New Jersey Guide-Sign Survey

ARTHUR W. ROBERTS

As part of a study to review difficulties of drivers in viewing large guide signs, or "interferences," on state highways in New Jersey, a survey from a fast-moving automobile was performed. The survey covered more than 1,000 approaches to interchange exits in the 2,000-mi New Jersey system. More than 580 motorist view interferences were discovered through visual observations. The method was verified to be 94 percent accurate using a videotape method and a legibility formula with a sample of approaches. Sign view blockage by difficult- and expensive-to-modify highway features and furniture represented 35 percent of the interferences. Computer graphic interchange modeling at an earlier design stage is recommended to help avoid view blockages in the future.

At interchanges, guide signing plays an important part in the overall effectiveness and efficiency of the operation of the interchange. Although guide signing cannot totally make up for unexpected interchange design, it can serve to lessen confusion and smooth traffic flow. This leads to more efficient and sometimes safer operation of interchanges and the road system as a whole.

At many interchanges, motorists are confronted with identification and reading difficulties concerning signs that have adequate target value, legend size, and legibility. However, because of the physical design of interchanges or approaches to interchanges, the placement of signs, or the placement of other fixed physical objects, absolute and unchanging interferences with the visibility of the signs to approaching motorists are created.

Because sign visibility interferences reduce motorist identification and reading time, sometimes considerably, erratic vehicle movements, speed variances, and other safety problems can result.

The capital and maintenance investments in large guide signs is significant. A 200 ft^2 ground-mounted sign with footings typically costs $16,000, and a sign bridge can cost more than $150,000. The return on investment is reduced when signs cannot perform their real functions. The design of interchanges is involved in the interference of sign views. Interchanges in New Jersey cost tens of millions of dollars. Landscaping and maintenance add to the cost.

It should be understood that purchasing rights-of-way, removing rock formations, and linking with existing roads create practical problems that sometimes constrain optimal sign placement. It also appears that traffic engineers do not have a practical way to obtain a driver's view of tentative plans.

Bureau of Transportation Systems Research, New Jersey Department of Transportation, 1035 Parkway Avenue, CN 612, Trenton, N.J. 08625.

LARGER STUDY ACTIVITIES

The subject of this report, an interchange guide-sign survey of view interferences from a moving automobile, was part of a larger study. The larger study also involved the use of a more detailed videotape review of a limited number of sites and the demonstration of four-dimensional computer graphic modeling of interchanges to integrate sign placements and physical design.

The videotapes of approaches were analyzed using a legibility distance formula reported by King (*1*), which includes consideration for the number of information elements on a sign. The accuracy of the observations from the automobile were checked by the videotape method at 19 interchange approaches. Ninety-four percent of the observations of permanent sign blockages was accurate, based on the limited sample.

The videotape method can be useful for performing accurate sign sight distance measurements and making percentage statements of sign interference severity. Observations from a moving automobile, however, are faster, less expensive, and adaptable to large-scale surveys of thousands of signs normally found in large highway systems.

SCOPE AND PROCEDURE

An interchange is defined as having one or more exits to a grade-separated route. An approach is a section of roadway that ends with an interchange exit, exits, or upstream exit decision point.

The number of interchanges in New Jersey was estimated to be 693. On the state system, interchanges have single, double, triple, and quadruple approaches. A random sample produced an estimate of 10 percent single and 90 percent double approach interchanges, which yields 1,317 approaches. The total number of approaches surveyed was 1,012, or about 75 percent.

The survey was carried out in daylight during the summer and fall of 1987 in a 1986 Dodge Aries to determine where the driver's view of a guide sign was less than maximum readability. The earliest point at which an interference was noted was established where the observer could clearly notice and read the entire message on the sign at a point downstream of where it should have been legible. An assumption was made that the smallest legends used were adequate for current standards. Because some signs were probably inadequate for current standards, the percentage of interferences found might be conservative. However, it must be noted that the observers were young people with good uncorrected vision, which would tend to make their judgment liberal.

The purpose of the larger project was limited to sign placement and design method improvements. This survey was not intended to substitute in any way as a traffic engineering operation. Approaches involving isolated sites, tolls, and state border crossings were not surveyed. The value, ambiguity, or lack of transmissivity of the message was not evaluated. The effects of blockage by moving or parked vehicles and the views from other lanes were not surveyed. Undoubtedly many more interferences would have been found had these factors been taken into account. The purpose here is to summarize an extensive preliminary investigation of sign view interferences by using a reasonably accurate, low cost, and fast methodology.

The following sign types were surveyed (Figure 1):

1. Advance,
2. Supplemental advance,
3. Exit direction,
4. Gore, and
5. Pull through, including both ground-mounted and overhead signs.

RESULTS

Of the 1,012 approaches surveyed, 583 interferences of varying severity were noticed that left the observers with less than maximum viewability within their readable range.

The interferences are classified and distributed by number and percentage in Table 1. The classification can be simplified into the following four main categories of interference, which do not include damaged or deteriorated signs:

1. Sign view blockage, which represents 97 percent of the cases observed. The term means that the approaching motorist's view is blocked by some fixed object. The method is accurate for this type of interference.
2. Complex environment, which represents only 1 percent of the cases observed. The term means that the environment or the construction of the sign is such that it is easily overlooked (Figure 2). Further definition of this type of interference appears to be needed.
3. Ambiguous meaning, which represents only 1 percent of the cases. The term means that the sign is placed on a parallel road in such a way that the driver may be uncertain whether or not an upstream decision was correct. The identification of this category may require special training.
4. Information overload, which was found at only one interchange approach. It must be noted that this survey method may be inadequate for this category.

Because the sign view blockage category represents 97 percent of the cases observed, a breakdown of the types and percentages is warranted and is shown in Table 1.

Trees accounted for 53 percent of the blockages observed (Figure 3). Poles accounted for 5 percent, curves and crests for 20 percent. Other signs accounted for 6 percent, and bridge spans, abutments, parapets, and piers accounted for 13 percent (Figures 4, 5, and 6).

Some types of interferences were not found, including the following:

- Visual cone: No signs were found to be outside the driver's 20-degree cone of vision until the end of the approach.
- Unexpected location: No signs were observed to be located in a spot that is unexpected by the drivers, thus causing a noticeable decrease in the readable range.

Signs that were found to have one or more interferences are as follows:

Type of Sign	*Percent of interferences*
Advance	48
Exit direction	36
Gore	11
Supplemental advance	10
Pull through	3
Miscellaneous	2

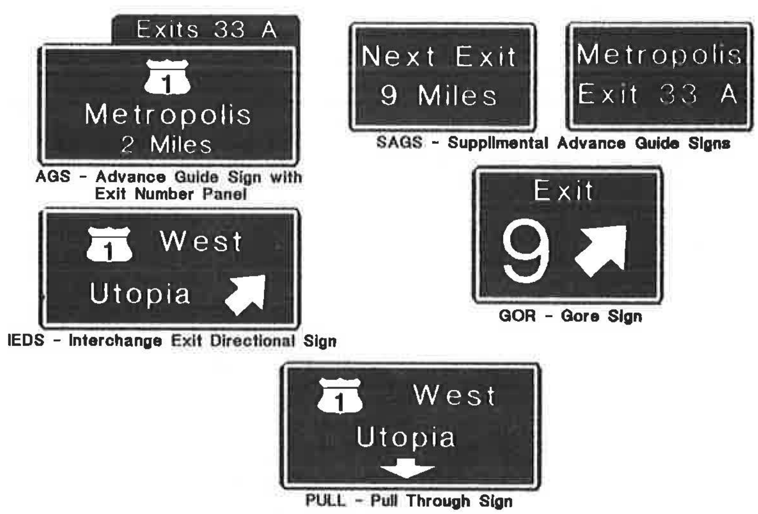

FIGURE 1 Sign types.

TABLE 1 DIRECTIONAL GUIDE-SIGN VIEW INTERFERENCES

Reason for view Interference	Frequency	Percentage of Total
Trees	309	53
Curves	86	15
Crests	32	5
Bridge spans	40	7
Telephone poles	32	5
Signs	39	6
Bridge abutments	11	2
Bridge parapets	10	2
Bridge piers	10	2
Complex environments	6	1
Ambiguous meaning: due to parallel roads	4	1
Buildings, information overloads, signs down, signs broken	4	1
	583	100

FIGURE 2 Complex environment.

FIGURE 4 Bridge span blockage.

FIGURE 3 Tree blockage.

FIGURE 5 Bridge pier blockage.

FIGURE 6 Parallel roads.

DISCUSSION OF RESULTS

The view blockage of highway signs has been reported before, recently by Hahn et al. (*2*), who noted, "The target value of many large guide signs is limited by high surrounding brightness, and by blockage by other highway features."

It was found that a little more than half of the blockages were caused by trees. The maintenance of landscaping is normally an annual event if sufficient funds are available. Trees and shrubs are relatively inexpensive to modify. Apparently, when they were originally located in the design phase, the impact of this growth process was often not foreseen. They can be cut back or removed to correct the interferences at relatively low cost.

Poles are a bothersome interference, but the interference appears to be minor in most cases. Small signs blocking large signs can be moved inexpensively. However, large signs, curves, embankments, walls, spans, parapets, and piers represent an estimated 35 percent of the problem. The correction of these interferences would require relocation of large signs, new road alignments, bridge replacement, or the reconstruction of other features, involving large capital investments.

It is recommended that more attention be placed on testing scale models at an early design stage, involving both signs and features before the building of new interchanges and alignments.

Three-dimensional dynamic computer graphics can provide a practical way to test the driver's view at an early stage with a more effective input and review of traffic engineers (*3*).

The technical means for traffic engineering input with optimal sign placement for each unique interchange has been crude in comparison with the means that are available today.

The information for this presentation is primarily taken from a report by Roberts and Black (*4*). The methodology in this survey may be used in other states to quickly assess the approximate number and location of sign view interferences without the need for specialized equipment. A rough, subjective assessment of the severity of the interference, such as a three-point scale, should also be used.

ACKNOWLEDGMENTS

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