



STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION

## EVALUATION OF TENNESSEE REFERENCE MARKERS

FINAL REPORT

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<b>16. Abstract</b>  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

1. Pigman, J.G.; "Preliminary Evaluation: ARTIMIS Reference Point Markers", Research Report KTC-95-11, Kentucky Transportation Center, University of Kentucky, June 1995.
2. Pigman, J.G.: "Evaluation of Reference Markers (Interim Report)", Research Report KTC-98-23, Kentucky Transportation Center, University of Kentucky, June 2001.
3. "Manual on Uniform Traffic Control Devices for Streets and Highways". U.S. Department of Transportation, Federal Highway Administration, 1988.

Table 1. Summary of Reference Marker Installation Quantities

Urban Area	Ramp Ground Mount - Single	Ramp Parapet Mount - Single	Median Barrier Mount - Double	Median Ground Mount - Double	Median Parapet Mount - Single	Median Ground Mount - Single	Totals
Nashville	570	24	637	222	12	42	1507
Knoxville	336	48	284	138	4	4	814
Memphis	66	6	200	12	14	4	302
Chattanooga	22	2	44	63	10	14	155
<b>Totals</b>	<b>994</b>	<b>80</b>	<b>1165</b>	<b>435</b>	<b>40</b>	<b>64</b>	<b>2778</b>

Table 2. Summary of Reference Marker Installation Coverage Areas

Urban Areas	Counties Included	Routes Covered	Total Miles	Total Mainline Markers	Total Ramp Markers	Total Markers
Nashville	Davidson, Rutherford, Williamson, Wilson	I-24, I-40, I-65, I-265, I-440	99.8	913	594	1507
Knoxville	Knox	I-40, I-75, I-275, I-640	58.6	430	384	814
Memphis	Shelby	I-40, I-55, I-240	43.4	230	72	302
Chattanooga	Hamilton	I-24, I-75, US 27	23.8	131	24	155
<b>Totals</b>			<b>225.6</b>	<b>1704</b>	<b>1074</b>	<b>2778</b>

Table 3. Summary of Reference Marker Mileage by Route and Milepoint Range

Area	Route	Milepoint Range	Total Miles
<b>Knoxville</b>	I-40	M.P. 368.6 to M.P. 405	36.4
	I-75	M.P. 107.8 to M.P. 117.6	9.8
	I-275	M.P. 0.4 to M.P. 2.6	2.2
	I-640	M.P. 0.2 to M.P. 10.4	10.2
		Total	58.6
<b>Nashville</b>	I-40	M.P. 192 to M.P. 227	35
	I-24	M.P. 192 to M.P. 227	12
		M.P. 51.8 to M.P. 66.4	14.6
	I-65	M.P. 65 to M.P. 77	12
		M.P. 79.8 to M.P. 97.4	17.6
	I-265	M.P. 0.4 to M.P. 2.0	1.6
	I-440	M.P. 0.4 to M.P. 7.4	7
	Total	99.8	
<b>Memphis</b>	I-40	M.P. 0.0 to M.P. 18.6	18.6
	I-55	M.P. 6.2 to M.P. 12.2	6
	I-240	MP 12.0 to MP 30.8	18.8
		Total	43.4
<b>Chattanooga</b>	I-24	M.P. 171.2 to M.P. 185	13.8
	I-75	M.P. 0.0 to M.P. 12.0	10
		(Excludes m.p. 3.0 to 5.0)	
	US 28	M.P. 0.0 to M.P. 2.0	2
	Total	25.8	

Figure 1. Schematic of Mainline Reference Marker Used in Tennessee

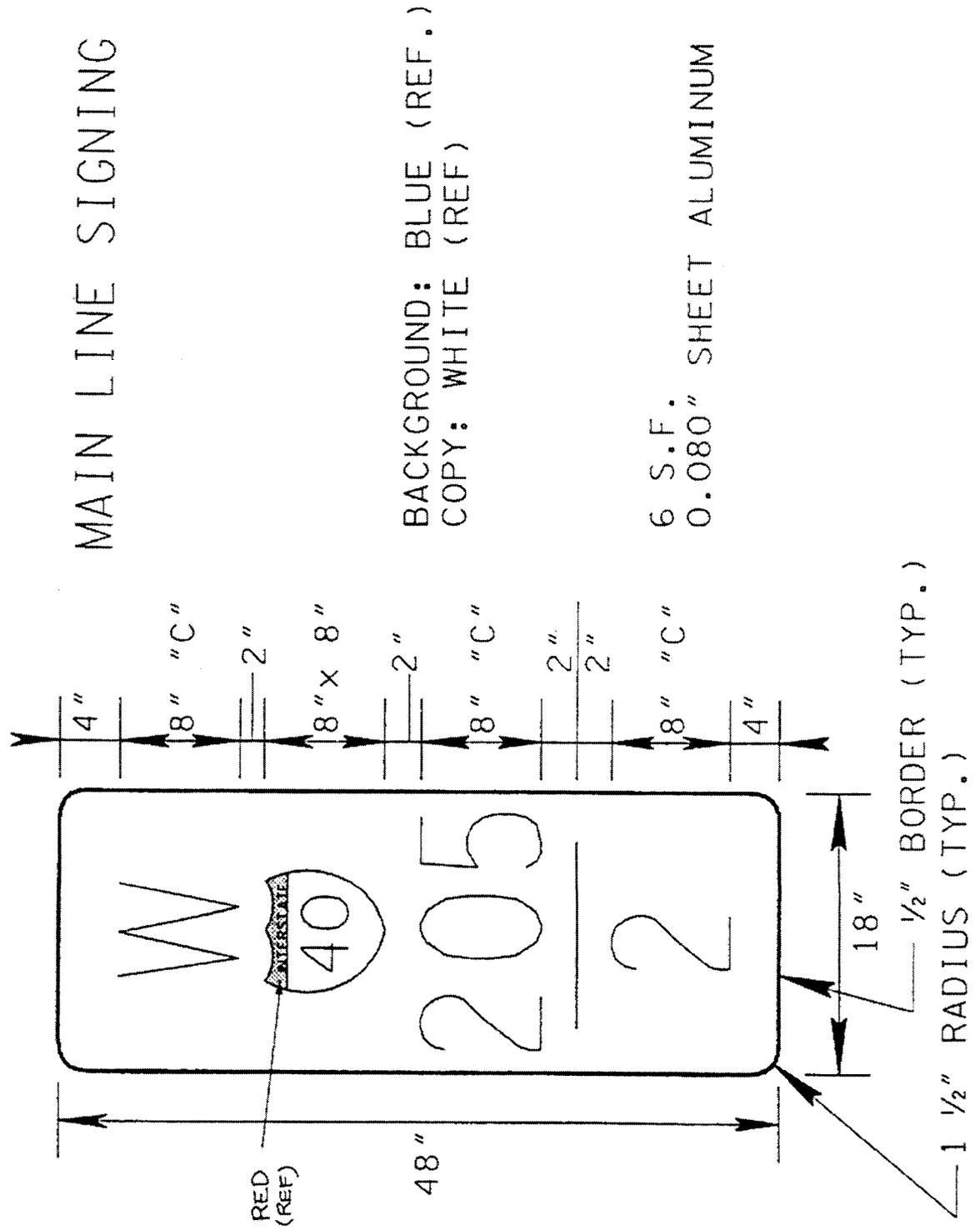
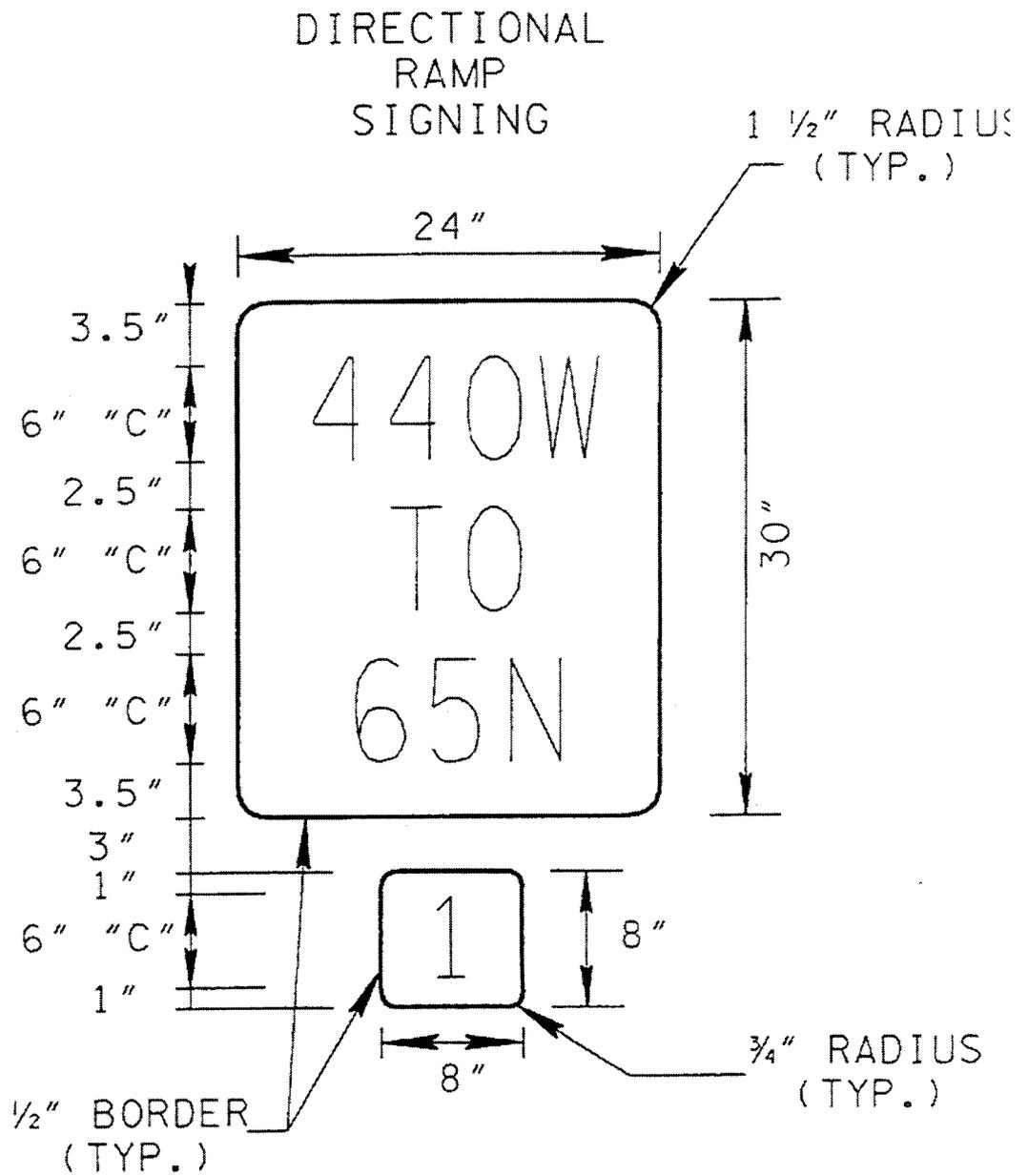


Figure 2. Schematic of Ramp Reference Marker Used in Tennessee

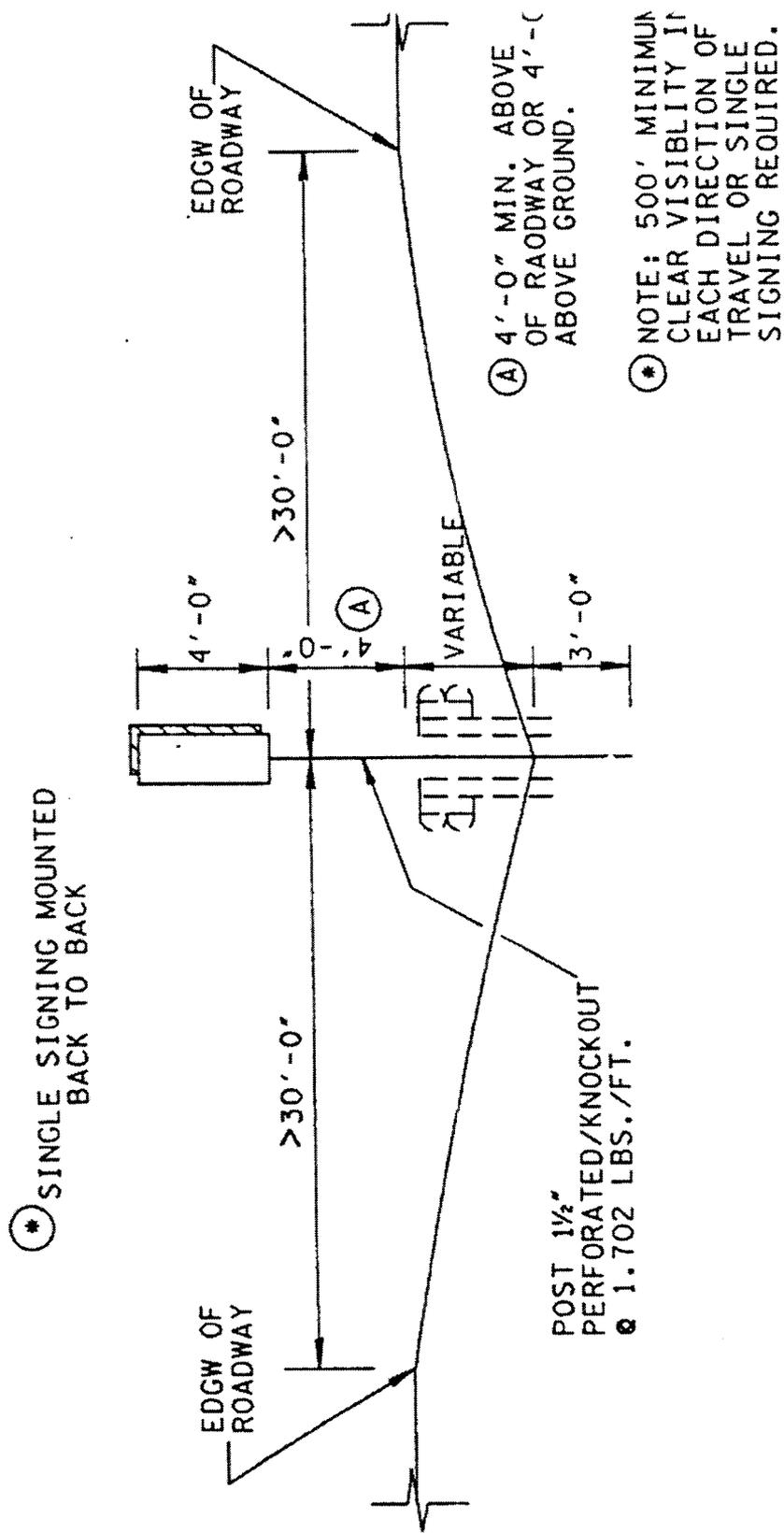


BACKGROUND: BLUE (REF.)  
COPY: WHITE (REF)

5.4 S.F.  
0.080" SHEET ALUMINUM

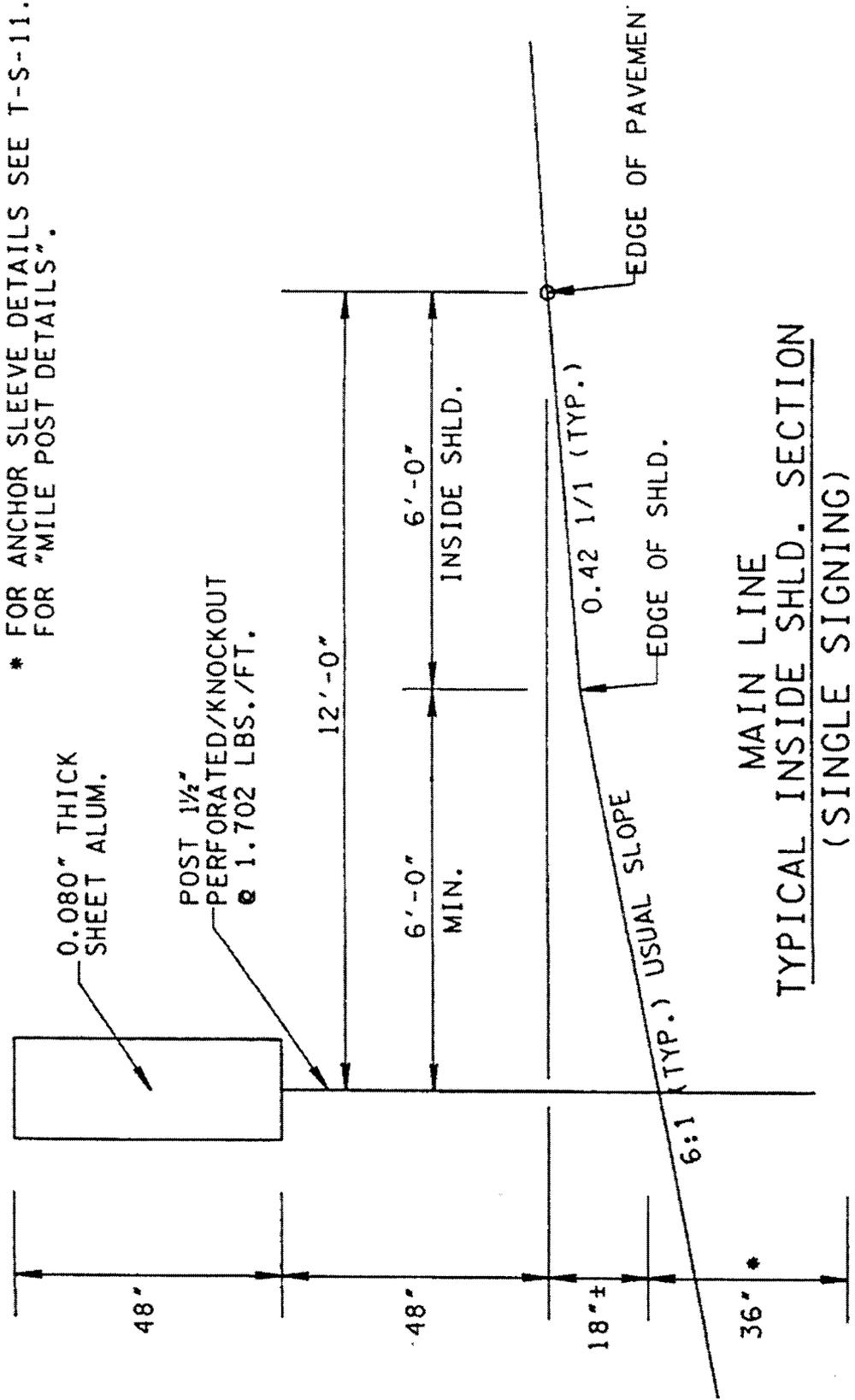


Figure 4. Schematic of Mainline Marker Installation for Grass Medians 60 Feet or Less in Width (Ground-Mounted Back-to-Back)



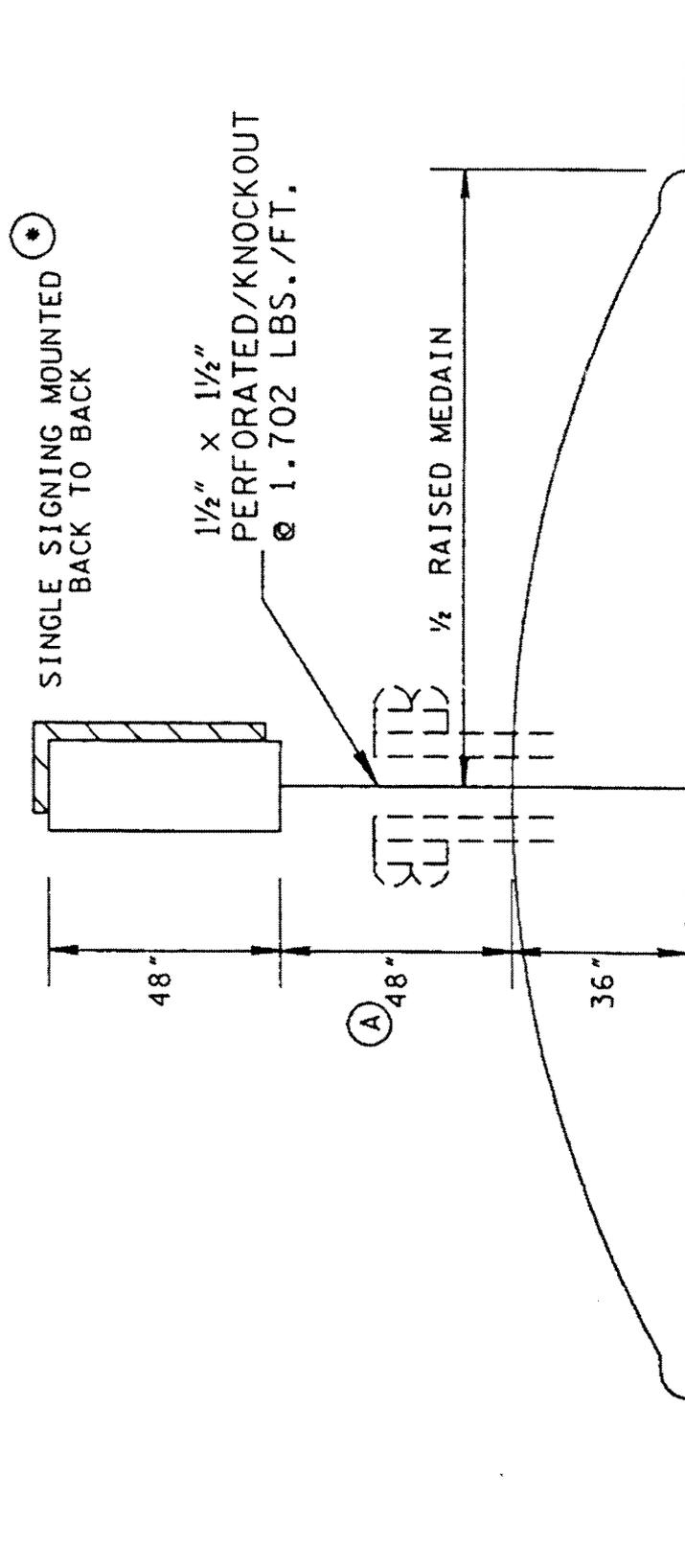
MAIN LINE  
TYPICAL MEDIAN LESS THAN 60'-0" ⊙  
 ALSO APPLIES FOR SECTIONS WITH GUARDRAIL IN MEDIAN.

Figure 5. Schematic of Mainline Marker Installation for Grass Medians 60 feet or More in Width (Ground-Mounted Single)



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

Figure 6. Schematic of Mainline Marker Installation for Raised Medians (Ground-Mounted Back-to-Back)

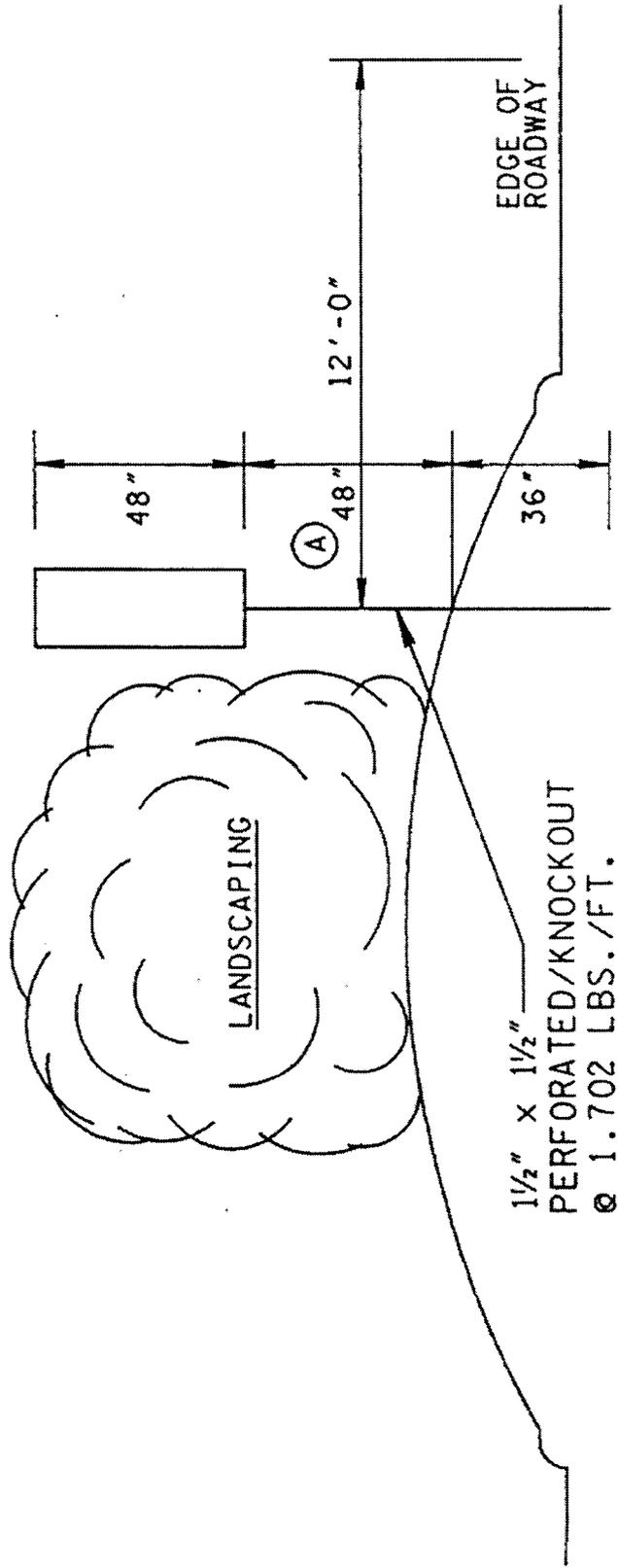


\* NOTE: 500' MINIMUM CLEAR VISIBILITY IN EACH DIRECTION OF TRAVEL OR SINGLE SIGNING REQUIRED.

MAIN LINE  
TYPICAL RAISED MEDIAN  
ALSO APPLIES FOR SECTIONS WITH GUARDRAIL IN MEDIAN.

(A) 6'-0" MIN. ABOVE OF ROADWAY OR 4'-0" ABOVE GROUND.

Figure 7. Schematic of Mainline Marker Installation for Raised Medians with Landscaping (Ground-Mounted Single)



MAIN LINE  
TYPICAL RAISED MEDIAN  
(SINGLE SIGNING)

(A) 6'-0" MIN. ABOVE  
OF ROADWAY OR 4'-0"  
ABOVE GROUND.

Figure 8. Schematic of Ramp Marker Installation for Bridge Parapets (Single Mounting)

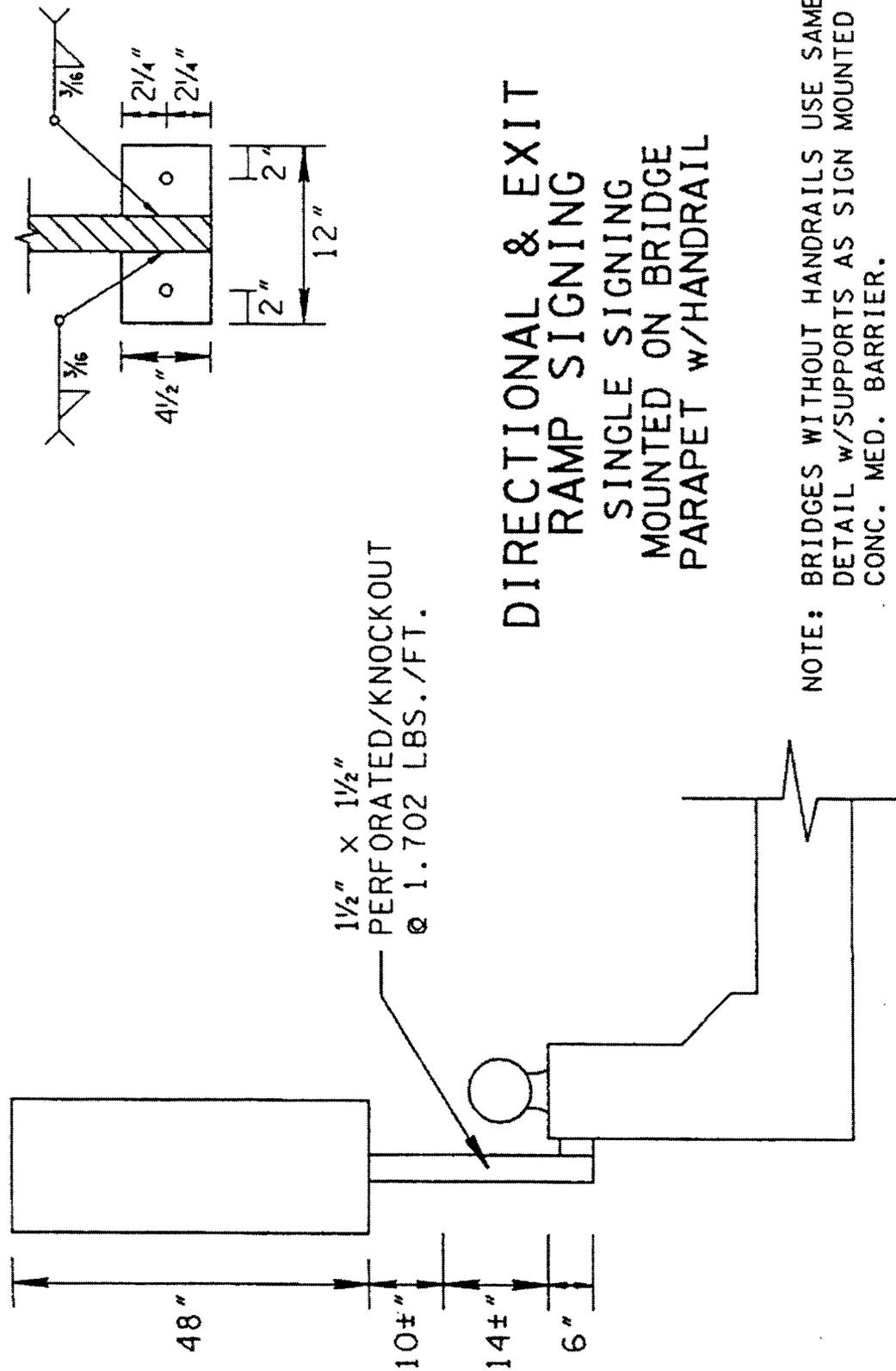


Figure 9. Schematic of Ramp Marker Installation for Inside Grass Shoulder Section (Single Mounting)

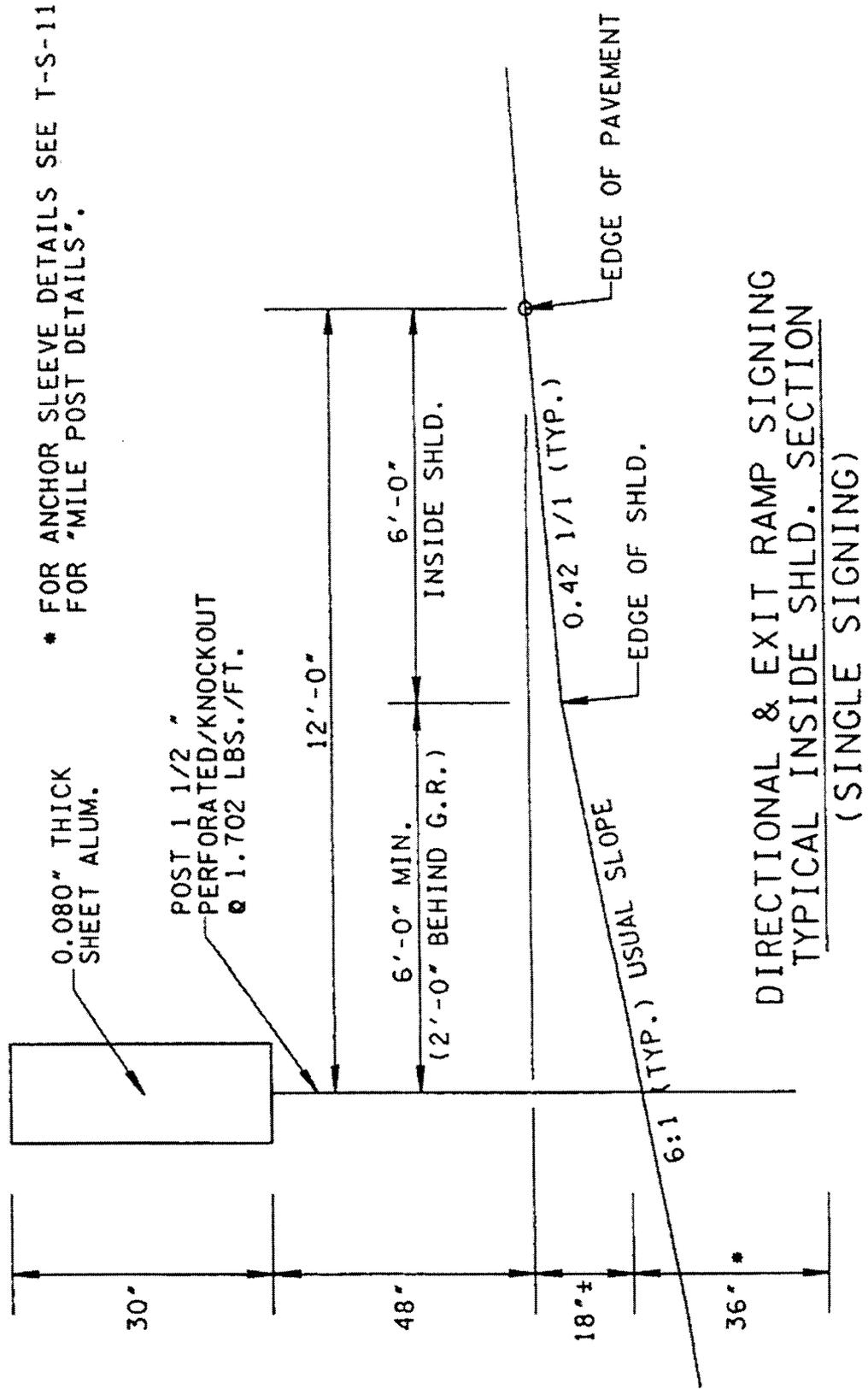


Figure 10. Map Showing Reference Marker Installations - Nashville

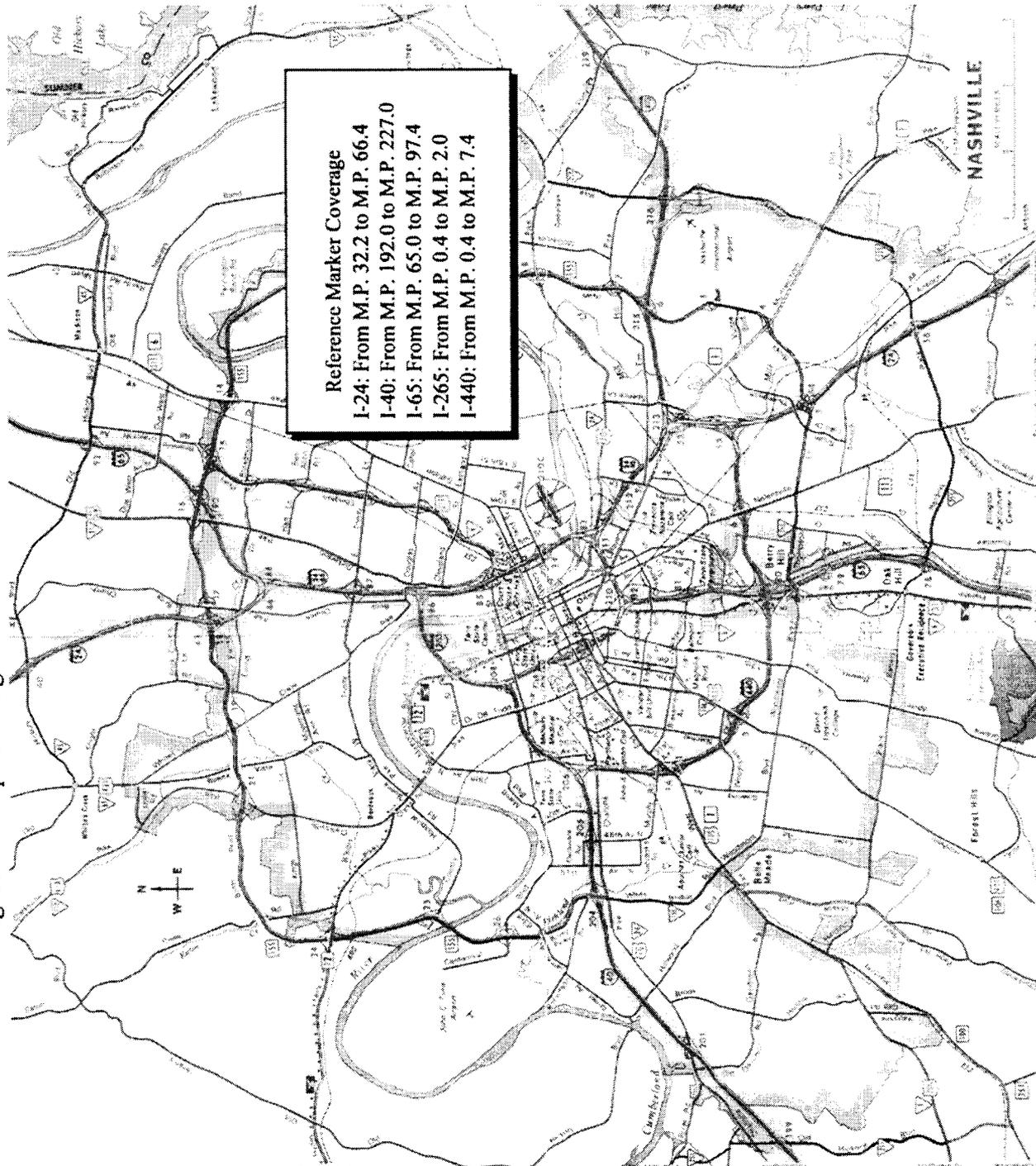


Figure 11. Map Showing Reference Marker Installations - Knoxville

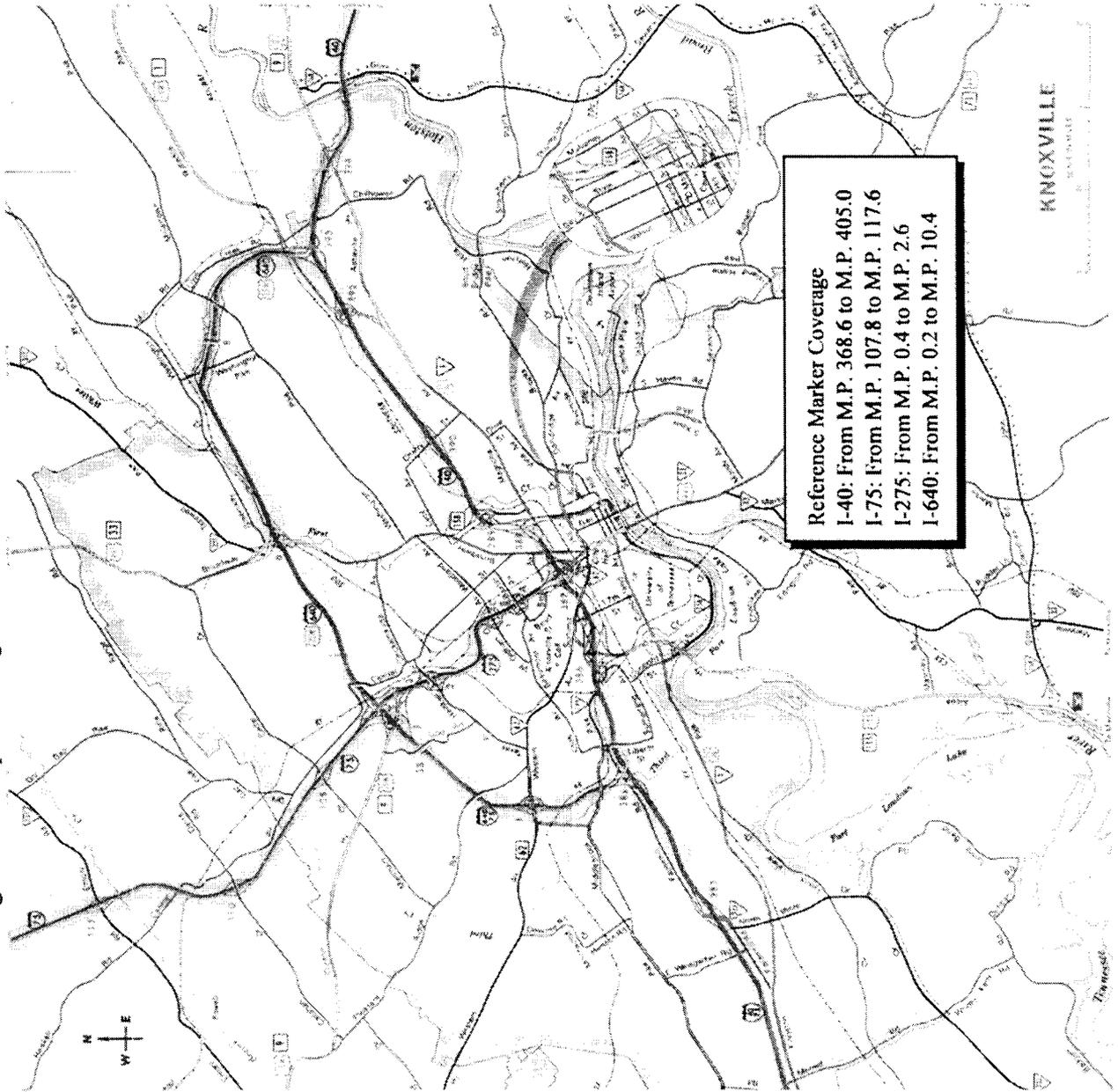


Figure 12. Map Showing Reference Marker Installations - Memphis

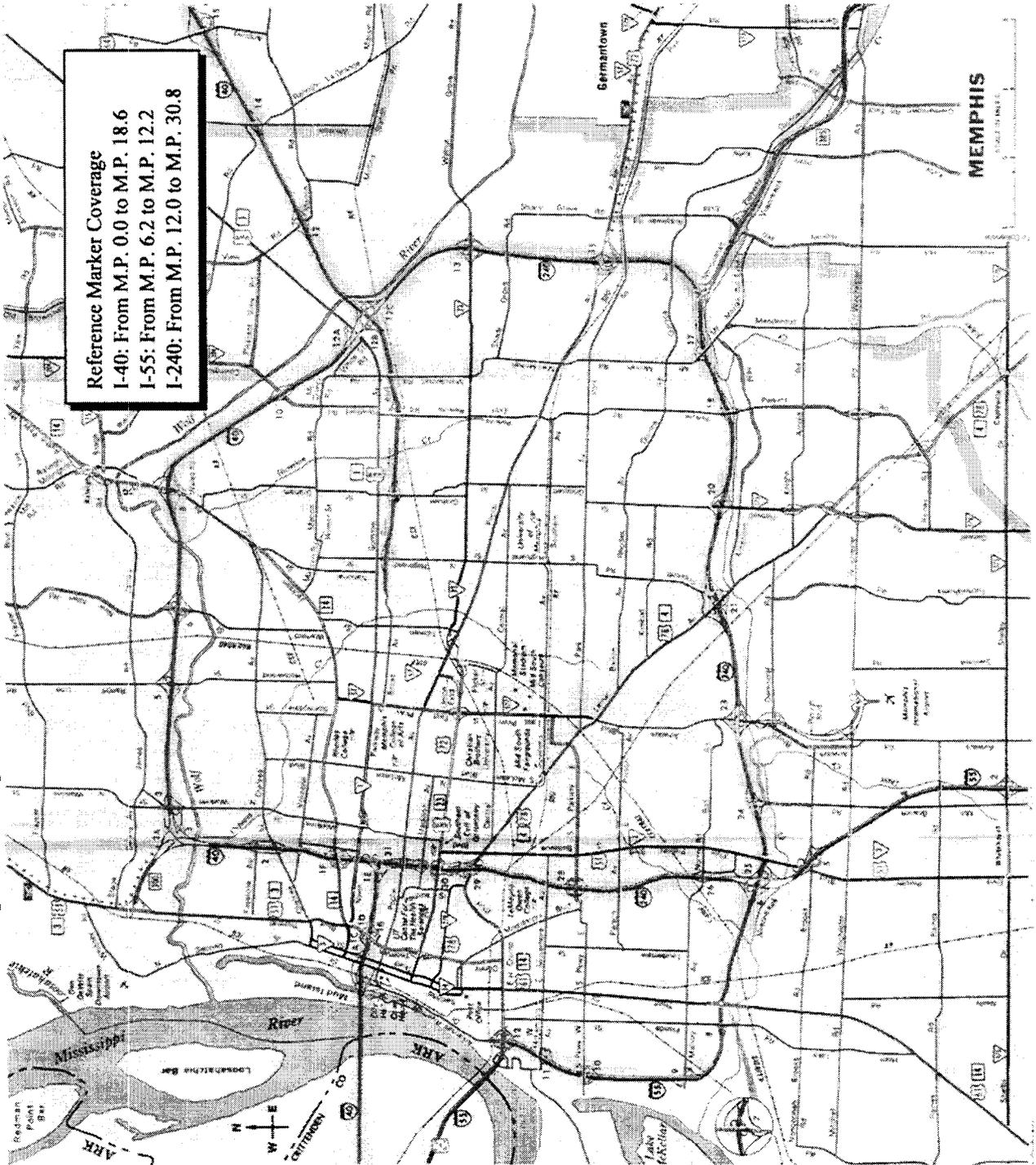


Figure 13. Map Showing Reference marker Installations - Chattanooga

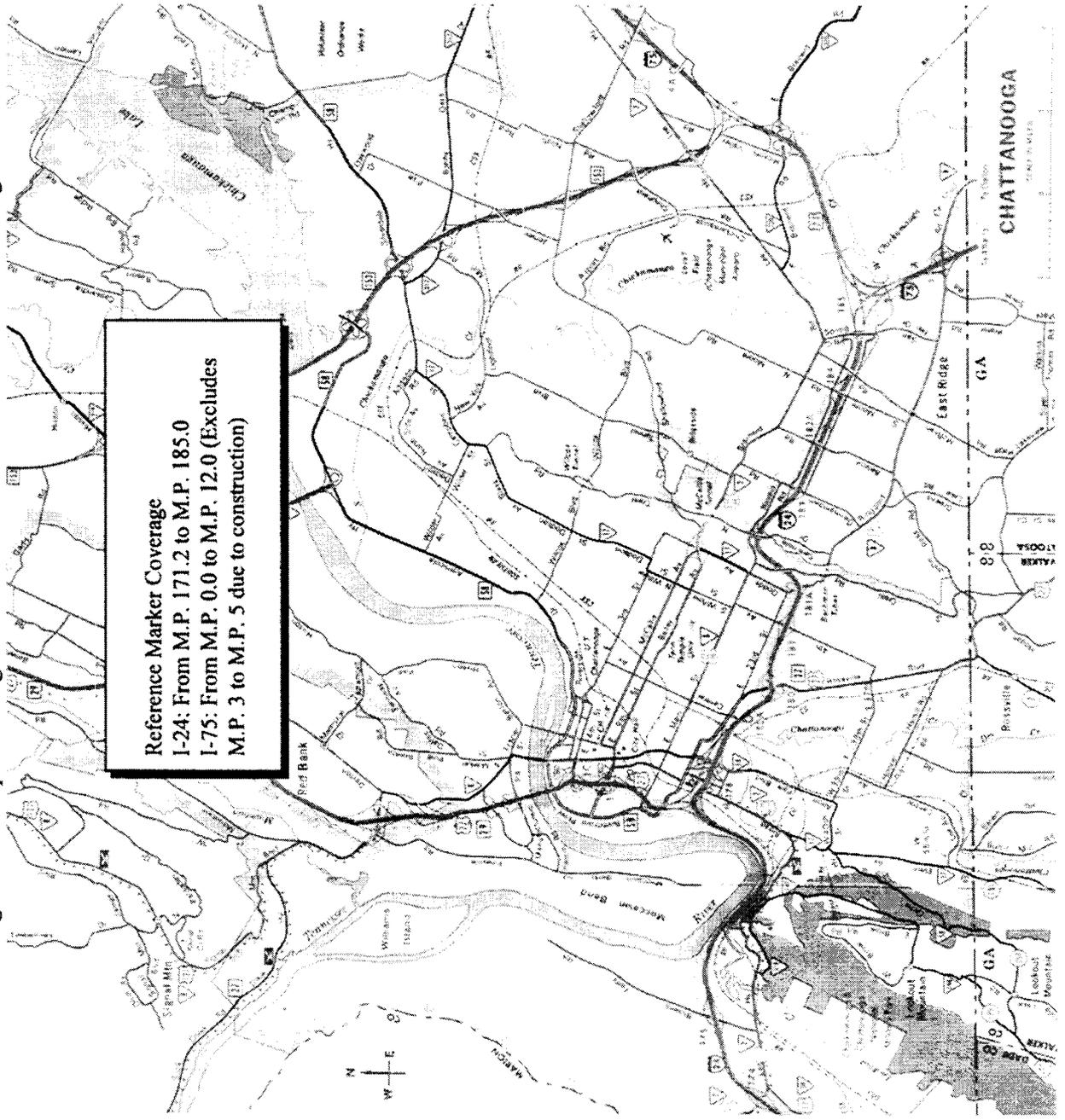


Figure 14. Photographs of Mainline Reference Markers in Tennessee

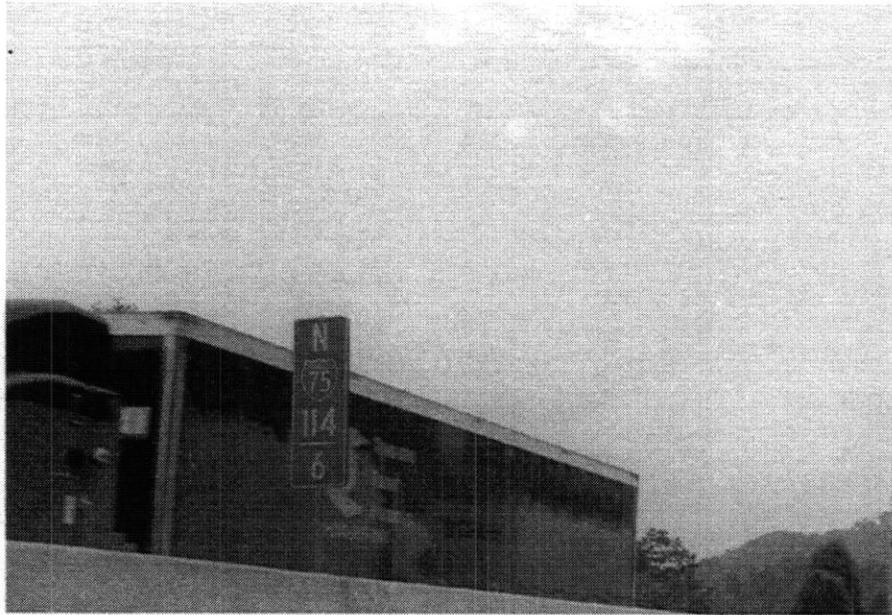


Figure 14a. Knoxville

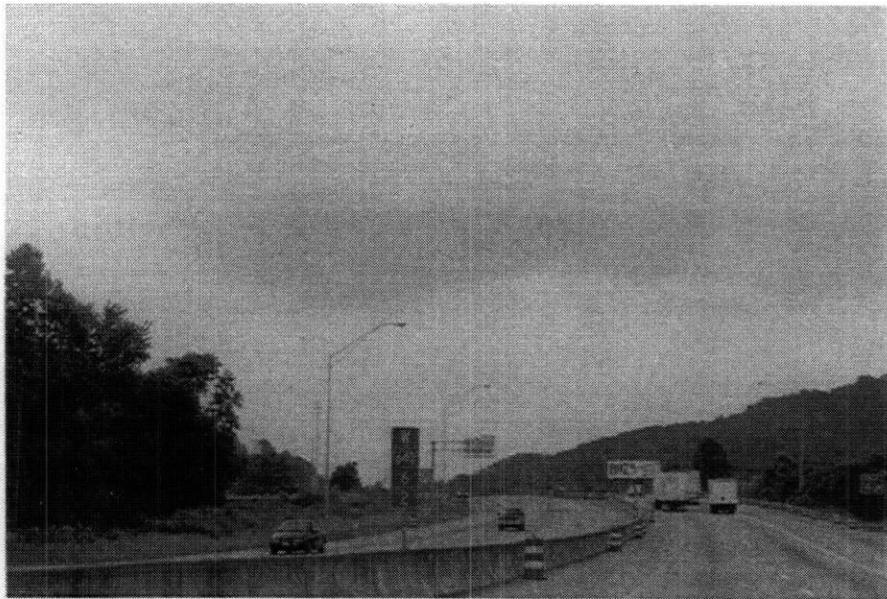


Figure 14b. Knoxville

Figure 14. Photographs of Mainline Reference Markers in Tennessee (continued)



Figure 14c. Chattanooga

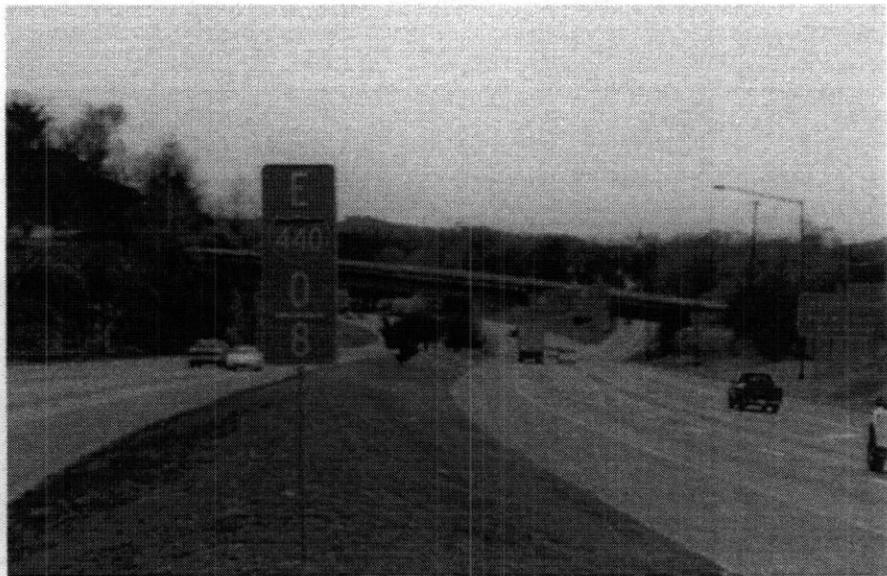


Figure 14d. Nashville

Figure 15. Photographs of Ramp Reference Markers in Tennessee



Figure 15a. Nashville

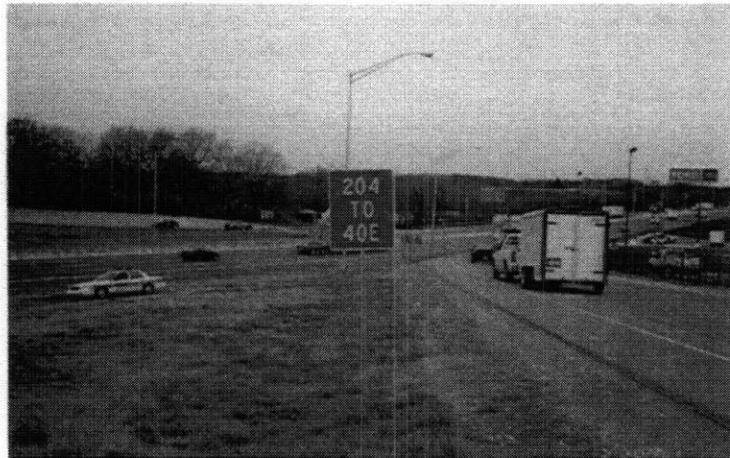


Figure 15b. Nashville



Figure 15c. Nashville

Figure 16. Photographs of Incident Response Units in Tennessee



Figure 16a. Chattanooga



Figure 16b. Chattanooga

Figure 17. Survey Form and Summary of Responses

**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](mailto: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? 65 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?  
62 Very Beneficial 10 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?  
53 Yes 19 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?  
47 Yes 6 No 18 Unknown

Do you feel that the public generally understands the markers and knows their purpose?  
18 Yes 42 No 16 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?  
47 Yes 14 No 11 Unknown

Are there cases where the reference markers have had a negative effect on response times?  
5 Yes 43 No 22 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.  
65 Appropriate 3 Not Appropriate 4 No Opinion

Spacing of markers for some projects in other states is 0.1 mile or approximately 500 feet.  
27 Appropriate 19 Not Appropriate 23 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.

19 Appropriate 26 Not Appropriate 26 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?

22 Single 40 Double 16 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?

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

**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](mailto: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 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 should 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

## 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.ukv.edu](mailto:jpigman@engr.ukv.edu)

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**

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**Phone: 859-257-4513**

**email: [jpigman@engr.uky.edu](mailto: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](mailto: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

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

6 Yes 5 No 5 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?

6 Single                      9 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?

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