	66	69	71	73	74	77	82	62	71	57.6	1.00
MD70C	55	*08/02/89*	65.8	5.5	15,631	8,137	52.1	54	58	60	61	63	64	66	68	70	72	73	75	81	61	70	68.0	1.13
CA08P	55	*06/06/88*	62.2	5.8	49,486	21,752	44.0	49	54	56	57	59	60	62	65	66	68	70	72	77	58	67	64.3	1.13
MI81 P	55	*10/13/88*	60.2	6.8	3,392	2,994	88.3	42	49	52	54	57	59	61	63	65	67	69	71	76	57	66	58.9	0.90
MI82P	55	*10/13/88*	58.1	5.8	5,208	3,932	75.5	44	49	52	53	55	57	58	61	62	64	65	68	75	54	63	66.2	1.06

1 milh = 1.61 kmlh
Note: All speed limits and vehicle speeds are shown in milh.

Table 52. Differences in speed characteristics for the Interstate comparison and nearby sites.

Comparison Site Number	Posted Speed Limit	Mean Speed	Std. Dev. Speeds	Total Volume	Free-Flow Volume	Pct. Free Flow	Percentile Speeds													Lower Limit	1 0-mi/h Pace Upper Limit	Pct. Pace	Skew. Index
							1	5	IO	15	25	35	50	65	75	85	90	95	99				
CA08C	55	-0.3	-0.1	1,371	936	0.1	-1	-1	0	-1	0	0	0	-1	0	-1	0	0	0	0	0	-0.1	-0.08
MI08C	55	0.3	-0.3	-6,432	-4,232	-0.9	0	0	0	1	0	1	0	1	1	1	0	0	-	2	0	0	-0.5	-0.05
MD70C	55	0.5	0.0	1,141	342	-1.7	1	0	1	0	1	0	0	1	1	1	1	0	1		1	1	0.0	0.13
CA08P	55	-0.3	0.1	8,272	712	-7.1	-2	-1	-1	-1	0	-1	-1	0	0	-1	0	-1	-2		0	0	-2.1	0.00
MI81 P	55	-0.4	-1.1	335	332	1.2	3	2	1	0	0	0	-1	-1	-1	-1	-1	-2	-3		0	0	1.3	0.08
MI82P	55	1.5	-0.6	839	434	-4.6	3	2	2	2	2	2	1	2	1	1	0	1	2		1	1	6.0	0.06

I milh = 1.61 km/h
Note: All speed limits and vehicle speeds are shown in mi/h.

Shown in figure 44 are the before and after 24-h cumulative speed distributions for free-flowing vehicles measured at California experimental site CA08E. The differences in the before and after percentile speeds at this site ranged from a decrease of 1 mi/h (1.6 km/h) at the 10th and 15th percentile speeds to a 2-mi/h (3.2-km/h) increase at the 90th and 95th percentile speeds.

Changes in the before and after 24-h percentile speeds for free-flowing vehicles for each of the four sites where speed limits were raised to 65 mi/h (105 km/h) are shown in figure 45. Examination of figure 45 reveals that driver speeds at these sites increased between 1 and 3 mi/h (1.6 and 4.8 km/h). Figure 45 also reveals that the 99th percentile speed, which contains the highest speed drivers, either did not change or was 1 to 2 mi/h (1.6 to 3.2 km/h) lower after the speed limit was raised to 65 mi/h (105 km/h) at the experimental sites.

As shown in figure 46, changes in the before and after percentile speeds at the comparison sites, where the 55-mi/h (89-km/h) speed limit remained in effect, were generally less than 2 mi/h (3.2 km/h).

Shown in figure 47 are the changes in the 24-h mean speed and the standard deviation of speeds at each rural Interstate experimental site. While there was an increase in the mean speed, there was a reduction in the standard deviation of speeds at three of the sites. As shown in table 52, changes in the mean speed and standard deviation of speeds were less than 0.5 mi/h (0.8 km/h) at the comparison sites.

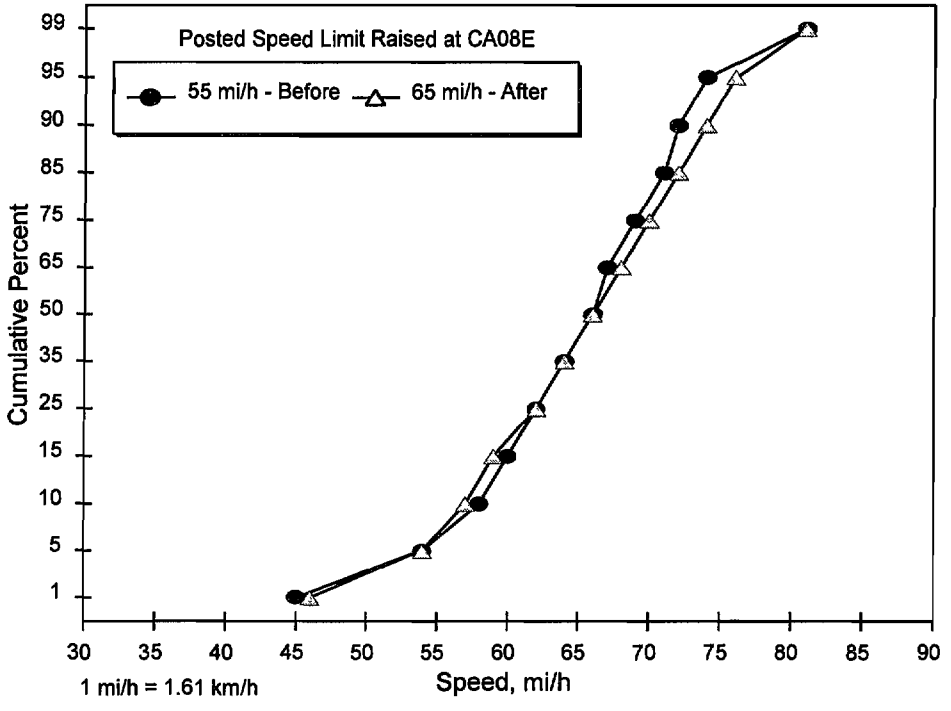


Figure 44. Before and after cumulative speed distributions at a rural Interstate experimental site in California.

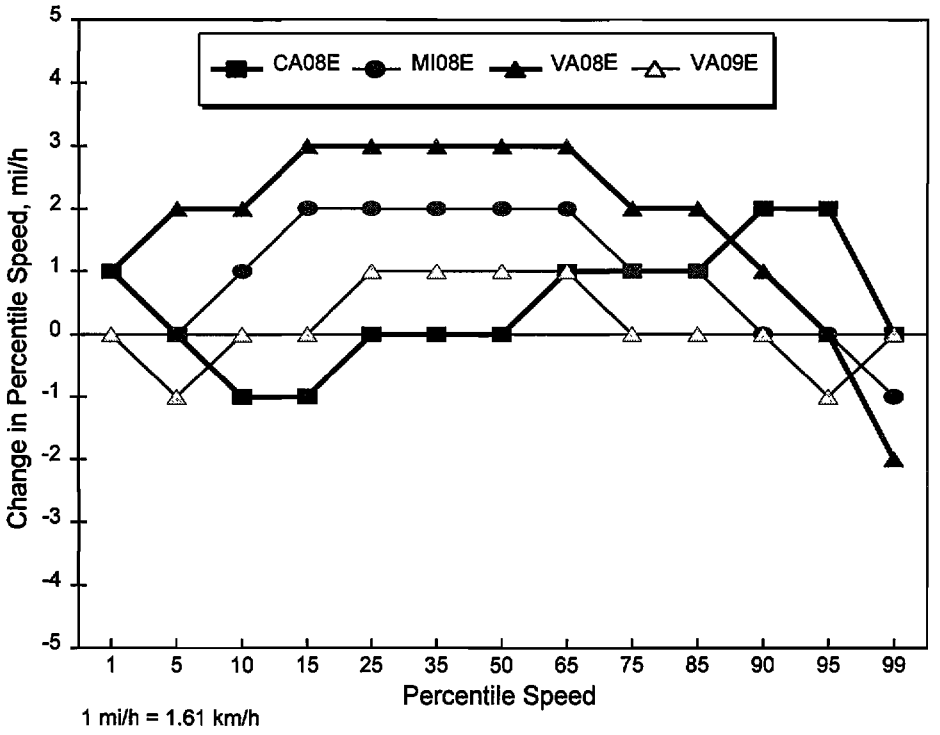


Figure 45. Changes in the percentile speeds for four selected rural Interstate experimental sites after the speed limit was raised.

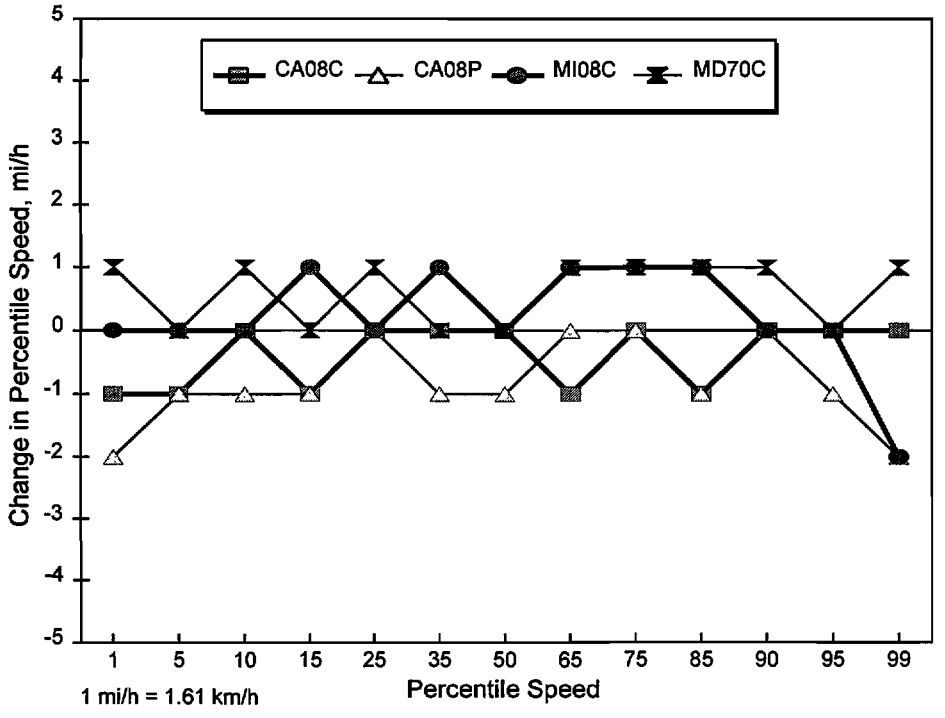


Figure 46. Changes in the percentile speeds for four selected Interstate comparison sites after the speed limit was raised at the experimental sites.

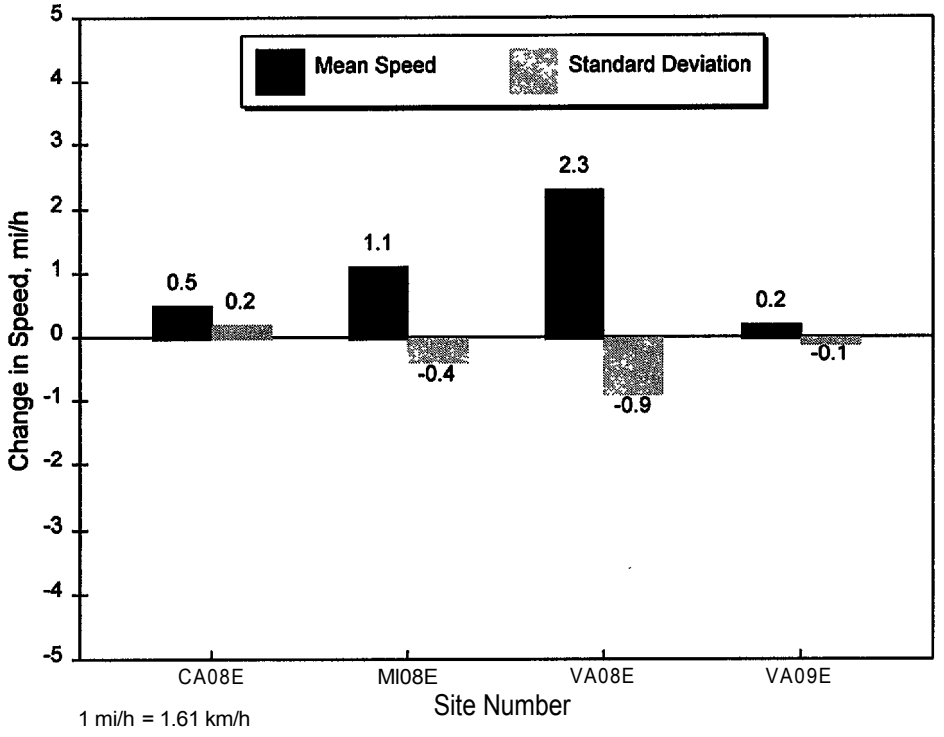


Figure 47. Changes in the mean and standard deviation of speeds at four selected rural Interstate experimental sites.

The percentages of drivers exceeding posted speed limits at the experimental and comparison sites are shown in tables 53 and 54, respectively.

As expected, raising the speed limit reduced the number and percentage of drivers exceeding the posted speed limit For the four experimental sites, the average reduction in drivers exceeding the speed limit was 39 percent. In addition, there was a 41 percent reduction in drivers exceeding the speed limit by 10 mi/h (16 km/h), and a 4 percent reduction in drivers exceeding the speed limit by 20 mi/h (32 km/h). While these are average values, the findings are similar at each of the four sites, as shown in table 53.

It should be noted that these figures do not necessarily represent a change in driver behavior, but instead reflect a change in how noncompliance is measured, i.e., from the posted speed limit.

Before the speed limit was raised, more than 90 percent of the drivers exceeded 55 mi/h (89 km/h) at the experimental sites. After the speed limit was raised to 65 mi/h (105 km/h), more than 50 percent of the drivers exceeded the posted limit.

Table 53. Percentage of drivers exceeding posted speed limits at the Interstate experimental sites.

Experimental Site Number	Before Limit	After Limit	Diff. Limit	Before: Percent Exceeding Posted Speed Limit 0	5	10	15	20	After: Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences: Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Raised from 55 to 65 mi/h at Experimental Sites																		
CA08E	55	65	10	93.0	82.9	50.0	17.4	3.7	53.5	24.3	5.7	1.2	0.3	-39.5	-58.6	-44.3	-16.2	-3.4
MI08E	55	65	10	95.2	79.1	47.4	19.0	5.6	58.5	22.8	5.1	1.2	0.3	-36.7	-56.3	-42.3	-17.8	-5.3
VA08E	55	65	10	90.8	63.1	27.7	9.1	2.7	47.1	13.4	2.6	0.6	0.1	-43.7	-49.7	-25.1	-8.5	-2.6
VA09E	55	65	10	98.9	89.7	56.7	21.8	5.2	61.5	22.3	4.4	1.1	0.3	-37.4	-67.4	-52.3	-20.7	-4.9

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Table 54. Percentage of drivers exceeding posted speed limits at the Interstate comparison and nearby sites.

Comparison Site Number	Posted Limit	Before: Percent Exceeding Posted Speed Limit 0	5	10	15	20	After: Percent Exceeding Posted Speed Limit 0	5	10	15	20	Differences: Percent Exceeding Posted Speed Limit 0	5	10	15	20
Speed Limit Raised from 55 to 65 mi/h at Experimental Sites																
CA08C	55	93.0	63.0	21.1	4.2	0.9	92.1	60.8	19.4	3.9	0.7	-0.9	-2.2	-1.7	-0.3	-0.2
MI08C	55	95.3	80.2	51.8	23.0	7.8	95.5	81.6	56.0	25.8	7.0	0.2	1.4	4.2	2.8	-0.8
MD70C	55	97.8	85.2	50.7	17.3	3.7	98.3	88.0	53.4	20.1	4.9	0.5	2.8	2.7	2.8	1.2
CA08P	55	93.3	65.5	29.0	9.6	2.7	90.7	64.4	29.6	7.9	1.8	-2.6	-1.1	0.6	-1.7	-0.9
MI81P	55	81.3	58.6	26.7	8.8	2.4	80.8	53.0	22.8	6.3	1.1	-0.5	-5.6	-3.9	-2.5	-1.3
MI82P	55	60.1	28.3	8.1	2.1	0.7	72.1	35.8	9.9	2.6	0.7	12.0	7.5	1.8	0.5	0.0

1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h.

Repeated Speed Measurements

Speed measurements were conducted before the speed limits were changed, and repeated at 3-month intervals thereafter for a 12-month period at the Virginia rural Interstate sites and the Maryland comparison site. Shown in figure 48 are changes over time in the 85th percentile speeds for these sites. The data indicate that the 85th percentile speeds increased from 1 to 3 mi/h (1.16 to 4.8 km/h) during the measurement periods at these locations.

Effects on a Contiguous section

Data were collected to provide an indication of whether raising the speed limit on a rural interstate site increased vehicle speeds on a contiguous urban Interstate section. Before and after 24-h free-flow speed data were collected on a section of rural Interstate (California site CA08E) where the speed limit was raised, on a contiguous urban Interstate (CA08P), and on a rural limited access highway (CA08C) where the posted speed limit remained at 55 mi/h (89 km/h).

Before and after data showing the effects of raising the speed limit on the 85th percentile speeds at these sites are given in figure 49. Although the number of sections sampled is too small to draw conclusions, it does not appear that the 85th percentile speeds increased on both of the 55-mi/h (89-km/h) sections after the speed limit was raised at the experimental site.

Spillover Effects on Nearby Rural Two-Lane Highways

One concern often expressed about raising rural Interstate speed limits is the spillover effect, which suggests that speeds may increase on nearby rural two-lane highways. To examine this effect, a rural two-lane site located 1 mi (1.6 km) from an interchange in Michigan was selected for speed measurement. In addition, data were collected 3 mi (4.8 km) from another rural interchange, also located in Michigan. The speed limit on the Interstate section was raised to 65 mi/h (105 km/h), while the speed limit on the rural two-lane highways remained at 55 mi/h (89 km/h).

The mean speeds for the Interstate sections, as well as the two-lane sections, are presented in figure 50. While the mean speed on the rural Interstate increased by 2 mi/h (3.2 km/h) 1 yr after the 65-mi/h (105-km/h) speed limit was posted, there was a 0.4-mi/h (0.6-km/h) decrease in the mean speed at the site located within 1 mi (1.6 km) from the interchange. The mean speed at the site located 3 mi (4.8 km) from the interchange fluctuated over the year. At the end of the I-yr after period, the mean speed at this site was 1.5 mi/h (2.4 km/h) higher than it was prior to the speed limit change on the Interstate section.

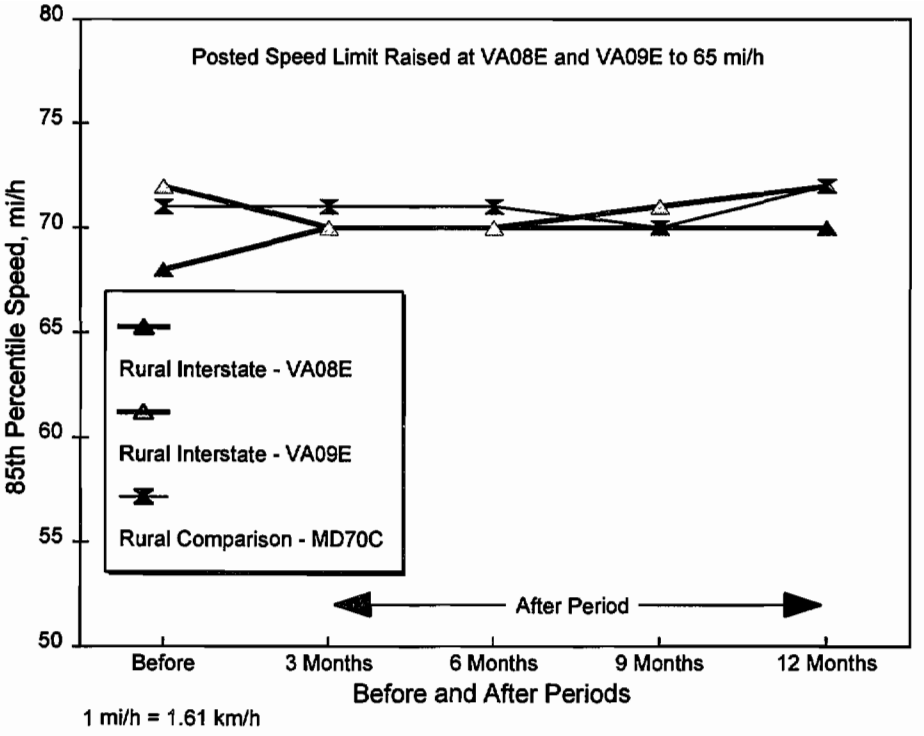


Figure 48. Before and after 85th percentile speeds at rural Interstate sites.

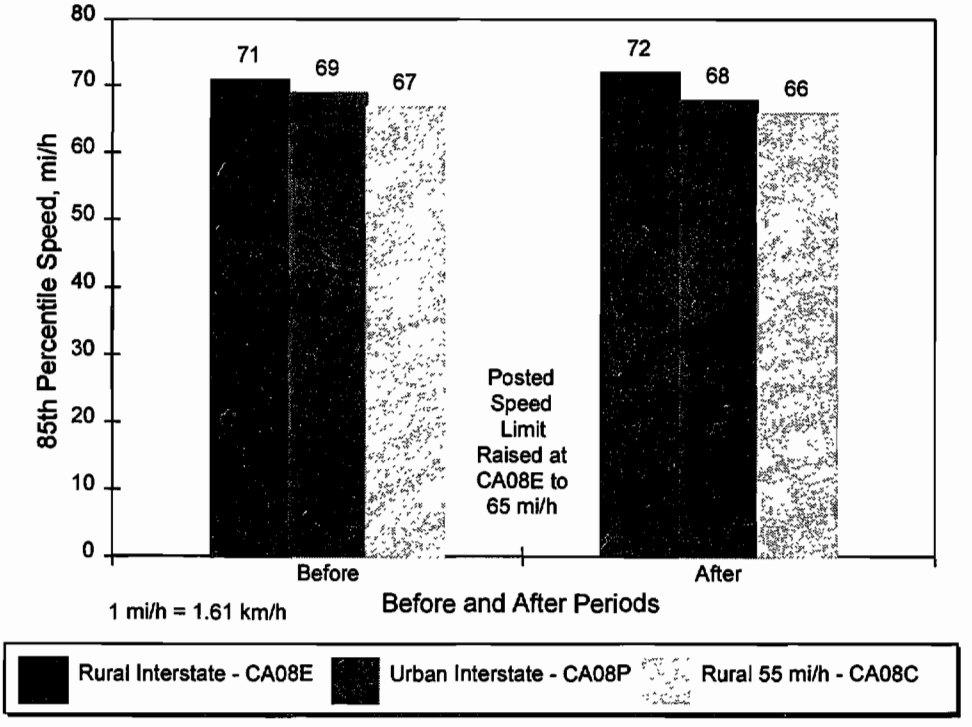


Figure 49. Before and after 85th percentile speeds at three California limited access sites.

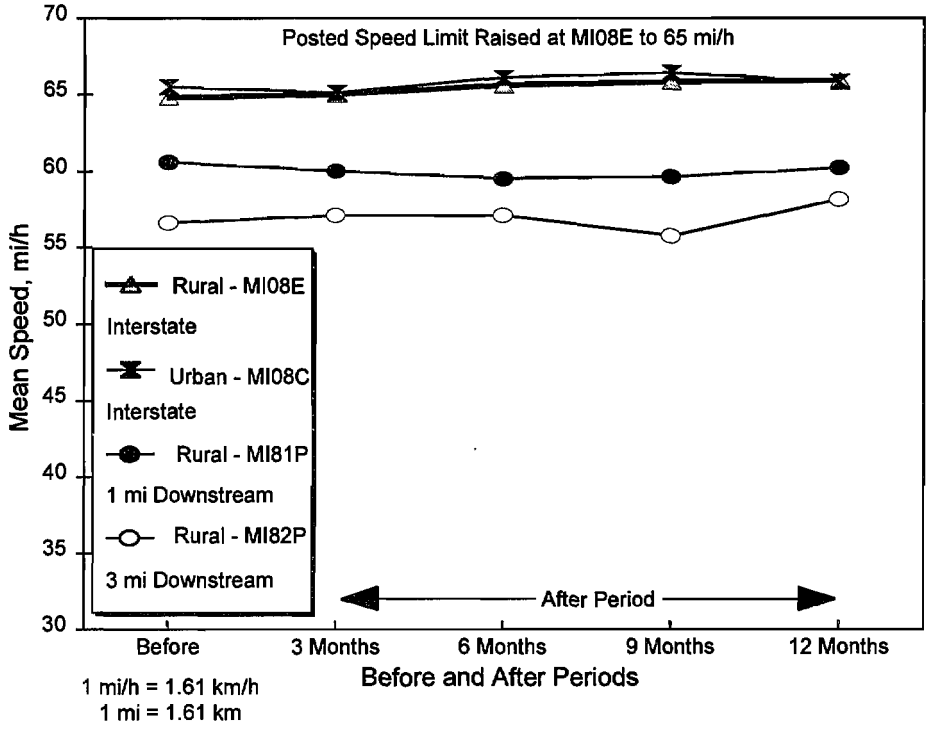


Figure 50. Before and after mean speeds at a rural Interstate site, an urban Interstate site, and two nearby rural two-lane highway locations.

Crash Results

As mentioned in the introduction to this appendix, before and after crash data were collected for four Interstate sites where speed limits were raised to 65 mi/h (105 km/h), and for three comparison sites and three nearby sites where speed limits were not changed. Due to funding and time constraints, data collection was limited to these sites, which were not randomly selected. Furthermore, only 1 year of crash data for the after period was available. Crash data for this limited number of sites were collected to obtain general information and the results apply only to these locations.

Before and after police-reported total crash and fatal and injury crash data were collected for the Interstate experimental, comparison, and nearby locations. As shown in tables 55 through 57, reported total crashes and injury crashes were obtained for a 3-yr before period and a 1-yr after period at each site, except for the California sites, where a 21-month period of after data was available.

Table 55. Crash data for the Interstate experimental sites.

Experimental Site Number	Diff. Limit	Length, Miles	Before Volume	After Volume	Third Before Period Total	Third Before Period Injury	Third Before Period Month	Second Before Period Total	Second Before Period Injury	Second Before Period Month	First Before Period Total	First Before Period Injury	First Before Period Month	Total Before Total	Total Before Injury	Total Before Month	First After Period Total	First After Period Injury	First After Period Month	Second After Period Total	Second After Period Injury	Second After Period Month	Total After Total	Total After Injury	Total After Month
Speed Limit Raised from 55 to 65 mi/h at Experimental Sites																									
CA08E	**10**	24.78	13,676	17,324	74	23	12	71	29	12	64	20	12	229	72	36	92	30	12	56	25	9	150	55	21
MI08E	10	15.63	34,399	37,365	145	32	12	157	36	12	136	31	12	436	99	36	219	44	12				219	44	12
VA08E	10	21.93	22,266	23,042	50	22	12	50	16	12	57	15	12	157	53	36	66	42	12				66	42	12
VA09E	10	31.73	24,184	24,394	109	47	12	152	63	12	130	59	12	391	169	36	169	66	12				169	66	12
4 Sites		94.27			376	124		430	144		407	125		1,215	393		566	184		56	25		624	209	

1 mi= 1.6 1 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period.

Table 56. Crash data for the Interstate comparison sites.

Comparison Site Number	Posted Limit	Length, Miles	Before Volume	After Volume	Third Before Period Total	Third Before Period Injury	Third Before Period Month	Second Before Period Total	Second Before Period Injury	Second Before Period Month	First Before Period Total	First Before Period Injury	First Before Period Month	Total Before Total	Total Before Injury	Total Before Month	First After Period Total	First After Period Injury	First After Period Month	Second After Period Total	Second After Period Injury	Second After Period Month	Total After Total	Total After Injury	Total After Month
Speed Limit Raised from 55 to 66 mi/h at Experimental Sites																									
CA08C	**55**	19.61	26,492	29,434	166	60	12	197	82	12	210	67	12	573	249	36	235	112	12	151	71	9	366	183	21
MI08C	55	19.91	39,713	33,261	435	122	12	458	129	12	390	107	12	1,263	356	36	432	133	12				432	133	12
MD70C	55	26.31	34,555	42,631	160	77	12	156	61	12	205	91	12	523	249	36	211	106	12				211	106	12
3 Sites		67.83			761	279		613	292		605	285		2,379	656		876	353		151	71		1,029	424	

1 mi= 1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in mi/h. Blanks indicate that crash data were not available for the period

Table 57. Crash data for the Interstate nearby sites.

Nearby Site Number	Posted Limit	Length, Miles	Before Volume	After Volume	Third Before Period Total	Third Before Period Injury	Third Before Period Month	Second Before Period Total	Second Before Period Injury	Second Before Period Month	First Before Period Total	First Before Period Injury	First Before Period Month	Total Before Total	Total Before Injury	Total Before Month	First After Period Total	First After Period Injury	First After Period Month	Second After Period Total	Second After Period Injury	Second After Period Month	Total After Total	Total After Injury	Total After Month
Speed Limit Raised from 55 to 65 mi/h at Experimental Sites																									
CA08P	55	21.72	82,428	98,972	200	111	12	252	109	12	285	132	12	737	352	36	334	143	12	277	129	9	611	272	21
MI81P	55	13.12	3,057	3,392	26	6	12	43	7	12	46	7	12	115	20	36	54	9	12				54	9	12
MI82P	55	9.18	4,369	5,208	47	18	12	42	17	12	35	13	12	124	48	36	62	20	12				62	20	12
3 Sites		44.02			273	135		337	133		366	152		976	420		450	172		277	129		727	301	

1 mi=1.61 km
1 mi/h = 1.61 km/h
Note: All speed limits are shown in milh. Blanks indicate that crash data were not available for the period.

Overall Crash Effects

The crash data were analyzed using the paired comparison ratio and the before and after analysis methods as discussed in appendix F. The first step in the analysis was to examine the comparability of the before crash data at the comparison sites to the before crash data at the experimental sites. The crash histories of the comparison and experimental sites were not comparable in the before periods, i.e., G = 11.14, with three degrees of freedom, which is significant at α = 0.05. Accordingly, only the before-and-after method is appropriate to estimate the overall safety effects of raising speed limits for this group of experimental sites.

The before-and-after analysis utilized comparison ratios to account for differences in before and after traffic volumes and unequal before and after time periods. The analysis indicated that total crashes at the study sites increased by 25 percent, Z = 4.51. Injury crashes, defined as a crash where one or more persons were killed or injured, appeared to have increased by 30 percent, based on the before-and-after analysis, Z = 3.07.

These results are statistically significant; however, the findings must be viewed with caution due to the limitations of the before-anti-after method, i.e., no control for extraneous factors, regression-to-the-mean, etc. In addition, the nonrandom method of site selection, the small sample of sites, and the short after time period (1 year) prevent the drawing of inferences from these data and applying them to other similar freeway facilities. No general statements are appropriate from this analysis.

Site-by-Site Analysis

On an individual site basis, the G-test revealed that the crash histories at the comparison sites were comparable with the crash changes at the experimental sites for three of the four locations. The Virginia site, VA09E, was not comparable to the Maryland comparison site. Accordingly, the paired comparison ratio method was used to estimate the safety effects at sites CA08E, MI08E, and VA08E. The before-and-after method was used at the VA09E site. The comparison ratios used to estimate these effects utilized before and after crash counts, traffic volumes, and unequal time periods.

A summary of the results for total crashes at each 'site is shown in table 58. There were no significant differences (α = 0.05) in total crashes at the California or Michigan sites; however, there was a significant increase in total crashes at the two Virginia sites.

The summary of the findings for injury crashes is given in table 59. Based on an analysis of injury crashes, the only statistically significant difference occurred at Virginia site VA08E, where injury crashes increased by 118 percent. It should be noted that the number of injury crashes at this site was small (53 in the 3-yr before period and 42 in the 1-yr after period).

Table 58. Interstate total crash results.

Site Number	Number of Reported Total Crashes: Experimental 3-yr Before	Experimental 1-yr After	Comparison 3-yr Before	Comparison 1-yr After	Percent Change	Z-Value	prob.
CA08E	229	150	573	386	-20.7	-1.86	0.07
MI08E	438	219	1,283	432	14.6	1.36	0.18
VA08E	157	86	523	211	61.9	3.06	0.004
VA09E	391	169	Data Not Available		28.6	2.72	0.008

Note: 21 months of after data were used at site CA08E and the comparison site.

Table 59. Interstate injury crash results.

Site Number	Number of Reported Injury Crashes: Experimental 3-yr Before	Experimental 1-yr After	Comparison 3-yr Before	Comparison 1-yr After	Percent Change	Z-Value	prob.
CA08E	72	55	249	183	-15.2	-0.81	0.42
MI08E	99	44	358	133	-7.7	-0.39	0.70
VA08E	53	42	249	108	117.8	3.29	0.001
VA09E	169	68	Data Not Available		19.7	1.25	0.21

Note: 21 months of after data were used at site CA08E and the comparison site.

Summary of Interstate Results

Before and after speed and crash data were collected at four Interstate sites to obtain general information on the effects of raising the speed limit from 55 to 65 mi/h (89 to 105 km/h) at these sites. Data collection costs and time constraints limited data collection to four nonrandomly selected sites. Due to the small sample of sites and nonrandom method of site selection, the results apply only to the sites examined.

Based on speed data collected at four sites, it appears that the mean and 85th percentile speeds increased 1 to 2 mi/h (1.6 to 3.2 km/h) after the speed limits were raised to 65 mi/h (105 km/h). Based on the limited data collected in this study, there does not appear to be an increase in the 99th percentile speed, which contains the highest speed drivers.

A before-and-after analysis of police-reported crashes at four sites indicates that total crashes increased by 25 percent and injury crashes increased by 30 percent.

While the results only apply to the sites studied, the findings are similar to the results reported by other researchers who have conducted studies on these high-speed limited access facilities.[43-4,5]

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