

*Virginia Transportation Research Council*

# *research report*

## Evaluation of Adding Distance Information to Mainline Specific Service (Logo) Signs

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BENJAMIN H. COTTRELL, Jr., P.E.  
Associate Principal Research Scientist

PRAVEEN K. EDARA, Ph.D.  
Assistant Professor  
University of Missouri-Columbia



**Standard Title Page—Report on State Project**

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| Author(s):<br>Benjamin H. Cottrell, Jr., P.E., and Praveen K. Edara                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |                  |                                           |                                                                                                     |
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| <p>Abstract:</p> <p>Specific service (or logo) signs provide information on attractions, camping, lodging, food, and gas services on the mainline of limited access highways in advance of the interchange that provides access to the services. At present, to ascertain the distance to a particular establishment, motorists depart from the mainline and read the distance on the logo signs on the ramps. Through a request from a state senator, the Virginia Department of Transportation (VDOT) was asked to consider adding distance information to mainline logo signs. The contention was that providing such information could help drivers decide whether to take a specific exit and thus avoid unnecessary weaving maneuvers if they deemed the service to be too far from the exit. Although there were potential benefits of this concept, there were concerns about its implementation—notably, whether the distance information could be easily read at freeway speeds.</p> <p>The purpose of this study was to determine the effectiveness or usefulness of adding distance information on mainline logo signs. The scope of the study was limited to a pilot study of adding distance information on mainline logo signs at three interchanges in Virginia. Because such information is not covered in the <i>Manual on Uniform Traffic Control Devices</i> (MUTCD), VDOT requested, and the Federal Highway Administration granted, permission to experiment with these signs. Distance information was added to existing logo signs at the three interchanges in the space available under the logo panels. The study examined legibility, motorist opinions, and crash history related to adding the distance information.</p> <p>The results of the study indicated that the legibility distance for the added information on the mainline logo signs was adequate in that it exceeded the rule of thumb of 40 feet/inch of letter height. Most legibility study participants found the distance information easy to read, although some found the information “cramped” on the signs. Most respondents to the motorist opinion survey found the signs “OK” or “easy to read” and the distance information useful. The presence of the distance information on the mainline logo signs did not affect the number of crashes at the sites used in the pilot study.</p> <p>The cost of replacing existing mainline logo signs statewide with new larger signs that would include distance information is estimated at \$10.5 million. Additional costs to replace the sign structures to accommodate the larger signs might be substantial. As the primary benefit of adding distance information to mainline logo signs is motorist convenience, the required expenditure may be designated a low priority.</p> |                            |                  |                                           |                                                                                                     |

**FINAL REPORT**

**EVALUATION OF ADDING DISTANCE INFORMATION TO MAINLINE SPECIFIC  
SERVICE (LOGO) SIGNS**

**Benjamin H. Cottrell, Jr., P.E.**  
**Associate Principal Research Scientist**

**Praveen K. Edara, Ph.D.**  
**Assistant Professor**  
**University of Missouri-Columbia**

Virginia Transportation Research Council  
(A partnership of the Virginia Department of Transportation  
and the University of Virginia since 1948)

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## ABSTRACT

Specific service (or logo) signs provide information on attractions, camping, lodging, food, and gas services on the mainline of limited access highways in advance of the interchange that provides access to the services. At present, to ascertain the distance to a particular establishment, motorists depart from the mainline and read the distance on the logo signs on the ramps. Through a request from a state senator, the Virginia Department of Transportation (VDOT) was asked to consider adding distance information to mainline logo signs. The contention was that providing such information could help drivers decide whether to take a specific exit and thus avoid unnecessary weaving maneuvers if they deemed the service to be too far from the exit. Although there were potential benefits of this concept, there were concerns about its implementation—notably, whether the distance information could be easily read at freeway speeds.

The purpose of this study was to determine the effectiveness or usefulness of adding distance information on mainline logo signs. The scope of the study was limited to a pilot study of adding distance information on mainline logo signs at three interchanges in Virginia. Because such information is not covered in the *Manual on Uniform Traffic Control Devices (MUTCD)*, VDOT requested, and the Federal Highway Administration granted, permission to experiment with these signs. Distance information was added to existing logo signs at the three interchanges in the space available under the logo panels. The study examined legibility, motorist opinions, and crash history related to adding the distance information.

The results of the study indicated that the legibility distance for the added information on the mainline logo signs was adequate in that it exceeded the rule of thumb of 40 feet/inch of letter height. Most legibility study participants found the distance information easy to read, although some found the information “cramped” on the signs. Most respondents to the motorist opinion survey found the signs “OK” or “easy to read” and the distance information useful. The presence of the distance information on the mainline logo signs did not affect the number of crashes at the sites used in the pilot study.

The cost of replacing existing mainline logo signs statewide with new larger signs that would include distance information is estimated at \$10.5 million. Additional costs to replace the sign structures to accommodate the larger signs might be substantial. As the primary benefit of adding distance information to mainline logo signs is motorist convenience, the required expenditure may be designated a low priority.

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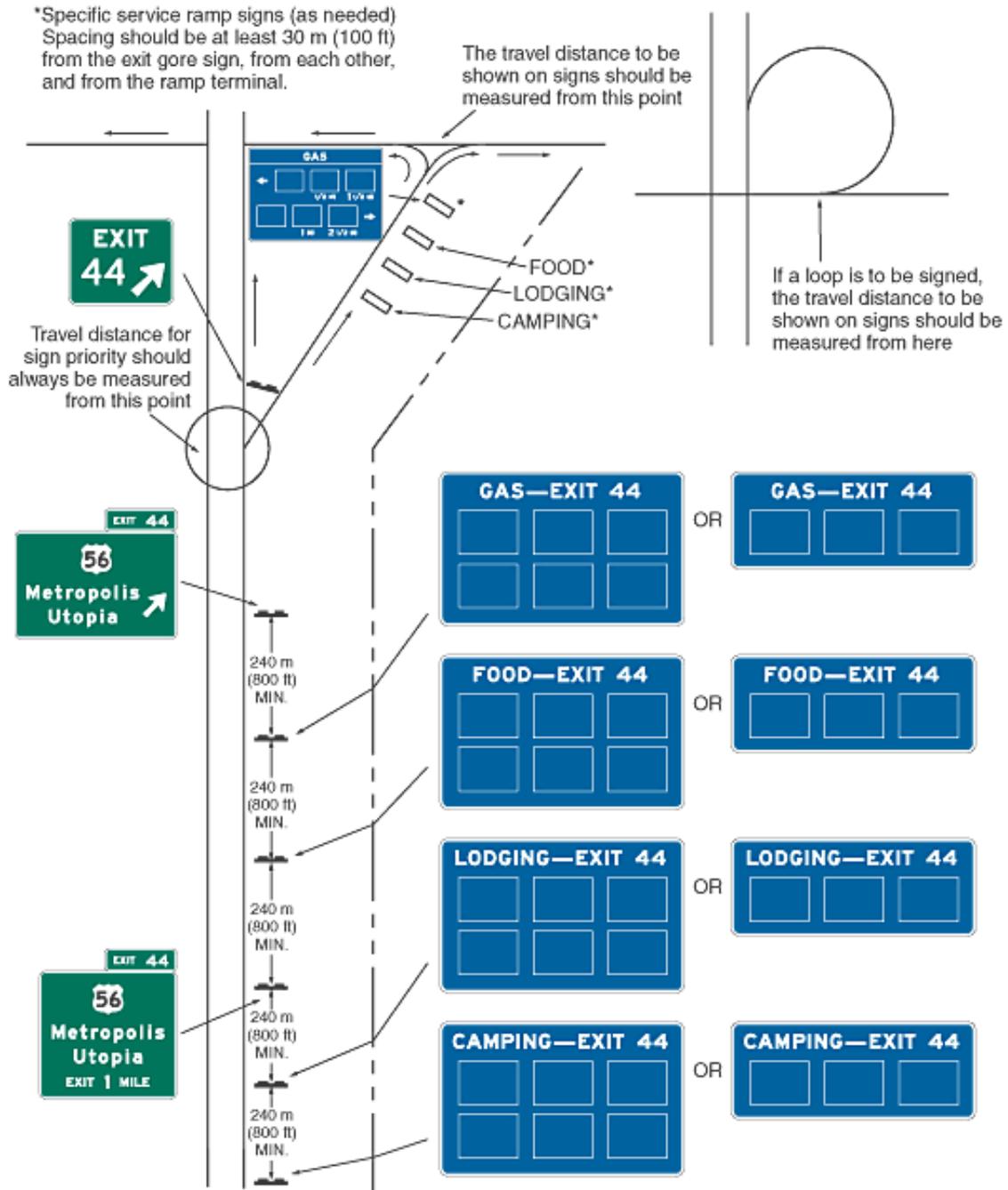
## **INTRODUCTION**

Specific service (or logo) signs provide information on attractions, camping, lodging, food, and gas services. Chapter 2F of the 2003 *Manual on Uniform Traffic Control Devices* (MUTCD) provides the standards for specific service signs on all classes of highways.<sup>1</sup> This series of signs is located on the mainline of limited access highways in advance of the interchange; a second set of signs that includes the distance to the service is located on the ramp (see Figure 1). Figure 2 displays mainline and ramp logo signs, respectively. Standards are provided in the MUTCD for the following: the type of attraction services that qualify to have a panel on a logo sign; the maximum number of signs that can be displayed along an approach to an interchange or intersection; the size and colors of the logo panels; the size of lettering; and location with respect to the interchange or intersection. The Virginia Logos portion of the Integrated Directional Signing Program (IDSP) dictates that to have a panel on a logo sign, eligible services except attractions and camping should be located within 3 miles of the exit; attractions and camping have a 15-mile range.<sup>2</sup> Virginia Logos is the company that administers the logo sign program in Virginia,

At present, to ascertain the distance to a particular establishment, motorists depart from the mainline and read the distance to various services on the logo signs on the ramps (Figure 2). If motorists decide that the distance to the desired destination is too far, they may return to the mainline and search at interchanges downstream. A second option is to choose an alternative business that provides a similar service but is closer.

Through a request from a state senator, the Virginia Department of Transportation (VDOT) was asked to consider adding distance information to mainline logo signs. The contention was that this could help motorists decide whether to take the exit by facilitating their decision to exit when distance to the service was an important decision-making criterion. Although there were potential benefits of this concept, there were concerns about its implementation—notably, whether the distance information could be easily read at freeway speeds.

**Figure 2F-2. Examples of Specific Service Sign Locations**



**Figure 1. Example of Series of Mainline and Ramp Logo Signs. From *Manual on Uniform Traffic Control Devices*, Federal Highway Administration, Washington, D.C., 2004.**



Figure 2. Mainline (top) and Ramp (bottom) Logo Signs on I-64 at Exit 120

## **PURPOSE AND SCOPE**

The purpose of this study was to determine the effectiveness or usefulness of adding distance information on mainline logo signs. The scope of the study was limited to a pilot study of adding distance information on mainline logo signs at three interchanges in Virginia. Because such information is not covered in the *Manual on Uniform Traffic Control Devices (MUTCD)*, in November 2006, VDOT requested, and the Federal Highway Administration granted, permission to experiment with these signs. Distance information was added to existing logo signs in the space available under the logo panels. The study examined legibility, motorist opinions, and crash history related to adding the distance information.

This study fulfills VDOT's obligation to document the results of the MUTCD experiment.

## **METHODS**

Seven tasks were completed to achieve the objectives of the study:

1. Review the literature.
2. Select study interchanges.
3. Add distance information to study signs.
4. Conduct a legibility study.
5. Conduct a motorist opinion survey.
6. Conduct a before-after crash analysis.
7. Conduct a costs and benefits assessment.

### **Literature Review**

The literature relating to logo signs, sign legibility, and motorist information needs was reviewed. The literature was identified using computerized searches such as Transport and TRIS Online and the services of the VDOT Research Library.

### **Interchange Selection**

Three interstate exits in Virginia were selected for the study: I-64, Exit 250A and B, near Newport News; I-95, Exit 152A, near Dumfries in Prince William County; and I-81, Exit 137, near Salem in Roanoke County. The sites were selected through discussions with staff at VDOT and Virginia Logos and field reviews.

## **Study Sign Modification**

### **Sign Design Issues**

VDOT staff had preliminary discussions with Virginia Logos regarding ways in which to add the distance information to the logo signs. To be consistent, the same distance information on the ramp logo signs was placed below the logo panel on the mainline signs. The MUTCD requires that the letter height for logo signs (except on the panels) be at least 10 inches for freeways and at least 6 inches for conventional roads or ramps. This refers to the header information such as “GAS–EXIT 44.” The consensus was that the distance information is secondary to the header and, therefore, should be smaller than the header.

The legibility of the distance information is dependent on letter height, font, and other factors. The standard assumption is that letters on highway sign can be read from 40 feet for every 1 inch of letter height.<sup>7</sup> By repositioning the logo panels, VDOT and Virginia Logos staff determined that the maximum letter size that could be used for distance information on existing logo signs was 8 inches. Therefore, the legibility distance would be about 320 feet. By contrast, the height of letters for distance information on ramp signs is 3 or 4 inches. To enhance the legibility of the distance information further, the Clearview highway font was used.<sup>8</sup>

### **Addition of Distance Information**

The distance information was added to all logo signs at the three interchanges. Distance information was added by Virginia Logos to all mainline logo signs in both directions at the three interstate exits selected. The installers repositioned the logo panels to make space below the panels to install numbers and letters from the 8-inch series. The addition of the distance information was completed by April 2007. Sample signs are shown in Figures 3 and 4.

### **Legibility Study**

The ability of motorists to read the distance information on the signs was assessed by having 17 test subjects drive through a study section on I-81 and provide legibility information with regard to nine logo signs, including six experimental signs and three standard signs. For the test signs, participants were asked to look for a particular logo panel and read aloud the distance to the business. Legibility information regarding standard logo signs was obtained for comparative purposes.

The test participants were employees of VDOT’s Southwest Region and Salem District, and their offices were located near the study signs on I-81. The test was conducted only during daytime, and the speed limit was 60 mph on the test section. The researchers recorded the distance information using a distance measuring instrument (DMI) as the subjects read the sign information and responded to questions regarding the signs. The form used to record the information is shown in Appendix A.



Figure 3. Distance Information on Mainline Logo Signs on I-95, Exit 152



Figure 4. Distance Information on Mainline Logo Signs on I-64, Exit 250

Using the DMI, the distance to travel the test loop and the distance to each test sign were determined. The legibility distance was calculated by subtracting the distance to the sign location from the distance at which the sign was read.

### **Motorist Opinion Survey**

A survey was developed to ascertain motorist opinion regarding the distance information on the test signs. This survey was conducted at rest areas near the study signs on I-95 and I-64. To conduct the survey, a one-page written questionnaire was handed to participants on a clipboard, completed by them, and returned to the surveyor. The eight-question survey form is shown in Appendix B. (Appendix B shows the survey form used for the I-64 survey participants. For the I-95 survey participants, Question 2 referred to “Interstate 95” rather than “Interstate 64” and the photographs of the signs were for signs on I-95.)

The motorist opinion survey was conducted on three occasions (one day each month): (1) in July 2007 at the Dale City I-95 Northbound car only rest area, (2) in November 2008 at the New Kent I-64 Westbound rest area, and (3) in December 2008 at the Dale City I-95 Northbound car only rest area. Because of rain midway through the survey period, the third survey was moved to the Fredericksburg I-95 Southbound rest area.

### **Crash Analysis**

A before-after crash analysis with treatment and control groups was conducted to determine if the addition of distance information on mainline signs had an effect on safety. Crash data were obtained for a 3-year period before the distance information was added to the experimental signs and for a 1-year period afterwards. Data were obtained from VDOT databases. Control sites that had characteristics similar to those of the treatment sites in terms of number of logo panels on service signs, segment length and geometrics, and average annual daily traffic were chosen at all three study locations.

A paired *t*-test was performed to determine if there was any change in the mean number of crashes before and after the addition of distance information on the signs.

### **Costs and Benefits Assessment**

The costs and benefits of adding distance information to logo signs and replacing the signs altogether were assessed.

## RESULTS AND DISCUSSION

### Literature Review

O'Leary and Turochy conducted an assessment of motorists' perceptions of interstate food logo signs in Virginia.<sup>3</sup> Their survey at four state welcome centers and one rest area yielded more than 500 completed surveys. The motorists' expectation of the proximity of businesses shown on the logo signs was consistent with the proximity requirement of 3 miles or less for VDOT's logo sign program.

Hawkins and Rose conducted a human factors study on the effect of adding dual-logo panels to specific service signs in Texas.<sup>4</sup> A timed survey consisting of a series of photographs was used, and the subjects were asked to determine if various business logos were present. The study found that dual logos have a lower recognition level at shorter response times; however, the difference in recognition levels between single and dual logos decreased as the response time and driver familiarity with the businesses (shown in signs) increased.

Lee et al. evaluated the human factors associated with the use of mixed use signs on which different types of services (e.g., food and camping) were shown on the same motherboard in Virginia.<sup>5</sup> A telephone survey of motorists showed that 65 percent of the respondents were not confused by these signs, indicating a low level of confusion. There was no statistically significant difference in the number of crashes before and after the use of these signs.

Hummer and Maripalli studied the human factors effects of nine-panel logo signs in North Carolina.<sup>6</sup> In this laboratory survey, subjects were first shown a brand name they were asked to scan in the time-based slide show of the logo sign images that followed. The subjects were asked to determine if the brand was on the sign. The study found that the typical MUTCD-approved six-panel signs were associated with an approximately 8 percent more accurate response rate than were the nine-panel signs being tested. Because of this small difference in response rate, the study concluded that the nine-panel signs performed well and should be considered in locations with more than six businesses interested in having their logo on the signs. The use of such signs would also reduce the number of extra signs and billboards by businesses not represented on the signs, thereby reducing driver distraction.

To summarize, research is limited with regard to enhancing the utility of the service signs on highways, and no studies on the addition of distance information to mainline logo signs were found in the literature review. Human factors studies based on intercept and laboratory surveys showed that the use of mixed use, dual logo, and nine-panel logo signs did not significantly increase driver confusion or distraction. Further, crash frequency was not affected by the use of such signs.

## Legibility Study

As described in the “Methods” section, 17 individuals participated in the legibility study.

### Legibility Distance and Travel Speeds

The mean legibility distance for the subject signs and the mean travel speeds of the participants as they viewed the nine signs on the test section of I-81 are shown in Table 1. The mean legibility distance for the six experimental signs ranged from 351 to 483 feet. The range for the southbound signs was lower than that for the northbound signs. It is likely that the study participants became familiar with what was expected of them after the first three signs, which may account for the larger legibility distances for the second set of test signs. The mean legibility distance for the three standard signs was 416 to 612 feet. The standard deviation for the standard signs was greater than for the test signs. This may indicate that there was more variability in the participants’ ability to recognize the logos for various businesses than in reading the distance information. The participants’ travel speeds ranged from 57 to 62 mph.

**Table 1. Mean Legibility Distance (feet) and Travel Speed of Participants (mph)**

| Sign Type    | Sign No./ Direction | Distance and Speed | Mean | Standard Deviation |
|--------------|---------------------|--------------------|------|--------------------|
| Experimental | Sign 1 SB           | Distance           | 351  | 141                |
|              |                     | Speed              | 59   | 2                  |
|              | Sign 2 SB           | Distance           | 373  | 119                |
|              |                     | Speed              | 60   | 3                  |
|              | Sign 3 SB           | Distance           | 374  | 113                |
|              |                     | Speed              | 59   | 2                  |
|              | Sign 6 NB           | Distance           | 483  | 137                |
|              |                     | Speed              | 61   | 3                  |
|              | Sign 7 NB           | Distance           | 425  | 125                |
|              |                     | Speed              | 61   | 3                  |
|              | Sign 8 NB           | Distance           | 439  | 142                |
|              |                     | Speed              | 62   | 3                  |
| Standard     | Sign 4 SB           | Distance           | 612  | 184                |
|              |                     | Speed              | 58   | 3                  |
|              | Sign 5 SB           | Distance           | 416  | 196                |
|              |                     | Speed              | 57   | 3                  |
|              | Sign 9 NB           | Distance           | 527  | 188                |
|              |                     | Speed              | 59   | 3                  |

### Legibility Distance and Estimated Travel Time for Various Speeds

Table 2 shows the mean legibility distance by sign location and estimated motorist travel time for various speeds. This table is intended to provide a range of preview times for various legibility distances for a range of typical highway speeds. The mean legibility distance was longest for the standard signs, followed by the northbound and then the southbound experimental signs. The rule of thumb that a sign can be read from 40 feet away for every 1 inch of letter height is used to estimate sign legibility and to accommodate older drivers.<sup>7</sup> With this rule of thumb, 8-inch numbers on signs should be legible from 320 feet. In this study, all signs studied were legible for a distance greater than 320 feet. For the southbound experimental signs, the

**Table 2. Mean Legibility Distance by Sign Location and Estimated Motorist Travel Time for Various Speeds**

| Sign                                    | Mean Legibility Distance, ft | Estimated Motorist Travel Time, sec |        |        |        |
|-----------------------------------------|------------------------------|-------------------------------------|--------|--------|--------|
|                                         |                              | 60 mph                              | 65 mph | 70 mph | 75 mph |
| Experimental southbound signs 1-3, mean | 366                          | 4.1                                 | 3.8    | 3.6    | 3.3    |
| Experimental northbound signs 6-8, mean | 449                          | 5.1                                 | 4.7    | 4.4    | 4.1    |
| Standard signs 4, 5, and 9 mean         | 518                          | 5.9                                 | 5.4    | 5.0    | 4.7    |

group with the shortest legibility distance, a vehicle would pass the signs in 3.3 to 4.1 seconds, depending on the speed. This is an estimate of the amount of time the motorist has available to read the sign.

### General Survey Questions

As discussed in the “Methods” section, Appendix A shows the other general survey questions asked of the 17 participants in the legibility study. The results of these questions are provided in Table 3.

Thirteen participants (76.5%) found the experimental southbound signs (1-3) easy to read, and 14 (82.4%) found the experimental northbound signs (6-8) easy to read. Six participants (35%) rated the distance information hard or somewhat hard to read, and 11 (65%) rated it “OK” or “easy to read.” When asked if they typically read everything on the logo sign or scan the sign, all 16 respondents or (94.1% of the participants) stated that they scan the sign. When asked if they typically read everything on the logo sign, scan the sign, or both,

**Table 3. Responses of Legibility Study Participants to General Survey Questions**

| Survey Question                               | Rating             | No. | %    |
|-----------------------------------------------|--------------------|-----|------|
| Ease of reading experimental SB signs 1-3?    | Easy to read       | 13  | 76.5 |
|                                               | Not easy to read   | 3   | 17.6 |
|                                               | No response        | 1   | 5.9  |
| Ease of reading experimental NB signs 6-8?    | Easy to read       | 14  | 82.4 |
|                                               | Not easy to read   | 1   | 5.9  |
|                                               | No response        | 2   | 11.8 |
| Ease of reading distance information?         | Hard               | 1   | 5.9  |
|                                               | Somewhat hard      | 5   | 29.4 |
|                                               | Ok                 | 4   | 23.5 |
|                                               | Easy               | 7   | 41.2 |
|                                               | Visibly stands out | 0   | 0.0  |
| Typically read everything or scan logo signs? | Read everything    | 0   | 0.0  |
|                                               | Scan               | 16  | 94.1 |
|                                               | No response        | 1   | 5.9  |
| Typically read everything, scan, or both?     | Read everything    | 0   | 0.0  |
|                                               | Scan               | 11  | 64.7 |
|                                               | Both               | 6   | 35.3 |
| Gender?                                       | Male               | 11  | 64.7 |
|                                               | Female             | 6   | 35.3 |
| Age?                                          | Under 40           | 7   | 41.2 |
|                                               | 40-60              | 8   | 47.1 |
|                                               | Over 60            | 2   | 11.8 |

65 percent stated that they scan the sign and 35 percent stated that they do both. Eleven participants were male, and 6 were female. Eight participants were 40 through 60 years of age, 7 were under 40, and 2 were over 60.

## **Participant Comments**

Comments from participants were varied:

- Information on sign cluttered, cramped, or too close together (6 participants).
- Logo recognized before distance information could be read (3 participants).
- Numeral 2 was hard to read (1 participant).
- Numerals 2 and 7 look alike (1 participant).
- Numerals 3 and 5 look alike (1 participant).
- Distance information font size is good (2 participants).
- Font should be bigger (1 participant).
- Distance information is helpful (9 participants).
- Distance information is not needed (3 participants).
- Looks for physical evidence for businesses at interchange (1 participant).
- Hanging Rock logo is hard to read (4 participants).
- Budget Inn logo is hard to read (1 participant).
- Darker color logos are hard to read (1 participant).

## **Limitations of the Study**

Ideally, night-time legibility should have also been studied. The researchers planned to survey motorists on the legibility of the study signs by using a video recording. The researchers attempted video recording with multiple visual settings during the day and night to capture on video an image of what motorists actually see when viewing logo signs. The research team was not satisfied with the quality of the video; none of the video recordings captured what motorists see. Therefore the decision was made to use the study method described. The initial two requests to solicit participation in the legibility study were for day and night study of the logo signs. Only one person volunteered for the night study; therefore, the third solicitation was for daytime only.

## **Motorist Opinion Survey**

There were a total of 111 respondents to the motorist opinion survey (see Appendix B) conducted at the rest areas near the study signs on I-95 and I-64. The results of the survey are provided in Table 4. As may be seen, 80 respondents (72.1%) were visitors to the area, and 102 respondents (91.9%) had seen two of the mainline logo signs with distance information shown on the questionnaire. Forty-seven respondents (42.3%) noticed something different about the signs; of those, 9 (19%) correctly noted the presence of distance information. Of those answering the question regarding a difference in the sign, 9 respondents (8.5%) noted the presence of distance information. Twenty respondents (18%) reported that the distance information was hard or somewhat hard to read; 88 respondents (76.2%) reported that the

**Table 4. Results of Motorist Opinion Survey (N = 111)**

| Survey Question                                                                                    | Response                                 | No. | %    |
|----------------------------------------------------------------------------------------------------|------------------------------------------|-----|------|
| Visitor to area?                                                                                   | Yes                                      | 80  | 72.1 |
|                                                                                                    | No                                       | 31  | 27.9 |
| See signs on interstate?                                                                           | Yes                                      | 102 | 91.9 |
|                                                                                                    | No                                       | 9   | 8.1  |
| Notice anything different about signs?                                                             | Yes                                      | 47  | 42.3 |
|                                                                                                    | No                                       | 59  | 53.2 |
|                                                                                                    | No response                              | 5   | 4.5  |
| If Yes, comment                                                                                    |                                          | 9   | 8.5  |
| Opinion on distance information?                                                                   | Hard to read                             | 8   | 7.2  |
|                                                                                                    | Somewhat hard                            | 12  | 10.8 |
|                                                                                                    | Ok                                       | 48  | 43.2 |
|                                                                                                    | Easy                                     | 40  | 36.0 |
|                                                                                                    | Other                                    | 0   | 0.0  |
|                                                                                                    | No response                              | 47  | 2.7  |
| Distance information useful? (Rate 1-5 with 1 being no help and 5 being most help) (108 responses) | Mean = 3.93<br>Standard deviation = 0.96 |     |      |
| Slow down to read signs?                                                                           | Yes                                      | 15  | 13.5 |
|                                                                                                    | No                                       | 94  | 84.7 |
|                                                                                                    | No response                              | 2   | 1.8  |
| Gender?                                                                                            | Male                                     | 73  | 65.8 |
|                                                                                                    | Female                                   | 32  | 28.8 |
|                                                                                                    | No response                              | 6   | 5.4  |
| Age?                                                                                               | Under 40                                 | 21  | 18.9 |
|                                                                                                    | 40-60                                    | 42  | 37.8 |
|                                                                                                    | Over 60                                  | 45  | 40.5 |
|                                                                                                    | No response                              | 3   | 2.7  |
| Virginia resident?                                                                                 | No                                       | 61  | 55.0 |
|                                                                                                    | Yes                                      | 46  | 41.4 |
|                                                                                                    | No response                              | 4   | 3.6  |

information was “OK” or “easy to read.” With regard to the usefulness of the distance information, the mean rating was 3.9 (of 5), with a standard deviation of 0.96.

Fifteen respondents (13.5%) reported that they slowed down to read the signs. The researchers had some concern about this response because a sizable percentage of motorists state that they slow down to read logo signs. There was no evidence to suggest that slowing down to read the sign was a problem. However, more information is needed to assess the issue. For example, it would be important to determine how much and how quickly a motorist slowed down and quantify the impacts of the speed reductions on traffic flow or safety if any. It is possible that the slowing might occur in response to typical mainline logo signs without distance information. Further, a more in-depth analysis of the data revealed that 14 of the 15 respondents who stated that they slowed down to read the signs did not correctly notice the difference in the signs (i.e., they did not note the presence of the distance information). They may have been saying that they slow down generally for logo signs, not necessarily that they were slowing down as a result of the distance information being on the sign.

Of the respondents who indicated their gender, 73 were male and 32 were female. Of the respondents who reported their age, 45 were over 60 years of age, 42 were 40 through 60 years of age, and 21 were under 40 years of age. Of those who answered the residency question, 46

were residents of Virginia and 61 were not. In the general comment section, 10 respondents (9%) noted that the distance information was helpful and 2 respondents (1.8%) reported that the distance information was not needed. One respondent remarked that the information should be larger, and another stated there was no need to list businesses more than 2 miles away.

In summary, it appears that most survey respondents saw the logo signs but did not notice the distance information on the study signs. The majority found the distance information “OK” or “easy to read” and considered the distance information useful.

### Crash Analysis

As discussed in the “Methods” section, crash data were obtained for a 3-year period before the distance information was added to the experimental signs and for a 1- year period afterward. Summary statistics of crashes are shown in Table 5. The treatment and control sites are shown in Figures 5 through 7.

A paired *t*-test was performed to determine if there was any change in the mean number of crashes before and after the addition of distance information on the signs. The treatment segments had a *t*-statistic of 0.73 with a *p*-value of 0.49 for a level of significance of  $\alpha = 0.10$ , meaning that the null hypothesis of means being equal cannot be rejected. For the control segments, the *t*-statistic was 1.75 with a *p*-value of 0.14. In summary, based on the crash analysis, adding distance information on the logo signs did not affect safety as measured by number of crashes.

**Table 5. Number of Crashes per Year at Treatment and Control Sites for Before and After Periods**

| Site                               | Milepoint |        | No. of Crashes/Year |       |
|------------------------------------|-----------|--------|---------------------|-------|
|                                    | From      | To     | Before              | After |
| <i>I-81 South (Salem)</i>          |           |        |                     |       |
| Treatment                          | 140.69    | 137.75 | 15                  | 16    |
| Control                            | 156.77    | 151.19 | 14                  | 9     |
| <i>I-81 North (Salem)</i>          |           |        |                     |       |
| Treatment                          | 132.65    | 137.22 | 26                  | 24    |
| Control                            | 147.03    | 150.38 | 10                  | 15    |
| <i>I-95 North (Prince William)</i> |           |        |                     |       |
| Treatment                          | 150.9     | 152.97 | 66                  | 42    |
| Control                            | 148.66    | 150.58 | 34                  | 34    |
| <i>I-95 South (Prince William)</i> |           |        |                     |       |
| Treatment                          | 155.51    | 153.43 | 115                 | 80    |
| Control                            | 152.97    | 150.73 | 72                  | 68    |
| <i>I-64 East (Newport News)</i>    |           |        |                     |       |
| Treatment                          | 248.28    | 250.63 | 62                  | 78    |
| Control                            | 238.97    | 242.41 | 31                  | 13    |
| <i>I-64 West (Newport News)</i>    |           |        |                     |       |
| Treatment                          | 255.02    | 250.54 | 64                  | 73    |
| Control                            | 247.04    | 242.6  | 70                  | 53    |



Figure 5. Treatment and Control Sites on I-64 Near Newport News



Figure 6. Treatment and Control Sites on I-81 in Roanoke County



Figure 7. Treatment and Control Sites on I-95 in Prince William County

### Driver Information Overload

When discussions about installing distance information on mainline logo signs began, some transportation professionals were adamant that this would result in driver information overload. The best case was that the signs would be ineffective because motorists would be unable to read all of the information. The worst case was that motorists might slow down abruptly to read the signs and thereby create a hazardous situation that could result in a crash.

An alternate view was that for logo signs with six panels, there would be a lot of information on the sign. However, logo signs are for motorist services and would be deemed important only if motorists were in need of the services displayed on the signs, especially food and gas. As noted in the literature review, research on the human factors effects of nine-panel logo signs found that more drivers scan the logo signs for a particular brand than read all of the logos.<sup>9</sup> That study pointed out that 68 percent of drivers scan signs, 26 percent read each panel, and 6 percent both read and scan the signs.<sup>9</sup> The most frequently used logo sign was for gas, followed by food.<sup>9</sup> If most motorists are scanning the sign, an information overload may be less likely. However, with 26 to 32 percent of motorists reading the signs, there is a potential for driver information overload. Suffice it to say that with the recent emphasis on driver distractions such as the use of cell phones and other in-vehicle devices, there may be some value in considering driver information overload and distraction together.

This study was not designed to investigate driver information overload. Such an investigation would best be conducted in a driving simulator laboratory or with instrumented vehicles.

## CONCLUSIONS

- The legibility study revealed that the distance information on the mainline logo signs was legible during the daytime. The distance information on the mainline logo signs was easy to read for most legibility study participants. To some, it appeared that the distance information was cramped on the logo signs.
- Most of the motorist opinion survey respondents found the signs “OK” or “easy to read” and the distance information useful.
- The presence of distance information on mainline logo signs had no effect on safety as measured by number of crashes.

## COSTS AND BENEFITS ASSESSMENT

It is difficult to quantify the benefits of providing distance information on mainline logo signs. It is possible that providing drivers with distance information to services on the mainline could help them decide whether to take a particular exit. The benefits of motorists having this additional information could include increased convenience (motorists will not travel further from the interstate than they are comfortable traveling), reduced congestion at interchange areas (fewer motorists will exit and then immediately re-enter the mainline upon seeing the distance to a service), and improved customer satisfaction for users of the road network (information on distance to services is provided earlier.).

There are two possible options to consider for installing distance information on mainline logo signs statewide: adding the information to existing signs, as was done in this study, or replacing the existing signs with larger signs to accommodate the distance information. The total cost for the installation of the distance information to the signs in this study was \$2,800, or \$933 per interchange. The costs mostly comprised labor costs.

Following the MUTCD guidance for spacing to the bottom borders and interline spacing would require signs be larger to accommodate distance information.<sup>1</sup> The MUTCD also states that letters or numerals on specific service signs on freeways must be 10 inches high. The distance information on the experimental signs used in this study was 8 inches high, the maximum height that would fit on the existing signs. In the legibility study, 35 percent of the respondents stated that the signs looked cramped. Therefore, the option considered for this assessment was to replace the existing signs with larger signs to satisfy the MUTCD requirements and improve the appearance of the sign. Estimates were made on the cost per square foot of sign and the number of square feet added per sign. These costs estimates are

based on sign design concepts, not actual detailed sign designs. As shown in Table 6, the cost of replacing existing mainline logo signs statewide with new larger signs that include distance information is estimated at \$10.5 million. There might also be substantial additional costs to replace the sign structures to accommodate the larger signs.

It is evident that the primary benefit of having distance information on mainline logo signs is motorist convenience. VDOT, as with most businesses and government agencies, has experienced a substantial revenue shortfall and is seeking ways to reduce costs rather than add new costs. Incurring cost to revise an existing program that primarily serves to improve the convenience of motorists is not likely to be viewed as a funding priority.

**Table 6. Estimated Costs for Replacing Mainline Logo Signs Statewide in Virginia**

|                                                        |              |
|--------------------------------------------------------|--------------|
| Number of mainline structures                          | 1,645        |
| Total square feet of signing on mainline               | 228,645      |
| Cost per square foot for 1 sign                        | \$40         |
| Added square feet of sign                              | 32,900       |
| Total square feet of signing on mainline for new signs | 261,545      |
| Total cost for larger signs                            | \$10,461,800 |
| Average cost per sign                                  | \$6,360      |

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APPENDIX A

**SIGN LEGIBILITY SURVEY FOR ADDING DISTANCE TO MAINLINE LOGO SIGNS**

Date 4-16

Time \_\_\_\_\_

Name \_\_\_\_\_

Section \_\_\_\_\_

Left eye \_\_\_\_\_

Right eye \_\_\_\_\_

Both \_\_\_\_\_

I am studying the readability of the distance information on mainline logo signs. As you drive along this test section, I will ask you questions. When you are first able to answer the question, please answer out loud to me. For example, I may ask you to tell me the distance to McDonald's. As soon as you see the McDonald's logo and can read the distance, say out loud 2.6 mi. Or I may ask you to read the next logo sign. When you can read the sign, say out loud Food Exit 250A, Wendy's. As a reminder, your first responsibility is to drive safely. Second is to answer my questions. Drive as you normally would in a state vehicle. Please stay in the right lane to exit 132. It may be necessary to slow down to avoid trucks blocking your view. Do you have any questions?

**Sign 1 Look for the Holiday Inn panel and tell me the distance to it.**

1. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

**Sign 2 Look for the KFC panel and tell me the distance to it.**

2. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

**Sign 3 Look for the Sheetz panel and tell me the distance to it.**

3. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

4. Were the signs easy to read? Yes No If no, please explain why.

5. Comments?

**Sign 4 Read the next logo sign.**

6. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

**Sign 5 Read the next logo sign.**

7. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

**Take exit 132 and loop around and take I-81 NB to head back to the TMC.**

**Sign 6 Look for the Econo Lodge panel and tell me the distance to it.**

8. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

**Sign 7 Look for the Arby's panel and tell me the distance to it.**

9. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

**Sign 8 Look for the Gomart panel and tell me the distance to it.**

10. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

11. Were the signs easy to read? Yes No If no, please explain why.

12. Comments?

**Sign 9 Read the next logo sign.**

13. Distance when began reading sign \_\_\_\_\_  
Speed \_\_\_\_\_

14. Were the signs easy to read? Yes No If no, please explain why.

15. Comments?

**General**

16. Is the distance information:

Hard to read Somewhat hard to read OK Easy to read Visibly stands out

17. What is your opinion of adding distance information on mainline logo signs?

18. Do you typically \_\_\_\_\_ read everything on the logo sign or \_\_\_ scan the sign\_\_\_\_\_

19. Do you typically \_\_\_\_\_ read everything on the logo sign \_\_\_ scan the sign\_\_\_\_\_ or  
\_\_\_\_\_both

20. Please provide any other general comments on the directional signs.

Gender: Male Female                      Age: under 40 40-60 over 60

Thank you very much. I greatly appreciate your participation in this study!

# LEGIBILITY STUDY SIGNS



Sign 1



Sign 2



Sign 3



Sign 4



Sign 5



Sign 6



Sign 7



Sign 8



**Sign 9**

APPENDIX B

SIGN SURVEY ON TRAVELER INFORMATION

VDOT wants your opinion on traveler information signs. Please answer the following questions. In most cases, please circle your response.

- 1. Are you a visitor to the area? Yes No
2. Did you see these signs on Interstate 64? Yes No



- 3. Do you notice anything different about these signs? Yes No If yes, what?
4. What is your opinion on the distance information shown on these signs?
Hard to read Somewhat hard to read OK Easy to read
5. Was the distance information helpful to you? On a scale of 1 to 5, with 1 being no help and 5 most helpful, please rate the signs: 1 2 3 4 5
6. Did you slow down to read the signs? Yes No
7. Please provide any other general comments on the distance information.

Gender: Male Female Age: under 40 40-60 over 60

Home state: \_\_\_\_\_ If Virginia, locality: \_\_\_\_\_

Thank you very much for completing the survey.