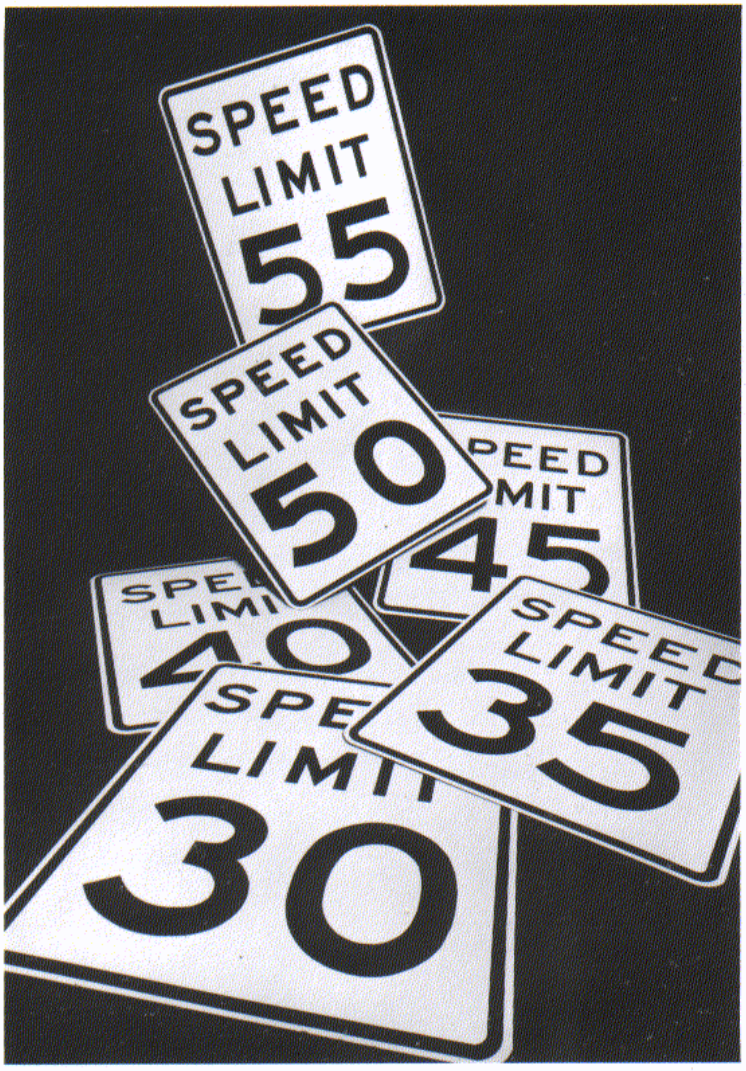
REALISTIC SPEED ZONING

Why & How



REALISTIC SPEED ZONING
Why and How

TO PUBLIC OFFICIALS AND INTERESTED CITIZENS RECEIVING THIS MANUAL:

All too often speed zoning is considered a cure-all for a community's traffic ills. Citizens frequently demand speed zoning in an effort to develop a quick solution to complicated traffic problems.

Realistic speed zoning is a traffic engineering tool used to derive the best traffic service for a given set of conditions. This manual tells what realistic speed zoning will do, what it won't do, and how to go about it.

We hope you will find this booklet useful and will keep it in your files for continuing reference. Additional copies are available upon request, and inquiries about the points therein are welcomed.

Presented as a public service by the
Automobile Club of Southern California.

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INTRODUCTION

This manual is a practical guide to realistic speed zoning for those who are unfamiliar with engineering and traffic surveys as defined in the California Vehicle Code.

Speed zoning should generally be applied to major thoroughfares carrying appreciable volumes of traffic, transition points on major highways from rural to urban conditions and areas with a high number of speed related collisions or unusual enforcement problems. The Vehicle Code supports this viewpoint:

> *"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."*

The first part of the manual tells why speed limits should be realistic and selected on the basis of an engineering and traffic survey. The second section shows how to complete such a survey and how to select a realistic speed limit. When called upon, the Public Affairs staff of the Automobile Club of Southern California will be happy to be of further service regarding specific speed zoning problems.

Acknowledgment is given to the Institute of Transportation Studies, University of California, for permission to use material from the syllabus "Fundamentals of Traffic Engineering" and to the California Department of Transportation for excerpts from the "State Traffic Manual."

SPEED ZONING - WHY?

FUNDAMENTALS OF REALISTIC SPEED ZONING

Most citizens can be relied upon to behave in a reasonable manner as they go about their daily activities. Many of our laws reflect observations of the way reasonable people behave under most circumstances. Traffic regulations are also based upon observations of the behavior of groups of motorists under various conditions. Generally speaking, traffic laws that reflect the behavior of the majority of motorists are found to be successful. Laws that arbitrarily restrict the majority of drivers encourage wholesale violations, lack public support and usually fail to bring about desirable changes in driving behavior. This is especially true of speed zoning.

Speed zoning is based upon several fundamental concepts deeply rooted in our American system of government and law:

- Driving behavior is an extension of social attitude. The majority of drivers operate their vehicles in a safe and reasonable manner as demonstrated by their consistently favorable driving records.
- The normally careful and competent actions of a reasonable 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 without the consent and voluntary compliance of the public majority.

Public acceptance of these precepts is normally instinctive. However, the same public, when emotionally aroused in a specific instance, will invariably reject these fundamentals and rely instead on more comfortable and widely held misconceptions, such as:

- Speed limit signs will slow the speed of traffic.
- Speed limit signs will decrease the accident rate and increase safety.
- Raising a posted speed limit will cause an increase in the speed of traffic.
- Any posted speed limit must be safer than an unposted speed limit, regardless of the type of roadway or conditions present.

Before-and-after studies consistently demonstrate that there are no significant changes in traffic speeds following the posting of new or revised speed limits. Furthermore, no published research findings have established any direct relationship between posted speed limits and accident frequency. Short-term reductions have resulted, however, from saturation enforcement efforts directed at speed and other traffic law violations.

Police agencies necessarily rely on reasonable and well-recognized speed laws to control the unreasonable violator whose behavior is clearly out of line with the normal flow of traffic.

WHY ARE REALISTIC SPEED ZONES DESIRABLE?

Realistic Speed Zones are of public importance for a variety of reasons:

- They satisfy the requirements of the state law for establishing prima facie speed limits on public streets and highways.
- They invite public compliance by conforming to the behavior of the majority and by giving a clear reminder to non-conforming violators.
- They offer an effective enforcement tool to the police by clearly separating the occasional violator from the reasonable majority.
- They tend to minimize current public antagonism toward police enforcement of obviously unreasonable regulations.
- They inject an element of logic and reason into an otherwise arbitrary and often emotional issue.
- They correctly serve to place responsibility for justifying so-called "tolerances" upon those administrative agencies that grant them.
- They lend credence and acceptability to the widely posted admonition, "Speed Laws Strictly Enforced," at many city boundaries.

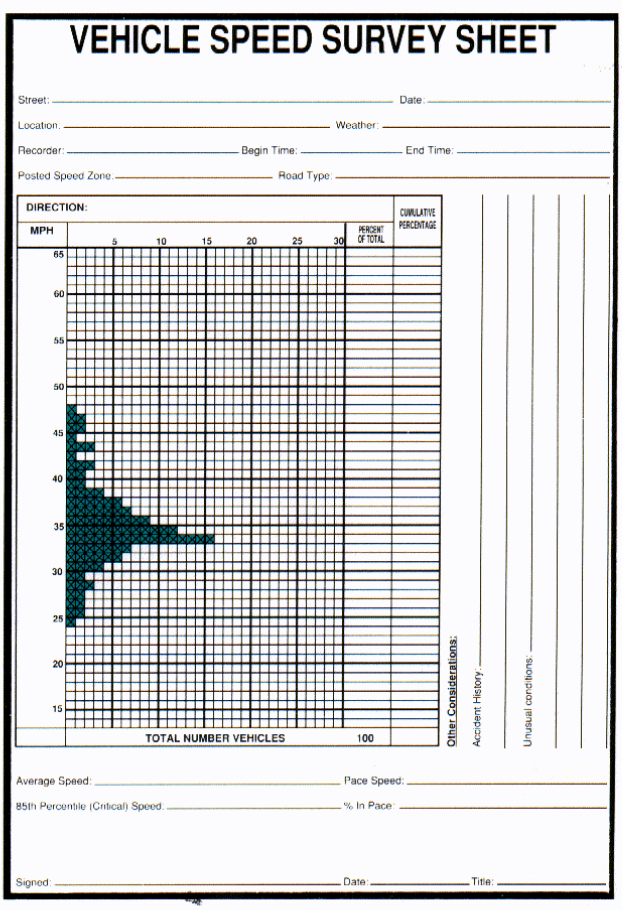
WHERE ARE REALISTIC SPEED ZONES APPLICABLE?

Speed zoning should be reserved for thoroughfares with appreciable volumes of traffic where such zoning can be shown to facilitate the orderly movement of traffic by increasing driver awareness of a reasonable speed.

Transition sections between rural and suburban conditions usually require "reminder" zoning. Business or residence districts that barely satisfy the legal definition for automatic 25 mph limits can also be zoned to advise the driver of a safe speed and to avoid confusion in determining if Vehicle Code prima facie limits apply.

Through streets that are not wide thoroughfares frequently require zoning to aid the police in determining what is a reasonable limit. On the other hand, it is seldom necessary to post limits relating to business or residence districts in obviously well-established urban areas, where such districts are clearly apparent to drivers.

The basic intent of speed zoning is to influence as many drivers as possible to operate at or near the same speed—thus reducing conflicts created by wide differentials in operating speeds. Low-volume streets offer little opportunity for traffic platoons to form so as to affect the speed of individual vehicles.


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 | PERCENT OF TOTAL | CUMULATIVE PERCENTAGE

65 60 55 50 45 40 35 30 25 20 15

TOTAL NUMBER VEHICLES 100

Other Considerations:

Accident History

Unusual conditions

Average Speed: Pace Speed:

85th Percentile (Critical) Speed: % In Pace:

Signed: Date: Title:

Figure 1

WHAT DOES THE LAW REQUIRE?

The California Vehicle Code reflects the sensible viewpoint that speed zoning, as with other types of traffic control, should be based on traffic conditions and natural driver behavior—and not simply upon a hasty or arbitrary response to a traffic event.

BASIC SPEED LAW

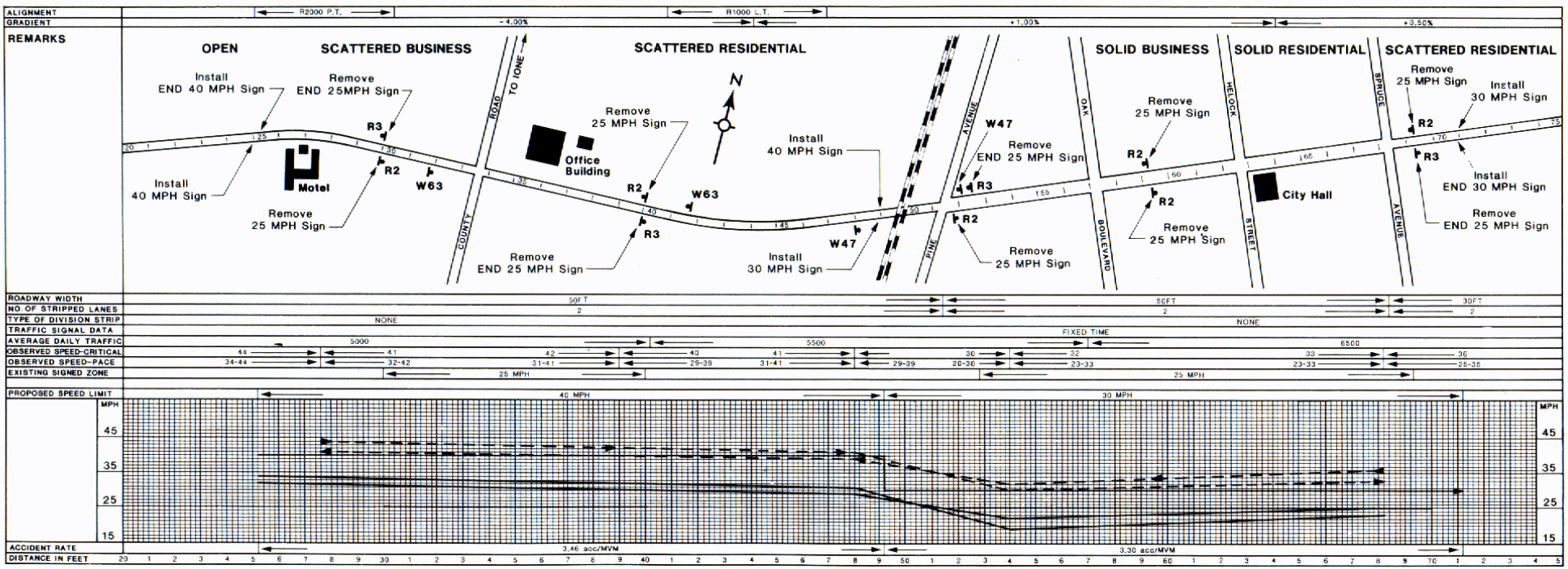
All fifty states base their speed regulations on the Basic Speed Law:

> *"No person shall drive a vehicle upon a highway at a speed greater than is reasonable or prudent having due regard for weather, visibility, the traffic on, and the surface and width of, the highway, and in no event at a speed which endangers the safety of persons or property."*

This law recognizes that driving conditions vary widely from time-to-time and place-to-place. No set of fixed driving rules will adequately serve all conditions. Motorists must constantly adjust their driving behavior to fit the conditions they meet. They must learn to do this with a minimum of assistance from the police. The basic speed law is founded on the belief that most motorists are able to modify their driving behavior properly, as long as they are aware of the conditions around them.

Figure 2

SPEED ZONE SURVEY SHEET



MAXIMUM SPEED LIMITS

In California, all speed limits in excess of 50 mph are maximum limits that cannot be exceeded under any circumstance. These limits include:

- 55 mph for all trucks and any vehicle towing a trailer. The 55 mph maximum speed limit also applies to all passenger vehicles travelling upon conventional (non-freeway) highways not more than two lanes in width.
- 65 mph for passenger vehicles on freeways, except for those special freeway segments posted at 70 mph. The 65 mph maximum speed limit also applies to passenger vehicles travelling upon conventional highways three or more lanes in width.

The 55 mph maximum speed limit for passenger vehicles may be raised to 60 mph or 65 mph, and the 65 mph limit may be lowered to 60 mph or 55 mph where conditions justify such action.

PRIMA FACIE SPEED LIMITS

All other speed limits are prima facie limits which, "on the face of it," are reasonable and prudent under normal conditions. A driver may exceed any prima facie limit if prevailing conditions make it safe to do so. However when a police officer issues a citation for exceeding a prima facie speed limit, the driver will be required to prove that his or her actions did not compromise safety. The opportunity given to the driver to exceed a prima facie speed limit recognizes the fact that any posted speed limit cannot adequately reflect the many different conditions of traffic, weather, visibility, etc., that may be found on the same highway at different times.

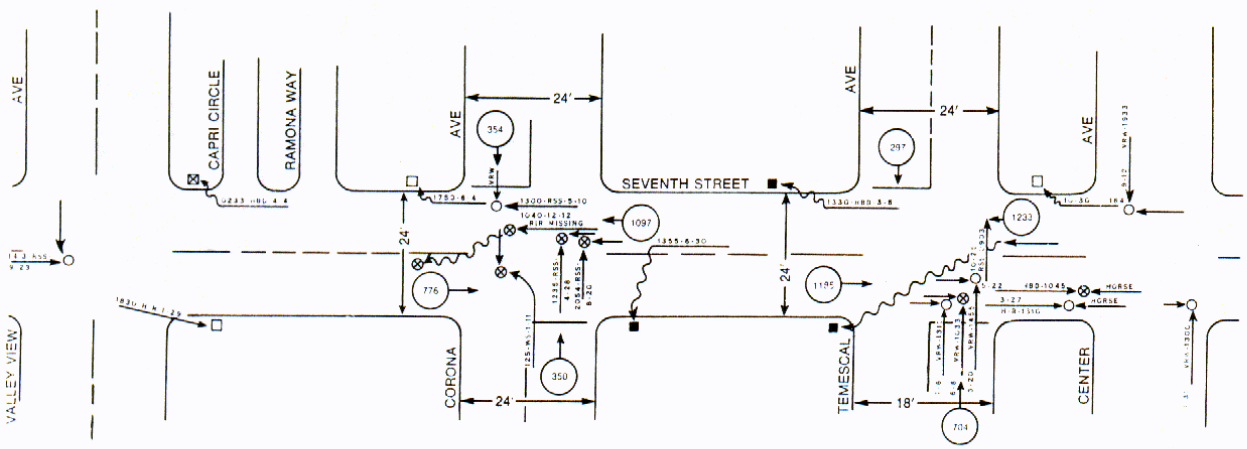
Certain blanket (or automatic) prima facie limits are established by law. They include the 15 mph limit in alleys, blind intersections and at blind railroad crossings; and the 25 mph limit in business and residence districts. A 25 mph prima facie limit also applies to roadways adjacent to schools, playgrounds in public parks, and senior centers when appropriate signs are in place.

Business and residence districts are defined in the Vehicle Code as areas meeting a specified minimum density of roadside development. A count of houses or active businesses facing on a highway must be made to determine whether or not a valid business or residence district exists. The law does not require posting these prima facie limits which are readily apparent.

INTERMEDIATE SPEED ZONES

State law permits local authorities to lower the maximum speed limit (55 mph) or to raise business and residence district speed limits (25 mph) on the basis of a traffic and engineering survey. These "intermediate limits" between 25 and 55 mph must be posted to define clearly the limits of the zone and the prima facie speed established. These intermediate prima facie speed zones are the subject of this speed zoning manual.

Figure 3



ACCIDENT SUMMARY

TYPE	1989 DAY	1989 NITE	1990 DAY	1990 NITE	1991 DAY	1991 NITE	TOTAL
FATAL	—	—	—	—	—	—	0
P.D.O.	2	—	8	2	—	—	12
INJURY	5	2	7	2	1	—	17
PED. INJ.	—	—	—	—	—	—	0
TOTAL	7	2	15	4	1	0	29

704 → DAILY TRAFFIC VOLUME

LEGEND

- VEH. MOVING AHEAD
- VEH. BACKING UP
- PEDESTRIAN
- TRAIN
- PARKED VEHICLE
- FIXED OBJECT
- PROPERTY DAMAGE ONLY
- INJURY ACCIDENT
- FATAL ACCIDENT
- HEAD ON
- HEAD ON SIDESWIPE
- REAR END
- OVERTAKING SIDESWIPE
- RIGHT ANGLE
- APPROACH TURN
- OVERTAKING TURN
- OUT OF CONTROL
- VEHICLE TURNED OVER

CONST CONSTRUCTION ZONE
DPH DRIVER PHYSICAL DEFECT
DV DEFECTIVE VEHICLE
ES EXCESS SPEED
FTC FOLLOWING TOO CLOSE
HBD HAD BEEN DRINKING
H-R HIT AND RUN
ILC IMPROPER LANE CHANGE
IP IMPROPER PASSING
IT IMPROPER TURN
INATT INATTENTION
MYC MOTORCYCLE
RSS RAN STOP SIGN OR SIGNAL
SFP STOPPED OR SLOWING FOR PEDESTRIAN
VO VISIBILITY OBSTRUCTED
VHW VIOLATED RIGHT OF WAY
WS WRONG SIDE OF STREET

SPEED ZONING - HOW?

ENGINEERING AND TRAFFIC SURVEY

As defined in the California Vehicle Code, an engineering and traffic survey is "*a survey of highway and traffic conditions in accordance with methods determined by the Department of Transportation for use by the state and local authorities.*" The survey shall include (but not be limited to) a consideration of the following:

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

Several key elements of the speed survey should be determined before undertaking the collection of field data.

LOCATION

On a small-scale map of the street to be surveyed, select enough speed check sites to assure a good representation of differing conditions throughout the study section. Normally in urban and suburban areas, measurements are made at about one-half-mile intervals or at points where traffic and roadway characteristics change.

Care should be taken to select locations sufficiently removed from any stop signs, traffic signals, or other traffic flow interruptions that significantly affect operating speeds. Mid-block locations generally represent typical flow conditions for accurate sampling.

EQUIPMENT

Field survey equipment consists simply of speed survey sheets and a speed measuring device, commonly radar, in an unmarked vehicle. Other tools include a stop watch, 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 density of roadside development.

PERSONNEL

While one person can normally accomplish the field survey task, it is desirable, under busy urban conditions, to assign both an observer and a recorder to measure prevailing speeds accurately and to inventory roadway and roadside conditions.

TIME OF DAY

Speed limits are established to advise the motorist of safe speeds during normal conditions. Prevailing speeds for zoning purposes are therefore measured during off-peak periods when traffic is closest to free or uninterrupted flow. This condition exists on most street networks throughout the majority of daytime hours. It is sometimes desirable for comparative purposes to measure peak-hour speeds; however, the characteristics of peak traffic flow are usually not representative of the conditions necessary for realistic speed zoning.

POSITIONING THE SPEED MEASURING DEVICE

To not affect the normal flow of traffic, the observer should locate the device as inconspicuously as possible. Radar antennas should be positioned at an angle of not greater than 15° to the centerline of the roadway and about three feet above the surface. In this position the device will measure speeds in either direction or in adjacent lanes. Speeds and direction are recorded by appropriate tallies on Vehicle Speed Survey Sheet(s). (Refer to Figure 1, Page 4.)

SIZE OF SAMPLE

Sample sizes are frequently related to traffic volumes within the study section. An engineering and traffic survey is normally satisfied by 100, but no less than 50, properly selected observations. This size of sample is usually enough to assure accuracy within the normal capability of the measuring device. On multi-lane streets, either divided or undivided, separate samples should be recorded for each direction of travel.

OBSERVING AND MEASURING PREVAILING SPEEDS

The data collection phase of the speed survey is extremely important and requires considerable care due to the many variables involved and the sources of possible bias in sampling. For this reason, it is necessary to assign a trained observer who is capable of properly selecting vehicles on a truly random basis. Some common *errors* that tend to introduce bias and the procedures for eliminating them are:

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

  When traffic is constantly platooned, try to select vehicles from varying positions in the platoons. If platoons are densely packed, it may mean that congestion has been reached and that traffic is too heavy to permit a good survey.

- *Selecting too large a proportion of trucks*

  Obtain about the same proportion of trucks in the sample as exist in the traffic stream.

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

  Untrained observers often ignore measuring normal-speed vehicles to "catch" the occasional high-speed vehicle. This should be avoided as the results will be biased toward the upper speed ranges.

INVENTORY OF ACCIDENT RECORDS

The required accident records inventory consists of a review of the most recent two-year traffic collision history for each roadway surveyed. Where a concentration of reported accidents or an accident rate significantly higher than normal for the type of roadway under study is observed, a detailed accident analysis should be made. This analysis would typically include a collision diagram for the route or for specific locations. Adequate consideration may then be given to other corrective measures including the degree of enforcement emphasis needed as well as the general applicability of posting a speed zone at all. (Refer to Figure 3, Page 8.)

INVENTORY OF ROAD CONDITIONS

This final phase of the survey consists of a review of the physical characteristics of the roadway and adjacent development. Particular attention must be paid to identifying conditions which are not easily

observed by motorists. For city and county roads, the results may be summarized on the Vehicle Speed Survey Sheet. For state highways and roadways with an abnormally high accident rate, the Speed Zone Survey Sheet should be used to document all pertinent data and to facilitate the analysis process. To assure compatibility with the prevailing speeds, identified deficiencies should be corrected. (Refer to Figure 1, Page 4 and Figure 2, Page 6.)

ANALYZING SPEED SURVEY FIELD DATA

Two characteristics developed from the prevailing speed data are of primary importance in the selection of a reasonable limit: the critical (85th percentile) speed, and the pace.

CRITICAL (85th PERCENTILE) SPEED

This is the speed at or below which 85% of the 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% of the total number of vehicles observed. In the example shown, 15% of the 100 vehicles observed (or 15 vehicles) were traveling at 40 mph or more, and the 85th percentile speed was therefore 40 mph. (Refer to Figure 1, Page 4.)

The 85th percentile speed is usually within two miles per hour of the upper limit of the pace. This can be compared on the cumulative speed curve that presents a measure of the validity of the field data or the presence of an abnormal bias. (Refer to Figure 4, Page 13.)

PACE

The pace is the 10 mph range of speeds containing the largest number of observations. This can usually be determined by visual inspection of the Vehicle Speed Survey Sheet. After determining the pace, it is useful to compute the percentage of vehicles in the pace, the percentage over the pace, and the percentage under the pace. A normal speed distribution will contain approximately 70% of the sample within the pace with 15% above and 15% below. (Refer to Figure 1, Page 4.)

SELECTING THE PROPER SPEED LIMIT

Experience has shown that the 85th percentile speed is the one characteristic of traffic speeds most nearly conforming to a safe and reasonable limit. Speed limits set **higher** than the critical speed will make very few additional drivers "legal" for each 5 mph that the posted speed limit is increased.

Speed limits set **lower** than the critical speed will make a large number of reasonable drivers "illegal" for each 5 mph increment that speed is reduced. This can be easily demonstrated by development of the cumulative speed curve (Figure 4). As the name implies, the cumulative speed (or "S") curve is a representation of cumulative speeds on a percentile basis. In the example shown, an increase of 5 mph from the 40 mph 85th percentile speed would "legalize" an additional ten percent of the sample traffic whereas a decrease of 5 mph would make "violators" of an additional 28% of the sampled traffic.

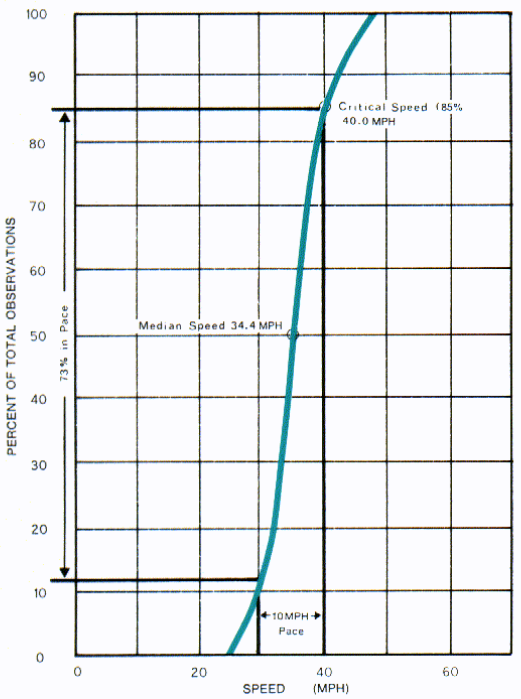
For practical purposes, the 5 mph increment at or immediately below the 85th percentile (or the upper limit of the pace) is the numerical value properly selected for posting a realistic and enforceable speed limit.

FINAL CONSIDERATIONS

As a final aid to establishing realistic speed zones, the following practical considerations should be kept in mind:

Figure 4

CUMULATIVE SPEED CURVE



LOCATION _____ TIME _____ TO _____

DIRECTION _____ PRESENT SIGNED ZONE _____ MPH.

DATE _____ NUMBER OF VEHICLES 100

- Intermediate speed limits are applicable to through routes. Such routes have the positive intersection controls, signing, striping and markings necessary to accommodate appreciable volumes of traffic from beyond the immediate neighborhood.
- Unusually short zones, less than a half mile in length, should be avoided.
- Speed zone changes should be coordinated with visible changes in roadway conditions or roadside development.
- Changes in speed zones should normally be in 10 mph increments; however in some urban areas 5 mph changes are acceptable.

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