Speed Zoning Guidelines

Ronald R. Greiwe
Traffic Studies Engineer, Department of Transportation
Indianapolis, Indiana

In the City of Indianapolis every year, we receive many requests to reduce speed limits, primarily on local streets. We rarely receive a request to raise the speed limits. Many times, these requests are to lower the speeds as the result of a recent accident and a subsequent public overreaction to the possible cause. These requests are made for all types of roads—locals, collectors, and arterials.

Another area that concerns the City of Indianapolis every year is the many requests we receive for multi-way stops to control speed. Research has shown that a four-way stop will only reduce the speed for a distance of approximately 150 to 200 feet each side of the stop. The only time a four-way stop may reduce the speed is when one is placed at every block (approximately 500 feet apart).

Therefore, a serious need exists for uniform laws, speed zoning, and enforcement.

Speed is an important consideration in highway transportation because the rate of vehicle movement has significant economic, safety, time, and service (comfort and convenience) meaning to both the motorist and the general public.

Speed zoning is a traffic engineering tool that has been employed for a number of years to influence motorist behavior. And traffic engineers and public officials must be well informed concerning all phases of speed problems.

INDIANA BASIC SPEED LAW

The Basic Speed Law, as described in the Indiana Statutes, provides two maximum lawful speeds. One is 30 miles per hour in any urban district. An urban district is defined as a territory contiguous to and including any street which is built up with structures devoted to business, industry, or dwelling houses situated at intervals of less than 100 feet for a distance of a quarter of a mile or more. The other is 55 miles per hour on the interstate defense network of dual highways and in other locations.

The Indiana Statutes also provide that whenever local authorities in their respective jurisdictions determine, on the basis of an engineering and traffic investigation, the maximum speeds, as provided in the Basic Speed Law, is greater or less than reasonable and safe under the conditions found to exist on a street or part of a street, the local authority may determine and declare a reasonable and safe maximum limit thereon within these limitations:

1) decreases to the limit within urban districts but not to less than 20 miles per hour;
2) increases to the limit within an urban district but not to more than 55 miles per hour; and
3) decreases to the limit outside an urban district but not to less than 35 miles per hour.

SPOT SPEED STUDY METHOD

A spot speed study is a study of the speed of traffic at one point or spot on a trafficway. It consists of a series, or a sample, of observations of the individual speeds at which vehicles are approaching an intersection or passing a point at a non-intersection location. These observations are used to estimate the speed distribution of the entire traffic stream at that location, under the conditions prevailing at the time of the study.

DEFINITIONS

Average spot speed is the arithmetic mean of the speeds of all traffic, or a component thereof, at a specified point.

Eighty-five percentile speed is that speed at or below which 85 percent of the vehicles on a roadway segment travel.

Ten miles per hour pace is the 10 miles per hour speed range containing the largest percentage of vehicles in a sample of spot speeds.

TIME, LENGTH, AND NUMBER OF OBSERVATIONS

Speed studies are generally conducted during off-peak hours for a minimum time period of one hour and with a minimum of 100 vehicles. Therefore, on lower volume roads, the time period may exceed one hour in order to obtain the desired number of observations.

EQUIPMENT

Speed data can be collected by manual or automatic methods. In the manual method, the speed of an individual vehicle is determined by the time that elapses for the vehicle to travel a measured course. This procedure requires a stopwatch, a 50- or 100-foot tape, and pavement marking material.

In the automatic method, electrical and/or mechanical devices are employed to measure the speeds of passing vehicles. Radar is the most commonly used automatic device for measuring spot speeds and is most often concealed in an unmarked vehicle.

PROCEDURE

All speed readings should be random and representative of the free-flowing conditions of the traffic stream. The following sampling procedures are recommended.

1) Always observe the first vehicle in a platoon because the following vehicles may be traveling at the speed of the lead vehicle, which cannot be passed at the time of the speed measurement.

2) Select trucks for speed observation in proportion to their presence in the traffic stream.

3) Avoid sampling a large proportion of high-speed vehicles.

If the observer is unable to record the speeds of all vehicles in one direction because of large volumes of traffic, then various methods of sampling may be used. Every second, third, or n-th vehicle may be selected for speed measurement. Caution is needed with this procedure because the n-th vehicle may be controlled by some external effect such as a platoon of vehicles moving through a coordinated signal system.

DATA SUMMARY AND ANALYSIS

The field data form sheet for recording spot speed data is shown in Figure 1. After this data has been collected, it can be analyzed manually by using the form shown in Figure 2. Computer software is also available for analysis of this data. A sample of the computer analysis output is shown in Figure 3.

The manual method can also use a graphical display as shown in Figure 4. From Figure 4, the eighty-fifth percentile speed, average speed, and fifteenth percentile speed can be determined. The 10 miles per hour pace can be determined from Figure 1.

The frequency curve and cumulative frequency curve are important information. Such items as conformance to a recognized distribution, degree of symmetry around the central position, and presence of any irregularities are readily evident from an evaluation of data shape as shown in Figures 3 and 4.

SETTING THE SPEED LIMIT

Figure 5 will help the engineer to make an evaluation of the measurable conditions along the highway being considered for speed zoning. If three or more of the conditions stated are met, a speed zone which has a maximum as given may be appropriate. The value of the maximum limit thus determined is only a preliminary estimate and must be considered in conjunction with the actual speed characteristics measured in the field.

In the selection of the numerical value of the speed limit, it is necessary to measure the actual vehicular speed characteristic. Spot speed studies are made to determine the eighty-fifth percentile speed, average speed, and the 10 miles per hour pace. In addition, as a check on the speed values determined from the spot speed study, the average test-run speed should be found.

The average test-run speed is most simply determined by using a passenger car with a calibrated speedometer, from which the speed is recorded at one-tenth of a mile intervals over the length of the highway being studied. Runs are made under light traffic conditions to insure that the conditions of the road and its environment, rather than traffic conditions, govern the driver's speed. Two runs in each direction are generally sufficient.

Maximum speed limits based on the eighty-fifth percentile speed and the 10 miles per hour pace are usually reasonable by all standards. The upper limit of the pace usually approximates the eighty-fifth percentile speed.

When the above values have been determined, a more accurate estimate of the speed limit to be set can be found by entering the second part of the check sheet. The speed limit which satisfies two or more of the conditions shown is the limit which should be set for the speed zone.

CONCLUSIONS

Traffic officials generally agree speed limits should reflect the speed of most drivers. All states and most local agencies use the eighty-fifth percentile speed of free-flowing traffic as the basic factor. However, it is fairly common to reduce the speed limit based on a subjective consideration of other factors. The main factors used in setting speed limits are:

eighty-fifth percentile speed;
roadside development;

accident experience;
adjacent limits;
10 miles per hour pace;
roadway geometrics
average test run speed; and
pedestrian volumes.

The most commonly reported lower level of the speed limit is five miles per hour below the eighty-fifth percentile speed with 10 miles per hour below being the extreme.

Based on the best available evidence, the speed limit should be set at the speed driven by 85 percent of the free-moving vehicles rounded up to the next five miles per hour environment. This method results in speed limits that are not only acceptable to a large majority of the motorists, but also fall within the speed range where accident risk is lowest. Allowing a five miles per hour tolerance, enforcement would be targeted at drivers who are clearly at risk.

If there are unusual hazards not readily apparent to drivers, then a warning sign could be installed giving the nature of the hazard and, if necessary, supplemented with a realistic advisory speed.

In conclusion, the majority of motorists drive at a speed they consider reasonable, convenient, and safe for existing conditions. And studies have shown that changing the speed limit has no effect on changing the prevailing speed of vehicular traffic.

Likewise, if speed limits are not set at or near the eighty-fifth percentile speed, it will be difficult to gain public acceptance for speed regulations.

REFERENCES

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