Encouraging Safe Speeds on Low-Volume Roads

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Controlling speeds on low-volume paved, gravel, and native-surfaced roads poses unique challenges for road managers. Some roads may have very low traffic volumes, in some instances 100 vehicles per day or less. Road surfaces of these unpaved roads can become rough with use and slick when wet, so posted speeds are often inaccurate. Using commonsense positive guidance can help prudent drivers travel these roads safely without posted speed limits.

The terms in the following paragraphs are used as defined in this paper.

Positive guidance (*1*,*2*) is information available to drivers to help them select an appropriate vehicle speed and path. This information includes vision of the road ahead so hazards can be avoided, signs, roadway markers, hazard markers, and so on.

Driver expectancy (*1–3*) is anticipation of what is just ahead based on experience over years of driving and the immediate experience on the road being traveled. What the driver saw in the section of road just driven (presence or absence of traffic control devices, road surface type, road condition, width, narrow bridges or culverts, lack of guardrails, etc.) is expected for the next kilometer (~1/2 to 1 mi) or so.

Driver responses are very predictable as long as positive guidance is given making the road ahead consistent with his or her expectations. When driver expectations are violated by sudden, unforeseen changes in the character of the road, longer response times and erratic behaviors frequently result.

A *prudent driver* is one driving with his or her vehicle under control at a reasonable speed for the road and existing conditions and within prudent or "normal" expectancy. A prudent driver would travel reasonably, using common sense and the positive guidance available to direct driving actions. Drivers traveling on narrow mountain roads for the first time may be overprudent. Drivers who travel on a road frequently may drive too fast or carelessly and be imprudent. Neither is a good example of prudence.

A *traffic engineering study* (*4*) or *engineering study* (*5*) is a study of a road or particular roadway feature and, based on sound engineering judgment, the corrective actions or devices recommended by a qualified traffic engineer for positive guidance. The commentary driving procedure (*6*) is a valid method for use in such studies.

Establishing Speed Limits

On paved highways with large volumes of traffic, there are commonly accepted methods for setting speed limits. One of the more common methods is based on the 85th-percentile of speed of existing traffic through the area (measured by radar for a 100-car sample). Some

agencies, the USDA Forest Service included, do not use radar; thus they are unable to establish speed limits using this standard method.

Gravel or native-surfaced roads with low traffic volumes, sometimes less than 100 vehicles per day (vpd), pose a different problem. Obtaining several 100-car samples for 85th-percentile speed studies on a road with less than 100 vpd would be impossible. It is obvious that other methods are needed.

The following method has been developed for low-volume roads. A prudent driver, preferably a qualified traffic engineer, drives the road at different speeds, choosing one that seems most prudent for the conditions of the road. The road is driven in both directions, and a prudent speed chosen for each direction. A ball bank indicator or stopping sight distance is used to determine safe speeds around curves. If followed carefully by an experienced driver using good judgment and documenting the findings, this method is acceptable for determining safe speeds on low-volume roads.

Unpaved Roads

It is recommended that speed limits not be established on unpaved roads (*7*). The characteristics of unpaved roads may help regulate safe operating speeds since terrain, surface conditions, geometric alignment, and sight distance may combine as positive guidance to dictate the safe speed of the road. Surface conditions are especially susceptible to changes over time and blading, or lack thereof. In that case, posted speed limits may be inappropriate for the existing conditions. Posting inappropriate signs breeds disrespect for all signs, a condition warned against in the *Manual on Uniform Traffic Control Devices* (*5*).

The best advice is usually to regulate speeds using measures other than speed limits in those instances where safe speeds can vary with changing roadway conditions and where road characteristics help regulate speed.

Safe Traffic Speeds on Unpaved Roads

Data indicate that compared with the mean speeds before sign installation, the mean speeds with signs are closer to the advised speed (*8*). Thus, it is possible to advise users of the safe speed on many low-volume unpaved roads without establishing a speed limit. This method relies on providing positive guidance, determined through a traffic engineering study, by signing those features on the road where a prudent driver would ordinarily need to be warned that her or his expectancy could be violated. Where the road is homogeneous without inconsistencies, signing may be unnecessary. Thus, a long series of tangents with flat curves may need no signs. Similarly, a road may need no speed limits or warning signs if it has short tangents and flat curves leading into increasingly sharper curves that slow traffic automatically and naturally so that all curves are expected, and each situation is visible to and can be expected by drivers.

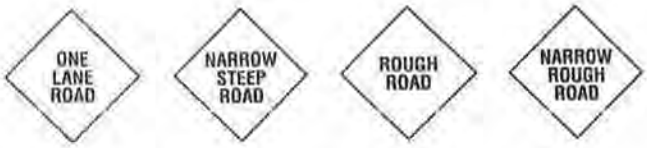

FIGURE 1 Diamond-shaped black-on-yellow warning signs.

FIGURE 2 Rectangular black-on-yellow message signs.

This philosophy allows drivers to travel the road as they deem prudent, being warned of only those areas and situations they may not be able to recognize without help.

Positive guidance must be provided for those situations in which the expectancy of prudent drivers would be violated. In some cases, a warning at the beginning of the road may be sufficient. Diamond-shaped black-on-yellow signs such as those shown in Figure 1 may be used. In other locations rectangular black-on-yellow signs or other appropriate messages may be needed to convey positive guidance (Figure 2). In those locations where it is appropriate, the signs shown in Figure 3 could be placed in addition to the signs above. In those situations where advisable, reassurance signing may be placed every 5 to 8 km (3 to 5 mi) along the road.

Another method to control traffic speed on gravel and native-surfaced roads is to use the appropriate signs and plates to slow traffic but only on those curves and in those locations about which drivers need to be warned (Figure 4). The use of a NEXT ____ KILOMETERS (MILES) plaque with any of the foregoing signs, where it applies, is an additional warning to drivers. When this method is used, drivers are free to choose their own speed on tangents and flat curves but are suf-

FIGURE 3 Speed-limit warning plaques.

FIGURE 4 Warning signs for specific locations.

ficiently warned as they approach sharp curves and other locations that could present a problem.

On gravel or native-surfaced roads, advisory speed plates may not always give drivers the best information. Road surface conditions change over time from newly maintained to ruts, washboards, potholes, and slippery surfaces when wet. In such cases, use of chevrons, arrows, delineators, and other devices should be considered instead of advisory speed plates, which may not always fit current speed conditions.

These philosophies for guiding vehicle speeds without setting speed limits for low-volume roads do not replace the standard speed limit determination methods for high-volume paved roads. These prudent approaches should be applied only to low-volume paved roads and to gravel and native-surfaced roads where speed limits are not advisable or enforced.

REFERENCES

1. Post, T. J., H. D. Robertson, and H. E. Price. *A User's Guide to Positive Guidance*. FHWA, U.S. Department of Transportation, June 1977.
2. Hostetter, R.S., K. W. Crowley, H. W. McGee, and W. E. Hughes. *Driver Needs on Two-Lane Rural Highways*. Vol. II (SLIDE). Report FHWA/RD-85/098. FHWA, U.S. Department of Transportation, 1975.
3. Layton, R. D. *Manual for Analysis, Evaluation and Selection on Highway Safety Improvements in Local Jurisdictions*. Transportation Research Report 80-14. Oregon State University, Corvallis, Jan. 1981.
4. *Highway Safety Program Guideline 13*. Traffic Engineering Services, 23 CFR Part 1204.4.
5. *Manual on Uniform Traffic Control Devices*. FHWA, U.S. Department of Transportation, 1988, Section 1A-4, p. 1A-4, and 1A-2, p. 1A-3.
6. Smith, B. L., and D. K. Murdock. *Commentary Driving Procedure and Commentary Driving: A Self-Taught Interactive Video/Workbook*. Kansas State University, Kansas Department of Transportation, and FHWA, U.S. Department of Transportation, 1993.
7. Walton, N. E., J. M. Mounce, and W. R. Stockton. *Signs and Markings for Low Volume Rural Roads*. FHWA, U.S. Department of Transportation, 1977.
8. Rutley, K. S. Control of Drivers Speed by Means Other Than Enforcement. *Ergonomics*, No. 18, 1975, pp. 89–100.