Evaluation of Tennessee Reference Markers

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EVALUATION OF TENNESSEE REFERENCE MARKERS

by

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in cooperation with

Tennessee Department of Transportation
State of Tennessee

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June 2001
January 25, 2002

Mr. Mike Presley
Tennessee Dept. of Transportation
Planning Division
Suite 900
James K. Polk Building
505 Deaderick Street
Nashville, TN 37243-0334

Subject: Evaluation of Reference Markers
        Project No. RES 1183
        Contract No. CUT 230

Dear Mr. Presley:

As you requested, I am providing a "camera-ready" copy of the report titled "Evaluation of Tennessee Reference Markers"; including a completed Technical Report Documentation Page. I will be available if you have questions concerning this transmittal.

Sincerely,

Jerry G. Pigman, P.E.
Research Engineer

Enclosures
Reference markers were installed on sections of interstates and freeways in Tennessee in 1999 and 2000. An evaluation was conducted to determine if the use of reference markers at spacings of 0.2-mile intervals could improve the effectiveness of emergency response and incident management processes. The evaluation included a general observational survey, meetings with emergency response personnel, and an opinion survey of the application, placement, color, and overall benefits of the reference markers. The condition of the markers was found to be very good and there appeared to be only minor problems within the relatively short period of time since installation.

Interview and surveys of participants in the emergency response process and others involved in traffic management systems indicate nearly unanimous endorsement of the reference markers. Dispatch personnel indicate that drivers are using the markers for identification of locations where incidents occur, with the resultant effect of a more efficient process for responding to incidents and crashes.

Results indicate highway agency and emergency response personnel generally feel that spacing of the reference markers at 0.2-mile intervals was satisfactory. Responses also indicated increased benefit related to the distinguishable color of blue for the reference markers, specifically related to the consistency with motorists service signs. The increased size of the signs over that used for standard milepost signs did not appear to be an issue with any of those offering opinions and the 18 by 48-inch size is recommended for future use.
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EXECUTIVE SUMMARY

Reference markers have been installed on sections of interstates and freeways in four cities in Tennessee in 1999 and 2000. Installations were completed in Nashville and Knoxville in June 1999. Installations in Memphis and Chattanooga were completed in July 2000. An evaluation was conducted to determine if the use of reference markers at spacings of 0.2-mile intervals on interstates and freeways could improve the effectiveness of the emergency response and incident management processes.

The evaluation included a general observational survey of the reference markers installed in the four cities, meetings with personnel involved in the incident management process, and an opinion survey of the application, placement, color, and overall benefits of the reference markers. Efforts were made to obtain opinions of individuals who had exposure to the marker projects and understood the intent and usage of the markers. The condition of the markers was found to be very good and there appeared to be only minor problems with maintenance within the relatively short time period since installation. Most of the markers were installed on median barrier walls and had less exposure to the routine damage problems related to maintenance/mowing and errant vehicles. Interviews and surveys of participants in the emergency response process and others involved in the traffic management systems indicate nearly unanimous endorsement of the reference markers. Dispatch personnel have indicated that drivers are using the markers for identification of locations where incidents occur, with the resultant effect of a more efficient process for responding to incidents and crashes. Tow operators have noted special benefits from the reference markers when calls for assistance were received directly from motorists.

Highway agency personnel and emergency response personnel have also expressed satisfaction with the markers. Results indicate highway agency and emergency response personnel generally feel that spacing of the reference markers at 0.2-mile intervals was satisfactory. It is apparent that more frequently spaced markers offer additional benefit and increased safety in curved sections, and where there are missing markers due to maintenance or vandalism problems. Considering all factors, it appears that the reduced clutter and economy of markers at 0.2-mile intervals outweighs increased benefits from more frequently spaced markers.

Opinions were also solicited concerning the use of reference markers with blue background color as compared to green. Responses indicated some increased benefit related to the distinguishable color of blue and the consistency with motorists service signs. There was also some support for use of the green reference markers. The green color symbolizes the standard guide sign and the color results in a marker similar to the standard milepost.
1.0 BACKGROUND

The need for improved incident management response is related to the direct and indirect costs of highway delays, congestion, and secondary crashes. Consequences of incidents and crashes are compounded when the occurrences are on major freeways, as compared to lower volume roadways. The effects are even more critical when the demands of peak hour traffic is introduced within large urban areas. Economic losses associated with delay are critical to many commercial vehicle operations and inconvenience experienced by others is also a major issue.

Increased growth in terms of population and employment in Tennessee’s four largest cities has resulted in positive economic benefits. However, these cities (Chattanooga, Knoxville, Memphis, and Nashville) have experienced increased traffic volumes with the accompanying growth and the net benefit has been compromised. Quick response to incidents is critical to lessen the impacts of delay when partial or total closure occurs on major freeways. A key component of the overall incident management process is the detection and verification of a specific occurrence. A key element of the emergency response process is the timeliness and accuracy of a location information provided to responding personnel. The report of an incident or crash is typically initiated by the driving public, and the responsiveness of emergency personnel is dependent upon the accuracy of location information. In addition, personnel in dispatch centers must make decisions about the location information and determine the appropriate emergency units to notify.

In order to improve the emergency response process in Tennessee’s four largest cities, a system of reference markers was installed in 1999 and 2000 on the major freeways within those areas. The reference markers were placed at 0.2-mile intervals on mainlines of major freeways within the four urban areas to supplement the current milepoint referencing system. The standard color used for the mainline reference marker was white letters on blue background, and the typical size was 18 by 48 inches with 8-inch letters (a schematic of a mainline marker is presented Figure 1). Additional markers were placed on ramps of directional interchanges of interstate highways, with a typical size of 24 by 30 inches and 6-inch white letters on blue background (a schematic of a ramp marker is presented in Figure 2). Markers were initially placed (for installations in Nashville and Knoxville) on entrance and exit ramps at interchanges with surface streets; however, this was later discontinued. It was determined by the Tennessee DOT that there was not sufficient benefit since these ramps are typically in close proximity to services and often have street name signs nearby. In addition, these signs would often interfere with roadside maintenance operations such as mowing.

2.0 OBJECTIVES

The objective of this evaluation was to determine if the installation of reference markers at intervals more frequent than the one-mile increments of standard mileposts would improve the ability of emergency personnel to respond to incidents or crashes on the freeway systems in the Tennessee cities of Chattanooga, Knoxville, Memphis, and Nashville.
A secondary issue was to determine if the experience gained in Tennessee could be used to support a recommendation for adopting a national standard for inclusion of reference markers in the Manual on Uniform Traffic Control Devices.

3.0 GENERAL PROVISIONS FOR MARKER REFERENCE INSTALLATIONS

The reference markers were installed in Chattanooga, Knoxville, Memphis, and Nashville in 1999 and 2000. Contracts were awarded separately for each city, and the general provision was for spacing of the markers at 0.2-mile intervals, or one-fifth the distance between mile markers. The numbering scheme was to be even numbers at 0.2-mile intervals. Exceptions were to apply when the minimum visibility distance of 500 feet could not be achieved, and the spacing of markers would then be decreased. Wherever possible, the markers were to be installed atop median barrier walls, with marker designations on both sides of the sign blank (Figure 3). A similar scheme of 0.2-mile intervals and back-to-back marker designations on the signs was used on roadways with grass medians of 60 feet or less, with the sign posts ground-mounted in the center of the median (Figure 4). At locations with medians 60 feet or more in width, single ground-mounted markers were placed on each side of the median at a distance of 12 feet from the edge of pavement or 6 feet from the edge of the shoulder for inside-shoulder installations (Figure 5). For raised medians, mainline markers were placed in the center of the median (Figure 6); otherwise, provisions were made to accommodate landscaping by mounting the signs in both directions at a distance of 12 feet from the edge of the near-side pavement (Figure 7).

Reference markers were also installed on the ramps of directional interchanges between interstate highways. Mounting location preference was the inside of the ramps at 100 feet beyond the gore at the beginning of the ramp, 100 feet prior to the gore at the end of the ramp, and at two locations equidistant between the two markers. A sequence plate was to be attached to the ramp marker increasing in the direction of travel on the ramp. Normal exit and entrance ramps were to have reference markers installed on the inside of the ramp at 300-foot intervals, beginning at 300 feet beyond the exit gore sign for exit ramps or beyond the beginning of the ramp for entrance ramps. Schematics showing the ramp marker placement on bridge parapets (Figure 8) and inside shoulder grass sections (Figure 9) are also presented.

4.0 SUMMARY OF REFERENCE MARKER INSTALLATIONS

Presented in Table 1 is a summary of the reference marker installations for the cities of Nashville, Knoxville, Memphis, and Chattanooga. As noted in the table and previously discussed, there were several applications of reference markers. The specific applications were categorized by installation location (mainline or ramp), mounting location (ground, parapet, or barrier), and mounting type (single or double). There was a total of 2,778 markers installed in the four cities, including 1,074 ramp markers and 1,704 mainline markers. A high percentage of the ramp markers, 994 of the total 1,074 were ground-mounted. A high percentage of the ground-mounted ramp markers were installed in Nashville and Knoxville due to the previously mentioned decision.
by the Tennessee DOT to discontinue installing ramp markers at interchanges with surface streets prior to the Memphis and Chattanooga contracts. However, only 499 of the 1,704 mainline markers were ground-mounted. This was consistent with the previously noted contract requirement to install mainline markers atop median barrier walls where possible. This permitted the sign posts to be placed away from the flow of traffic where contact and impacts would be unlikely. Likewise, placement of signs/markers on the median barrier wall allowed the use of back-to-back sign blanks which were visible in both directions. The assumption was made that for travel in either direction, the markers would be no farther than 500 feet from a driver, so that the driver would be able to see ahead 500 feet or turn in the opposite direction and observe the marker on the back of the next marker behind. Obviously, the curvature of the roadway would be a factor, and the contractor was instructed to install additional markers if geometrics restricted the ability to observe the next marker ahead.

Presented in Table 2 is a summary of the coverage areas for installations of reference markers in each of the four cities. Maps showing the extent of reference marker installations are presented for the four cities in Figures 10-13. Included were interstate routes in the urban areas, in addition to a section of US 27 in the Chattanooga area. The largest number of markers was installed in the Nashville area (1,507) over a distance of 99.8 miles, followed by Knoxville with 814 markers over a distance of 58.6 miles. Smaller numbers were installed in Memphis (302 markers) over a distance of 43.4 miles, and 155 markers in Chattanooga covering 23.8 miles. Additional detail is summarized for reference marker installations in each city by providing mileage by route and milepoint range in Table 3.

5.0 EVALUATION PROCEDURES AND RESULTS

An observational survey was conducted to determine the condition of reference markers installed in each of the four cities in Tennessee. The general conditions of the markers were observed and photographs were taken to show the types of installations in each city. The observations and photographs were made over a period of time between April 2000 and March 2001. Included in Figures 14-15 are photographs of typical applications of reference markers in Tennessee as observed during the inspections.

Efforts were also undertaken to obtain information concerning opinions of individuals who had exposure to the markers and understood the intent of installing the markers. A survey form was developed for use in soliciting information from those involved in the incident management process. Through meetings with incident management personnel in teams in Chattanooga and Nashville, input was received through interactions with the group and opinions were documented on the survey forms. Responses were received from 72 representatives involved in the incident management process. Two-thirds (48) of the responses were received from the Chattanooga area, with 16 from Nashville, 6 from Knoxville, and 2 from Memphis. Included were a variety of incident management-related personnel, in addition to a significant number of personnel who were part of the HELP Program within the Tennessee Department of Transportation. This program is
A service patrol which offers first-level response and assistance for the following: 1) location of an incident, 2) response to the scene with appropriate equipment, and 3) prompt clearance of the scene and restoration of the roadway capacity. Reference markers have proven to be an integral part of the overall response plan, with critical locations information being provided to the service patrol units. Photographs of the incident response units being used to respond to an incident in Chattanooga area and adjacent to one of the reference markers are shown in Figure 16.

A copy of the survey form and combined responses from all of the four cities in Tennessee are included as Figure 17. The focus of this survey was to determine opinions concerning the general use of reference markers and to determine whether spacing and color of the markers installed in Tennessee were acceptable in conveying the message intended. It was found that 53 of the 72 indicated that they had received calls from motorists or were aware of the use of reference markers in describing a location where emergency response was needed. However, it was noted that only 30 percent felt that the public generally understood the application and purpose of the markers. A much higher percentage (77) noted that incidents had occurred where the markers had a positive effect on the response times of emergency response personnel. A very high percentage (96) felt that the 0.2-mile spacing of the markers was appropriate, even though 57 percent indicated that they were aware of motorists being unable to observe a marker with the 0.2-mile spacing. Again, a very high percentage (94) felt that use of the reference marker sign with white letters on a blue background was appropriate, as opposed to only 42 percent expressing the opinion that the use of white letters on green signs was appropriate.

Approximately one-third of those responding indicated that they were aware of maintenance problems associated with the reference markers. Following is a summary of comments received from those responding to the survey when asked to expand on issues related to maintenance, design or placement, and additional installations:

- Replacement of damaged or missing signs is low
- Reference markers are a great help in locating accidents
- Public needs to be made aware of markers and their purpose
- Reference markers should be larger for easier reading
- Orange/red signs may be better for emergency location use
- Motorist-aid call boxes would also be helpful along interstates

### 6.0 SUMMARY AND RECOMMENDATIONS

Reference markers in the cities of Chattanooga, Knoxville, Memphis, and Nashville have been shown to be a beneficial supplement to the emergency response process. A major initiative by the Tennessee Department of Transportation to elevate incident response and prompt roadway clearance has included reference markers. This initiative began in July 1999 when the HELP Program was started in Knoxville and Nashville as a means of providing freeway motorist assistance and incident response. The program has since been expanded to include freeways in Chattanooga and Memphis. Reference markers have been installed on 225 miles of freeways in the four cities and serve as a critical component to the emergency response process for
identification and location of an incident.

An accurate roadway reference system in the form of reference markers helps insure prompt attention and response to an incident. Interviews and surveys of participants in the emergency response process and other representatives involved in traffic management systems have offered nearly unanimous endorsement of the reference markers. Dispatch personnel and tow operators have indicated that drivers are routinely using the markers for identification of the location where an incident has occurred. The resultant effect has been a more efficient process for responding to incidents and crashes.

From a survey of those involved in the emergency response process in Tennessee, there was very high approval and support of use of the reference marker sign using white letters/symbols on a blue background (as opposed to white on green) and spacing of the markers at 0.2-mile spacings (as opposed to 0.1-mile spacings). Observations and information collected as part of the evaluation of reference markers in Tennessee, as well as previous evaluations in Kentucky (1, 2), indicate that placement of markers at either 0.1 or 0.2-mile can benefit the emergency response process. Considering the minimal reduction in benefits that could be expected from the greater spacings, and the decreased cost, the 0.2-mile spacing of reference markers is recommended at this time. Exceptions should be considered for locations where curvature of the roadway would not allow a driver to see a marker at every point on the road when installed at 0.2-mile spacings. Color of the reference markers is important from the perspective of standardization and the ability of motorist to distinguish the markers for emergency notification. The “white on green” marker symbolizes the standard guide sign and arguments could be made for use of a marker which is similar to the standard milepost marker. The “white on blue” marker is representative of motorist service signs, including police services and rest areas. Either color of marker could be used with supportive arguments from the Manual on Uniform Traffic Control Devices (3). Documentation was presented in the initial proposal for reference marker installation as part of the ARTIMIS project in northern Kentucky and Cincinnati indicating that there are fewer drivers color deficient for blue than green. It was also noted that red/green is the most common color weakness and that blue/yellow is less common. Therefore, if the objective was to provide signing with the least potential for color weakness problems, then the “white on blue” markers would be more clearly distinguishable to a higher percentage of drivers. Based on the overall acceptability of both colors of markers and what appears to be increased conspicuity of the color blue as compared to green, it is recommended that a standardized reference marker be developed with white letters on a blue background.

Installations in each of the four cities had reference markers installed on both median barriers and on either grass shoulders or grass medians. From observations and from previous research (2), it appears that considerably fewer problems occurred on sections where the markers were placed on the median barrier wall. This result was expected from the standpoint of less exposure to mowing operations and errant vehicles which could come into contact with the posts and/or markers. Because of the reduced exposure and increased visibility due to the close proximity to the driving lanes, it is recommended that markers be placed on median barrier walls.
where practical.

Ramp reference markers placed on ramps of directional interchanges were also found to be a beneficial and necessary part of an identification and location system. The use of a ramp sequence plaque with numbers increasing in the direction of travel served to more clearly identify the location and are recommended for use on other installations of reference markers.

The size of the reference markers was significantly larger than the standard milepost marker because of the need to place more letters on the markers to distinguish the direction, route indicator, mile number, and tenth of a mile number. The largest milepost marker is 10 inches by 36 inches compared to the largest reference markers with dual interstate shields which are 18 inches by 48 inches. The difference in marker size did not appear to be an issue with any of those offering opinions and is recommended for use when installing reference markers.

7.0 REFERENCES


Table 1. Summary of Reference Marker Installation Quantities

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Table 2. Summary of Reference Marker Installation Coverage Areas

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<th>Total Ramp Markers</th>
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## Table 3. Summary of Reference Marker Mileage by Route and Milepoint Range

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<td><strong>Total</strong></td>
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<td>M.P. 0.0 to M.P. 12.0</td>
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<td>(Excludes m.p. 3.0 to 5.0)</td>
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Figure 1. Schematic of Mainline Reference Marker Used in Tennessee

MAIN LINE SIGNING

BACKGROUND: BLUE (REF.)
COPY: WHITE (REF)

6 S.F.
0.080" SHEET ALUMINUM

RED (REF)

1 ½" RADIUS (TYP.)

½" BORDER (TYP.)
Figure 2. Schematic of Ramp Reference Marker Used in Tennessee

DIRECTIONAL RAMP SIGNING

1 1/2" RADIUS (TYP.)

24"

30"

440W TO 65N

3.5"

6" "C"

2.5"

6" "C"

2.5"

6" "C"

3.5"

6" "C"

3"

1"

6" "C"

1"

1/2" BORDER (TYP.)

8"

3/4" RADIUS (TYP.)

BACKGROUND: BLUE (REF.)
COPY: WHITE (REF)

5.4 S.F.
0.080" SHEET ALUMINUM
Figure 3. Schematic of Mainline Marker Installation for Median Barrier Wall (Mounted Back-to-Back)

1½" x 1½" PERFORATED/KNOCKOUT @ 1.702 LBS./FT.

4' - 0"

2' - 0"

4' - 3"

4½"

6"

12"

2½"

2½"

MAIN LINE SIGNS MOUNTED ON CONC. MED. BARRIER MOUNTED BACK TO BACK.
Figure 4. Schematic of Mainline Marker Installation for Grass Medians 60 Feet or Less in Width (Ground-Mounted Back-to-Back)

SINGLE SIGNING MOUNTED BACK TO BACK

EDGW OF ROADWAY

>30'-0"

>30'-0"

POST 1½" PERFORATED/KNOCKOUT @ 1.702 LBS./FT.

A 4'-0" MIN. ABOVE OF ROADWAY OR 4'-0" ABOVE GROUND.

NOTE: 500' MINIMUM CLEAR VISIBILITY IN EACH DIRECTION OF TRAVEL OR SINGLE SIGNING REQUIRED.

MAIN LINE

TYPICAL MEDIAN LESS THAN 60'-0"

ALSO APPLIES FOR SECTIONS WITH GUARDRAIL IN MEDIAN.
Figure 5. Schematic of Mainline Marker Installation for Grass Medians 60 feet or More in Width (Ground-Mounted Single)

* FOR ANCHOR SLEEVE DETIALS SEE T-S-11.
* FOR "MILE POST DETAILS".

0.080" THICK SHEET ALUM.

POST 1½" PERFORATED/KNOCKOUT @ 1.702 LBS./FT.

12'-0" 6'-0" 6'-0" MIN. INSIDE SHLD.

0.42 1/1 (TYP.) USUAL SLOPE

EDGE OF SHLD.

EDGE OF PAVEMENT

MAIN LINE TYPICAL INSIDE SHLD. SECTION (SINGLE SIGNING)
Figure 6. Schematic of Mainline Marker Installation for Raised Medians (Ground-Mounted Back-to-Back)

- Single signing mounted back to back
- 1½" x 1½" perforated/knockout @ 1.702 lbs./ft.
- 6'-0" min. above of roadway or 4'-0" above ground
- Typical raised median
- Also applies for sections with guardrail in median

Note: 500' minimum clear visibility in each direction of travel or single signing required.
Figure 7. Schematic of Mainline Marker Installation for Raised Medians with Landscaping (Ground-Mounted Single)

**Main Line**

**Typical Raised Median**

(Single Signing)

- 1½" x 1½" Perforated/Knockout @ 1.702 lbs./ft.
- 6'-0" min. above of roadway or 4'-0" above ground.

- Landscaping

- Mainline

- Typical Raised Median

- Single Signing

- Edge of Roadway

- 48" x 12'-0"
Figure 8. Schematic of Ramp Marker Installation for Bridge Parapets (Single Mounting)

DIRECTIONAL & EXIT RAMP SIGNING
SINGLE SIGNING MOUNTED ON BRIDGE PARAPET w/HANDRAIL

NOTE: BRIDGES WITHOUT HANDRAILS USE SAME DETAIL w/SUPPORTS AS SIGN MOUNTED CONC. MED. BARRIER.
Figure 9. Schematic of Ramp Marker Installation for Inside Grass Shoulder Section (Single Mounting)

- 0.080" THICK SHEET ALUM.
- FOR ANCHOR SLEEVE DETAILS SEE T-S-11 FOR "MILE POST DETAILS".

POST 1 1/2" PERFORATED/KNOCKOUT @ 1.702 LBS./FT.

12'-0"

6'-0" MIN. 6'-0"

(2'-0" BEHIND G.R.) INSIDE SHLD.

18° ± 6:1 (TYP.) USUAL SLOPE

0.42 1/1 (TYP.) EDGE OF SHLD.

EDGE OF PAVEMENT

DIRECTIONAL & EXIT RAMP SIGNING
TYPICAL INSIDE SHLD. SECTION
(SINGLE SIGNING)
Reference Marker Coverage
1-24: From M.P. 32.2 to M.P. 66.4
1-40: From M.P. 192.0 to M.P. 227.0
1-65: From M.P. 65.0 to M.P. 97.4
1-265: From M.P. 0.4 to M.P. 2.0
1-440: From M.P. 0.4 to M.P. 7.4
Figure 11. Map Showing Reference Marker Installations - Knoxville

Reference Marker Coverage
1-40: From M.P. 0.0 to M.P. 18.6
1-55: From M.P. 6.2 to M.P. 12.2
1-240: From M.P. 12.0 to M.P. 30.8

Reference Marker Coverage
1-40: From M.P. 368.6 to M.P. 405.0
1-75: From M.P. 107.8 to M.P. 117.6
1-275: From M.P. 0.4 to M.P. 2.6
1-640: From M.P. 0.2 to M.P. 10.4
Figure 13. Map Showing Reference marker Installations - Chattanooga

Reference Marker Coverage
I-24: From M.P. 171.2 to M.P. 185.0
I-75: From M.P. 0.0 to M.P. 12.0 (Excludes M.P. 3 to M.P. 5 due to construction)
Figure 14. Photographs of Mainline Reference Markers in Tennessee

Figure 14a. Knoxville

Figure 14b. Knoxville
Figure 14c. Chattanooga

Figure 14d. Nashville
Figure 15. Photographs of Ramp Reference Markers in Tennessee

Figure 15a. Nashville

Figure 15b. Nashville

Figure 15c. Nashville
Figure 16. Photographs of Incident Response Units in Tennessee

Figure 16a. Chattanooga

Figure 16b. Chattanooga
EVALUATION OF REFERENCE MARKERS
Prepared by the University of Kentucky Transportation Center
(Return survey to Jerry Pigman at Fax No. 859-257-1815)
Phone: 859-257-4513email: jpigman@ engr.uky.edu

1. Are you familiar with the reference markers which have been installed as part of the TNDOT freeway signing projects in the Tennessee area? ___ Yes ___ No

If you are familiar with the markers, what is your personal impression of the effects or potential effects which the markers may have on the emergency response process? 

___ Very Beneficial ___ Possibly Beneficial ___ Not Beneficial

2. Have you received calls from motorists or are you aware of anyone who has used the reference markers in their description of the location where emergency response is needed? ___ Yes ___ No ___ Unknown

If you have received calls or are aware of incidents where these markers have been used to describe the location of an incident, was there a positive impression of the markers? ___ Yes ___ No ___ Unknown

Do you feel that the public generally understands the markers and knows their purpose? ___ Yes ___ No ___ Unknown

3. Are you aware of incidents where the reference markers have had a positive effect on the response times as a result of emergency personnel being provided better information to locate the incident? ___ Yes ___ No ___ Unknown

Are there cases where the reference markers have had a negative effect on response times? ___ Yes ___ No ___ Unknown

4. Please provide your opinion concerning the frequency of reference marker spacing:

Spacing of markers for TNDOT projects is 0.2 mile or approximately 1,000 feet. ___ Appropriate ___ Not Appropriate ___ No Opinion

Spacing of markers for some projects in other states is 0.1 mile or approximately 500 feet. ___ Appropriate ___ Not Appropriate ___ No Opinion
Are you aware of motorists being unable to observe a marker when using the 0.2-mile spacing of reference markers?

30. Yes 23. No 18. Unknown

5. Please provide your opinion concerning color of the reference markers for effective emergency response use:

The TNDOT markers are white numbers and letters on blue background.

64. Appropriate 4. Not Appropriate 5. No Opinion

The Lexington, KY markers are white numbers and letters on green background.


1.06 Where interstate routes run concurrently, should only the dominant single route symbol or double route symbols should be used on the reference markers?


7. Do you feel that reference markers should be placed on other highways in your area to assist with the emergency response process?

62. Yes 8. No 1. No Opinion

1.08 Are you aware of any maintenance problems with the reference markers or posts?

18. Yes (If yes, explain below) 42. No 10. Unknown

1.09 Do you feel that changes should be made in the design or placement of the reference markers to make them more understandable and usable for the public?

15. Yes (If yes, explain below) 42. No 10. No Opinion

1.10 Please provide other comments related to the reference markers.

(maintenance issues, design or placement of the markers, expanded use)

- Replacement of damaged or missing signs is slow
- The reference markers are a great help in locating accidents
- The public needs to be made aware of the signs and their purpose
- Reference signs should be larger for easier reading
- Orange/red signs may be better for emergency location use
- Motorist aid call boxes would also be helpful along the interstate
Appendix
Survey Forms and Results
1. Are you familiar with the reference markers which have been installed as part of the TNDOT freeway signing projects in the Chattanooga area? _43_ Yes _6_ No

If you are familiar with the markers, what is your personal impression of the effects or potential effects which the markers may have on the emergency response process?

_41_ Very Beneficial _7_ Possibly Beneficial _0_ Not Beneficial

2. Have you received calls from motorists or are you aware of anyone who has used the reference markers in their description of the location where emergency response is needed?

_32_ Yes _16_ No

If you have received calls or are aware of incidents where these markers have been used to describe the location of an incident, was there a positive impression of the markers?

_28_ Yes _5_ No _13_ Unknown

Do you feel that the public generally understands the markers and knows their purpose?

_11_ Yes _26_ No _11_ Unknown

3. Are you aware of incidents where the reference markers have had a positive effect on the response times as a result of emergency personnel being provided better information to locate the incident?

_28_ Yes _10_ No _10_ Unknown

Are there cases where the reference markers have had a negative effect on response times?

_3_ Yes _31_ No _12_ Unknown

4. Please provide your opinion concerning the frequency of reference marker spacing:

Spacing of markers for TNDOT projects is 0.2 mile or approximately 1,000 feet.

_43_ Appropriate _3_ Not Appropriate _2_ No Opinion

Spacing of markers for some projects in other states is 0.1 mile or approximately 500 feet.

_19_ Appropriate _13_ Not Appropriate _15_ No Opinion
Are you aware of motorists being unable to observe a marker when using the 0.2-mile spacing of reference markers?

20 Yes  18 No  10 Unknown

5. Please provide your opinion concerning color of the reference markers for effective emergency response use:

The TNDOT markers are white numbers and letters on blue background.

41 Appropriate  4 Not Appropriate  3 No Opinion

The Lexington, KY markers are white numbers and letters on green background.

13 Appropriate  17 Not Appropriate  17 No Opinion

1.06 Where interstate routes run concurrently, should only the dominant single route symbol or double route symbols be used on the reference markers?

14 Single  28 Double  6 No Opinion

7. Do you feel that reference markers should be placed on other highways in your area to assist with the emergency response process?

41 Yes  6 No  0 No Opinion

1.08 Are you aware of any maintenance problems with the reference markers or posts?

10 Yes (If yes, explain below)  32 No  6 Unknown

1.09 Do you feel that changes should be made in the design or placement of the reference markers to make them more understandable and usable for the public?

9 Yes (If yes, explain below)  31 No  6 No Opinion

1.10 Please provide other comments related to the reference markers.

(maintenance issues, design or placement of the markers, expanded use ?)

- Replacement of damaged or missing signs is slow
- Opinion that ads on television may increase public awareness of signs
- Overhead bridge mount signs would also be helpful along the interstate
- Reference signs should be larger for easier reading
- Orange/red signs may be better for emergency location use
- Motorist aid call boxes would also be helpful along the interstate
- Place markers in rural areas where landmarks are few
1. Are you familiar with the reference markers which have been installed as part of the TNDOT freeway signing projects in the Knoxville area? 5 Yes 0 No

If you are familiar with the markers, what is your personal impression of the effects or potential effects which the markers may have on the emergency response process? 4 Very Beneficial 2 Possibly Beneficial 0 Not Beneficial

2. Have you received calls from motorists or are you aware of anyone who has used the reference markers in their description of the location where emergency response is needed? 5 Yes 1 No

If you have received calls or are aware of incidents where these markers have been used to describe the location of an incident, was there a positive impression of the markers? 3 Yes 0 No 3 Unknown

Do you feel that the public generally understands the markers and knows their purpose? 1 Yes 5 No 0 Unknown

3. Are you aware of incidents where the reference markers have had a positive effect on the response times as a result of emergency personnel being provided better information to locate the incident? 4 Yes 2 No 0 Unknown

Are there cases where the reference markers have had a negative effect on response times? 1 Yes 2 No 3 Unknown

4. Please provide your opinion concerning the frequency of reference marker spacing:

Spacing of markers for TNDOT projects is 0.2 mile or approximately 1,000 feet. 6 Appropriate 0 Not Appropriate 0 No Opinion

Spacing of markers for some projects in other states is 0.1 mile or approximately 500 feet. 2 Appropriate 2 Not Appropriate 0 No Opinion
Are you aware of motorists being unable to observe a marker when using the 0.2-mile spacing of reference markers?

_0_ Yes  _4_ No  _1_ Unknown

5. Please provide your opinion concerning color of the reference markers for effective emergency response use:

The TNDOT markers are white numbers and letters on blue background.

_6_ Appropriate  _0_ Not Appropriate  _0_ No Opinion

The Lexington, KY markers are white numbers and letters on green background.

_2_ Appropriate  _1_ Not Appropriate  _3_ No Opinion

1.06 Where interstate routes run concurrently, should only the dominant single route symbol or double route symbols should be used on the reference markers?

_1_ Single  _3_ Double  _2_ No Opinion

7. Do you feel that reference markers should be placed on other highways in your area to assist with the emergency response process?

_5_ Yes  _0_ No  _1_ No Opinion

1.08 Are you aware of any maintenance problems with the reference markers or posts?

_0_ Yes (If yes, explain below)  _3_ No  _2_ Unknown

1.09 Do you feel that changes should be made in the design or placement of the reference markers to make them more understandable and usable for the public?

_1_ Yes (If yes, explain below)  _3_ No  _1_ No Opinion

1.10 Please provide other comments related to the reference markers. (maintenance issues, design or placement of the markers, expanded use?)

- Use the media to educate the public on the signs
EVALUATION OF REFERENCE MARKERS
Prepared by the University of Kentucky Transportation Center
(Return survey to Jerry Pigman at Fax No. 859-257-1815)
Phone: 859-257-4513  email: jpigman@engr.uky.edu

1. Are you familiar with the reference markers which have been installed as part of the TNDOT freeway signing projects in the Memphis area?  _2_ Yes  _0_ No

If you are familiar with the markers, what is your personal impression of the effects or potential effects which the markers may have on the emergency response process?
_1_ Very Beneficial  _1_ Possibly Beneficial  _0_ Not Beneficial

2. Have you received calls from motorists or are you aware of anyone who has used the reference markers in their description of the location where emergency response is needed?
_1_ Yes  _1_ No

If you have received calls or are aware of incidents where these markers have been used to describe the location of an incident, was there a positive impression of the markers?
_1_ Yes  _1_ No  _0_ Unknown

Do you feel that the public generally understands the markers and knows their purpose?
_0_ Yes  _2_ No  _0_ Unknown

3. Are you aware of incidents where the reference markers have had a positive effect on the response times as a result of emergency personnel being provided better information to locate the incident?
_1_ Yes  _1_ No  _0_ Unknown

Are there cases where the reference markers have had a negative effect on response times?
_1_ Yes  _0_ No  _1_ Unknown

4. Please provide your opinion concerning the frequency of reference marker spacing:

Spacing of markers for TNDOT projects is 0.2 mile or approximately 1,000 feet.
_1_ Appropriate  _0_ Not Appropriate  _1_ No Opinion

Spacing of markers for some projects in other states is 0.1 mile or approximately 500 feet.
_0_ Appropriate  _0_ Not Appropriate  _2_ No Opinion
Are you aware of motorists being unable to observe a marker when using the 0.2-mile spacing of reference markers?

- 0. Yes
- 0. No
- 2. Unknown

5. Please provide your opinion concerning color of the reference markers for effective emergency response use:

The TNDOT markers are white numbers and letters on blue background.

- 1. Appropriate
- 0. Not Appropriate
- 1. No Opinion

The Lexington, KY markers are white numbers and letters on green background.

- 1. Appropriate
- 0. Not Appropriate
- 1. No Opinion

1.06 Where interstate routes run concurrently, should only the dominant single route symbol or double route symbols should be used on the reference markers?

- 1. Single
- 0. Double
- 1. No Opinion

7. Do you feel that reference markers should be placed on other highways in your area to assist with the emergency response process?

- 1. Yes
- 1. No
- 0. No Opinion

1.08 Are you aware of any maintenance problems with the reference markers or posts?

- 0. Yes (If yes, explain below)
- 1. No
- 1. Unknown

1.09 Do you feel that changes should be made in the design or placement of the reference markers to make them more understandable and usable for the public?

- 0. Yes (If yes, explain below)
- 1. No
- 1. No Opinion

1.10 Please provide other comments related to the reference markers.
(maintenance issues, design or placement of the markers, expanded use?)
EVALUATION OF REFERENCE MARKERS
Prepared by the University of Kentucky Transportation Center
(Return survey to Jerry Pigman at Fax No. 859-257-1815)
Phone: 859-257-4513 email: jpigman@engr.uky.edu

1. Are you familiar with the reference markers which have been installed as part of the TNDOT freeway signing projects in the Nashville area? 15 Yes 0 No

If you are familiar with the markers, what is your personal impression of the effects or potential effects which the markers may have on the emergency response process?
16 Very Beneficial 0 Possibly Beneficial 0 Not Beneficial

2. Have you received calls from motorists or are you aware of anyone who has used the reference markers in their description of the location where emergency response is needed?
15 Yes 1 No

If you have received calls or are aware of incidents where these markers have been used to describe the location of an incident, was there a positive impression of the markers?
14 Yes 0 No 2 Unknown

3. Are you aware of incidents where the reference markers have had a positive effect on the response times as a result of emergency personnel being provided better information to locate the incident?
14 Yes 1 No 1 Unknown

Are there cases where the reference markers have had a negative effect on response times?
0 Yes 10 No 6 Unknown

4. Please provide your opinion concerning the frequency of reference marker spacing:

Spacing of markers for TNDOT projects is 0.2 mile or approximately 1,000 feet.
15 Appropriate 0 Not Appropriate 1 No Opinion

Spacing of markers for some projects in other states is 0.1 mile or approximately 500 feet.
6 Appropriate 4 Not Appropriate 6 No Opinion
Are you aware of motorists being unable to observe a marker when using the 0.2-mile spacing of reference markers?

10. Yes 1. No 5. Unknown

5. Please provide your opinion concerning color of the reference markers for effective emergency response use:

The TNDOT markers are white numbers and letters on blue background.

16. Appropriate 0. Not Appropriate 0. No Opinion

The Lexington, KY markers are white numbers and letters on green background.

3. Appropriate 8. Not Appropriate 5. No Opinion

1.06 Where interstate routes run concurrently, should only the dominant single route symbol or double route symbols should be used on the reference markers?


7. Do you feel that reference markers should be placed on other highways in your area to assist with the emergency response process?

15. Yes 1. No 0. No Opinion

1.08 Are you aware of any maintenance problems with the reference markers or posts?

8. Yes (If yes, explain below) 6. No 1. Unknown

1.09 Do you feel that changes should be made in the design or placement of the reference markers to make them more understandable and usable for the public?

5. Yes (If yes, explain below) 7. No 2. No Opinion

1.10 Please provide other comments related to the reference markers. (maintenance issues, design or placement of the markers, expanded use?)

- Replacement of damaged or missing signs is slow
- The reference markers are a great help in locating accidents
- The public needs to be made aware of the signs and their purpose