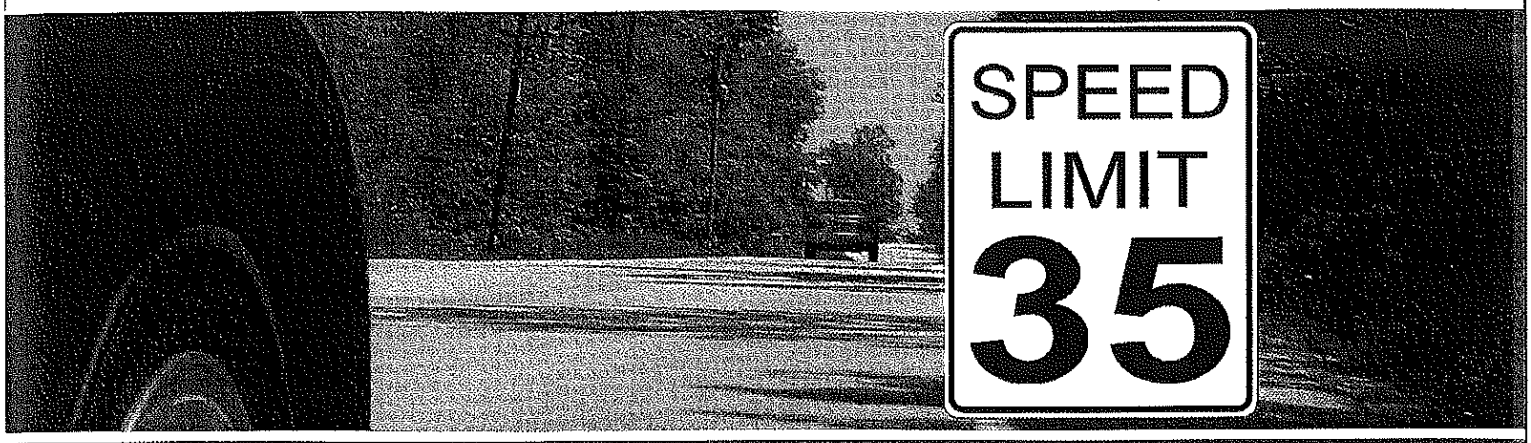


Effective Speed Zoning

Why and How

Introduction

Speed zoning is the practice of establishing speed limits that are reasonable and safe for specific sections of roadway. This assumes both that it's possible to determine a "reasonable" speed for specific driving situations and that there's a cause-and-effect relationship between the driving speed and traffic safety.

People often think the second part of this statement means that when motorists drive at higher speeds, a greater number of crashes, deaths, and injuries inevitably occur than when they drive at slower speeds. Therefore, it follows that lowering speed limits is an effective way to deal with complicated traffic challenges. But as it turns out, this commonsense "solution" is both simplistic and usually not true.

If used properly, speed zoning is an effective traffic engineering tool that can enhance traffic safety—but the key word is *properly*. Numerous studies have shown that artificially lowering speed limits can diminish their overall effectiveness, decrease safety, and promote a culture of disregard not only for speed limits but for traffic regulations generally. Setting unreasonable speed limits can also establish de facto speed traps, in which sensible and safe drivers are unfairly cited for traffic violations.

This booklet is a practical guide to effective speed zoning. It is based on the legal provisions for establishing speed limits in California, which are clearly specified in the California Vehicle Code (CVC) and the California Manual on Uniform Traffic Control Devices (CA MUTCD). The first part of the booklet explains why setting effective speed limits must be based on an engineering and traffic survey. The second part shows how to complete such a survey and select an effective speed limit.

The Auto Club hopes that you find this booklet useful and that you keep it handy for reference. To request additional copies, please call (714) 885-2300; you may also download a PDF copy at AAA.com/roadahead. We are happy to be of further service regarding specific speed-zoning problems in your community. If you have additional questions, please call (714) 885-2326.

Fundamentals of Effective Speed Zoning

The system of laws in the United States is based on the premise that most of the time, the vast majority of people conduct their lives in a reasonable manner. For traffic regulations, this means that most of the time, the majority of motorists drive safely and sensibly.

Further, the evidence suggests that speed limit laws that arbitrarily, unreasonably, or unjustifiably restrict the majority of drivers encourage wholesale violations, lack of public support, and usually fail to bring about the desired changes in driving behavior.

By contrast, reasonable and well-recognized speed laws are useful to law enforcement agencies to control the unreasonable violator, whose behavior is unsafe and out of line with that of most motorists.

The rationale for speed zoning is also based on the following fundamental concepts, which are deeply rooted in our system of government and law:

- The normally careful and competent actions of a responsible person should be considered legal.
- Laws are established for the protection of the public and the regulation of unreasonable behavior by the individual.
- Laws cannot be effectively enforced unless the majority of people voluntarily consent to and comply with them.

In general, most people accept, understand, and follow these concepts. But, as mentioned earlier, when confronted by local traffic challenges—an increase in traffic volumes or the frequency or severity of car crashes in a particular area, for example—people often reject these concepts and rely instead on a number of widely held misconceptions, such as:

- Lowering a posted speed limit will reduce traffic speeds.
- Raising a posted speed limit will increase traffic speeds.
- Lower speed limits will reduce the rate of crashes and increase safety.
- Any posted speed limit is safer than an unposted speed limit.

In fact, these commonsense notions are not supported by studies, which consistently demonstrate that:

- The speed of traffic does not change significantly after new or revised speed limits are posted.
- There is no direct relationship between posted speed limits and the frequency of traffic crashes.

Why Are Effective Speed Limits Desirable?

Effective speed limits are important for a number of reasons:

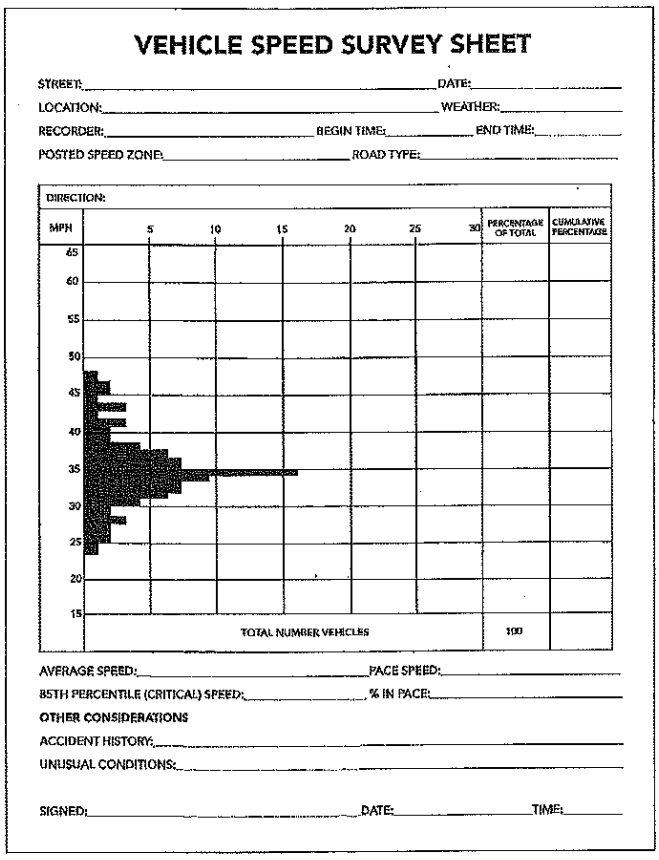
- They satisfy the requirements of state law for establishing prima facie speed limits (see the definition below) on public streets and highways.
- They invite public compliance because they conform to the behavior of the majority of drivers and give a clear reminder to nonconforming violators.
- They provide law enforcement agencies with an effective tool to separate the occasional violator from the safe and reasonable driving majority.
- They help minimize public antagonism toward enforcement of perceived "unreasonable" regulations.
- They are based on logic, reason, and proven safety research rather than on arbitrary, emotional, or politically driven motives.
- They lend credence and acceptability to the widely posted admonition "Speed Laws Strictly Enforced."

Where Do Effective Speed Limits Apply?

The basic purpose of speed zoning is to influence motorists to drive at about the same speed as other cars on the road. This helps keep traffic flowing smoothly and reduces the conflicts that occur when people drive at widely varying speeds, which often results in traffic crashes caused by unsafe lane changes, tailgating, and other hazardous driving maneuvers.

In general, speed zoning is most effective when it's applied to:

- Streets, roads, and highways that carry high volumes of traffic.
- Transitions from rural to urban conditions on major highways, and from commercial to residential areas within urban environments. Such areas usually require "reminder" posting, making motorists aware that they've moved into a different driving environment.
- Areas with a high number of speed-related collisions or unusual enforcement problems.



VEHICLE SPEED SURVEY SHEET

STREET:_____ DATE:_____

LOCATION:_____ WEATHER:_____

RECORDER:_____ BEGIN TIME:_____ END TIME:_____

POSTED SPEED ZONE:_____ ROAD TYPE:_____

DIRECTION:

MPH	5	10	15	20	25	30	PERCENTAGE OF TOTAL	CUMULATIVE PERCENTAGE
65								
60								
55								
50								
45								
40								
35								
30								
25								
20								
15								
	TOTAL NUMBER VEHICLES						100	

AVERAGE SPEED:_____ PACE SPEED:_____

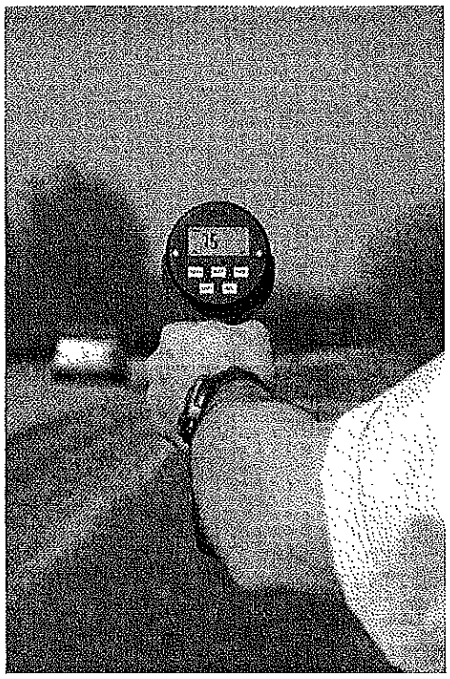
85TH PERCENTILE (CRITICAL) SPEED:_____ % IN PACE:_____

OTHER CONSIDERATIONS

ACCIDENT HISTORY:_____

UNUSUAL CONDITIONS:_____

SIGNED:_____ DATE:_____ TIME:_____



Engineering and Traffic Survey

To be effective, speed zoning must be based on engineering and traffic surveys, which the CVC defines as surveys of "highway and traffic conditions in accordance with methods determined by the Department of Transportation for use by state and local authorities." Such surveys include, but are not be limited to:

- Prevailing speeds as determined by traffic-engineering measurements
- Traffic crash records
- Highway, traffic and roadside conditions not readily apparent to the driver

However, before researchers begin to collect field data, they need to address the following matters:

Location

On a small scale map of the street or roadway to be surveyed, choose enough speed check sites to make sure you get a representative sample of differing traffic conditions. In urban and suburban areas, measurements are typically made at half-mile intervals or at locations where traffic and roadway characteristics change.

Be sure to pick site locations that are far enough away from stop signs, traffic signals, or anything else that would interrupt the flow of traffic; such elements significantly affect traffic speed. In general, checking traffic speeds midblock (in a residential area) or midway between intersections (on a roadway) will produce accurate speed samples.

Equipment

Field survey equipment typically consists of speed survey sheets and a speed measuring device (usually radar) in an unmarked vehicle. Other tools include a stopwatch, a "ball-bank" indicator for establishing advisory speeds on horizontal curves, a measuring wheel for determining sight distances, a camera, and a manual counter for recording pedestrian movements and the density of roadside development.

Personnel

Normally, one person can complete a field survey. However, under busy urban conditions it's useful to assign an observer and a recorder to make sure that you accurately measure prevailing speeds and take note of roadway and roadside conditions.

Time of Day

The reason for posting speed limits is to advise motorists of safe driving speeds during normal driving conditions, so it's best to measure prevailing traffic speeds during off-peak hours, when traffic is most likely to be free-flowing. For purposes of comparison, you might also decide to measure speeds during peak hours.

Positioning the Speed Measuring Device

Locate the speed measuring device as inconspicuously as possible to avoid adversely affecting the normal flow of traffic. Position radar antennas at an angle of not greater than 15 degrees to the centerline of the roadway, about three feet above the surface. In this position, the device will measure speeds in either direction or in adjacent lanes. Record the speed and direction of traffic on vehicle speed survey sheets.

Sample Size

Performing 100 (but no fewer than 50) properly selected observations of prevailing traffic speeds is usually sufficient to ensure accuracy within the normal capability of the measuring device. On multi-lane streets (divided or undivided), record separate samples for each direction of travel.

Observing and Measuring Prevailing Speeds

Collecting accurate data is very important and requires considerable care. To adequately deal with the many variables involved in data collection and to avoid potential sources of bias, be sure to assign trained observers who can select vehicles on a truly random basis.

Errors that commonly lead to biased results, and ways to eliminate them, include:

- **Selecting the vehicle in a platoon of traffic**

If you encounter platooned traffic, select vehicles from varying positions in the platoons. However, densely packed traffic may make it impossible to gather the information needed for an accurate survey.

- **Selecting too large a proportion of trucks**

Record the speed of about the same percentage of trucks in the sample as exists in the traffic stream.

- **Selecting too large a proportion of higher-speed vehicles**

Untrained observers often avoid recording vehicles traveling at normal speeds and instead focus on "catching" the occasional high-speed vehicle. Avoid this practice because it biases results toward the upper speed ranges.

Inventory of Crash Records

Accurate engineering and traffic surveys incorporate the crash records from the most recent two-year traffic collision history for the roadway being surveyed. If you observe a concentration of reported crashes or a crash rate that's significantly higher than normal for the type of roadway being studied, create a detailed crash analysis, which would typically include a collision diagram for the route or for specific locations on the route. This enables you to adequately consider other corrective measures, including a greater emphasis on traffic enforcement, as well as whether creating a speed zone is ultimately a feasible idea.

Inventory of Road Conditions

This final phase of the survey consists of reviewing the physical characteristics of the roadway and adjacent development. It's especially important to identify conditions that aren't readily apparent to motorists, such as those identified in the CA MUTCD. For city and county roads, summarize the results on the vehicle speed survey sheet. For state highways and roadways with abnormally high crash rates, use the speed zone survey sheet to document all pertinent data and to facilitate the analysis process.

Analyzing Speed Survey Field Data

In selecting a reasonable speed limit, it's important to consider two characteristics developed from prevailing speed data: the critical (85th percentile) speed and the pace.

Critical (85th percentile) Speed

The critical speed is the speed at or below which 85 percent of traffic is moving. The critical speed can be determined directly from the vehicle speed survey sheet. From the top speed, count the number of vehicles equaling 15 percent of the total number of vehicles observed. In the example shown on page 12, 15 percent of the 100 vehicles observed (that is, 15 vehicles) were traveling at 40 mph or more; the 85th percentile speed was therefore 40 mph.

The 85th percentile speed is usually within 2 mph of the upper limit of the pace. This can be compared on the cumulative speed curve, which presents a measure of the validity of the field data or the presence of an abnormal bias.

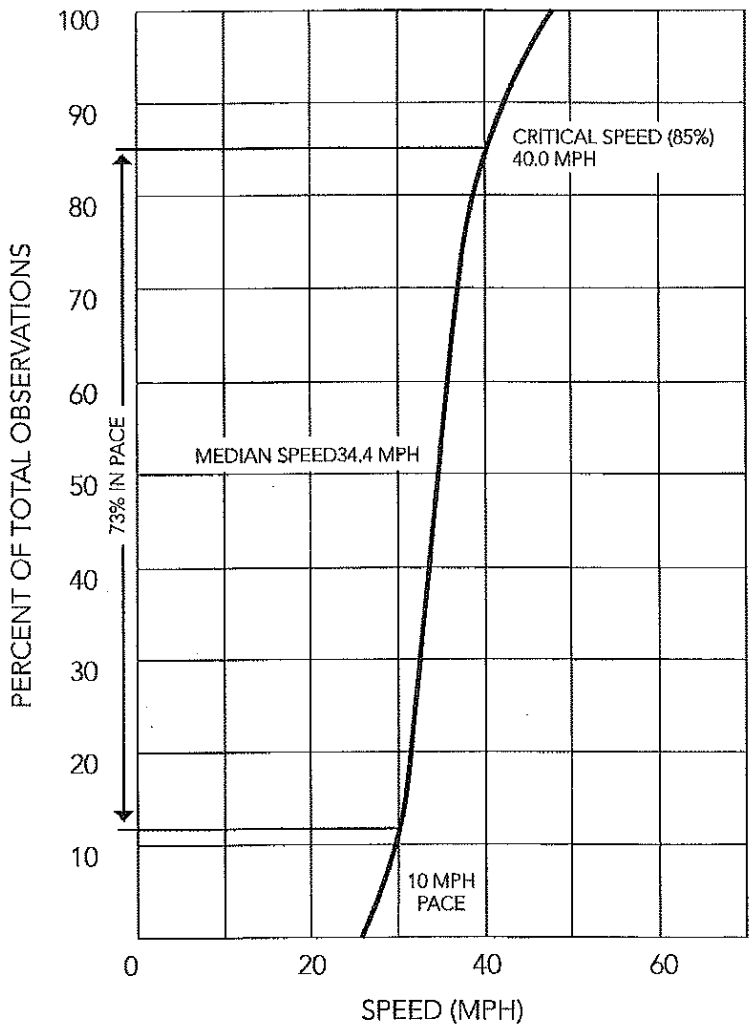
Pace

The pace is defined as the 10 mph range of vehicle speeds containing the largest number of observed vehicles travelling within that range. This figure can usually be determined by visually inspecting the vehicle speed survey sheet. After you determine the pace, compute the percentage of vehicles in the pace, over the pace, and under the pace. A normal speed distribution will contain approximately 70 percent of the sample within the pace, with 15 percent above the pace and 15 percent below.

Selecting the Proper Speed Limit

The 85th percentile speed is the single characteristic that most nearly conforms to a safe and reasonable speed limit. Speed limits set *higher* than the critical speed will make only a few additional drivers "legal" for each 5 mph that the posted speed limit is increased. However, speed limits set *lower* than the critical speed will make a large number of reasonable drivers "illegal" for each 5 mph increment that the posted speed is reduced. For example, results from speed surveys show that an increase of 5 mph from the 40 mph 85th percentile speed would "legalize" only an additional 10 percent of the sampled traffic, whereas a decrease of 5 mph would make "violators" of an additional 28 percent of the sampled traffic.

CUMULATIVE SPEED CURVE



LOCATION _____ TIME_____TO_____

DIRECTION _____ PRESENT SIGNED ZONE _____MPH

DATE _____ NUMBER OF VEHICLES _____100___

SPEED ZONING – HOW TO IMPLEMENT IT

Current California law regarding setting speed limits, as defined by the CVC and the CA MUTCD, requires the following:

- To establish a posted speed limit, the 85th percentile speed shall be rounded to the nearest *5 mph increment.*
- If there are conditions "not readily apparent" to drivers, the posted speed limit might be lowered by 5 mph, with complete and concise documentation explaining the "not readily apparent" conditions.
- In cases where the 85th percentile speed is rounded to the farthest 5 mph increment (a lower 5 mph) instead of the nearest 5 mph (the higher 5 mph), no further reduction in the posted speed limit is allowed, regardless of any other existing conditions.
- The State Legislature has specifically prohibited using roadway features that are readily apparent to drivers as justifications for artificially lowering posted speed limits, because drivers can see these conditions and adjust their speeds accordingly.

The CVC *specifically clarifies* that:

"It is the intent of the Legislature that physical conditions such as width, curvature, grade and surface conditions, or any other condition readily apparent to a driver in the absence of other factors, would not require special downward speed zoning."

Final Considerations

As a final aid to establishing effective speed zones, keep the following considerations in mind:

- Intermediate speed limits are appropriate for through routes, which have the positive intersection controls, signing, striping, and markings necessary to accommodate sizable volumes of traffic from outside the immediate neighborhood.
- Unusually short zones—less than a half-mile in length—should not be considered for speed zoning.
- Speed zone changes should be coordinated with visible changes in roadway conditions or roadside development.
- Change in speed zones should normally be kept at 5 mph increments. In some areas, 10 mph changes might be necessary and acceptable. If this is the case, adequate advance warning signs informing motorists of such changes should be installed.

Myths and Facts about Speed, Speed Limits and Traffic Safety

MYTH:
Establishing speed limits on California roads and streets is regulated by the state with little local control and input.

FACT:
Although there are time-tested statewide and national standards to regulate the posting of speed limits on certain roads and streets, substantial flexibility in those standards exists for local agencies to post speed limits that are appropriate for and adjusted to the local conditions, while preserving the reasonable expectations of all drivers using those roads. Some of these include:

- Specific allowances for a 5 mph reduction to the recommended posted speed limit for conditions not readily apparent to drivers, such as crash history, roadside conditions, and the higher-than-normal presence of bicycle and pedestrian traffic, equestrian traffic, etc. (California Vehicle Code section 22358.5).
- Streets in a residential or business district are exempt from the uniform state standards if they are posted at the statutory prima facie limit (that is, 25 mph). [CVC section 22352 (2)(A)].
- Any street that is not on the maps submitted by a local agency to the Federal Highway Administration and meets the following criteria is exempt from compliance with the uniform state standards:

  1. Roadway width of not more than 40 feet
  2. No more than a half-mile of uninterrupted length (examples of interruptions are signals and stop signs).
  3. No more than one traffic lane in each direction. [California Vehicle Code section 40802 (b)(1)]

MYTH:
Simply reducing the speed limit on a particular street will slow the speed of traffic.

FACT:
Before-and-after studies have consistently demonstrated that there are no significant changes in traffic speeds following posting of new or revised speed limits. The studies have concluded that:

1. A lower posted speed limit has a very minor statistical impact on the driving behavior of most motorists, but from a practical standpoint there is no noticeable reduction in speeds, and no real change in the rate of speed-related traffic crashes.
2. The data show that to achieve a minor reduction of 3–4 mph in prevailing speeds on a roadway, the posted speed limit would need to be lowered to the point that it would make the overwhelming majority of drivers in violation of the law as they would simply continue driving at prudent speeds for the roadway conditions. This would make a practical level of enforcement rather impossible and the posted speed limit would effectively become useless.
3. Posted speed limits must be based on the rational behavior of the majority of drivers using a roadway. The rational method of speed zoning promotes respect for the law and mirrors what the majority of public considers acceptable behavior on our highways.

MYTH:
Posting lower speed limits will decrease the crash rate and increase safety.

FACT:
Artificially lowered speed limits have minimal, if any, impact on driver behavior and no effect on improving traffic safety. In fact, the difference in the rate of speed between the few drivers who strictly observe artificially low posted speed limits and most who drive at a more natural speed for the road conditions creates a dangerous speed disparity dynamic that causes crashes and endangers all drivers using the roadway.

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