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16. Abstract

This report describes the tasks conducted during the first year of a three-year study evaluating the use of guide signs on conventional highways in rural areas. The tasks were concentrated in four basic activity areas: 1) assessment of current practice, 2) identification of driver information needs, 3) evaluation of guide sign legibility, and 4) identification of potential study sites. Some of the first year tasks include: a survey of TxDOT district signing practices, a driver survey assessing the information needs of drivers and their understanding of conventional guide signs, an evaluation of the legibility of the State Highway and Farm-to-Market Road (F.M.) route markers and two designs for cardinal direction markers.

The first year findings were used to develop several preliminary recommendations for rural guide signing. Some of the recommendations include: providing more advance signing farther from intersections/interchanges, increasing the height of numbers in several route markers, developing/evaluating the effectiveness of alternative designs for the F.M. route marker, and providing destination information (city names) at intersections/interchanges, and making greater use of overhead signing.

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EVALUATION OF RURAL GUIDE SIGNING:

FIRST YEAR ACTIVITIES

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IMPLEMENTATION STATEMENT

This report describes the activities conducted during the first year of a three-year study evaluating guide signing on rural, or conventional, highways. This type of guide signing does not include guide signing on access controlled highways. The results of the first year activities will be used to evaluate the effectiveness of current guide signing practices and to identify areas where the effectiveness could be improved. In the second and third year of the study, these results will be used in the development and evaluation of alternative guide signing strategies for conventional highways. Implementation of the recommendations may be instituted through the revision of: the *Texas Manual on Uniform Traffic Control Devices*, TxDOT Standard Sheets, or TxDOT policies.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration or the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation. This report is not intended for construction, bidding, or permit purposes.

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At the initiation of this study, TxDOT formed a Technical Panel (TP) for consultation, review and approval of the research activities encompassed by this study. The members of the TP were able to provide the researchers with valuable insights related to many different aspects of traffic control devices. The research team met with the TP several times throughout the study, and the assistance and comments received from the TP were instrumental in conducting the study activities. The researchers would like to acknowledge the following members of the TP for their time, efforts, and contributions:

Technical Panel Chairman

- Mr. Lewis Rhodes, Traffic Operations Division, Texas Department of Transportation.

Technical Panel

- Mr. Rick Collins, Traffic Operations Division, Texas Department of Transportation.
- Mr. Paul Frerich, Yoakum District, Texas Department of Transportation.
- Mr. Dick Gumtau, Regional Office, Federal Highway Administration.
- Mr. Steve Hill, Abilene District, Texas Department of Transportation.
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- Ms. Anne Newsome, Travel and Information Division, Texas Department of Transportation.
- Mr. Joe Raska, Materials and Test Division, Texas Department of Transportation.
- Mr. Richard Rogers, Transportation Planning and Programming Division, Texas Department of Transportation.
- Mr. Bill Tucker, San Antonio District, Texas Department of Transportation.
- Ms. Mary Ulrich, Travel and Information Division, Texas Department of Transportation.

Other individuals who provided comments and suggestions on the research study include:

- Mr. Bob Musselman, Division Office, Federal Highway Administration.
- Mr. Mark Olson, Division Office, Federal Highway Administration.

In addition to those listed as authors of this research report, there were several other individuals who contributed to the conduct of this research study. These individuals helped coordinate or plan many of the research activities. The authors would like to acknowledge the following individuals for their valuable contributions:

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- Nada Trout, Texas Transportation Institute.
- Val Pezoldt, Texas Transportation Institute.

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SUMMARY

This report describes the first year activities of a three-year study evaluating guide signing for rural (or conventional) highways. There were four major areas of activity in the first year: assessment of current practices, identification of driver information needs, evaluation of guide sign legibility, and identification of potential study sites. The tasks that were conducted within each of these activity areas are summarized in Table S-1.

Table S-1. First Year Activity Areas and Tasks

Activity Area	Tasks	Description
Assessment of Current Practices	Policies, Guidelines, and Standards	Identification of applicable TxDOT practices.
	Working Paper and Workshop	Preparation of a paper describing guide signing issues and discussion in a Technical Panel meeting.
	Survey of District Practices	A 15 question survey sent to district personnel. There were 96 responses from 23 districts.
Identification of Driver Information Needs	Driver Survey	An 18 question survey administered at four small-town events. A total of 428 drivers completed the survey.
	Focus Groups	Three focus groups were conducted to obtain driver opinions and comments. Each group consisted of ten drivers.
Evaluation of Guide Sign Legibility	Static Test	The driver read several route markers and cardinal direction markers from a stationary vehicle.
	Single Dynamic Test	The driver read a single route marker and cardinal direction marker while driving a vehicle at 56 kph (35 mph).
	Multiple Dynamic Test	The driver identified the position of a prespecified highway number while driving a vehicle at 56 kph (35 mph).
Identification of Potential Study Sites	District Survey	One question in the district survey asked individuals to identify possible study sites.
	Driver Survey	One question in the driver survey asked participants to indicate locations where they had difficulties finding their way.
	Conventional Highway Guide Sign Program	The TxDOT sign program was reviewed to identify sites where there will be changes in guide signing.

The results of the first year activities have identified a number of findings which indicate where potential recommendations could improve the quality of rural guide signing. Some of the most significant of the findings include:

- Guide signing on urban freeways is based on a different philosophy than guide signing on rural conventional highways. Drivers in urban areas rely upon destination information as the primary source of navigational information.
- Participants prefer to see destinations (city names) at the intersection.
- Overhead signing should be more widely used on conventional highways.
- Maps and highway signs are the most important sources of navigational information.
- The highway number was the primary source of directional information, along with destination (city names) information.
- Advance information is important to drivers, and current practices may place the information too close to the intersection.
- Survey and focus group participants did not recognize or place importance on the differences between highway classifications.
- The 85th percentile legibility ratio for the older driver group ranged between 2.8 and 4.6 meters per centimeter (m/cm) (23 to 38 feet per inch (ft/in)) for route markers using Series D numbers.
- The three legibility tests yielded roughly the same legibility distances.
- Table S-2 summarizes the 85th percentile legibility distances of the State Highway (S.H.) and Farm-to-Market Road (F.M.) route markers.

Table S-2. Summary of Route Marker Legibility

Type of Marker	Number of Digits	Height of Number[1]	85th Percentile Legibility Distance[2]	
			Best[3]	Certain[3]
S.H.	3	175 mm/7-inch	77 m (254 ft)	70 m (229 ft)
F.M.	4	100 mm/4-inch	38 m (125 ft)	32 m (104 ft)

Notes: [1]Series D number.
[2]Average of three evaluations for older drivers.
[3]The "best" measurement is the distance at which the driver thinks he/she can first read the sign. The "certain" measurement is the distance at which the driver is certain of the sign legend.

- In dynamic testing, there were no statistically significant differences (at a confidence level of 90 percent) in the legibility distances of the two designs for cardinal direction markers. The current design uses a 150 mm (6-inch) height for all letters. In the newer design, the initial letter is 175 mm (7-inch) and the remaining letters are 150 mm (6-inch). Significant differences (at a 90 percent confidence level) were observed in the static tests of legibility distance.

- The legends of several guide signs may be too small to meet the needs of older drivers. In particular, the numbers in the F.M. route should be increased.
- Almost half of the drivers have some level of difficulty seeing the letters or numbers on highway guide signs.
- There was no statistically significant difference in the mean legibility distances between the younger and older age groups. There was a statistically significant difference in the 85th percentile legibility distance between the two age groups.
- The mean legibility ratios for the evaluations compared favorably with the standard design parameter of 6 m/cm of letter height (50 ft/in of letter height). However, this means that only half of the drivers are accommodated by the standard design parameter.
- Texas MUTCD guidelines are generally adequate, although they do not address all situations.
- There are perceived differences in guide signing between the districts.

The findings from the first year activities have led to the development of several preliminary recommendations which will be evaluated in future study activities. Some of the more significant of the preliminary recommendations include:

- Providing more advance signing and providing it farther from the intersection/interchange. The advance information should include lane position information.
- Maintaining a consistent number height in route markers. This can be accomplished by increasing the width of the route marker when there are three or four digits in the highway number. The U.S. Highway route marker already uses this practice.
- Consideration should be given to developing a new design for the F.M./R.M. route marker. The current design, which uses a 100 mm (4-inch) number height in a four-digit number, has an 85th percentile legibility distance of 30 to 46 meters (100 to 150 feet) for older drivers.
- Consideration should be given to adding destination information (city names) to the route number information presented at intersections and/or interchanges.
- The development of a system of control cities for conventional highways may prove useful to drivers.

- The legibility distances for the proposed cardinal direction marker design (larger initial letter) were not significantly greater than for the current design. Improved legibility may not be sufficient justification for implementing the proposed new design.
- Consideration should be given to greater use of overhead signing on conventional highways, particularly at grade-separated interchanges.

CHAPTER I
INTRODUCTION

Although the majority of highway travel is conducted in urban areas, the majority of highway mileage is located in rural areas. Furthermore, rural highway mileage constitutes a large percentage of the total highway mileage in Texas. Although these rural highways do not typically carry high traffic volumes, their navigational needs are just as important as those of urban or access-controlled highways. The Texas Transportation Institute (TTI) is now in the fourth year of a study sponsored by the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA) that is evaluating driver comprehension of traffic control devices (1). Early tasks in this study determined that drivers may not fully understand the messages conveyed by conventional guide signing and that some of the standard practices may not be fulfilling the information needs of drivers. Therefore, this research study on rural guide signing was initiated to investigate the guidance needs of rural drivers and to determine how guide signing practices might be improved to meet these needs.

The purpose of this study is to develop improved guidelines for the use of guide signs on rural highways. For this study, rural highways are defined as non-access controlled highways located in rural areas and urban areas with a population below 5,000. Non-access controlled highways are also referred to as conventional highways. The terms "rural highway" and "conventional highway" are used interchangeably throughout this report. The primary focus of this study is on driver navigation and wayfinding and the signs and sign combinations that provide this information to drivers. The signs which are being evaluated in this study include route markers, cardinal direction markers, directional arrow markers, distance signs, and destination signs.

STUDY METHODOLOGY

This research study includes a number of different activities that have been, or will be, conducted during the three-year study period. Although there is some overlap from one year to another, the first year of the study was intended to identify and evaluate existing practices for, and understanding of, conventional guide signs. The second year is intended to develop and

evaluate alternative signing strategies and the third year is intended to develop and finalize guidelines for conventional guide signing.

As mentioned previously, the focus of the first year of the study was to identify and evaluate existing practices for conventional guide signing, and how drivers understand and use guide signs. The research activities that were conducted during the first year fall into four major areas, with several different tasks being conducted in each of the areas. These four areas are listed below. Within each activity area, several individual tasks were performed to collect the necessary information. Chapters II through V of this report describe the tasks and findings associated with each of the activity areas.

1. Assessment of current practices,
2. Identification of driver information needs,
3. Evaluation of guide sign legibility, and
4. Identification of potential study sites.

Assessment of Current Guide Signing Practices for Conventional Highways

Three different tasks were conducted in the first year to assess the state-of-the-art for current guide signing practices in Texas. These tasks are described in Chapter II and include:

1. Identification of pertinent TxDOT guidelines, policies, and standards for the use of guide signs on conventional highways.
2. Development of a working paper which identified the key issues to be addressed in the study, described the activities to be conducted, and suggested potential guidelines/practices which could result from the study. The working paper was then discussed in a workshop which included representatives from TxDOT, FHWA, and TTI.
3. Identification of the guide signing practices used in the individual TxDOT districts through a survey that was distributed to multiple personnel in each district.

Driver Information Needs

Two tasks were intended to determine the information needs of drivers in rural areas and their understanding and use of conventional guide signing. The two tasks are described in Chapter III and include:

1. A survey of 428 drivers was administered at four small town events. The 18 questions in the survey addressed trip planning, use and understanding of conventional guide signs, characteristics of Texas highways, and general questions.
2. Three focus groups of 10 drivers each were conducted to solicit driver opinion and knowledge of conventional guide signing.

Evaluation of Guide Sign Legibility

Four guide signs were evaluated in three different legibility tests to assess the legibility of the signs, with an emphasis on older drivers. In two of the tests, the driver was attempting to read one or more signs while driving the test vehicle. The third test was conducted from a stationary vehicle. The signs evaluated in the tests included the three-digit State Highway route marker, the four-digit Farm-to-Market Road route marker, the current design for cardinal direction markers, and a new design for cardinal direction markers where the initial letter is 25 mm (1-inch) taller. Chapter IV describes the activities and results associated with this effort.

Identification of Potential Study Sites

The second year of the study includes field observations of conventional guide signing installations. During the first year, potential locations for future study were identified. Sources used to identify potential locations include the district survey, the driver survey, and the TxDOT program for guide sign improvements. The information obtained from this task will be reviewed in the second year of the study in order to select sites where field studies will be conducted. Chapter V describes the first year research activities in this area.

USE OF METRIC UNITS IN THIS RESEARCH

The United States is currently in the process of transitioning to the International System (SI) of metric units. One of the major concerns associated with the change to metric units is the conversion of traffic signs to metric units. However, as of the present time, traffic signs have not been converted to metric units, nor have standard metric legends been developed. In fact, traffic sign legends have been exempted from the September 30, 1996 FHWA deadline for transitioning to metric units. Therefore, this research used American customary units in all guide signs evaluations, including both surveys and legibility experiments. It was particularly important to use familiar units in the driver surveys in order to reduce the potential for driver confusion in responding to the sign. Had metric units been included in the survey guide signs, driver confusion might have undermined the measurement of driver comprehension.

In this report, both metric and American units are provided when dimensions are given. The metric units have been determined from the American units through the use of hard (rounded-off) conversion. For traffic signs, the basic hard conversion is 1 inch equals 25 mm. This means that metric-based sign dimensions and letter heights are 1.6 percent smaller than American-based sign dimensions and letter heights. It is important to note that, although this report provides metric letter heights and legibility distances, the legibility results described in Chapter IV are based on letter heights measured in inches and the distances measured in feet. The metric units shown in this report may not be the same as they would have been had the letter heights and distances actually been measured using metric units.

Metric equivalencies for letter heights, sign sizes, and speeds used in this report are shown in Tables I-1 to I-3. These equivalencies were obtained from American Association of State Highway and Transportation Officials (AASHTO) metric conversion publications (2, 3).

Table I-1. Metric Equivalents for Letter Height

System	Unit	Letter Heights						
American	inch (in)	4	6	7	8	9	10	12
Metric (SI)	millimeter (mm)	100	150	175	200	225	250	300

Table I-2. Metric Equivalents for Sign Size

System	Unit	Sign Sizes		
American	inch (in)	24×12	24×24	30×24
Metric (SI)	millimeter (mm)	600×300	600×600	750×600

Table I-3. Metric Equivalents for Speed

System	Unit	Speeds										
American	miles per hour (mph)	15	20	25	30	35	40	45	50	55	60	65
Metric (SI)	kilometers per hour (km/h)	20	30	40	50	60	60	70	80	90	100	110

CHAPTER II
ASSESSMENT OF CURRENT PRACTICES

Three tasks were conducted at the beginning of the study to assess the current practices or state-of-the-art relative to the use of guide signs on conventional highways. These three tasks included: 1) identification of TxDOT policies, guidelines, and standards for guide signing on conventional highways, 2) development of a working paper describing the key issues and the discussion of the working paper in a Technical Panel workshop, and 3) a survey of TxDOT district practices relative to guide signing on conventional highways.

CURRENT TXDOT POLICIES, GUIDELINES, AND STANDARDS

The principles governing the design, application, and placement of traffic control devices in the United States are contained in the national *Manual on Uniform Traffic Control Devices* (MUTCD) (4). TxDOT has developed the *Texas Manual on Uniform Traffic Control Devices* (Texas MUTCD or TMUTCD) (5), for use in Texas. The Texas MUTCD is based on, and in substantial conformance with, the national Manual. The MUTCD is the primary reference for the use of traffic control devices. According to Article III, Sections 29-31 of the Uniform Act (6), all traffic control devices erected on highways shall conform to the requirements of the Texas MUTCD. Throughout this report, any mention of the MUTCD is intended to be the Texas MUTCD, unless specifically indicated as the national MUTCD.

The principles for guide signs on conventional highways are contained in Chapter D of Part II of the MUTCD. There are 54 sections in this chapter which describe many different aspects of conventional guide signing. Section 2D-2 of the TMUTCD contains the following description of the purpose and application of guide signs:

> "*Guide signs are essential to guide vehicle operators along streets and highways, to inform them of intersecting routes, to direct them to cities, towns, villages, or other important destinations, to identify nearby rivers and streams, parks, forests, and historical sites, and generally to give such information as will help them along their way in the most simple, direct manner possible.*"

Figure II-1 illustrates some of the primary guide signs contained in the Texas MUTCD that are used to provide navigational and directional information on conventional highways. Most of these signs are black and white, except for the distance and destination signs, which are white on green. Figure II-2 illustrates typical assemblies for the installation of guide signs. Figure II-3 illustrates the typical placement of guide signs at a rural intersection. Because the Texas MUTCD has not yet been converted to metric units, Figure II-3 contains only American customary units.

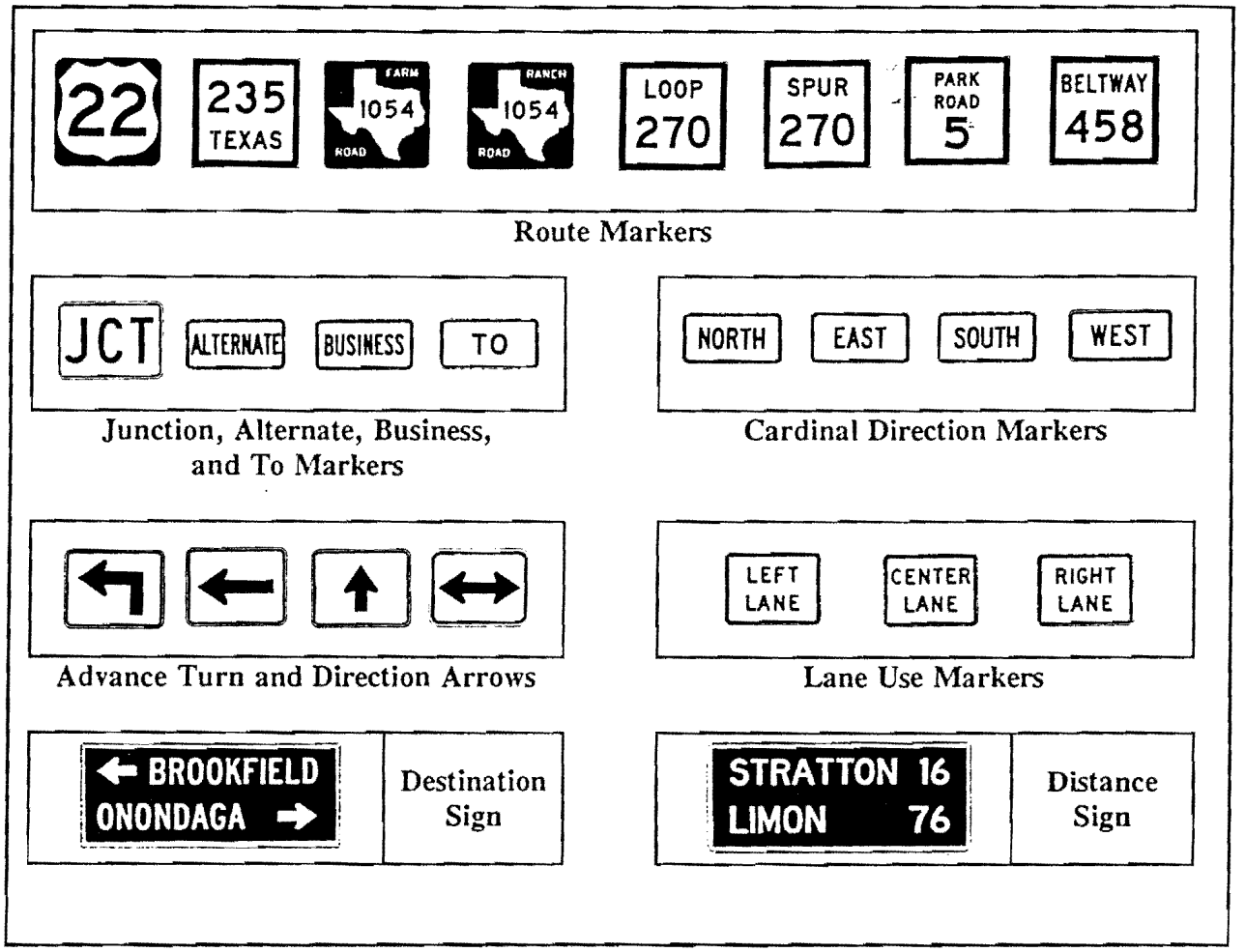


Figure II-1. Guide Signs in the Texas MUTCD (5)

It is worth noting that the Texas MUTCD contains two separate chapters on guide signing. Chapter IID contains the practices for conventional (non-access controlled) highways and Chapter IIE/F for expressways and freeways. Not only are the two types of signing addressed in separate chapters, they are based on different philosophies. The major emphasis of freeway

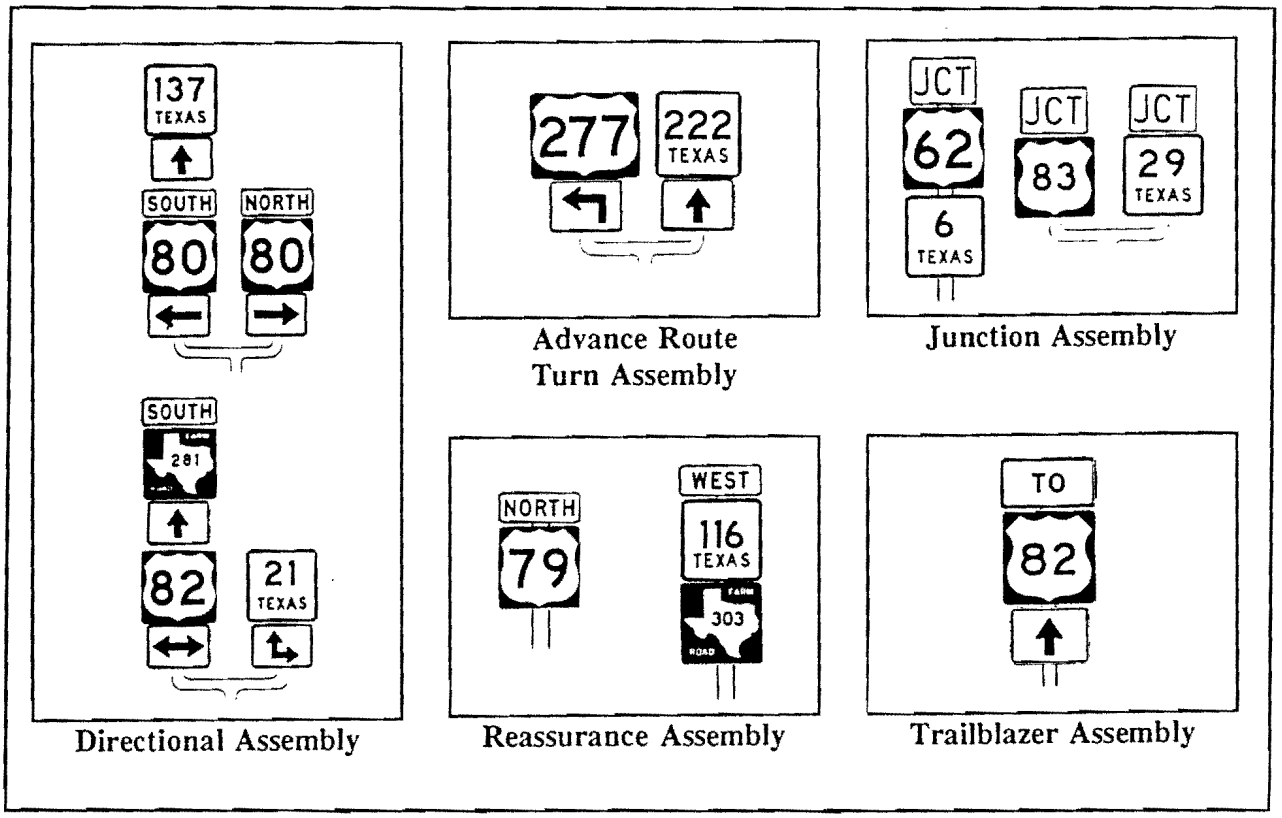


Figure II-2. Guide Sign Assemblies in the Texas MUTCD (5)

signing is on destinations. Control cities and street names provide the primary exiting information for drivers. Route shields and cardinal directions are used in freeway signing, but they are not emphasized at the level of control cities and street names. On the other hand, the major emphasis of conventional guide signing is on route number and cardinal directions. City names are provided in the destination sign in advance of an intersection/interchange, but not at the point where the driver performs a maneuver. The two different guide signing philosophies may create inconsistencies which make it more difficult for drivers to navigate on conventional highways.

The two guide sign philosophies emphasize different types of information for conventional highways and for freeways and expressways. They also present navigation information in different sequences. On freeways and expressways, decision information such as the destination and the highway route number are provided well in advance of the exit. For minor interchanges, an advance guide sign is placed 0.4 to 0.8 kilometer (¼ to ½ mile) from the exit gore. For intermediate or major interchanges, redundant decision information is presented by placing additional advance guide signs at recommended distances of 1.6 and 3.2 kilometer (1 and

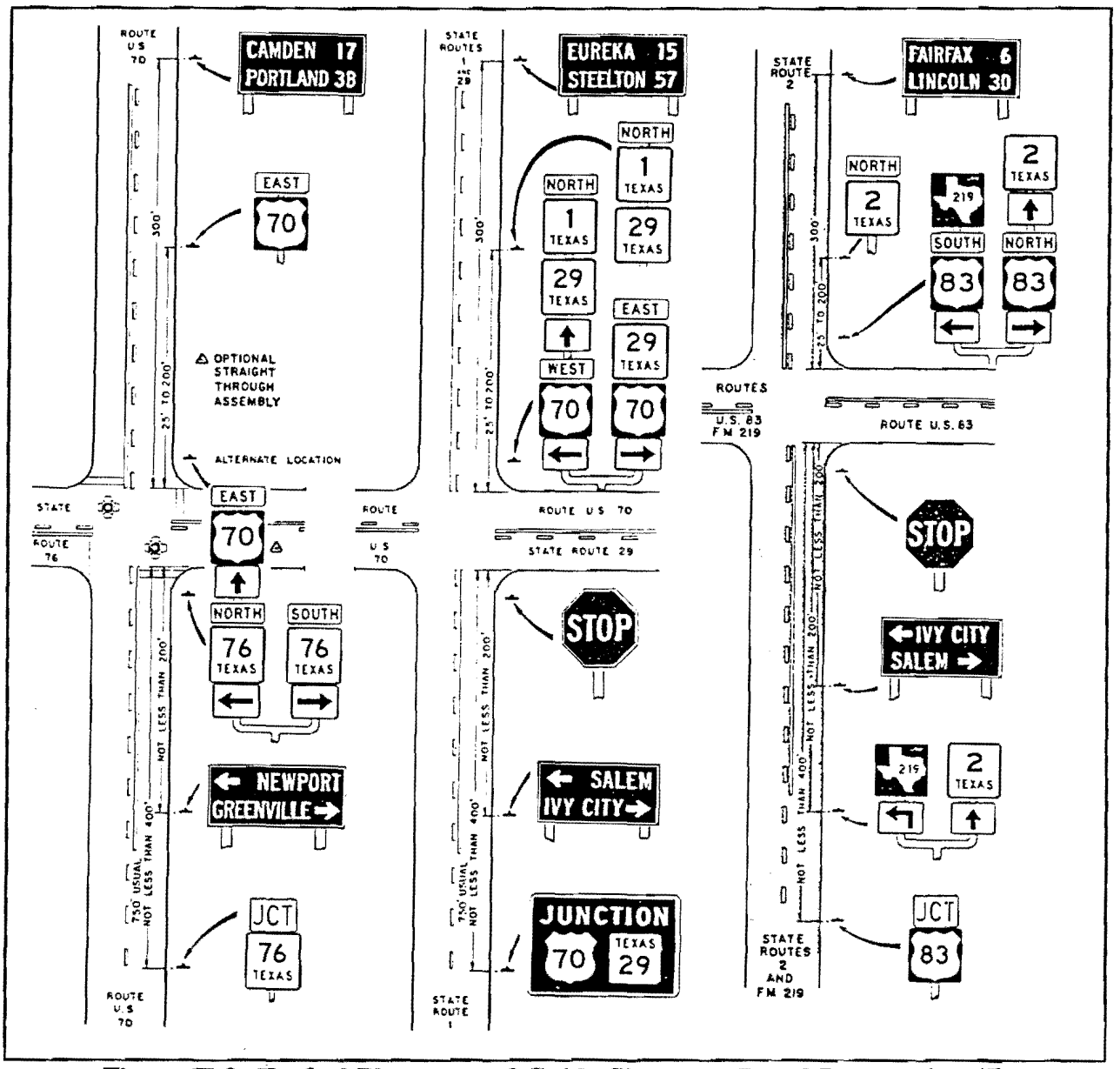


Figure II-3. Typical Placement of Guide Signs at a Rural Intersection (5)
(For one direction of travel only)

2 miles) before the exit. Exit direction signs placed at the beginning of the deceleration lane or in the vicinity of the theoretical gore repeat the route and destination information shown on the advance guide sign(s). The final sign in this sequence is a gore sign with the word EXIT. The gore sign is placed on the physical gore between the main roadway and the exit ramp to indicate the place of departure from the main-line roadway.

The sequencing of advance guide signs, the exit direction sign, and the gore sign on freeways and expressways separates the driver's decision and execution processes into two

distinct operations. This practice attempts to eliminate last-second exit decisions and reduce erratic maneuvers at the exit point. As depicted in Figure II-3, information is more closely-spaced at intersections on conventional highways. Closely-spaced access points necessitate the closer spacing of information. Where operating speeds are slower (compared to freeways and expressways), closer spacing of the decision and execution processes should not present a serious problem; it may be problematic, however, at high-speed rural locations. Providing decision information, such as destination names, in addition to route numbers and cardinal directions at the execution point may facilitate the execution process.

The *Standard Highway Sign Designs for Texas* (7) manual contains the standard designs for guide signs. Figure II-4 illustrates the standard designs for several of the signs evaluated in this study. TxDOT has not yet developed metric sign designs, therefore, Figure II-4 contains only American units. There are several key aspects of these designs which are worth noting. For instance, in the S.H. and F.M. route markers, the height of the number decreases as the number of digits increase. In other words, the more information that is presented to drivers, the smaller it gets. The height of the numbers in the standard four-digit F.M. route marker is 150 mm (4-inch) Series D. This is one-third the height of a number in the U.S. Highway route marker. The Series C alphabet, which has a lower legibility than Series D, is used in cardinal direction markers. Furthermore, the letter spacing in the North and South markers is compressed, further reducing the legibility.

Other TxDOT polices, guidelines, and standards which relate to the signs being evaluated in this research include the following:

- Texas Manual on Uniform Traffic Control Devices, 1980 revised through 1988
- Standard Highway Sign Designs for Texas, 1980 revised through 1990
- Administrative Circular No. 4-90: 3/23/90 - Highway Designations and Posted Signs
- Commission Minute Order 89979: 2/27/90 - Creation of Business Route classification
- D-18TE Memorandum: 7/9/91 - Uniform Signing Standards and Practices
- D-18STO Memorandum: 3/27/90 - Statewide Operations Program
- D-18STO Letter to DEs: 12/27/88 - Destination Signing
- Traffic Control Standard Sheets
  - IE(3) Rest and Picnic Area Guide Signs - 7/90

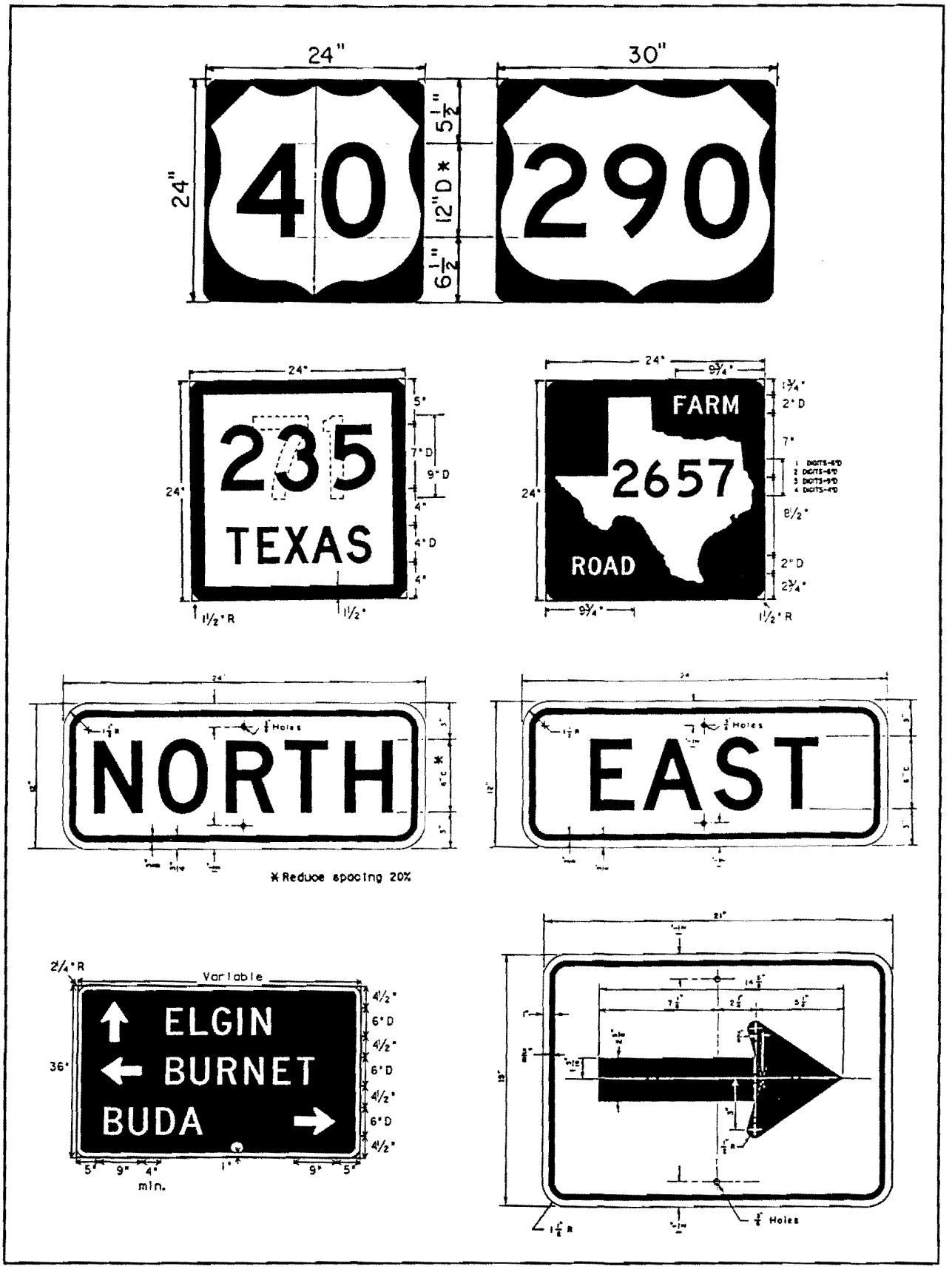


Figure II-4. Standard Designs for Selected Guide Signs (7)

- IM(1) Interstate, U.S., & State Route Markers for Attachment to Guide Signs-7/90
- IM(2) Arrow and Route Marker Attachment Details for Guide Signs - 7/90
- M(1) U.S. & State Route Markers for Independent Mounting - 7/90
- M(2) U.S. & State Route Markers for Independent Mounting - 7/90
- M(3) Route Marker Auxiliaries - 7/90
- SMD(1-1) Pipe Mounting Details for Small Roadside Signs - 4/78
- SMD(1-2) Pipe Mounting Details for Small Roadside Signs - 4/78
- SMD(1-5) Driveable Sign Support Systems for Small Roadside Signs - 11/86

WORKING PAPER AND WORKSHOP

From the outset of this study, the researchers wanted to obtain input and direction from TxDOT personnel relative to the current use of guide signs and the intended focus of research activities. The Technical Panel (TP) for this study provided the necessary input from TxDOT personnel. One of the first study activities was a workshop on guide signs for conventional highways. The 17 workshop participants included the Technical Panel (TxDOT personnel), FHWA representatives, and the researchers. The workshop discussions were based on a guide sign working paper which was prepared by the researchers and distributed to the workshop participants in advance of the meeting. The workshop lasted over six hours, and the discussion helped the researchers identify current guide sign practices and better establish the focus of the research activities. Some of the issues which were discussed included:

- The types of guide signs to be evaluated in the study,
- The impact of metrication and the MUTCD rewrite on the research study,
- Coordination of research activities with the TxDOT Highway Signing Task Force,
- The identification of the designations used for Texas highways,
- The impact of the Texas Trunk System on the research study,
- The identification of TxDOT guide signing policies,
- The discussion of guide sign concerns and potential deficiencies,
- The development of questions which the research study should attempt to answer,
- Potential guidelines or practices which could result from the research, and
- Descriptions of the research activities that were planned for the study.

Summary of Working Paper Workshop Findings

The discussion on these topics was very informative and provided useful direction and input for the research activities that were conducted during the first year of the study. Some of the issues/comments/questions that were raised in the workshop include:

- The current system of conventional guide signing has been in place for many years and is generally understood by drivers. The research should not attempt to replace the current system, but should focus upon refining its effectiveness.
- The research should focus only on guide signing related to route guidance: route markers, cardinal direction markers, arrow markers, destination signs, and distance signs.
- Freeway guide signing combines destinations and route shields on the same sign, and drivers have become accustomed to it.
- The development of a system of control cities for conventional highways may better meet the information needs of drivers.
- Redundant signing may help to meet the information needs of drivers.
- Current advance signing does not always provide the driver with the necessary lane position information. Lane use markers should be used more often with advance signing.
- The lack of centralized control on guide signing may be the source of inconsistencies in guide signing across the state.
- The placement of junction and destination signing may be too close to the intersection to be completely effective. An example is a destination sign, for which the minimum placement is 61 meters (200 feet) from the intersection.
- Considerable demand for the driver's attention at intersection approaches makes it difficult to observe and respond to signs while also looking for conflicts and maneuvering the vehicle. Sign placement should avoid overloading the driver with too many signs at one location. On conventional highways, sign spreading might be accomplished by moving junction, destination, reassurance, and distance signs further from the intersection.

SURVEY OF DISTRICT PRACTICES

A survey of selected TxDOT district personnel was conducted during the first year of the research study. The survey afforded an opportunity to gather information on numerous aspects of conventional guide signing practices. It was intended to meet several objectives:

1. Assess adequacy of the Texas MUTCD guidelines for conventional guide signing in meeting the information needs of motorists.
2. Identify differences between districts in the manner in which rural guide signing is implemented.
3. Identify district practices for processing sign requests.
4. Determine opinions of TxDOT personnel concerning motorists' requirements for navigational information.
5. Identify unique or innovative solutions to unusual or uncommon guidance situations.
6. Identify potential changes to the Texas MUTCD regarding the use of guide signs on conventional highways.
7. Identify potential changes to the *Standard Highway Sign Designs for Texas* manual regarding the design of conventional guide signs.
8. Identify potential study site locations for the research study.
9. Determine opinions of TxDOT personnel regarding the usefulness of documents to address topics related to guide signing for conventional highways.
10. Determine opinions of TxDOT personnel regarding the usefulness of guidelines for various types of guide signs.

District Survey Methodology

Fifteen questions comprised the survey, and respondents were given opportunities to offer any comments or additional information which they felt would be appropriate or helpful to the research effort. The survey instrument is contained in Appendix A. The survey was distributed to each district by the TxDOT Division of Maintenance and Operations. No county or local agencies were contacted. Typically, the survey was sent to the District Engineer, District Traffic Engineer, District Maintenance Engineer, District Sign Shop Supervisor, one Area Engineer, and one Maintenance Construction Supervisor within each district. District Traffic

Engineers (and in some cases, District Maintenance Engineers) typically handle traffic engineering-related issues as part of their daily job responsibilities. Most of these engineers have a good understanding of traffic engineering principles. Surveys were also completed by engineers and technicians who do not deal with traffic engineering issues on a regular basis. Some of these individuals may not be familiar with all of the traffic engineering principles related to a specific issue.

District Survey Results

A total of 96 completed surveys were returned to TTI. The following paragraphs summarize the major results and findings of the district survey. Appendix B contains the percentage of responses for each of the multiple choice questions and a summary of the comments for each question.

The survey asked if locations exist where the application of Texas MUTCD guidelines does not adequately convey needed or timely information to motorists. Over 90 percent indicated that such locations do not exist within their districts. Certain problems were identified, however, by some of the respondents: confusion due to too many signs, differences between freeway/expressway signs and conventional signs, confusion over sign meanings, inadequate letter size on certain signs, need to utilize freeway/expressway signing on certain conventional highways, and concerns about sign interpretation and/or understanding along the border with Mexico.

Thirty percent of the respondents indicated that many districts observe different practices in implementing conventional guide signs. These different practices fall into nine categories or areas of concern: uniformity of guide sign policies, uniformity of guide signing within individual districts, signing for traffic generators, number of signs used, application of cardinal direction markers, application of destination and distance signs, guide signing of intersecting roadways, types of signs mounted on a pole, and cemetery signing.

The districts appear to have fairly similar procedures for handling sign requests, as indicated by the response to two questions. However, the degree of "formality" in these procedures - whether or not they are standard written policies or are simply habits that have developed over

time - is uncertain. Often, the area engineers and/or local maintenance sections authorize routine or standard guide signing. The district traffic section is not typically involved in this process. In many cases, only special requests or guide signs for complex situations are handled by the district traffic engineering section. When a special case exists, the survey responses indicated that the typical process includes the following steps:

1. The sign request is forwarded to the district traffic engineer for review. Field studies are conducted if necessary, and the request is evaluated on the basis of applicable Texas MUTCD guidelines. A decision is made by the traffic section to approve or reject the sign request.
2. If the request is approved, the district sign shop fabricates the sign per the instructions of the district traffic section.
3. The sign is installed by district maintenance personnel as directed by the district traffic section.

The level of involvement of engineering staff in the provision of conventional guide signing is fairly high. Over 60 percent of the respondents indicated that an engineer is "always involved" in the request, design, and/or installation of a new sign, and nearly 25 percent responded that an engineer is "usually involved." No respondent indicated that an engineer is "never involved," and fewer than ten percent replied "rarely involved."

Inadequate advance notice of intersections and interchanges, overlapping highway routes, and routes through urban areas are the situations most likely to cause driver confusion. By comparison, too few guide signs and a lack of directions to traffic generators and tourist attractions are relatively unlikely to be a cause of driver confusion.

In the opinions of the survey respondents, route markers are the most important means of satisfying motorists' needs for navigational information. Advance and direction arrows, destination signs, and cardinal direction markers were of relatively equal value, yet secondary in priority to route markers. By comparison, the respondents were prompted for their opinions as to which sign type drivers considered to be of primary importance in terms of navigational information. Again, route markers were ranked first, followed closely by destination signs. Distance signs, advance and direction arrows, and cardinal direction markers were of approximately equal value. In both instances, lane use markers received fairly low ratings.

Survey respondents were asked to identify and describe unique guide signing practices which had been implemented within their respective districts. Among the unique practices that were reported were the use of oversize signs and lettering and overhead guide signs on conventional roadways and signing of intersecting county roads.

The remaining survey questions were intended to provide a variety of information to assist in planning study activities and to focus the research effort during the second and third years of the project. Nearly thirty potential study sites were identified by the survey at which to observe driver behavior and/or to install new or revised guide signing.

The survey asked for comments on or suggested changes to the Texas MUTCD specifically related to conventional guide signs. The responses that were received dealt with (number of comments in parentheses): special interest signing (7), signing for traffic generators (6), larger signs and/or lettering (5), destination signs (5), route numbers (4), reduced number of signs (3), format of the MUTCD (2), overhead mounting of guide signs (2), improved standardization and uniformity (2), and increased or improved training of maintenance personnel (2). In addition, numerous modifications to the *Standard Highway Sign Designs for Texas* document were suggested. Summaries of the comments for the MUTCD and *Standard Highway Sign Designs* are provided on pages B-8 and B-9. Each of these subjects should be considered a potential focus for further research throughout the duration of this study.

The potential usefulness of various types of documents related to conventional guide signing was investigated. Information and criteria on installing traffic generator and special event guide signs is of the greatest potential use, in the opinions of the district personnel. Documents to describe possible combinations of various types of guide signs and information on maintenance, installation, and fabrication practices may also be of use. Guidelines for the use of eleven different types of conventional guide signs were all considered to be of definite or potential use. The eleven types of guide signs included: distance signs, destination signs, route markers, cardinal direction markers, direction arrows, lane use markers, junction assemblies, advance route turn assemblies, directional assemblies, reassurance assemblies, and trailblazer assemblies.

Summary of District Survey Findings

The TTI survey of district guide signing practices for conventional highways afforded an opportunity to gather information about numerous aspects of conventional guide signing on Texas highways. Analysis of this data led to the following findings:

- **The Texas MUTCD guidelines for guide signing on conventional highways are, in general, effective in providing needed and timely guidance information to motorists.** However, there are some exceptions which deserve further investigation.
- **Many of the districts observe different guide signing practices.** The main differences include uniformity of guide sign policies, signing for traffic generators, the total number of signs used, and applications of cardinal direction markers and destination and distance signs.
- **Some district personnel may be unaware of formal or standard district policies and procedures for processing requests for new signs.** Contradictory responses received from personnel from the same district provided evidence for this conclusion.
- **There is substantial evidence that route markers are by far the most important type of conventional guide sign for providing navigational information to motorists.** Advance and direction arrows, destination signs, and cardinal direction markers are of approximately equal importance. Lane use markers and distance signs were considered to have the lowest priority of the given sign choices.
- **It is the opinion of the TXDOT personnel surveyed that drivers consider the route marker to be the most important source of navigational information.** Destination signs are of nearly equal importance. Distance signs and advance and direction arrows are also important sources of information. Lane use markers were considered to be of lower priority as sources of navigational information.
- **Engineering staff have a high level of involvement in the sign review, design, and installation process.** Most of this involvement is focused on the review and approval of new sign requests. Eighty-five percent of respondents to the survey indicated that an engineer is "always" or "usually" involved in this process.
- **Failure to provide adequate advance notice of intersections and interchanges, the existence of overlapping highway routes, and routes through urban areas are the situations most likely to be a cause of driver confusion.** The use of too few guide

signs and failure to provide directions to traffic generators and tourist attractions are considerably less likely to create driver confusion.

- **Approximately half of the survey respondents indicated that a need exists to revise the Texas MUTCD requirements for conventional guide signing.** Suggested changes were related to special interest signing, signing for traffic generators, larger signs and/or lettering, destination signs, route markers, reduced number of signs, format of manual, overhead mounting of guide signs, improved standardization and uniformity, and improved training of maintenance personnel.
- **Approximately one-quarter of the survey respondents indicated a need to revise the *Standard Highway Sign Designs for Texas* manual.** Suggested changes included increased size of letters and/or signs, standardization of several types of signs (e.g., county road guide signs and cemetery signs), increased conspicuity of signs, and elimination of certain types of route marker signs. Significantly, several of those surveyed indicated that they were not familiar with this document.
- **A document to address the issue of traffic generator or special event guide signs would be useful to many TXDOT personnel.** Such a document might include information or revised guidelines and criteria for traffic generator signs. Documents on possible combinations of guide signs, maintenance practices, and installation of guide signs are likely to be of use as well. Little perceived need exists for a document to address fabrication practices for guide signs.
- **Documents containing guidelines for each of the given guide sign types might be useful.** No single document received overwhelming support or disfavor. The analysis did not reveal any considerably greater or lesser need for a document addressing any particular sign type.

CHAPTER III
DRIVER INFORMATION NEEDS

In order to provide effective guide signing for motorists on rural highways, it is necessary to gain an understanding of the information they need and how the information can best be presented. Two key tasks in the first year of the study were intended to evaluate the information needs of drivers. These two tasks included a guide signing survey given to drivers at four small-town events and focus groups that were conducted in three cities.

DRIVER SURVEY

A survey was conducted to determine ways of improving the guide signing on Texas rural highways. The survey was intended to identify the navigational information needs of drivers, the manner in which they use this information and plan highway trips, their understanding of and use of conventional guide signs, their understanding of highway characteristics and the differences between highway classifications, and some general questions about Texas highways.

Driver Survey Methodology

The driver survey contained 18 questions about guide signing and related issues. It also contained 9 additional questions which were used to identify demographic and other background characteristics. Appendix C contains the instrument used in the driver survey. The survey was administered at four events located in small or rural type cities in Texas. The cities were selected because they are not located on the Interstate Highway System. These events at which the driver survey was given included:

- **Bluegrass Festival** - This festival is a Friday through Saturday event which attracts approximately 3,000 people. It is held in Overton, which is about 32 kilometers (20 miles) southeast of Tyler and 40 kilometers (25 miles) southwest of Longview.
- **Riesel Community Fair** - This fair is a Thursday through Saturday event which attracts about 20,000 people. It is held in Riesel, which is about 24 kilometers (15 miles) southeast of Waco and 113 kilometers (70 miles) northwest of Bryan/College Station.

- **Old-Time Fun Festival** - This festival is a Saturday and Sunday event which attracts approximately 1,500 people. It is held in Wallis, which is about 48 kilometers (30 miles) west of Houston and 16 kilometers (10 miles) south of Sealy.
- **The Great Texas Mosquito Festival** - This festival runs from Thursday through Saturday and attracts approximately 30,000 people. It is held in Clute, which is about 72 kilometers (45 miles) south of Houston and about 16 kilometers (10 miles) north of Freeport.

Driver Survey Results

A total of 428 surveys were completed from the four survey locations. The following paragraphs summarize the major results and findings of the driver survey. Response percentages for the total survey sample are shown in Appendix D.

Four questions dealt with the planning and informational source needs of drivers when making a trip. The results of the survey showed that drivers rely on many different means to plan and obtain navigational information on trips, but depend primarily on maps and highway signs. The type of information used to plan a trip depends on whether the trip is a business trip or a pleasure trip. In the case of a business trip, the travel time is most important, followed by the quality of the highway and the need to avoid traffic during the trip. When the trip is for pleasure purposes, the emphasis of planning is on the scenery and attractions that are along the way.

Ten questions concentrated on various signs that are used on rural highways. Respondents were shown the basic shapes for Interstate, U.S., State, and Farm-to-Market/Ranch-to-Market highway route markers and asked to identify the class of highway. Two-thirds of those surveyed correctly identified the Interstate, U.S., and Farm-to-Market (F.M.) route markers. Respondents had greater difficulty with the State Highway route marker, as less than half correctly identified its use as the State Highway route marker. Only twenty percent of the respondents could identify the Texas silhouette of the F.M. route marker as also representing a Ranch-to-Market Road. Most likely, this result is due to the location of the four survey sites which are all in areas were the F.M. designation is more commonly used than the R.M. designation. For each of the four signs surveyed, more than one-quarter of the respondents incorrectly identified the

sign's proper use. For the State Highway route marker, "Farm-to-Market Road" was the incorrect alternative selected most often. For the Interstate, U.S., and Farm-to-Market/Ranch-to-Market route markers, "State Highway" was the incorrect alternative selected most often.

Three-quarters of those surveyed correctly identified the proper use of the Advance Turn Assembly, although eighteen percent mistakenly associated the advance turn arrow auxiliary sign with a curve ahead sign. One question required the subject to place the signs at highway intersections in their proper order. The two signs after an intersection, the reassurance assembly and the distance sign, were placed in their positions correctly most often, by forty-eight percent and seventy percent, respectively. On average, the junction assembly was placed in the first position, its proper position, while the destination sign and turn assembly were switched from what is used in standard practice.

Two questions addressed the importance of various signs and the information presented by these signs. Three-quarters of the respondents considered route markers, arrow auxiliary signs, and destination signs as very important when traveling. The information provided by two of these signs, the route number and the name of the next city or town, was considered the most important information provided by rural guide signs. The visibility of the numbering and lettering used on these signs was evaluated by asking drivers if they have difficulty seeing them. Forty-five percent responded that they have difficulty some of the time or all of the time. There was some concern that older drivers are having trouble with the size of the numbers and letters. Interestingly, while fifty-eight percent of the 65 and older respondents said they have some problems, only thirty percent of the 55 to 64 age group said they have some problems.

The third part of the survey investigated whether drivers make assumptions about the characteristics of a highway based on the administrative classification. Interstate and U.S. Highways were identified fifty percent of the time or more as multi-lane (four or more total lanes), high speed highways that connect and are located within large cities. Conversely, State Highway and F.M. roads were identified by a majority of subjects as two lane roads that connect and are located within small cities and rural areas. A majority of respondents also indicated State Highways could be posted for 88 kilometers per hour (55 miles per hour) or higher.

Some general questions about rural guide signing and Texas highways were asked. The respondents rated the quality of the guide signing on Texas highways, from one (very poor) to ten (very good). The average rating of guide sign quality was 7.4. A space was provided for the person taking the survey to comment on guide signing and to identify places where they have had problems with rural guide signing. Twenty sites were identified as potential study areas for future use in this study. The comments fell into five basic categories: increase sign or lettering size, make the signs more durable, better reflectivity, advance notice of and less clutter at an intersection, and positive comments about the signing.

Nine questions of the survey were asked to determine the demographic make-up of the survey respondents. The categories included age, gender, Texas residency, driving experience, level of education, family background, types of vehicle driven, size of city of residence, and trip distribution. The typical respondent of the survey was an Anglo resident of Texas with a minimum of five years of driving experience in a car or pick-up, who has a minimum of some college education and is between the ages of 25 and 54. Roughly equal representation occurs for the gender and city size categories. Respondents drive seventy percent of the time on roads that they are very familiar with, driving on unfamiliar roads only ten percent of the time. Table D-1 in Appendix D summarizes the characteristics of the survey sample.

Summary of Driver Survey Findings

The TTI survey of driver information needs on conventional highways afforded an opportunity to gather information about numerous aspects of conventional guide signing on Texas highways. Analysis of this data led to the following findings:

- Drivers use the highway map most often for trip planning and navigation. The highway sign was the second most used source of information.
  - The information provided by these two sources needs to be uniform/identical.
- Different criteria is used to plan trips between cities based on the type of trip:
  - Business: travel time, quality of the highway, avoiding traffic.
  - Pleasure: scenery, attractions along the highway.
- The highway type represented by the route markers are **not** universally known.
  - The State Highway route marker had the lowest recognition among respondents. Less than half could correctly identify this sign.

- ▸ Use of a single route marker for all State and F.M./R.M. highways to reduce confusion between the two present signs. Some present association of the F.M. marker with State Highways because of the Texas silhouette.

- The Advance Turn Assembly is understood by most drivers, with the exception of older drivers and those with less than a high school education.
  - ▸ A possible alternative could be the use of a graphical representation of the intersection(s), especially if there is more than one intersection located near the sign.
- The order for intersection signing was generally recognized, although the position of the destination sign and the Turn Assembly were switched. The turn assembly was placed in advance of the intersection more often than the destination sign.
  - ▸ These two signs could be switched, combined, or positioned on the opposite side of the intersection.
- The signs considered the most important were the destination sign, route markers, and arrow signs (advance turn and turn). A majority of respondents also felt lane assignment markers, cardinal direction markers, and auxiliary markers were very important.
  - ▸ There was a trend of greater importance for all signs as the age of the driver increased, especially the route markers and arrow signs.
- Just under half of drivers have some difficulty seeing the lettering or numbering on guide signs.
  - ▸ The legibility of guide signs among older drivers should be evaluated.
- The most important type of information was the highway number and the name of the next city or town.
  - ▸ This information, in conjunction with that from question 12, supports emphasis on the route markers/highway number and destination sign/name of the next city or town as the base for guide signing.
- Associations/assumptions about a highway are made based on the highway classification:
  - ▸ Interstate Highway - Multilane, high speed, located in and connects large cities, cross state lines, and require use of ramps for access.
  - ▸ U.S. Highway - High speed, located in and connects large cities, and cross state lines.
  - ▸ State Highway - Two-lane, high speed, connects small towns and rural areas, and located in large and small cities.
  - ▸ F.M./R.M. Highway - Two-lane, lower speed, located in small cities, and connect small towns and rural areas.

- Fewer assumptions/associations made by older drivers.
- Strongest assumptions/associations made for Interstate and Farm-to-Market highways.

- Overall quality of guide signs on Texas highways is above average (7.4 on a scale of 1-very poor to 10-very good).
- Twenty potential investigation sites were identified.
- Comments suggesting general improvements were made:
  - Larger signs or lettering/numbering.
  - More reflective signing/easier to see at night.
  - Advanced notification of intersections sooner.
  - More reassurance assemblies, both directly after intersections and between intersections.
  - Signs showing cities and available services.

FOCUS GROUPS

Three focus group sessions were conducted as part of this study. The purpose of the focus groups was to gather information and driver opinions regarding signs and driving on rural highways in the state of Texas. The interviewer's objective in these sessions was to focus on the participant's habits, experiences, and concerns regarding signs and driving on Texas highways. The focus group format was used because it allows the interviewer to focus attention on personal experiences. The focus group method allows participants to provide spontaneous responses to a given subject and to offer comments and opinions about the subject matter. Responses tend to be more specific than those obtained by traditional interview survey techniques, and are closely related to the driver's own personal experience.

Study Methodology

The three focus groups were conducted in three Texas cities and were intended to represent the groups described below. Each group consisted of ten individuals and individuals were compensated for their time.

- Rockport - A small coastal town about 81 kilometers (50 miles) north of Corpus Christi. The participants in this focus group were recruited from a local chapter of the American Association of Retired Persons in order to obtain comments from the older driver population.

- Somerville - A rural community about 48 kilometers (30 miles) southwest of Bryan/College Station. The participants in this focus group were recruited to represent the opinions from a small town in a rural environment.
- Bryan/College Station - A medium-sized urban area located about 161 kilometers (100 miles) northwest of Houston. This area is the home of Texas A&M University and it is the largest urban area in Texas which is not connected to an Interstate Highway. The participants were recruited to obtain comments from drivers who rely upon the conventional highway network.

The moderator (a member of the research team) began by explaining that the purpose of the session was to discuss the habits, experiences, and possible concerns of participants regarding rural guide signs and driving on Texas highways. During the focus group proceedings, the purpose of the moderator was to lead the discussion and to ensure that all group members had an opportunity to share their ideas and feelings. Several subject areas were discussed during each focus group session, including driving patterns, trip planning, navigational aids, signing, arrows, highway classification systems, urban versus rural signing, and the general adequacy of the guide signing system. Slides were used to illustrate current guide signing practices and to solicit input on the effectiveness of current guide signs.

Focus Group Results

A total of 30 people participated in the three focus groups. The following paragraphs describe the major findings resulting from the focus group discussions. Appendix E contains a table summarizing the findings of the focus groups.

Driving Patterns

Individual driving patterns were investigated, including when the subjects drove, the types of roads they drove on and/or preferred to drive on, and how often they travelled on unfamiliar highways.

The preferred time of day for travel varied from group to group. The Rockport subjects, in general, avoided nighttime driving whenever possible. They attributed this to their degraded

eyesight. Adverse weather conditions, especially fog and heavy rainstorms, were also avoided by this group of subjects. The Somerville subjects, however, expressed a preference for driving at night or during the early morning hours in order to avoid heavy traffic. A majority of the College Station group had no preference for either daytime or nighttime driving.

All thirty participants had travelled on all types of highways. The Somerville and College Station subjects expressed a preference for Interstate highways because they are faster and have fewer stops. On the other hand, some of the Rockport subjects try to avoid larger cities and travel on State Highways and bypasses. Driving on so-called "back roads" is done primarily to enjoy the scenery, and not for any perceived safety benefits.

A majority of the focus group participants travel primarily on highways with which they are familiar. Those that indicated they do travel on unfamiliar roadways stated that they have experienced little trouble. Evidence from the Rockport group indicated that unfamiliar driving ranges from none to 40 percent of all travel, and that the average person travels on unfamiliar highways approximately 20 percent of the time.

Trip Planning

Maps are the most important, and sometimes essential, trip planning tool, according to all three groups. The College Station focus group emphasized short routes, the type of road, and the route number when using a map; Interstates and landmarks were also important. The Somerville group indicated that cities and route numbers are used as reference points; many marked their route selection on the map prior to making the trip. Members of the Rockport study often selected routes that are scenic or that have less traffic; not being in a hurry and passing through "quaint" towns were also factors in their route choice decisions.

The general consensus between the three groups was that "directions from other people" are not particularly useful when planning a trip. Members of the Rockport group indicated that they do not seek directions from other people at all. Only one member of the Somerville group mentioned that he uses directions from other people; he obtains route numbers and city names. The College Station group makes greater use of directions from others; county road numbers, landmarks, and accurate distance "estimates" are essential.

For the College Station group, cardinal directions, the Interstate shield, and the color of the signs were reported to be the most important. One Somerville group member relies strictly on guide signs, primarily route numbers and city name guide signs.

Navigational Aids

Route numbers and cardinal directions were considered essential by all participants. More frequent use of cardinal directions in conjunction with route markers was suggested by one group. Some members of this same group recommended that the words "left" and "right" also be used.

Guide signs containing city names were also important. The consensus in the Rockport group was that more destination signs are needed. This group also indicated that placing three city names on a single sign would not be too much information, provided all three cities are in the same direction. Destination signs displaying the next small city and the next major city were preferred. The College Station subjects indicated that destination and distance signs are important and that they should be placed within 81 kilometers (50 miles) of the named city. When asked how frequently this information should be presented, some replied every ten miles while others simply indicated more frequently than at the present. Four members of this group were in favor of three city names on a single sign when two are small towns within 81 kilometers (50 miles) and the third is a larger town or major city. The remaining six group members favored two names on a single sign. The Somerville group also emphasized the importance of guide signs with city names and agreed that more are needed. One suggestion was after each intersection, and another stated at least every ten miles. For destination signs, the group consensus was to display the next three cities, provided they are not too far from each other, with the closest city listed first and the furthest listed last. On distance signs, all groups preferred mileage placed to the right of the city name and distance signs for upcoming major out-of-state cities.

Highway Classification System

Each group considered the existing system of highway classification and was asked to describe problems or provide suggestions pertinent to highway classification. Results varied between groups.

According to members of the Rockport focus group, the highway classification system is fine and helpful as is and needs no improvement. It was agreed, however, that the important element in the classification system is the set of numbers, not the shape or road classification.

The following descriptions were provided by members of the College Station focus group for various highway classifications:

- Interstate Highway - you can travel very fast
- F.M. Road - a Farm-to-Market Road; no center stripe or a gravel road; need to exercise care on this type of road
- U.S. Highway - a major highway; goes a long distance
- Park Road - road dead ends into a park or lake

Three members of this group identified the even/odd scheme for highway numbering on Interstate highways. Several stated that the U.S. Highway sign should say "highway." The Texas State Highway route marker was confusing to some. There was a feeling that words should be used to explain the type of road.

The Somerville subjects agreed that the numbers, shapes, and shades are useful in informing of the different types of highways. The Texas symbol is helpful in identifying an F.M. road. No suggestions were received from this group on improving the highway classification system.

Urban Versus Rural Signing

All subjects in the College Station and Somerville focus groups agreed that they look for different information on urban guide signs than they do on rural guide signs. One aspect of urban signing that many felt should be incorporated into rural guide signing is the use of overhead mounting of signs. A majority of the College Station participants favored this approach, especially for ease of viewing during nighttime driving. The remainder felt that showing the existing signs more frequently would be adequate. The Somerville group asked for larger lettering and more guide signs on rural routes, as well as distance information (e.g., LONGVIEW - EXIT 3/4 MILE) and more advertising signs (e.g., rest areas, hotels, restaurants). The Rockport group was also in favor of overhead mounting of signs and the

increased use of urban-type guide signs on rural roads. However, they also recognized that cost is a major factor in such installations.

General Adequacy of the System

The general consensus among all three groups is that the present system is adequate and that Texas highways are the best to drive. Some areas of potential improvement were noted:

- Some signs might be displayed better.
- At times, there is too much information on a sign.
- Signing prior to entrances to loops needs to be improved.
- More guide signs of all types are needed in rural areas.

Summary of Focus Group Findings

The TTI focus groups afforded an opportunity to gather information and driver opinions regarding signs and driving on rural Texas highways. Analysis of the sessions led to the following findings:

- Different types of drivers have different driving patterns.
  - Older drivers prefer to drive during the daytime, and on the State Highways and bypasses near cities.
  - Residents from rural areas prefer to drive in early morning and later evening in order to avoid traffic.
- Maps are used extensively in trip planning. There was a consensus of the groups that city names and route numbers were the primary information that was looked for on maps and guide signing.
  - Directions from other people were considered useless because of the lack of references to landmarks, county road numbers, or accurate "estimates" of distances.
- Route markers, cardinal direction markers, auxiliary markers, destination signs, and distance signs were all considered to be very important.
  - It was the opinion of some group members that signs with city names should be placed at least every 16 kilometers (10 miles) and could effectively have three cities listed.

Other participants stated that city name information should be presented more frequently than it is now, but did not specify how frequently.

- The odd/even highway number system for the Interstate and U.S. Highways was understood by most members of the focus groups.
  - The three digit numbering for the Interstate highways was not as well known.
- Two ways of improving the signing at intersections were suggested:
  - Show the existing signing more frequently.
  - Use overhead signing, especially for left turning routes and nighttime viewing.

CHAPTER IV
EVALUATION OF GUIDE SIGN LEGIBILITY

A major concern of this research study is the adequacy of guide sign legibility, particularly with respect to the older driver population. Therefore, three different legibility evaluations were conducted in the first year to assess the legibility of two route markers and two designs for the cardinal direction marker.

STUDY METHODOLOGY FOR LEGIBILITY EVALUATIONS

Three different evaluation procedures or tests were used to assess the legibility of the four different guide signs. There were 32 participants in the legibility evaluations, and subjects were compensated for their participation.

Evaluation Tests

Most previous research into the legibility of signs has been performed under static conditions and often in laboratories, conditions which do not always represent actual driving conditions. Therefore, for the evaluations in this research, the legibility of the signs was measured from a moving vehicle in an effort to more realistically simulate normal driving conditions. Measurements were also made from a stationary vehicle in order to provide a basis of comparison to previous research. A more accurate representation of the actual driving environment was also created in one of the legibility tests which required the subject to discern the highway number from several route markers on a single assembly. Table IV-1 summarizes the key aspects of the three legibility tests conducted for the legibility evaluations. All subjects participating in the study were required to have a current valid driver's license. Prior to performing these tests, each subject was given an acuity test and a contrast sensitivity test to allow correlation between legibility distances and visual acuity.

The two dynamic tests began 152 to 183 meters (500 to 600 feet) from the sign assemblies. The subject was in the driver position and began driving the vehicle toward the signs at approximately 56 kph (35 mph). At a predetermined distance from the signs, an occluder device

was used to block the subject's view of the signs. The subject brought the vehicle to a stop and indicated the proper response. For the multiple dynamic test, the subject was asked to indicate the position (upper left, lower left, or lower right) of a prespecified route marker. The subject response in the single dynamic test was to identify the highway number in the route marker, as well as the cardinal direction displayed. In both dynamic tests, the subject then drove back to the start and repeated the test with the same target signs. For the succeeding trials, the occluder was dropped at a distance that was 8 meters (25 feet) less than the previous run.

Table IV-1. Legibility Evaluation Tests

Test Procedure	Number of Sign Assemblies[1]	Vehicle	Subject Response
Static	Four	Stopped	Read highway number and cardinal direction.
Single Dynamic	One	Moving at 56 kph (35 mph)	
Multiple Dynamic	Three		Indicate the position of a specified route marker in the assembly.

Note: [1]A sign assembly consisted of one cardinal direction marker, a route marker, and a directional arrow marker.

In the static test, four assemblies were located at the sign installation, and the test subject sat in the passenger seat. The test began with the vehicle at a given distance from the signs, and the subject attempted to read the highway numbers and cardinal directions. The subject's view of the signs was blocked and the vehicle was then moved 8 meters (25 feet) closer to the signs. The subject was then asked to read the signs again. This procedure was repeated until all four assemblies could be read.

Multiple runs were conducted for each of the legibility tests. The total evaluation for each subject lasted approximately two hours. Signs were changed whenever a subject was certain of the sign legends. Figure IV-1 illustrates the typical sign installation used in the evaluations. This installation met the height and spacing requirements for guide signs and also provided the ability to quickly switch the signs in the assembly. A total of ten different S.H. and ten different F.M. route markers were used in the evaluations.

During the testing process, the subject was not told when they had correctly identified the sign legend or location; therefore, each individual legibility test continued, allowing the subject to get 8 meters (25 feet) closer to the sign assembly with each pass, until the subject responded

Figure IV-1. Typical Sign Installation

that they were certain of the identity of the legend or location and thus ended the test. For each individual legibility test, there were two distances of primary interest. These distances were denoted as "best" and "certain." Best refers to the distance at which the subject first correctly identified the sign legend or location. Certain refers to the distance at which the subject indicated that he/she was certain of the sign legend or location.

Guide Signs Evaluated

The signs used in this portion of the study included: the State Highway (S.H.) route marker (M1-6T) with a three digit, 175 mm (7-inch) tall number, the Farm-to-Market Road (F.M.) route marker (M1-6F) with a four digit, 100 mm (4-inch) tall number, and all four cardinal direction markers (M3-1 to M3-4). The cardinal direction markers included the current design, in which all letters are 150 mm (6-inch) Series C, and a new design in which the initial letter is 175 mm (7-inch) Series C and the remaining letters are 150 mm (6-inch) Series C. All sign dimensions were based on English (inch) measurements. The original study plan also included directional arrow markers (M6-1 and M6-3). However, the legibility evaluations for the initial subjects indicated that the arrows could be discerned at distances that were much greater than the other

signs. As a result, the legibility of the arrow markers was not recorded for the remaining subjects. Figure IV-1 illustrates one of the route markers and both types of cardinal direction markers.

RESULTS OF LEGIBILITY EVALUATIONS

In the selection of subjects, it was decided to concentrate on older drivers. For this study, an older driver was defined as any driver 60 years of age or older. A younger driver was defined as any driver 50 years of age or younger. There were no subjects between the ages of 50 and 60. Of the 32 subjects who participated in this study, 24 were classified as older drivers and 8 were classified as younger drivers. The mean age of the older driver group was 71.0 (standard deviation = 6.4). Younger drivers averaged 29.9 years in age (standard deviation = 8.5). The ratio of females to males in both categories was kept at 1:1.

A comparison of the mean legibility distances for older and younger drivers on State Highway (S.H.) and Farm-to-Market Road (F.M.) route markers for all three evaluation tests can be seen in Tables IV-2 and IV-3.

Table IV-2. Legibility Distances for 3-digit S.H. Route Marker[1]

Evaluation Test	Legibility Measurement[2]	Legibility Distance, meters (feet)			
		Older Drivers[3]		Younger Drivers[3]	
		Mean	85th Percentile	Mean	85th Percentile
Static	Best	121 (398)	76 (250)	152 (499)	134 (438)
	Certain	108 (354)	69 (225)	135 (442)	111 (363)
Single Dynamic	Best	117 (383)	76 (250)	136 (446)	126 (413)
	Certain	111 (364)	69 (225)	127 (416)	114 (375)
Multiple Dynamic	Best	138 (453)	80 (263)	157 (516)	145 (475)
	Certain	128 (421)	73 (238)	151 (497)	137 (450)
Average of Tests	Best	125 (411)	77 (254)	148 (487)	135 (442)
	Certain	116 (380)	70 (229)	138 (452)	121 (396)

Notes: [1]The 3-digit S.H. highway route marker uses a 175 mm (7-inch) tall, Series D number.
[2]The "best" measurement is the distance at which the driver thinks he/she can first read the sign. The "certain" measurement is the distance at which the driver is certain of the sign legend.
[3]For the legibility evaluations, older drivers were age 60 and over and younger drivers were age 50 and under.

Table IV-3. Legibility Distances for 4-digit F.M. Route Marker[1]

Evaluation Test	Legibility Measurement[2]	Legibility Distance, meters (feet)			
		Older Drivers[3]		Younger Drivers[3]	
		Mean	85th Percentile	Mean	85th Percentile
Static	Best	65 (212)	38 (125)	79 (258)	71 (213)
	Certain	58 (190)	35 (113)	65 (213)	55 (181)
Single Dynamic	Best	56 (182)	31 (100)	68 (224)	57 (188)
	Certain	53 (174)	31 (100)	63 (207)	53 (175)
Multiple Dynamic	Best	75 (247)	46 (150)	82 (268)	73 (238)
	Certain	67 (220)	31 (100)	78 (255)	65 (213)
Average of Tests	Best	65 (214)	38 (125)	76 (250)	65 (213)
	Certain	60 (195)	32 (104)	69 (225)	58 (190)

Notes: [1]The 4-digit F.M. route marker uses a 100 mm (4-inch) tall, Series D number.
[2]The "best" measurement is the distance at which the driver thinks he/she can first read the sign. The "certain" measurement is the distance at which the driver is certain of the sign legend.
[3]For the legibility evaluations, older drivers were age 60 and over and younger drivers were age 50 and under.

The legibility distances for the certain condition for both S.H. and F.M. markers and older and younger drivers as presented in Table IV-2 can be seen graphically in Figure IV-2. This figure shows the mean and 85th percentile legibility distances for both the younger and older groups obtained in the multiple dynamic phase of testing.

An analysis of the data obtained in the research showed that there was no significant difference in the mean legibility distances of the younger and older groups. A comparison of mean legibility ratios obtained in this study with the standard ratio of 6 meters per centimeter of letter height (50 feet per inch of letter height) showed the standard to be adequate for both age groups. However, when looking at the legibility distance distributions, specifically the 85th percentile distances, the differences between the groups becomes apparent. In terms of 85th percentile legibility ratios, younger drivers were adequately provided for by the standard 6 m/cm (50 ft/in), while the older drivers were inadequately provided for and found to vary between 2.8 and 4.6 m/cm (23 and 38 ft/in) depending on the test being performed.

An analysis of subject data was also performed by dividing the subjects into two visual acuity groups (20/25 and better and 20/25 and poorer), and comparing legibility distances of the

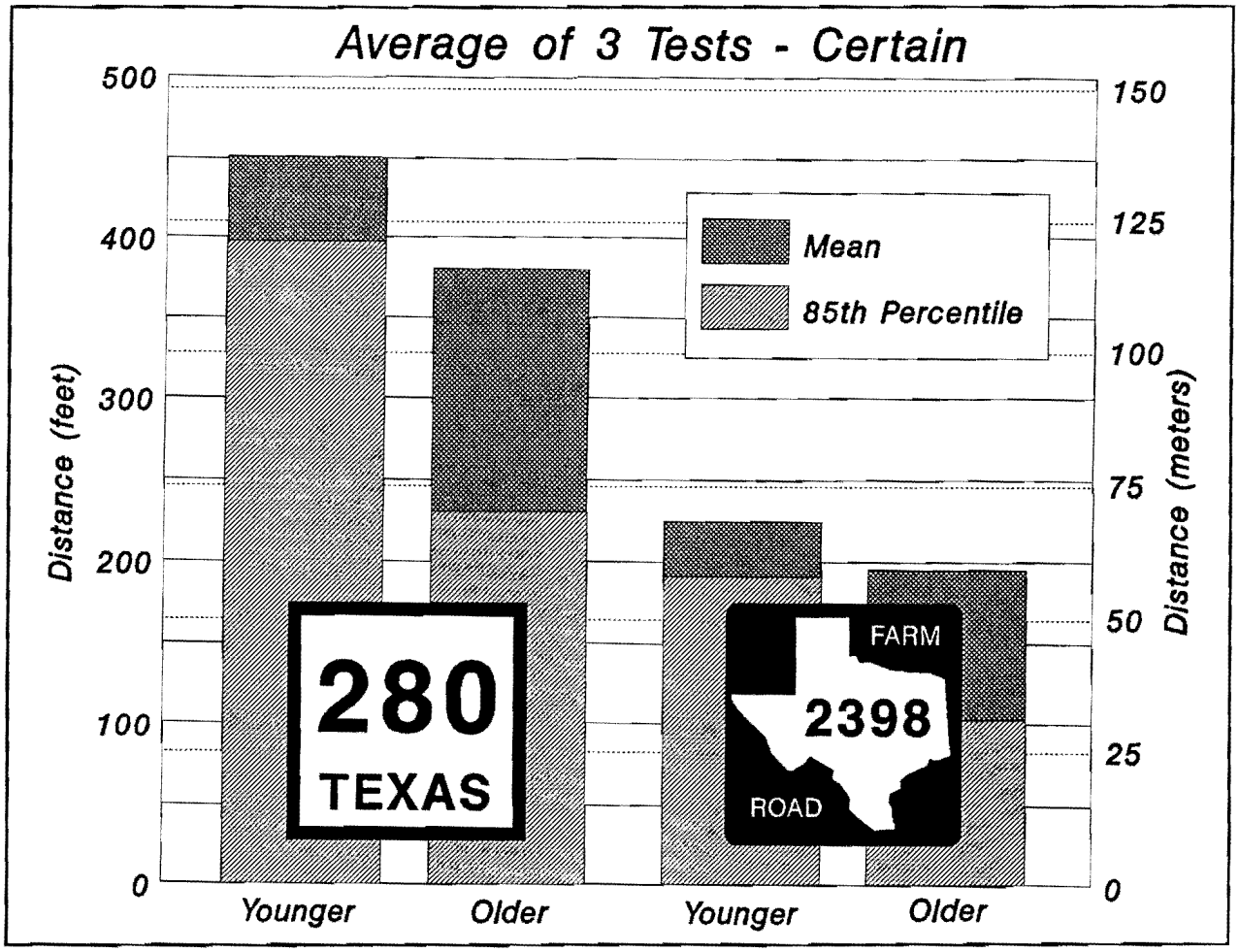


Figure IV-2. Multiple Dynamic Legibility Distances

subjects in each group. The legibility distances of the two groups were found to be significantly different. Not surprisingly, the group with superior static acuity exhibited longer legibility distances. The results of this analysis also showed that subjects with 20/25 vision were adequately provided for by the standard of 6 m/cm (50 ft/in), while subjects in the 20/25 and poorer group were inadequately provided for and found to vary between 3.8 and 6.0 m/cm (32 and 50 ft/in), depending on the test being performed.

An analysis to determine if there was any significant difference in the results obtained by the three different types of tests showed that there was no significant difference between the results from the static test and the single dynamic test, but that there were some significant differences between results from the multiple dynamic tests and the single dynamic tests. Differences between the results from the multiple dynamic tests and the static tests were found to be significant only in fifty percent of the cases.

Variability in results was found to be high in all testing and can be attributed to a number of sources, including varying visual acuity within each age group, varying subject strategies for viewing the signs under dynamic conditions, the possibility of preservation, and the fact that certain combinations of letters and numbers are easier to distinguish than others.

State Highway Route Marker

The State Highway route markers utilize 175 mm (7-inch) letters, and thus with the 6 m/cm (50 ft/in) standard rule of thumb, should have legibility distances of approximately 107 meters (350 feet). By averaging the mean legibility distances for the three types of tests performed, multiple dynamic, single dynamic, and static, older drivers were noted to have an average best legibility distance of 125 meters (411 feet) and a certain legibility distance of 116 meters (380 feet). Younger drivers, on the other hand, were noted to have an average best legibility distance of 148 meters (486 feet) and an average certain legibility distance of 130 meters (452 feet).

In comparison, by averaging the 85th percentile legibility distances for the three types of tests, older drivers were found to have an average best legibility distance of 77 meters (254 feet) and an average certain legibility distance of 70 meters (229 feet). Younger drivers were noted to have an average best legibility distance of 135 meters (442 feet) and an average certain legibility distance of 121 meters (396 feet).

By comparing the mean and 85th percentile legibility distances above, it becomes apparent that for older drivers there is a greater variance in the legibility distances. For younger drivers, a decrease of approximately 10 percent is seen in legibility distances when comparing the 85th percentile values with the mean values. Older drivers, on the other hand, experience a decrease of approximately 39 percent in legibility distance when comparing the 85th percentile values with the mean values.

Farm-to-Market Road Route Marker

The Farm-to-Market Road route markers utilize 100 mm (4-inch) letters, and thus with the 6 m/cm (50 ft/in) standard rule of thumb, should have legibility distances of approximately 61 meters (200 feet). By averaging the mean legibility distances for the three types of tests

performed, older drivers were noted to have an average "best" legibility distance of 65 meters (213 feet) and a "certain" legibility distance of 59 meters (195 feet). Younger drivers, on the other hand, were noted to have an average "best" legibility distance of 76 meters (250 feet) and an average "certain" legibility distance of 69 meters (225 feet).

In comparison, by averaging the 85th percentile legibility distances for the three types of tests, older drivers were found to have an average best legibility distance of 38 meters (125 feet) and an average "certain" legibility distance of 32 meters (104 feet). Younger drivers were noted to have an average "best" legibility distance of 65 meters (213 feet) and an average "certain" legibility distance of 58 meters (190 feet).

By comparing the mean and 85th percentile legibility distances above, it is again apparent that for older drivers there is a greater variance in the legibility distances. For younger drivers, a decrease of approximately 16 percent is seen in legibility distances when comparing the 85th percentile values with the mean values. Older drivers, on the other hand, experience a decrease of approximately 44 percent in legibility distance when comparing the 85th percentile values with the mean values.

Cardinal Direction Markers

A comparison of mean legibility distances of the conventional and the proposed cardinal direction markers for older drivers under static testing and certain conditions can be seen in Figure IV-3. From this figure, it can be noted that the mean older driver legibility distances for cardinal direction markers are approximately the same as the mean legibility distances for S.H. markers for older drivers, approximately 107 meters (350 feet).

A more complete summary of the data obtained on the legibility of the two types of cardinal direction markers under the single dynamic phase can be seen in Table IV-4. This table provides mean and 85th percentile legibility distances for both older and younger drivers for all four cardinal directions.

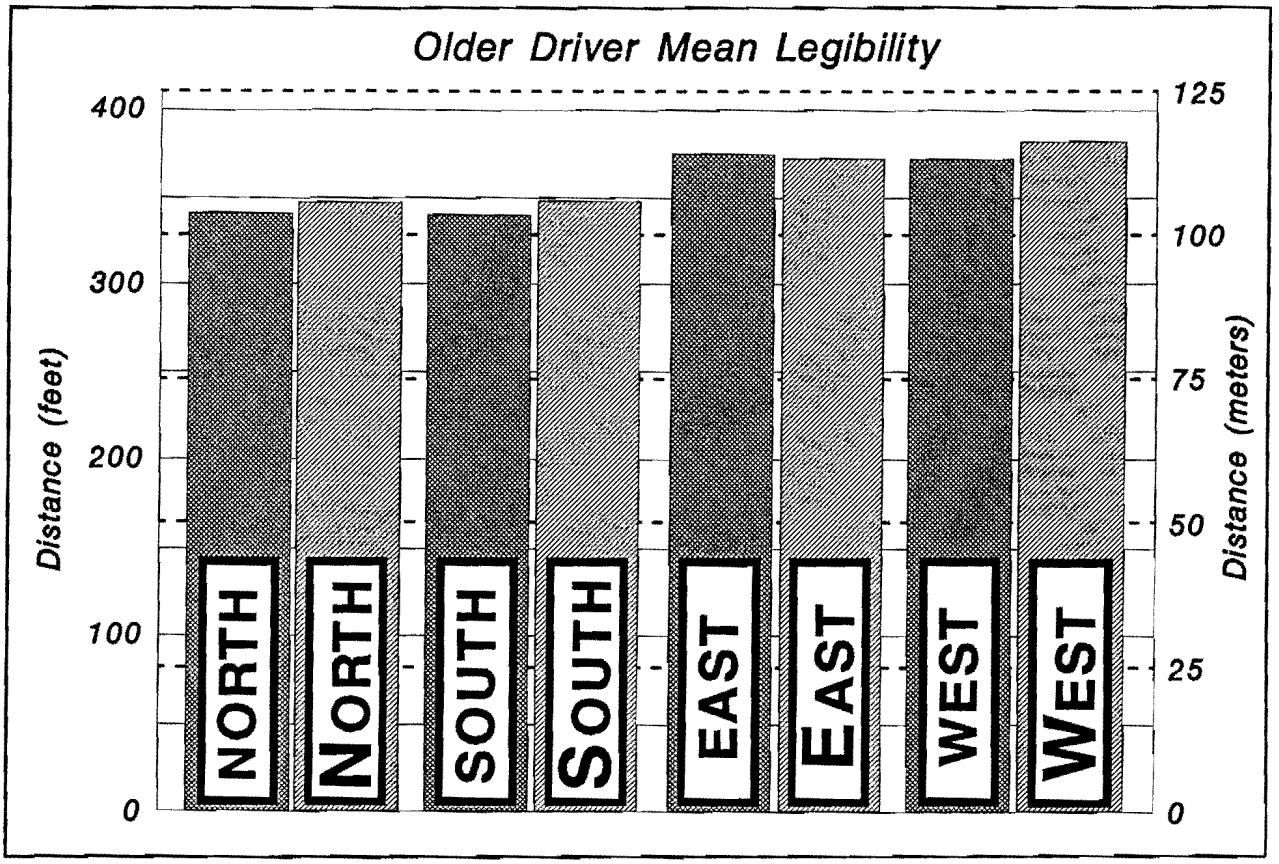


Figure IV-3. Mean Cardinal Direction Marker Legibility Distances

An analysis of the legibility differences between the standard cardinal direction marker and the proposed larger initial letter cardinal direction marker found that there was a statistically significant difference between the two types under static testing, but not under dynamic testing. On average, the proposed cardinal direction markers yielded legibility distances approximately 2.6 meters (8.5 feet) greater than those of conventional cardinal direction markers. As this additional distance is very small and considering that the observations were made at 7.6 meter (25 foot) increments, there is little evidence to justify the costs associated with implementing the proposed design based solely on increased legibility.

SUMMARY OF LEGIBILITY EVALUATION FINDINGS

The evaluations of the legibility of four guide signs provided an opportunity to assess the effectiveness of the design of these signs, particularly with respect to the needs of the older driver population. The data gathered from the legibility evaluations led to the following findings:

Table IV-4. Comparison of Legibility Distances for Cardinal Direction Markers

Type of Sign[1]	Legibility Measurement[2]	Legibility Distance, meters (feet)			
		Older Drivers		Younger Drivers	
		Mean	85th Percentile	Mean	85th Percentile
NORTH current design	Best	97 (319)	53 (175)	130 (425)	107 (350)
	Certain	90 (294)	38 (125)	114 (375)	99 (325)
NORTH new design	Best	98 (323)	61 (200)	143 (469)	122 (400)
	Certain	90 (296)	46 (150)	122 (400)	99 (325)
SOUTH current design	Best	99 (325)	61 (200)	139 (456)	122 (400)
	Certain	94 (310)	53 (175)	128 (419)	122 (400)
SOUTH new design	Best	101 (333)	61 (200)	137 (450)	122 (400)
	Certain	94 (308)	61 (200)	126 (413)	114 (375)
EAST current design	Best	132 (433)	107 (350)	139 (456)	99 (325)
	Certain	122 (400)	91 (300)	126 (413)	84 (275)
EAST new design	Best	136 (446)	114 (375)	134 (438)	91 (300)
	Certain	124 (408)	99 (325)	122 (400)	69 (225)
WEST current design	Best	139 (455)	114 (375)	145 (475)	107 (350)
	Certain	134 (441)	114 (375)	139 (456)	99 (325)
WEST new design	Best	142 (465)	122 (400)	145 (475)	91 (300)
	Certain	133 (435)	114 (375)	137 (450)	91 (300)

Notes: [1]Current design uses all 150 mm (6-inch) letters. New design has 175 mm (7-inch) initial letter and 150 mm (6-inch) remaining letters.
[2]The best measurement is the distance at which the driver can first read the sign. The certain measurement is the distance at which the driver is certain of the sign message.

- No significant difference was found between the mean legibility distances of the younger and older groups.
- A comparison of mean legibility ratios obtained in this study with the standard 6 meters per centimeter of letter height (50 feet per inch of letter height) showed the standard to be adequate for both age groups.
- A significant difference was observed in the 85th percentile legibility distances of younger and older groups.
- For 85th percentile legibility ratios, younger drivers were adequately provided for by the standard 6 m/cm (50 ft/in) while the older drivers were inadequately provided for and found to vary between 2.8 and 4.6 m/cm (23 and 38 ft/in) depending on the test being performed.

- An analysis of subjects by visual acuity groups, 20/25 and better and 20/25 and poorer, found a significant difference in mean legibility distances between the groups.
- Subjects with 20/25 vision were adequately provided for by the standard of 6 m/cm (50 ft/in), while subjects in the 20/25 and poorer group were inadequately provided for and found to vary between 3.8 and 6.0 m/cm (32 and 50 ft/in) depending on the test being performed.
- No significant difference was found between the legibility distances obtained under the single dynamic test and the static test.
- A significant difference was found between the legibility distances obtained under the static test and the multiple dynamic test fifty percent of the time.
- A significant difference was found between the legibility distances obtained under the single dynamic test and multiple dynamic test in all cases.
- The 85th percentile legibility distances for the three-digit S.H. route marker (175 mm, 7-inch numbers) ranged between 70 and 77 meters (229 and 254 feet) for the older drivers.
- The 85th percentile legibility distances for the four-digit F.M. route marker (100 mm, 4-inch numbers) ranged between 32 and 38 meters (104 and 125 feet) for the older drivers.
- No significant difference was found between the mean legibility distances of the conventional cardinal direction markers and the proposed larger initial letter cardinal direction markers under static testing.
- A significant difference was found between the mean legibility distances of the conventional cardinal direction markers and the proposed larger initial letter cardinal direction markers under dynamic testing.
- On average, the proposed cardinal direction markers had legibility distances of approximately 2.6 meters (8.5 feet) greater than those of conventional cardinal direction markers. As this additional distance is very small and considering that the observations were made at 7.6 meter (25 foot) increments, there is little evidence to justify the costs associated with implementing the proposed design based solely on increased legibility.

CHAPTER V
STUDY SITE IDENTIFICATION

One of the major activity areas of the second year of the research will be field studies of rural guide signing at various study sites. Therefore, one of the major objectives of the first year of the research was to identify potential sites where field studies could be conducted. The potential study sites were identified through three different study activities: a question contained in the district survey, a question contained in the driver survey, and the TxDOT Conventional Highway Sign Program for each district.

POTENTIAL STUDY SITES IDENTIFIED IN THE DISTRICT SURVEY

Question 11 of the district survey (described in Chapter II) asked TxDOT district personnel to identify potential study sites for this research. Several possible study site attributes were listed: some aspect of guide signing at the site will be changed in the near future, drivers appear to become confused at the location, complaint letters have been received about the guide signing, or lack thereof, at the location, or unique or unusual signing treatments have been employed to resolve deficiencies or other concerns. Drawings, photos, slides, plans, or other documents describing the sites were requested as a source of additional information.

Twenty-four respondents identified one or more potential study sites. A total of 31 locations were recommended; however, a number of these are on urban freeways and are thus outside the scope of this study. Eighteen of the recommended study sites have been designated for further consideration. Table V-1 summarizes the results of Question 11 of the district survey.

Table V-1. Potential Study Sites Identified in the District Survey

Please identify specific locations that we might use as study sites in this research.	
District	**Potential Study Site**
Paris	U.S. 82 at F.M. 1417 east of Sherman
Fort Worth	S.H. 121 North in Grapevine
	F.M. 2499 at S.H. 6
Wichita Falls	U.S. 70/U.S. 183/U.S. 283/U.S. 287/F.M. 1763 concurrent routes between Vernon and Electra
Lufkin	Intersection of U.S. 69, Loop 287, and U.S. 69 Business in Lufkin
	U.S. 59 South at Loop 224 in Nacogdoches
Yoakum	U.S. 77 Alternate/U.S. 87/U.S. 183 concurrent routes near Cuero
	S.H. 238 south of U.S. 87 Business in Calhoun County
Austin	U.S. 290 at S.H. 21
	U.S. 79 at U.S. 79 Business and F.M. 619 east of Taylor
San Antonio	F.M. 473 5 mile east of Comfort at intersection
	S.H. 27 at S.H. 39 in Ingram
	U.S. 87/S.H. 27 concurrent routes in Comfort
Corpus Christi	U.S. 181 North at S.H. 80 and S.H. 123 in Karnes County
Pharr	U.S. 281 Business at F.M. 1925 in Edinburg
Brownwood	U.S. 183 at U.S. 190 and U.S. 281 in Lampasas
Childress	U.S. 82 at U.S. 83 in King County
	U.S. 62 at U.S. 83 in Childress County

POTENTIAL STUDY SITES IDENTIFIED IN THE DRIVER SURVEY

Question 17 of the driver survey (described in Chapter III) asked survey participants to identify locations where they may have had difficulty finding their way, along with a brief description of the source of the difficulties. There were a total of 181 responses to this question. Most of the responses were too vague to identify a specific location (many drivers simply wrote "Houston" or "Dallas") or were located on highways outside the scope of this study (such as freeways or in cities with a population over 5,000). From the 181 responses, a total of 20 locations were identified and designated for further consideration. Table V-2 summarizes the results of Question 17 of the driver survey.

Table V-2. Potential Study Sites Identified in the Driver Survey

Please indicate the highway number and closest town of any places where you had a problem finding your way. A brief description of the problem would be helpful. Feel free to indicate more than one location. (Please do not include places in large cities or on Interstate highways.)

District	Potential Study Site	Description of Difficulty
Paris	S.H. 11 in Sulphur Springs	---
Waco	S.H. 7 at S.H. 320 in Marlin	Hardly any signs for directions.
	U.S. 84 at S.H. 14 in Mexia	---
Tyler	F.M. 135 in Overton	No signs to tell direction.
	U.S. 271 in Gladewater	---
	U.S. 175 near Jacksonville	Direction to 175 from Henderson.
Lufkin	U.S. 59 in Nacogdoches	---
	S.H. 21 at S.H. 7 in Crockett	Directions are confusing.
Houston	S.H. 227 at S.H. 228 in Lake Jackson	---
	S.H. 228 at S.H. 332 in Lake Jackson	---
	S.H. 332 at F.M. 521 near Brazoria	---
	S.H. 36 in Rosenberg	Poor signs not much notice.
Austin	U.S. 377 in Mason	---
	U.S. 183 in Luling	Lots of turns.
Bryan	S.H. 75 in Huntsville	Too many signs.
	S.H. 105 in Brenham	Trouble looking for S.H. 36.
Dallas	S.H. 34 outside of Terrell	Arrows are in wrong direction.
	U.S. 77 in Waxahachie	Hard to go south on U.S. 77.
Brownwood	S.H. 36 in Comanche	---
Childress	S.H. 86 in Quitaque	---

TXDOT CONVENTIONAL HIGHWAY SIGN PROGRAM

The Conventional Highway Sign Program which is part of the Project Development Plan (Category 10 Funds) was obtained from the Traffic Operations Division. Using this list, several districts which plan to replace existing guide signs or to install new guide signs on conventional highways were identified. Phone calls were made to the district traffic engineers office in each of these districts to determine the suitability of these locations as study sites. Details regarding location of the planned improvements, a description of the actions to be taken, the expected date of construction, and a copy of any available sign plans were requested. Table V-3 summarizes the locations which were identified during these conversations with TxDOT district personnel.

Table V-3. Potential Study Sites Identified from the TxDOT Conventional Highway Signing Program

District	Potential Study Site
Fort Worth	U.S. 377 at U.S. 377 Business east and west of Granbury
	S.H. 199 at F.M. 370 in Azle
	S.H. 199 at Stewart Street in Azle
	U.S. 281 at S.H. 114 north of Jacksboro
	U.S. 281 at U.S. 380 and S.H. 114 south of Jacksboro
	U.S. 281 at S.H. 199 south of Jacksboro
	U.S. 281 at S.H. 6 south of Stephenville
	U.S. 281 at S.H. 108
Tyler	S.H. 19 at U.S. 287 northwest of Palestine
	S.H. 31 at West Loop 323 in Tyler
	Loop 323 at American Legion Road northeast of Tyler
Dallas	U.S. 175 from Dallas County Line to east of S.H. 274
Altanta	S.H. 249 from U.S. 79 west of Carthage to U.S. 59 south of Carthage
	U.S. 59 at intersection of Loop 390 and S.H. 43
	U.S. 59 from F.M. 699 in Carthage to S.H. 149 south of Carthage
	S.H. 149 from U.S. 79 west of Carthage to U.S. 59 south of Carthage
	U.S. 79 at S.H. 149
	S.H. 315 in Panola County
Beaumont	U.S. 96 at U.S. 69 south of Lumberton
	U.S. 96 at S.H. 237 in Silsbee
	U.S. 96 at U.S. 96 Business in Silsbee
	U.S. 69 at S.H. 327 west of Silsbee
	U.S. 69 at S.H. 347 in Beaumont
Brownwood	U.S. 183/U.S. 190/U.S. 281 in Lampasas
	U.S. 183/U.S. 190 in Lometa
	U.S. 87/S.H. 71 in Brady
El Paso	S.H. 20 from Doniphan Road to Montana Street
	U.S. 62 from Executive Center Drive to Alameda Street
	S.H. 20 from Raynolds Street to F.M. 659
	U.S. 62 from S.H. 20 to Montana Street
	U.S. 54 from Paisano Drive/U.S. 62 to New Mexico State Line
	U.S. 54 Business from Gateway North to Sun Valley Street
	U.S. 62 from Geronimo Street to Yarbrough Drive
	Loop 375 from U.S. 62/U.S. 180 to Zaragosa Road

CHAPTER VI
SUMMARY AND PRELIMINARY RECOMMENDATIONS

This three-year research study is being conducted to evaluate the current system of guide signing used on conventional highways. The type of highway which is addressed in this study has the following characteristics: non-access controlled and located in rural areas or in cities with a population less than 5,000. The previous chapters in this report describe the study activities conducted during the first year of the study and the findings resulting from those activities. This chapter summarizes the findings of these activities and also presents preliminary recommendations which can be developed from the first year findings. It also contains a brief description of some of the future study activities to be conducted and some of the significant issues which will be considered in future research activities.

SUMMARY OF FIRST YEAR FINDINGS

The first year research activities for this study were concentrated in four areas: assessment of current practices for rural guide signing, identification of driver information needs, evaluation of guide sign legibility, and identification of potential study sites. Within each area, several different tasks were conducted. Each of the chapters in this report contain detailed descriptions of the findings resulting from these tasks. However, the most significant of the findings are described below.

Assessment of Current Practices

Three separate tasks were used to assess the current practices for conventional guide signing: identification of current TxDOT written practices, development of a working paper and discussion in a workshop, and identification of district practices through a survey. The key findings resulting from these activities include:

- Guide signing on urban freeways is based on a different philosophy than guide signing on rural conventional highways. Drivers in urban areas rely upon destination information as the primary source of navigational information.

- The development of a system of control cities for conventional highways may prove useful to drivers.
- Advance information is important to drivers, and current practices may place the information too close to the intersection.
- Texas MUTCD guidelines are generally adequate, although they do not address all situations.
- There are perceived differences in guide signing between the districts.
- There was a difference in opinions between the Technical Panel and the survey respondents on the importance of advance lane position information.
- The legends of several guide signs may be too small to meet the needs of older drivers. In particular, the height of the numbers in the F.M. route marker should be larger.

Identification of Driver Information Needs

Two tasks were used to assess the information needs of drivers on conventional highways: a survey on guide signing given to 428 drivers and three focus groups of ten drivers each which were used to solicit driver opinions about guide signing. The key findings resulting from these activities include:

- Maps and highway signs are the most important sources of navigational information.
- Participants did not recognize or place importance on the differences between highway classifications.
- The highway number was the primary source of directional information, along with destination (city names) information.
- Participants prefer to see destinations (city names) at the intersection.
- Almost half of the drivers have some level of difficulty seeing the letters or numbers on highway guide signs.
- Overhead signing should be more widely used on conventional highways.

Evaluation of Guide Sign Legibility

Three different evaluation tests were used to determine the legibility of the S.H. and F.M. route markers and two different designs of cardinal direction markers. The needs of older

drivers were emphasized due to the fact that 24 of the 32 participants were over the age of 60. The key findings of the legibility evaluations include:

- There was no statistically significant difference in the mean legibility distances between the younger and older age groups. There was a statistically significant difference in the 85th percentile legibility distance between the two age groups.
- The mean legibility ratios for the evaluations compared favorably with the standard design parameter of 6 meters per centimeter of letter height (50 feet per inch of letter height). However, this means that only half of the drivers are accommodated by the standard design parameter.
- The 85th percentile legibility ratio for the older driver group ranged between 2.8 and 4.6 m/cm (23 and 38 ft/in).
- The three legibility tests yielded roughly the same legibility distances.
- The 85th percentile legibility distances for the three-digit S.H. route marker (175 mm, 7-inch numbers) ranged between 70 and 77 meters (229 and 254 feet) for the older drivers.
- The 85th percentile legibility distances for the four-digit F.M. route marker (100 mm, 4-inch numbers) ranged between 32 and 38 meters (104 and 125 feet) for the older drivers.
- There were no statistically significant differences in the static legibility distances of the two designs for the cardinal direction markers.

Identification of Potential Study Sites

Three sources of information were used to identify potential sites where field studies can be conducted in the second year of study: a question in the district survey, a question in the driver survey, and the TxDOT Conventional Highway Sign program. Approximately seventy potential sites were identified.

PRELIMINARY RECOMMENDATIONS

The research activities conducted during the first year of this study were not intended to provide any results which can be implemented at the present time. However, the findings from

these first year activities can be used to identify preliminary recommendations which can be evaluated in greater detail in future study activities. These preliminary recommendations address the design of advance signing, route markers for Texas highways, destination signing, cardinal direction markers, and sign placement.

Advance Signing

The findings from the driver survey and focus groups indicated that drivers would prefer to see improved advance signing for highway intersections/interchanges. The two improvements most often mentioned by drivers were providing information farther in advance and providing advance information about the necessary lane position.

The usual practice for advance signing for a highway intersection is to place a Junction Assembly 229 meters (750 feet) from the intersection, although the distance can be reduced to not less than 122 meters (400 feet). Advance turn information is required only when a turn must be made to remain on the indicated highway. The Advance Turn Assembly should be erected not less than 122 meters (400 feet) from the intersection/interchange. The research findings indicate that drivers would prefer to see Junction signing farther in advance and that turn or lane position information be provided with the Junction Assembly. Consideration should be given to increasing the placement distance for the Junction Assembly to 0.4 kilometer (1/4 mile) or providing redundant Junction signing 0.4 kilometer (1/4 mile) from the intersection. Drivers also indicated that showing the distance to the intersection in the Junction Assembly would be helpful. Figure VI-1 illustrates two possibilities for displaying the distance and lane position information in advance intersection signing.

S.H. Route Marker

The current design for the S.H. route marker uses a 175 mm (7-inch) high number when there are three digits in the highway number and 225 mm (9-inch) when there are one or two digits in the highway number. The legibility evaluations indicated that the 85th percentile legibility distances among older drivers for the three-digit S.H. route marker ranged between 69 and 84 meters (225 and 275 feet).

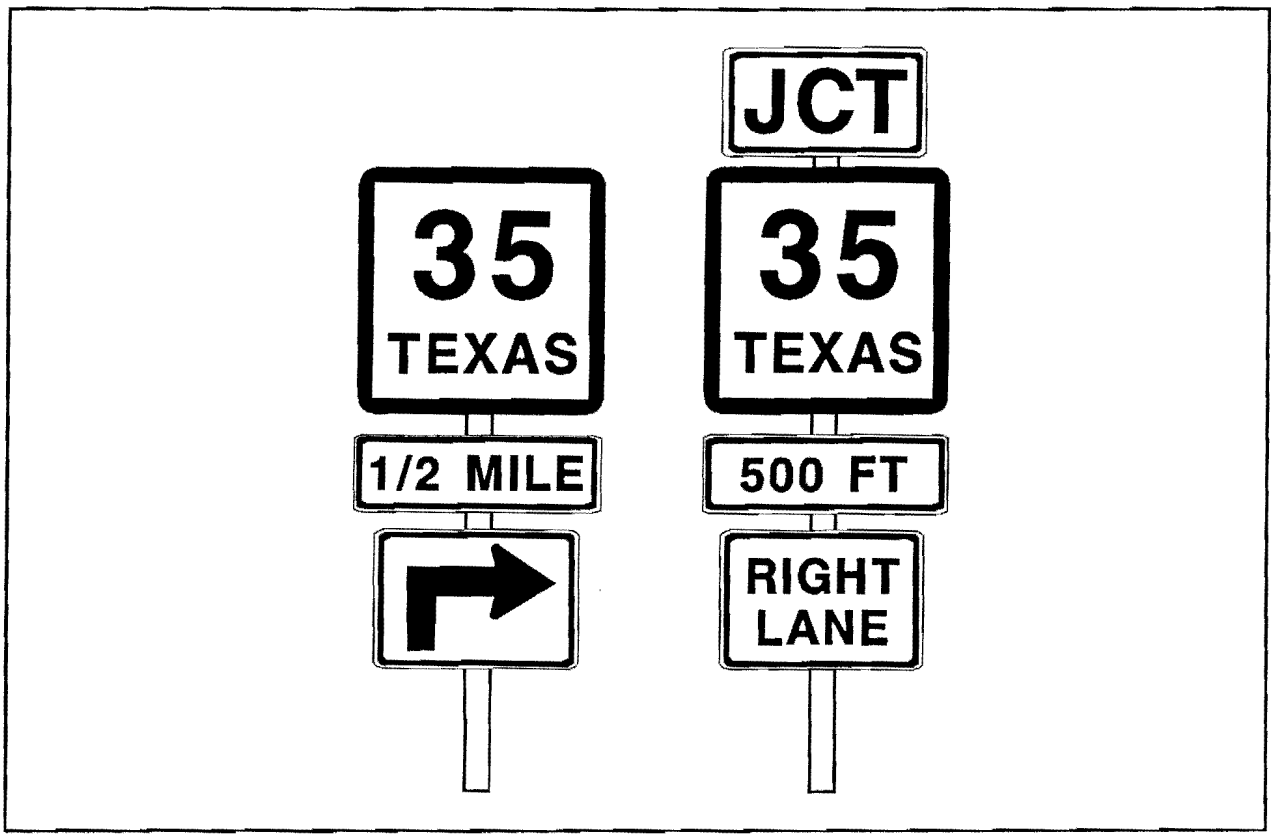


Figure VI-1. Possible Alternatives for Advance Intersection Signing

Although this study has not yet performed an assessment of the necessary legibility distances for this route marker, it seems appropriate that a consistent number height should be used for the route marker, regardless of the number of digits in the sign. Instead of reducing the letter height as the number of digits increases, consideration should be given to maintaining the same letter height for all numbers and using a wider sign blank for the three-digit number. This approach is consistent with the U.S. Highway route marker. This sign uses a 300 mm (12-inch) number regardless of the number of digits. When there are three-digits in a U.S. Highway number, a 750×600 mm (30×24 inch) route marker is used. Figure II-4 (page II-5) illustrated the current practice for U.S. Highway route markers. Figure VI-2 compares the current and preliminary recommended design for the S.H. route marker.

F.M. and R.M. Highway Route Marker

The current design for the F.M./R.M. route marker uses a 100 mm (4-inch) high number when there are four digits in the highway number. The legibility evaluations indicated that the 85th percentile legibility distance among older drivers for the current F.M./R.M. route marker

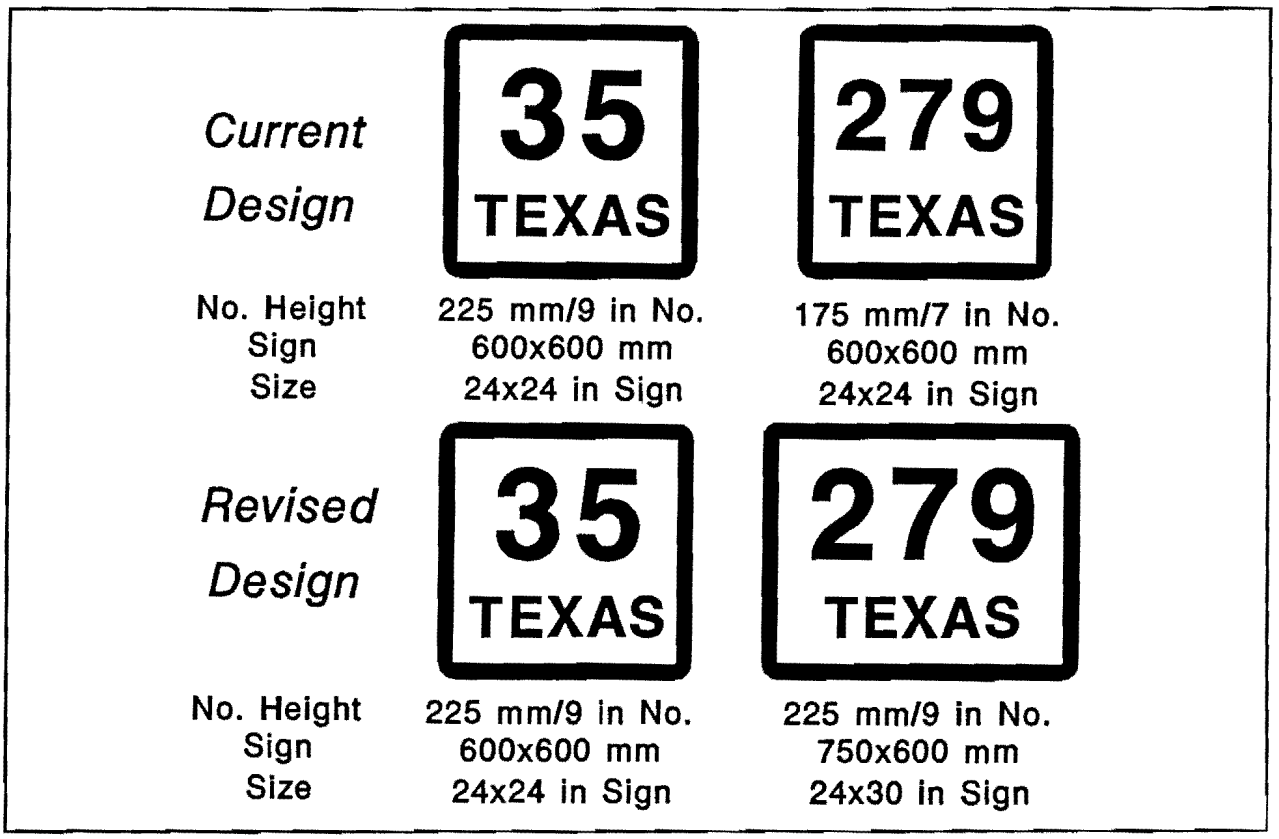


Figure VI-2. Preliminary Recommended Design for the SH Highway Route Marker

ranged between 30 and 38 meters (100 and 125 feet) in the three legibility tests. These distances are probably less than is necessary in all conditions and indicate that consideration should be given to using taller numbers in these signs. In order to have legibility distances that are consistent with the existing or preliminary recommended design of the S.H. route marker, the four-digit F.M./R.M. sign should have 175 mm (7-inch) to 225 mm (9-inch) high numbers.

Future activities in this area will include the development and evaluation of potential alternative designs for the F.M./R.M. route marker. Although these activities have not yet begun, some possible designs have been developed for preliminary consideration. They are illustrated in Figure VI-3. Each of the possible alternative designs uses a 175 mm (7-inch) tall number on a 750×600 mm (24×30 inch) sign blank. As described for the S.H. route marker, the use of a wider sign blank for multiple-digit numbers is consistent with the U.S. Highway route marker. The designs shown in Figure VI-3 would allow a 225 mm (9-inch) tall number when there are three or fewer digits.

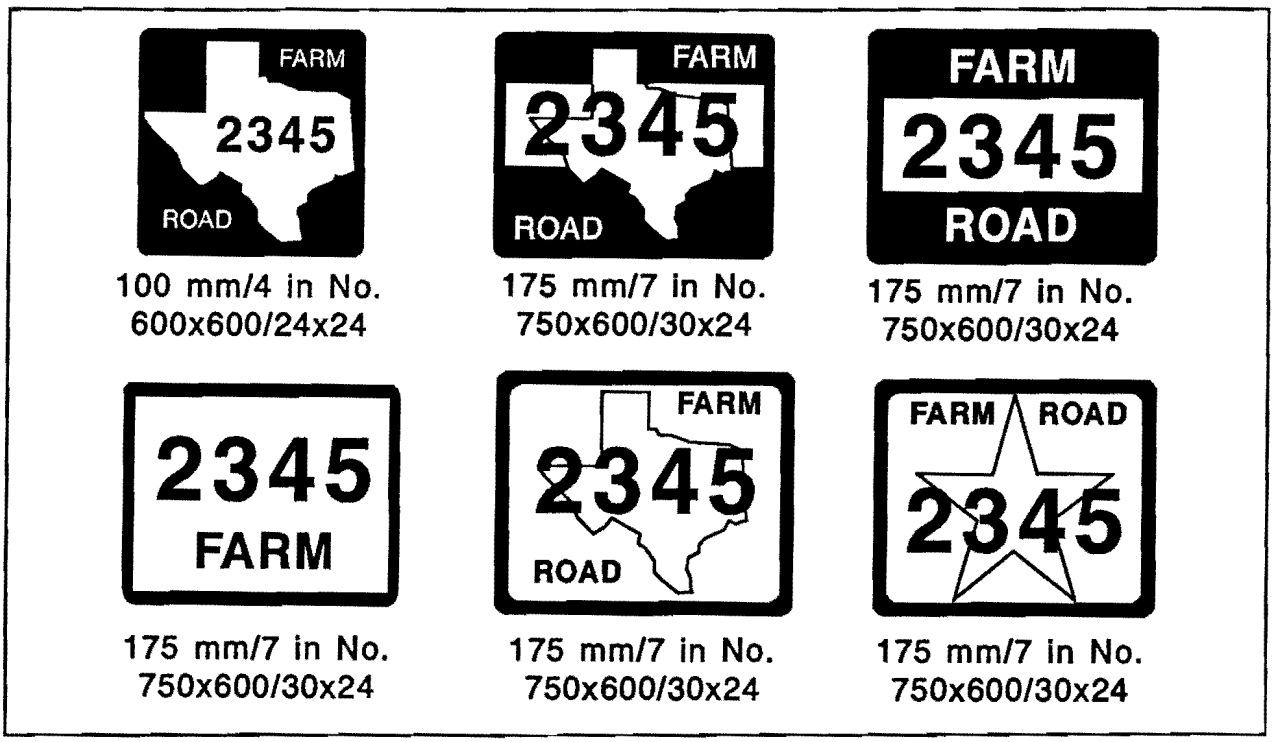


Figure VI-3. Possible Alternative Designs for the FM Highway Route Marker

Destination Signing

Current guide signing practices for urban freeways use street names, control cities, and cardinal directions as the primary directional information. Although route shields are used, the highway numbers are not emphasized to the level that they are on rural highways. This "urban" system has acclimated many drivers to navigating by cities and street names, instead of numbers. Both the driver survey and the focus groups validated this concept, as a large percentage of participants indicated the importance of city names in navigating on rural highways.

Consideration should be given to moving the city destination information to highway intersections/interchanges or placing redundant destination information at intersections/interchanges. This practice is already utilized in at least one state, as shown in the pictures in Figure VI-4. Consideration should be given toward implementing similar practices in Texas.

Figure VI-4. Use of City Names in Intersection/Interchange Signing

Cardinal Direction Markers

The FHWA has recently proposed a new design for cardinal direction markers in which the first letter is larger than the other letters (i.e., NORTH, SOUTH, EAST, and WEST). For the standard 600×300 mm (24×12 inch) cardinal direction marker, the initial letter is 175 mm (7-inch) Series C and the remaining letters are 150 mm (6-inch) Series C. Both the proposed design and the current design (all 150 mm/6-inch Series C) were tested in the legibility evaluations. The results indicated that the legibility distances of the two designs were not statistically different. On average, the legibility of the proposed design was 2.6 meters (8.5 feet) greater than the current design. However, this average should be used with caution, as legibility was assessed at 7.6-meter (25-foot) increments. The results indicate that improved legibility may not be sufficient justification for implementing the proposed design for the cardinal direction markers.

Sign Placement

Most signing for conventional highways is post-mounted, as opposed to overhead signing. The focus group participants indicated that post-mounted signing was adequate for many installations, but that overhead guide signing should be used at many intersections/interchanges. In particular, drivers indicated a desire for overhead signing on multilane highways, where unusual maneuvers are required, where a turn is necessary to remain on the current highway (especially if the driver has been on the highway for several miles), and at grade separated interchanges where the driver uses an exit ramp to access the intersecting highway.

FUTURE ACTIVITIES

During the second and third years of this study, the evaluation of rural guide signing will continue through several research activities. The major activities to be conducted are summarized below. Activities during the second year of the study will focus on observing driver behavior at the previously selected study sites, developing alternative practices, and evaluating the effectiveness of the alternative practices. The activities of the third year of the study will focus upon the development of the final recommendations for the design and use of guide signs on rural highways.

Field Studies

The potential study sites identified during the first year will be reviewed and several locations will be selected for field studies. In the field studies, driver behavior will be observed in an attempt to determine the effectiveness of existing signing and any needed signing improvements. The field studies may include observations of vehicular movements at the study sites, identification of driver viewing behavior through eye-tracking video equipment, and possible before-and-after evaluations where signing improvements have been made.

Alternative Guide Signing Practices

The findings from the previous research activities will be used to develop alternative strategies for meeting the information needs of rural drivers. The signing alternatives will

address sign layout, sign placement, and signing combinations. Some of the alternatives which will be evaluated include a new design for the F.M. route marker, use of city names at the intersection, locating guide signs further from the intersection, and improved junction signing.

The effectiveness of the alternative will be assessed through laboratory experiments, driver surveys, legibilities, and/or review by the Technical Panel and other appropriate TxDOT personnel. The comments of the panel will be used to modify the signing alternatives and the revised alternatives will be evaluated through additional evaluations.

Preliminary Recommendations for Rural Guide Signing Practices

The findings of previous study activities will be used to develop preliminary recommended practices for rural guide signing. The recommended practices may include new signs, new designs for existing signs, revisions to the placement of rural guide signs, and/or the order in which the directional information is presented to rural drivers. Recommendations for the development of public information programs may also be developed, along with recommended changes to the Texas MUTCD. The preliminary recommended practices will be presented to selected TxDOT personnel (and the Highway Signing Task Force, if appropriate) through a technical memorandum. Comments and suggestions received from these personnel will be used to revise the recommendations.

Legibility Evaluations

Legibility evaluations will be conducted for any new signs or revised sign designs to determine if these signs will function properly in the field. As with the first year effort, the needs of the older driver population will be emphasized.

Evaluation of Preliminary Recommended Practices

The preliminary recommendations for rural guide signing practices will be evaluated to insure its effectiveness. This evaluation will be conducted using one or more of the following procedures:

- **Field Study** - The guide signing at one or more of the study sites will be modified to reflect the recommended practice. Drivers will be observed, and the data collected at these sites will be compared to the data collected previously to determine if the signing is more effective.
- **Laboratory Study** - The recommended practice will be evaluated by exposing drivers to a series of pictures or a video of an intersection exhibiting the recommended practice. A similar type of evaluation may be conducted at the Texas A&M Riverside Campus using actual signs on a closed test course.
- **Driver Surveys** - An additional driver survey may be administered at the same type of locations used in previous driver surveys. The driver responses to the recommended practice will be compared to the responses in the previous driver surveys.

Final Recommendations for Rural Guide Signing Practice

The results of all the activities conducted during the course of the study will be used to develop a recommended practice for rural guide signing. The recommended practice may consist of a series of guidelines, recommended changes to the MUTCD, and/or a driver information program. The final recommended practice will be described in the final report, which will also include a description of the third year activities. The final report may consist of several volumes to improve the implementation of the study's recommendations.

SIGNIFICANT RESEARCH ISSUES

There are several significant issues which were identified in the first year of the study and which will be considered in the development of alternative strategies and the final guidelines. Some of these were considered in the first year, while others were identified and noted for future consideration.

Older Driver Population

Drivers over the age of 55 are the fastest growing segment of the population. The mobility and safety needs of these drivers have been identified in numerous research documents, including a Transportation Research Board Special Report (8) and a report from the Texas-Based Task

Force on Older Drivers (9). The normal aging process includes a decline of sensory, cognitive, and motor skills which can adversely affect driving performance. However, these declines occur differently in different drivers and are not directly related to chronological age. One of the major changes is related to vision. As a driver ages, their visual acuity declines.

In this study, the needs of older drivers will be considered in all research activities. In the first year of the study, the older driver population was emphasized in the legibility evaluations and one of the focus groups. Future research activities will consider the needs of older drivers with respect to the placement of navigational information.

Metrication

The federal government has committed the United States to converting to the metric system over the next few years. Current federal guidelines state that all plans, specifications, and estimates be in metric units by September 30, 1996. To comply with this mandate, TxDOT has made a similar commitment to metric conversion, having created a Metric Conversion Committee in July of 1992 to address all of the issues related to converting to the metric system. One of the key elements of the metric conversion may include the replacement of all signs containing any measurements in the legend. Guide signs, particularly distance signs, would make up a large percentage of these signs. Such a widespread replacement of signs, if deemed necessary, would provide an excellent opportunity to implement any new or revised guide sign practices developed from this study.

MUTCD Rewrite

The National Committee on Uniform Traffic Control Devices (NCUTCD) is currently preparing a new version of the National MUTCD. The revised MUTCD will be completely reformatted and rewritten. Once the NCUTCD has completed its task (the target date for this is 1996), it will submit the revised MUTCD to FHWA for approval through the Federal Register rulemaking process. When the new edition of the National MUTCD is officially approved, Texas will probably prepare its own version of the new manual. The revisions of the national and Texas MUTCDs provide another excellent opportunity to implement the signing standards or guidelines developed from this study.

Highway Signing Task Force

In May of 1990, a Highway Signing Task Force was created within TxDOT as the result of the Highway Systems Functional Review Report. The task force was asked to review and update standards for highway route classification and signing. The task force final recommendations were to include, but not be limited to:

1. Creation of a comprehensive highway classification and signing policy and appropriate standards.
2. Elimination of signing and designation conflicts for all classes of roadways.
3. Establishment of signing standards for loops, spurs, truck and business routes.
4. Procedures for ensuring that routes are signed as designated.
5. Definitions of principle arterial systems and other classifications.
6. Recommending a uniform county road numbering standard, to number bridges in relation to road numbers, and assist emergency services in the location of emergency sites.

This task force met several times during 1990 and 1991. Most of the task force deliberations were limited to items 1 and 6. Items 2 and 3 were accomplished through a Commission Minute Order and item 4 was accomplished through an Administrative Circular. With respect to item 5, the task force determined that the Federal Highway Administration's definitions for functional classification were in use throughout TxDOT and should continue to be used.

The objectives and activities of this task force appear to have much overlap with the objectives of this research study. Therefore, it is appropriate that a close, cooperative relationship be established between the task force and the research study in order to benefit from the knowledge and experience of the task force's members. The task force may also provide a vehicle through which the findings and recommendations of the research could be implemented into TxDOT policy.

Texas Highway Designation Information

The Texas highway system consists of over 123,000 centerline kilometers (77,000 centerline miles) of highways. Included in this mileage are 4,373 different numbered highway routes. Administratively within TxDOT, these numbered routes use the 22 different designations shown in Table VI-1. However, drivers may not be aware of all these designations, and in fact, may recognize other designations such as an off-Interstate business loop or a by-pass highway. In addition to the potential for confusion due to the large number of highways and highway designations, there are some 800 highways with duplicate numbers, and there are a few cases where highways of different designations with the same number exist in the same county. Confusion can also be created by two highways in the same area which have similar numbers, such as 385 and 358. The potential for confusion is further increased by the fact that two of the administrative designations have only one highway in that classification and one designation does not have any highways in it. There are also two highways in Texas (OSR and NASA 1) for which there is no obvious classification.

Texas Highway Trunk System

The Texas Highway Trunk System is a future rural highway system that includes and compliments the Interstate System. The completion date of the Texas Highway Trunk System is subject to the availability of funding, but is targeted for year 2020. Emphasis of the Trunk System will be on overall system mobility, rather than access. Therefore, all highways on the Trunk System will be four-lane divided, or greater. Trunk System routes that intersect with other Trunk System routes will be grade separated, as will all railroad crossings.

Table VI-1. Texas Highway Designations
(Abbreviations Indicate the TxDOT Administrative Designation for that Highway)

Primary Highway Classification	Highway Subclassifications				
	Standard[1]	Business	Alternate	Loop	Spur
Interstate	IH	BI[2]			
U.S. Highway	US	BU	UA		UP
State Highway	SH[3]	BS	SA	SL[4]	SS
Farm to Market	FM	BF[5]			FS
Ranch to Market	RM				RS
Ranch Road	RR[5]				RU[6]
Park Road	PR				
Recreational Road	RE				RP
Principal Arterial Street System	PA				

Notes: [1]Standard highway means that the highway has no subclassification.
[2]Business Interstate is not part of Interstate system.
[3]NASA 1 and OSR are classified as State Highways.
[4]Includes Beltway designation.
[5]Only one in the state.
[6]None of these currently exist.

CHAPTER VII
REFERENCES

1. K.N. Womack, H.G. Hawkins, Jr., and J.M. Mounce. *Motorist Comprehension of Traffic Control Devices: Statewide Survey Results*. Research Report 1261-2, Texas Transportation Institute, College Station, Texas, February 1992.
2. *Guide to Metric Conversion*. American Association of State Highway and Transportation Officials, Washington, D.C., 1993.
3. *Traffic Engineering Metric Conversion Factors: Addendum to the Guide to Metric Conversion*. American Association of State Highway and Transportation Officials, Washington, D.C., 1993.
4. *Manual on Uniform Traffic Control Devices for Streets and Highways*, U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 1988.
5. *Texas Manual on Uniform Traffic Control Devices*, Texas Department of Highways and Public Transportation, Austin, Texas, 1980, revised through 1988.
6. *Vernon's Civil Statutes Article 6701d. - Uniform Act Regulating Traffic on Highways*. Texas Motor Vehicle Laws, Texas Department of Public Safety, Austin, Texas, 1989-1990.
7. *Standard Highway Sign Designs for Texas*. Texas Department of Transportation, Austin, Texas, 1980, revised to 1990.
8. *Transportation in an Aging Society: Improving the Mobility and Safety for Older Persons*. Special Report 218, Transportation Research Board, Washington, D.C., 1988.
9. *Texas-Based Task Force on Older Drivers: Report and Recommendations*. Texas Department of Health and Texas Department of Transportation, Austin, Texas, December 1992.

APPENDIX A
INSTRUMENT FOR DISTRICT SURVEY

The following pages contain the survey instrument used to identify district practices related to conventional guide signing. The survey instrument was distributed by the Division of Maintenance and Operations to all TxDOT districts. Within each district, the survey was distributed to the District Engineer, District Traffic Engineer, District Maintenance Engineer, District Sign Shop Supervisor, one Area Engineer, and one Area Maintenance Construction Supervisor.

Various questions in the survey refer the respondent to page 6 of the survey for illustrations of certain signs. The original page 6 of the survey is reproduced on page A-8 of this report.

M E M O R A N D U M

TO: ALL DISTRICT ENGINEERS

DATE: April 26, 1993

FROM: Gary K. Trietsch, P.E.

Originating Office
D-18TE

SUBJECT: Sign Practices Survey - Study 1373,
"Evaluation of Rural Guide Signing"

The Texas Transportation Institute is conducting a research study of conventional guide signing. The primary objective of this study is to develop improved guidelines for the use of guide signs on conventional, rural highways.

We are seeking your help in determining the current practices for conventional guide signing and in locating potential study sites for this research effort. Please forward one copy of the survey to the following district personnel:

One Area Engineer
District Traffic Engineer
District Maintenance Engineer
District Sign Shop Supervisor
One Maintenance Construction Supervisor

In addition to forwarding a copy of the survey to the above-mentioned people, we also request that you complete the survey.

Each survey should be completed based on what that person believes to be the correct answer without consulting with anyone else. As indicated on the survey, your comments will be kept confidential so we request that you be frank and feel free to attach or identify any information which you think might be useful in this study.

This research effort will be an important step in determining changes to the Texas Manual on Uniform Traffic Control Devices, and Department policies and practices concerning signing needs for all motorists, including the older driver. Please send your completed survey as soon as possible, but no later than May 26, 1993, to:

Mr. H. Gene Hawkins, Jr., P.E.
Assistant Research Engineer
Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843-3135

The completed survey should be returned in an envelope marked **CONFIDENTIAL**. If there are any questions, please call Mr. Hawkins at 409/845-6004 or TexAn 857-6004. The Department contact for this research project is Mr. Lewis Rhodes and he may be reached at 512/416-3330 or TexAn 249-3330.

Gary K. Trietsch

LR:tj
Attachment
cc: Division of Transportation Planning (D-10R)

Survey of Guide Signing Practices for Conventional Highways

TxDOT/TTI HPR Study 1373

NAME: _____

POSITION: _____

District No: _____ City: _____ County: _____

TEXAN No: _____

This survey is part of a research study evaluating guide signing on conventional highways. For purposes of this survey, **Conventional Highways** are defined as non-access controlled highways located in all rural areas and in those urban areas where conventional guide signing principles are applied. Therefore, the following types of highways are not included in this survey - interstate, freeways, highways in urban areas with freeway type guide signing or city street signing.

You may use the back of the survey or additional pages, if necessary. Please return the survey to Gene Hawkins at TTI (Address at end of survey). Responses to this survey will be treated confidentially. Individual responses will not be reported to TxDOT.

1. Are there conventional highways within your district where you feel the application of Texas MUTCD guidelines does not adequately convey needed or timely navigational information to motorists?

   ☐ Yes ☐ No

   If yes, please identify the highways and explain the deficiencies:

2. Are you aware of any differences between your district and other districts in the manner in which conventional guide signs are implemented?

   ☐ Yes ☐ No

   If yes, please describe these differences:

3. Does your district have a formal procedure for handling sign requests?

☐ Yes ☐ No

If yes, please explain:

4. In your opinion, what would or should take priority in conventional guide signing to satisfy motorist requirements for navigational information? (Please rank in order, with 1 being the most important). See page 6 for illustrations of these signs.

_____	Route Marker	Other Factors:	_____ _____
_____	Cardinal Direction Marker		_____ _____
_____	Advance and Direction Arrows		_____ _____
_____	Lane Use Markers		_____ _____
_____	Destination Sign (city names)		_____ _____
_____	Distance Sign (mileage)		_____ _____

5. In your opinion, what do drivers consider as the most important navigational information? (Please rank in order, with 1 being the most important). See page 6 for illustrations of these signs.

_____	Route Marker	Other Factors:	_____ _____
_____	Cardinal Direction Marker		_____ _____
_____	Advance and Direction Arrows		_____ _____
_____	Lane Use Markers		_____ _____
_____	Destination Sign (city names)		_____ _____
_____	Distance Sign (mileage)		_____ _____

6. When a new guide sign is approved and installed in your district or area, is an engineer involved in approving the request, design, and/or installation of the new sign?

☐ Always ☐ Sometimes ☐ Usually ☐ Rarely ☐ Never

Please describe the general process used to approve and install a guide sign.

7. In your opinion, what type of situations are most likely to cause driver confusion with respect to guide signs on conventional highways? (Please rank in order, with 1 being the most likely to cause confusion).

_____ Overlapping routes
_____ Routes through urban areas
_____ Conflicting cardinal direction markers and compass direction
_____ Lack of adequate sign size
_____ Lack of adequate advance notice of intersections/interchanges
_____ Too many guide signs
_____ Too few guide signs
_____ Lack of directions to traffic generators/tourist attractions

Other Situations:

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

8. What are some of the unique practices your district has implemented in order to address unusual conditions or conditions not normally found. Please include descriptions of practices which exceed the requirements of the Texas MUTCD. Also include photos, slides, plans, or photocopies, if available.

9. Please indicate any changes you would like to see made to the Texas MUTCD with respect to the use of guide signs on conventional highways.

10. Please indicate any changes you would like to see made to the *Standard Highway Sign Designs for Texas* manual with respect to the design of conventional guide signs.

11. Please identify specific locations that we might use as study sites in this research. Possible attributes of a study site include: some aspect of guide signing at the site will be changed in the near future, drivers appear to become confused at a site, complaint letters have been received about the guide signing (or lack thereof) at a site, or unique or unusual guide signing treatments have been used at a site to resolve deficiencies or concerns. Other attributes may also be possible. Please include drawings, photos, slides, plans, or photocopies, if available.

12. Please indicate your opinion about the usefulness of a document or documents which would address the following topics related to guide signing for conventional highways.

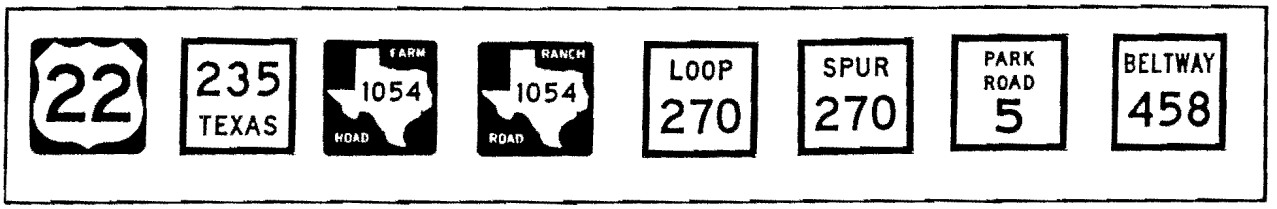
Definitely Useful	**Might be Useful**	**Not Useful**	**Topic**
☐	☐	☐	Possible combinations of various types of guide signs.
☐	☐	☐	Information/criteria for installing traffic generator and special event guide signs
☐	☐	☐	Information on installation practices
☐	☐	☐	Information on fabrication practices
☐	☐	☐	Information on maintenance practices
			Other Topics
☐	☐	☐	_____
☐	☐	☐	_____
☐	☐	☐	_____
☐	☐	☐	_____

13. Please indicate your opinion about the usefulness of a document or documents which would include guidelines for the use of the following types of guide signs. See page 6 for illustrations of these signs.

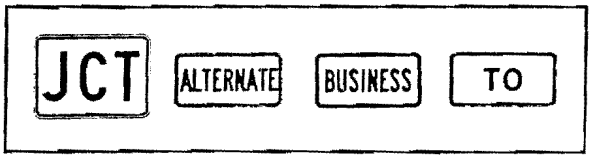
Definitely Useful	Might be Useful	Not Useful	Topic
☐	☐	☐	Distance signs
☐	☐	☐	Destination signs
☐	☐	☐	Route Markers
☐	☐	☐	Cardinal Direction Markers
☐	☐	☐	Direction Arrows
☐	☐	☐	Lane Use Markers
☐	☐	☐	Junction Assembly
☐	☐	☐	Advance Route Turn Assembly
☐	☐	☐	Directional Assembly
☐	☐	☐	Reassurance Assembly
☐	☐	☐	Trailblazer Assembly
			Other types of guide signs
☐	☐	☐	_____
☐	☐	☐	_____
☐	☐	☐	_____
☐	☐	☐	_____
☐	☐	☐	_____

Please return survey to:
H. Gene Hawkins, Jr.
Texas Transportation Institute
Texas A&M University
College Station, Texas 77843-3135 TexAn 857-9946

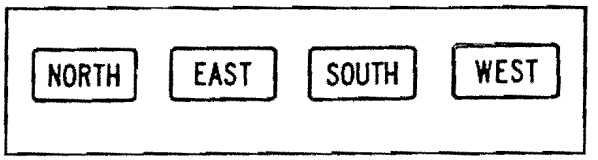
TYPES OF CONVENTIONAL GUIDE SIGNS



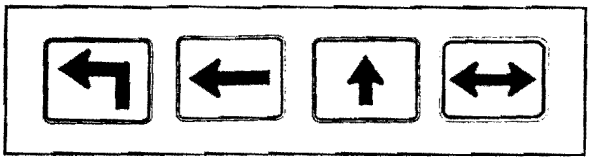
Route Markers



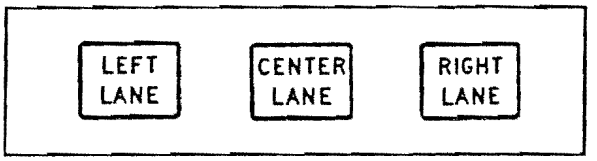
Junction, Alternate, Business, and To Markers



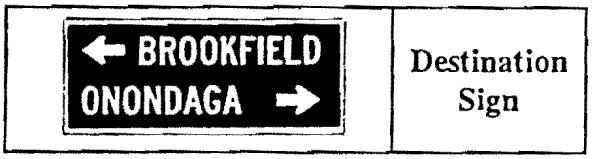
Cardinal Direction Markers



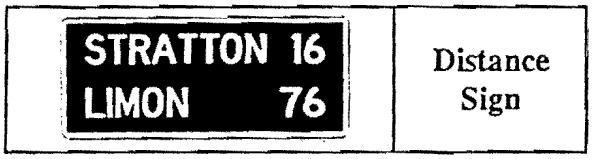
Advance Turn and Direction Arrows



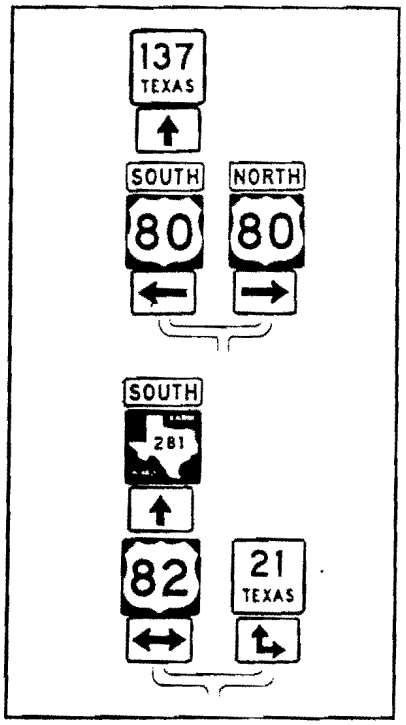
Lane Use Markers



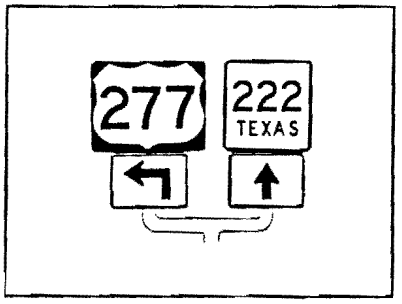
Destination Sign



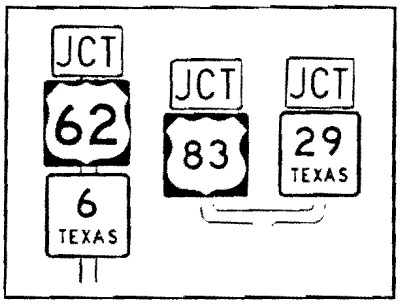
Distance Sign



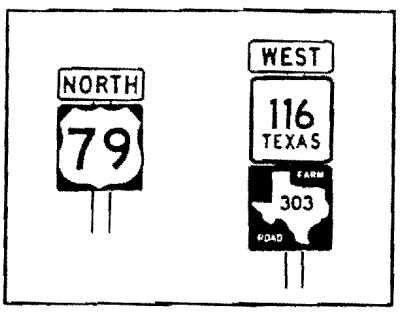
Directional Assembly



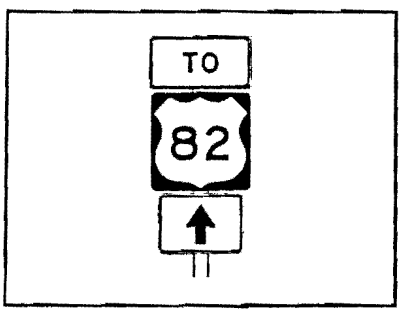
Advance Route Turn Assembly



Junction Assembly



Reassurance Assembly



Trailblazer Assembly

APPENDIX B

SUMMARY OF DISTRICT SURVEY RESPONSES

The following pages contain the responses to the district survey on conventional guide signing. A total of 96 responses were received from 23 different districts. Table B-1 summarizes the distribution of survey responses from the various positions.

Table B-1. Distribution of District Survey Responses by Position

Title or Equivalent Position	Number of Responses Received
District Engineers	7
District Traffic Engineers	25
District Maintenance Engineers	13
District Sign Shop Supervisors	11
Area Engineers	19
Area Maintenance Construction Supervisors	21

The responses for each question are shown as a percentage of the total responses. Individual comments are not listed, although the total number of comments are shown.

1. Are there conventional highways within your district where you feel the application of Texas MUTCD guidelines does not adequately convey needed or timely navigational information to motorists?

   9.6% Yes

   90.4% No

   If yes, please identify the highways and explain the deficiencies:

Sample of Comments Received:

- The failure to adequately convey needed or timely navigational information to motorists results from the misapplication of the Texas MUTCD guidelines.
- Corners are cluttered with too many signs, such that they are confusing to some drivers. Three or more multiroute highways are a problem to sign.
- Problems exist on certain rural four-lane divided highways. The exact differences between full freeway signing and conventional two-lane two-way highway signing need to be spelled out in considerable detail.
- There is confusion over the meaning of the advance turn arrow.
- In general, letter sizes on Farm-to-Market and Ranch-to-Market signs (route markers) are too small to be read at adequate distances. Many such roads carry medium to high volumes at 55 mph or greater. The Texas MUTCD guidelines seem to assume low volumes and that drivers can slow down and look in order to read these signs.
- At certain intersections, it has been necessary to utilize signing which is somewhat like expressway signing to communicate with motorists.
- Along the border, cardinal direction markers may not be understood.

2. Are you aware of any differences between your district and other districts in the manner in which conventional guide signs are implemented?

   30.2% Yes

   69.8% No

   If yes, please describe these differences:

Sample of Comments Received:

- Uniformity of guide sign policies.
- Uniformity of guide signing within individual districts.
- Signing for traffic generators.
- Number of signs used.
- Application of cardinal direction markers.
- Application of destination and distance signs.
- Guide signing for intersecting roadways.
- Types of signs mounted on a single pole.
- Cemetery signing.

3. Does your district have a formal procedure for handling sign requests?

   84.2% Yes

   15.8% No

   If yes, please explain:

Sample of Comments Received:

Procedures for processing requests for new signs are generally the same statewide. New sign requests are usually received verbally or in writing from private citizens or local governments. These requests may be made directly to the district office, or in many cases they originate at the local, county, or area level with district maintenance personnel. Once a request for a sign originates, the general procedure for handling the request is as follows:

1. The request is forwarded to the district traffic engineer for review. Field studies are conducted if necessary, and the request is evaluated on the basis of applicable Texas MUTCD guidelines. A decision is made by the traffic section to approve or reject the sign request.
2. If the request is approved, the district sign shop fabricates the sign per the instructions of the district traffic section.
3. The sign is installed by district maintenance personnel as directed by the district traffic section.

Sixty-four (81%) of the respondents that explained their district's formal procedures indicated that the request is handled by the district traffic engineer or the district traffic section at some point in the process. These respondents represented 22 of the 23 participating districts.

Some minor variations from this general procedure were noted. Ten survey respondents representing six of the participating districts indicated that the method of handling the request for a new sign varies according to the type of signing. Requests which these respondents described as "normal," "simple," "routine," "common," or "standard" are normally handled by the area engineer and/or local maintenance sections in cooperation with the district sign shop. Sign requests described as "complicated," "special," or "non-routine" signing are all handled through the district traffic engineer according to the procedure described previously.

Nine individuals representing seven districts mentioned the role of an area engineer in the decision to install a new sign. In some cases, the area engineer's responsibility is simply to review the request and provide input to the district traffic engineer regarding the proposed sign. At other times, primarily when the request is for standard or routine signing, the area engineer makes the final decision on whether or not a sign is justified and should be provided.

4. In your opinion, what would or should take priority in conventional guide signing to satisfy motorist requirements for navigational information? (Please rank in order, with 1 being the most important).

Table B-2. Summary of Rankings for District Survey Question 4

Sign Type or Group	Percent Selecting Each Ranking								
	1	2	3	4	5	6	7	8	9
Route Marker	64.2	13.7	13.7	2.1	3.2	1.1	2.1	---	---
Cardinal Direction Marker	2.1	26.6	19.1	25.5	13.8	11.7	---	1.1	---
Advance and Direction Arrows	9.5	22.1	31.6	16.8	15.8	3.2	---	---	1.1
Lane Use Markers	3.1	5.2	14.6	27.1	19.8	30.2	---	---	---
Destination Signs	18.8	19.8	12.5	16.7	26.0	5.2	1.0	---	---
Distance Signs	1.0	10.4	9.4	11.5	18.8	46.9	1.0	1.0	---
Other	See comments below								

The other factors and the rankings assigned by the respondents included:

- Advance route turn assembly (ranked 2 by one respondent);
- Directional assembly (ranked 1 by one respondent, ranked 2 by two respondents, and ranked 4 by one respondent);
- Junction assembly (ranked 1 by one respondent);
- Reassurance assembly (ranked 5 by one respondent); and
- Junction marker (ranked 2 by one respondent).

In addition, confirmation assemblies were listed as "other factors" by two individuals, but no rankings were assigned.

5. In your opinion, what do drivers consider as the most important navigational information? (Please rank in order, with 1 being the most important).

Table B-3. Summary of Rankings for District Survey Question 5

Sign Type or Group	Percent Selecting Each Ranking							
	1	2	3	4	5	6	7	8
Route Marker	43.7	22.9	24.0	3.1	4.2	2.1	---	---
Cardinal Direction Marker	1.1	13.7	12.6	29.5	24.2	17.9	1.1	---
Advance and Direction Arrows	3.2	16.8	24.2	25.3	24.2	6.3	---	---
Lane Use Markers	1.1	4.2	11.6	21.1	24.2	37.9	---	---
Destination Sign	44.8	16.7	12.5	8.3	12.5	4.2	1.0	---
Distance Sign	5.2	25.0	14.6	13.5	10.4	29.2	1.0	1.0
Other	See comments below							

Five respondents stated and ranked factors that were not included as choices. The other factors included:

- Directional assemblies (ranked 1 by one respondent, ranked 2 by one respondent, and ranked 3 by one respondent); and
- Junction markers (ranked 2 by one respondent).

One respondent listed confirmation assemblies as an "other factor," but did not specify a ranking.

6. When a new guide sign is approved and installed in your district or area, is an engineer involved in approving the request, design, and/or installation of the new sign?

61.1% Always
6.3% Sometimes
24.2% Usually
8.4% Rarely
0.0% Never

Please describe the general process used to approve and install a guide sign.

The information was essentially the same as that received in the comments for Question 3. The general process calls for simple or routine sign requests to be addressed by the responsible area engineer in conjunction with the maintenance section foremen and district sign shop. Requests for unusual or complicated signing are typically forwarded to the district traffic section, where they are reviewed by the traffic engineering staff and/or the district traffic engineer. If the request is approved, the details for sign fabrication are provided to the district sign shop, where the sign is manufactured. The district traffic engineer provides details of the sign's location and installation to the responsible maintenance section, which receives and then installs the sign.

7. In your opinion, what type of situations are most likely to cause driver confusion with respect to guide signs on conventional highways? (Please rank in order, with 1 being the most likely to cause confusion).

Table B-4. Summary of Rankings for District Survey Question 7

Situation	Percent Selecting Each Ranking								
	1	2	3	4	5	6	7	8	9
Overlapping Routes	22.1	22.1	17.9	15.8	6.3	5.3	7.4	3.2	---
Routes through urban areas	17.9	17.9	20.2	14.7	12.6	7.4	5.3	4.2	---
Conflicting cardinal direction markers and compass directions	9.7	15.1	19.4	11.8	17.2	8.6	10.8	6.5	1.1
Lack of adequate sign size	5.4	10.8	9.7	16.1	11.8	21.5	10.8	14.0	---
Lack of adequate advance notice of intersections/interchanges	22.3	21.3	18.1	13.8	13.8	4.3	5.3	1.1	---
Too many guide signs	14.1	6.5	5.4	10.9	10.9	9.8	17.4	23.9	---
Too few guide signs	8.7	4.3	5.4	16.3	16.3	20.7	20.7	15.2	---
Lack of directions to traffic generators/tourist attractions	1.1	3.3	4.4	11.1	11.1	23.3	21.1	24.4	1.1

Question 7 generated several comments regarding driver confusion due to poor or inadequate guide signing or other causes.

Sample of Comments Received:

- Conventional guide signing in urban areas is an important issue. According to six survey participants, competition from advertising and commercial signs is the main problem. One respondent stated that commercial signing often obstructs the driver's view of route markers and other guide signs. Several mentioned sign "clutter," which reduces guide sign target value. Another respondent stated that a change of direction of a route on multi-lane roadways in urban areas is a cause of driver confusion. Travel through urban construction zones was also listed as a source of driver confusion.
- Overlapping routes and the forest of guide signs they produce is our biggest problem.
- On overlapping routes, not being consistent with route markers is a problem. For example, one sign post may contain route markers for both concurrent routes; the next route marker signpost only has one of the routes.
- At many intersections and interchanges, there are too many sign assemblies to digest all of the information for the short period that they are in view.
- People not familiar with an area in many cases do not know what direction they are going, let alone the direction on a route that they need to go to arrive at their destination.

8. What are some of the unique practices your district has implemented in order to address unusual conditions or conditions not normally found. Please include descriptions of practices which exceed the requirements of the Texas MUTCD. Also include photos, slides, plans, or photocopies, if available.

A majority of the survey respondents (63%) either did not answer question 8 or indicated that they were unaware of any unique practices within their district. Thirty-six respondents provided information in the form of a written response, drawings, plans, and/or photographs. Several of these responses addressed practices unrelated to guide signing. Unique district practices and innovative solutions were generally related to the use of oversize signs and lettering, the use of overhead signing, signing of intersecting county roads, and various other practices.

Sample of Comments Received:

- Electronic lane use arrows.
- Review of unusual conditions by the District Engineer and the Traffic Safety Review Team to develop and implement the best solution that complies with the MUTCD.
- Installation of a flashing light on the sign post to attract attention to the sign in certain situations (e.g., a flashing beacon placed on an advance route marker for an intersection located just over a hill).
- Installation of street name signs at signalized intersections on S.H. 6 between U.S. 59 and U.S. 290 and on F.M. 1960 between U.S. 290 and U.S. 59.
- Use of large mobile message board trailers to notify drivers of temporary or new locations or situations.
- Signing of an F.M. route and county roads as historical roads, using brown for the route markers and cardinal direction markers.
- Highway advisory radio.

9. Please indicate any changes you would like to see made to the Texas MUTCD with respect to the use of guide signs on conventional highways.

Seven respondents stated that, in their opinion, the Texas MUTCD is adequate. A total of 49 respondents answered either "none," "no comment," or simply did not respond. The suggested changes to the Texas MUTCD may be grouped into ten categories (the number of comments applicable to each category follows):

- Special interest signing (7 comments)
- Signing for traffic generators (6 comments)
- Larger signs and/or lettering (5 comments)
- Destination signs (5 comments)
- Route markers (4 comments)
- Reduce number of signs (3 comments)
- Format of Manual (2 comments)
- Overhead mounting of guide signs (2 comments)
- Improve standardization and uniformity (2 comments)
- Training of maintenance personnel (2 comments).

10. Please indicate any changes you would like to see made to the *Standard Highway Sign Designs for Texas* manual with respect to the design of conventional guide signs.

Twenty-two responses/comments were received. Many of the responses addressed issues unrelated to guide signs. The remaining 74 respondents indicated that no changes should be made, that the existing manual is adequate, or simply did not respond. Several stated that they were not familiar with this document and had never seen it before.

Sample of Comments Received:

- Increase the size of signing - use larger signs - to accommodate older drivers.
- Color code routes through major urban areas.
- Eliminate mileage on directional signs. (Respondent was probably referring to distance signs.)
- Eliminate all route markers except on Interstates, U.S. Highways, and State Highways. State Highway route markers on conventional and Interstate highway guide signs should be the same design, with either the word "TEXAS" always above the number or always below the number. Renumber all farm and ranch roads with numbers 999 and below by adding a 4,000 to the current number. Renumber all loops, spurs, park roads, beltways, etc. Eliminate all duplicate numbers, such as U.S. 183 and Texas 183, and alternate routes, such as U.S. 90A and U.S. 77A. On business route markers, do not insist on using segment suffixes.
- Provide better fabrication dimensions and guidelines for the D1-1, D1-1a, D1-3, D1-3A, D2-1, and D2-3 destination and distance signs.
- Standardize the specifications for county road guide signs.
- Standardize cemetery signs and their application. The word cemetery should be spelled out and not abbreviated.
- Provide clarification on the use of abbreviations and periods in abbreviations.
- Make signs more conspicuous.
- Show details of the street name sign at signalized intersections.
- "BUSINESS" on the Interstate business marker does not stand out clearly.
- Include all available guide signs in the MUTCD.
- Indicate spacing between letters in addition to letter height, etc.
- Print the sign manual on longer-lasting material.

11. Please identify specific locations that we might use as study sites in this research. Possible attributes of a study site include: some aspect of guide signing at the site will be changed in the near future, drivers appear to become confused at a site, complaint letters have been received about the guide signing (or lack thereof) at a site, or unique or unusual guide signing treatments have been used at a site to resolve deficiencies or concerns. Other attributes may also be possible. Please include drawings, photos, slides, plans, or photocopies, if available.

    Responses/comments to Question 11 identified 34 specific locations.

12. Please indicate your opinion about the usefulness of a document or documents which would address the following topics related to guide signing for conventional highways.

Table B-5. Summary of Responses for District Survey Question 12

Topic	Percent Selecting Each Category		
	Definitely Useful	Might Be Useful	Not Useful
Possible combinations of various types of guide signs.	36.2	59.6	4.3
Information/criteria for installing traffic generator and special event guide signs	59.1	37.6	3.2
Information on installation practices	34.0	52.1	13.8
Information on fabrication practices	19.6	42.4	38.0
Information on maintenance practices	37.2	51.1	11.7

Survey respondents were provided an opportunity to list other topics to be considered. A number of suggestions were received (all were ranked "definitely useful"), including documents to address:

- Better signing for older drivers.
- Design criteria as to the size, location, and need when developing plans.
- Use of the D7-1 through D7-11 signs.
- Justification, cost effectiveness, and application of high intensity sign materials.
- Information on placement of delineation.
- Procedures and practices for preparing sign layouts for TxDOT maintenance to install.
- Information for use of computerized letter cutting systems.

13. Please indicate your opinion about the usefulness of a document or documents which would include guidelines for the use of the following types of guide signs. See page A-8 for illustrations of these signs.

Table B-6. Summary of Responses for District Survey Question 13

Topic	Percent Selecting Each Category		
	Definitely Useful	Might Be Useful	Not Useful
Distance Signs	40.0	43.5	16.5
Destination Signs	52.3	34.9	12.8
Route Markers	45.3	37.2	17.4
Cardinal Direction Markers	35.3	43.5	21.2
Direction Arrows	41.9	36.0	22.1
Lane Use Markers	40.7	38.4	20.9
Junction Assembly	40.7	38.4	20.9
Advance Route Turn Assembly	46.5	37.2	16.3
Directional Assembly	40.7	41.9	17.4
Reassurance Assembly	32.9	49.4	17.6
Trailblazer Assembly	37.6	49.4	12.9

Several respondents identified other types of guide signs to be considered. These are presented below:

- Airports ("definitely useful");
- Entertainment areas ("might be useful");
- Crossover sign ("definitely useful");
- Tourist information signing ("might be useful");
- County road guide signs ("definitely useful");
- Lane assignment signs ("might be useful"); and
- Use of expressway guide signs on conventional roads ("definitely useful").

Four respondents stated that the MUTCD already contains adequate guidelines for these types of signs, and that problems would not exist if everyone would follow these already-established guidelines.

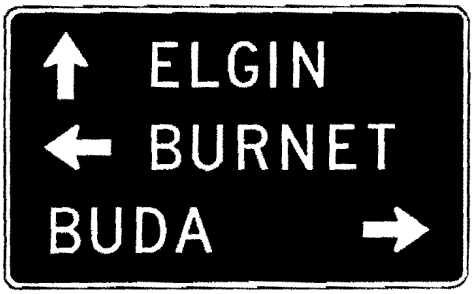
APPENDIX C
INSTRUMENT FOR DRIVER SURVEY

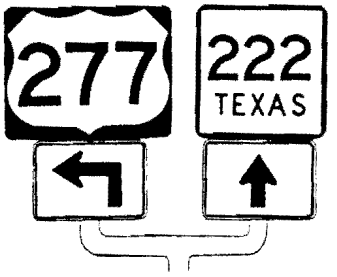
This appendix provides a representation of the survey instrument used in the driver survey. The survey instrument was a self-administered paper survey which took 15 to 20 minutes for a driver to complete. The survey contained 18 questions covering four different areas of interest, plus additional background questions. This appendix contains a copy of the actual instrument used to administer the survey.

RURAL GUIDE SIGN SURVEY

Texas Transportation Institute

Texas Department of Transportation





This survey covers guide signs for rural highways. The Texas Transportation Institute at Texas A&M University is conducting the survey for the Texas Department of Transportation. The purpose of these questions is to find out if there are ways that guide signs on Texas' rural highways can be improved. The signs that are the topic of this survey are those that connect cities and towns in Texas (not including Interstate freeways).

To find out how to improve travel in Texas, the Department of Transportation would like to know how you plan for trips to unfamiliar places, what tools you use to find your way, the importance of various signs, and your opinions based on your own travel experiences.

Part I. The questions below ask how you plan for and find your way on Texas highways.

1. On a trip to an unfamiliar area, which of the following do you typically do? (Check **ALL** that apply.)
   - ☐ Use a map to plan the trip before you leave
   - ☐ Use a map during the trip for directions
   - ☐ List the cities that you are supposed to travel through
   - ☐ Call friends or relatives that are familiar with the area to ask for directions
   - ☐ Call a business or organization in the unfamiliar area to ask for directions
   - ☐ Drive to the general area and stop to ask for directions
   - ☐ Follow highway signs
   - ☐ Other (please describe) _____

2. What sources of information do you use to guide you on trips? (Check **ALL** that apply.)
   - ☐ a. City names
   - ☐ b. Landmarks
   - ☐ c. Maps
   - ☐ d. Directions from a passenger in the car
   - ☐ e. Directions prepared before leaving
   - ☐ f. Directions obtained during the trip
   - ☐ g. Highway signs
   - ☐ h. Other (please describe) _____

3. Which **ONE** of the responses to Question 2 do you rely on most. _____

4. What is important to you when you are planning a trip between cities? (Choose only **TWO** responses in each column.)

	BUSINESS TRIP	PLEASURE TRIP
Travel time	☐	☐
Ease of access	☐	☐
Distance traveled	☐	☐
Attractions along the way	☐	☐
Scenery	☐	☐
Quality of highway	☐	☐
Number of lanes on the highway	☐	☐
Avoiding traffic	☐	☐
Other (Please explain)	☐ _____	☐ _____

Part II. The following questions are about the signs used to provide directions on Texas highways.

5. What types of highways use the sign shown below? (Check **ALL** that apply.)

- ☐ Farm-to-Market Road
- ☐ U.S. Highway
- ☐ State Highway
- ☐ Ranch-to-Market Road
- ☐ Interstate

6. What types of highways use the sign shown below? (Check **ALL** that apply.)

- ☐ Farm-to-Market Road
- ☐ U.S. Highway
- ☐ State Highway
- ☐ Ranch-to-Market Road
- ☐ Interstate

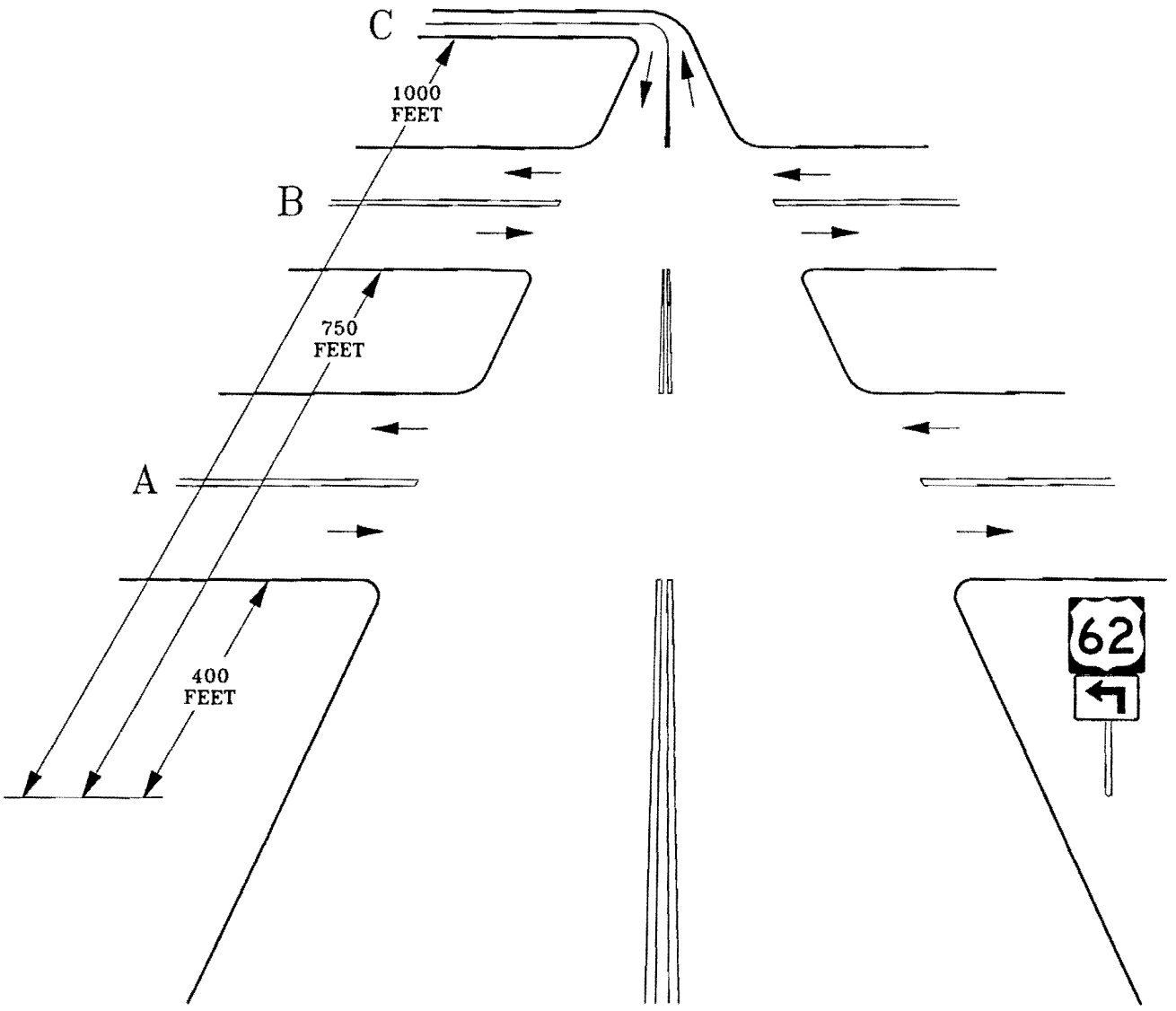
7. What types of highways use the sign shown below? (Check **ALL** that apply.)

- ☐ Farm-to-Market Road
- ☐ U.S. Highway
- ☐ State Highway
- ☐ Ranch-to-Market Road
- ☐ Interstate

8. What types of highways use the sign shown below? (Check **ALL** that apply.)

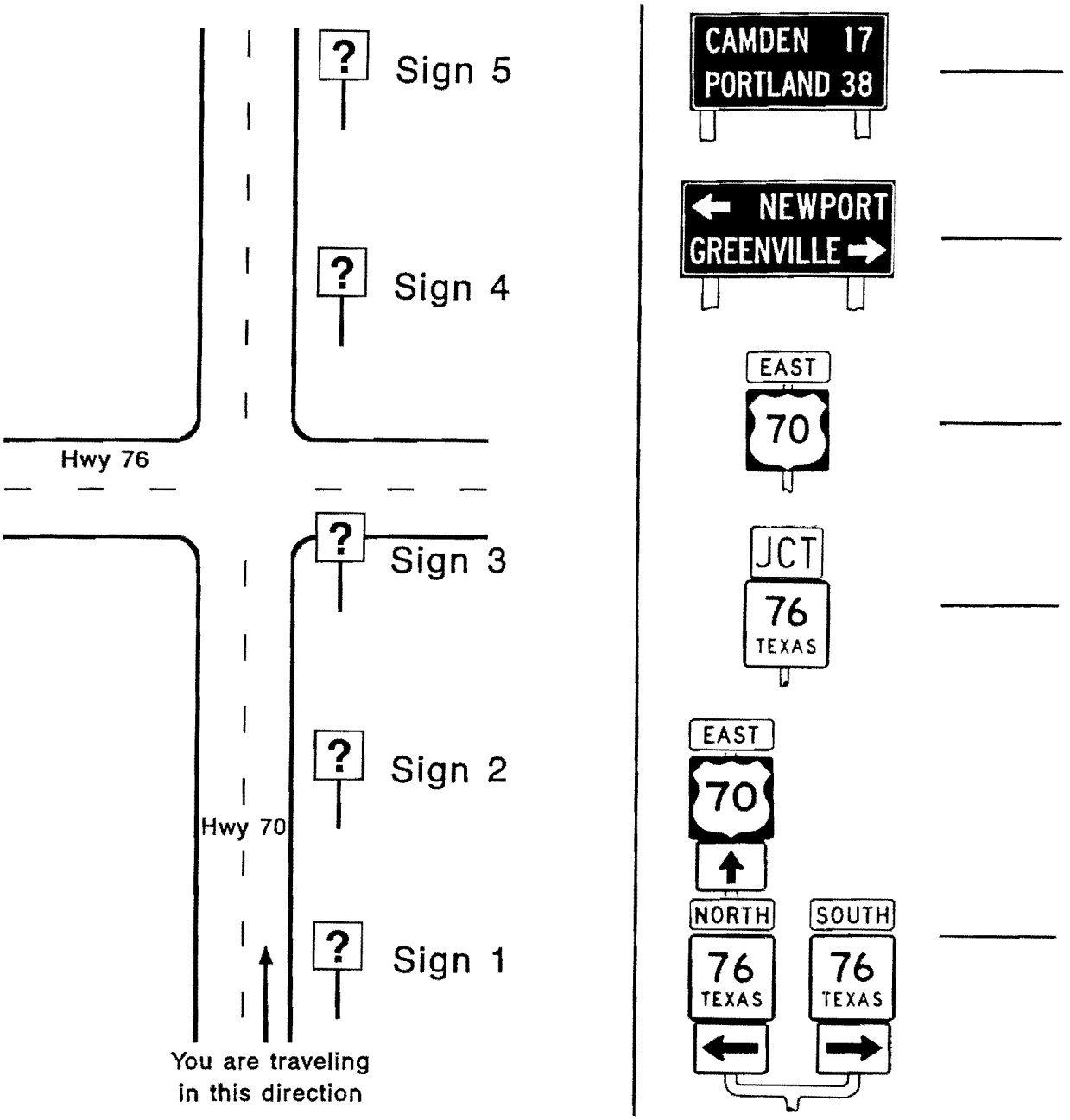
- ☐ Farm-to-Market Road
- ☐ U.S. Highway
- ☐ State Highway
- ☐ Ranch-to-Market Road
- ☐ Interstate

9. To stay on Highway 62, what road should you turn onto?



- ☐ Road A, which is 400 feet from the sign.
- ☐ Road B, which is 750 feet from the sign.
- ☐ Road C, which continues through the intersections and curves to the left 1000 feet from the sign.

10. Please indicate the order in which you would see the signs on the highway pictured below. Place a 1 by the first sign, a 2 by the second sign, and so on.

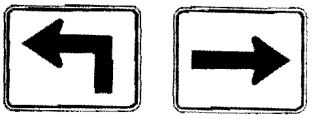


11. Do you have any comments or suggestions about the order or placement of these signs?

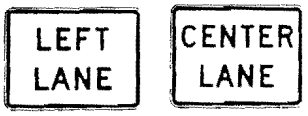
12. Please indicate the importance of the following groups of signs in terms of their value to you when you travel.

☐ Very Important ☐ Somewhat Important ☐ Not Important

☐ Very Important ☐ Somewhat Important ☐ Not Important



☐ Very Important ☐ Somewhat Important ☐ Not Important



☐ Very Important ☐ Somewhat Important ☐ Not Important

☐ Very Important ☐ Somewhat Important ☐ Not Important

☐ Very Important ☐ Somewhat Important ☐ Not Important

☐ Very Important ☐ Somewhat Important ☐ Not Important

☐ Very Important ☐ Somewhat Important ☐ Not Important

13. Do you have difficult seeing the numbers or letters on some guide signs?

Numbers

☐ Yes
☐ Sometimes
☐ No

Letters

☐ Yes
☐ Sometimes
☐ No

14. Please indicate the **THREE** most important types of information provided by rural guide signs. (Place a 1 by the most important, 2 by the second in importance, and 3 by the third most important.)

_____ The name of the next city or town
_____ The distance to the next city or town
_____ The number of the highway that you are on
_____ The direction your highway is headed (North, South, East, or West)
_____ Advance notice of an intersecting highway
_____ Arrows telling you which direction to turn at an intersection
_____ Other (please describe) _____

Part III. The following question is about the characteristics of Texas highways.

15. Please check the characteristics which apply to each type of highway. (Each characteristic may apply to more than one highway.)

	Interstate Highway	U.S. Highway	State Highway	Farm-to-Market Rd
Has two lanes (one in each direction)	☐	☐	☐	☐
Has four or more total lanes	☐	☐	☐	☐
Has 55 mph or higher speed limit	☐	☐	☐	☐
Connects small towns and rural areas	☐	☐	☐	☐
Connects large cities	☐	☐	☐	☐
Located in small cities	☐	☐	☐	☐
Located in large cities	☐	☐	☐	☐
Crosses state lines	☐	☐	☐	☐
Must use entrance ramp to get on highway	☐	☐	☐	☐

Part IV. The following questions are general questions about guide signs and Texas highways.

16. On a scale of 1 to 10 (with 1 being very poor, 5 being average, and 10 being very good), how would you rate the quality of guide signs on Texas highways? (Circle one.)

1	2	3	4	5	6	7	8	9	10
Very Poor				Average					Very Good

17. Please indicate the highway number and closest town of any places where you had a problem finding your way. A brief description of the problem will be helpful. Feel free to indicate more than one location. (Please do not include places in large cities or on Interstate highways.)

_____

_____

_____

_____

_____

_____

_____

18. Is there anything else you would like the Texas Department of Transportation to know about rural guide signs?

_____

_____

_____

_____

Part V. For comparison purposes, please answer the following questions.

B1. What is your age?

- ☐ 16-24
- ☐ 25-54
- ☐ 55-64
- ☐ 65+

B2. What is your gender?

- ☐ Male
- ☐ Female

B3. Are you a resident of Texas?

☐ Yes ☐ No If no, in what state do you live?_____

B4. How long have you been driving?

☐ less than 1 year
☐ 1 to 5 years
☐ more than 5 years

B5. What is the highest level of school you completed?

☐ Less than high school.
☐ High school graduate (or equivalent).
☐ Trade school graduate.
☐ Some college.
☐ College graduate.
☐ Advanced Degree.

B6. What is your family background?

☐ African-American (black)
☐ Anglo (white)
☐ Asian
☐ Hispanic
☐ Other (please indicate) _____

B7. What type of vehicle do you drive on highways? (Check **ALL** that apply)

☐ Car or Pick-up
☐ Large Truck (3 or more axles)
☐ RV
☐ Other _____

B8. In what type of area do you live?

☐ Large city (greater than 50,000 population)
☐ Medium city (5,000 to 50,000 population)
☐ Small city (less than 5,000 population)
☐ Rural area (outside of a city)

B9. We would like to know how familiar you are with the highways you travel on. Please indicate the percent of your highway driving that is on each type of highway.

%	
_____	Very Familiar (Highways that you drive on a regular basis)
_____	Somewhat Familiar (Highways that you drive every now and then)
_____	Unfamiliar (Highways that you rarely or never drive on)
100%	Total Percent

APPENDIX D

SUMMARY OF DRIVER SURVEY RESPONSES

This appendix summarizes the results of the driver survey. The survey instrument (see Appendix C) contained 18 questions on guide signing and highway navigation. There were also 9 background questions. Table D-1 summarizes the characteristics of the sample for the driver survey as determined from the 9 background questions.

Table D-1. Driver Survey Sample Characteristics

Characteristic		Number of Respondents	Driver Survey	Texas Population	Texas Drivers
Gender	Male	240	56.6%	49.3%	51.5%
	Female	184	43.4%	50.7%	48.5%
Age	16 - 24	36	8.5%	18.9%	15.2%
	25 - 54	281	66.3%	57.4%	62.4%
	55 - 64	75	17.7%	10.2%	10.4%
	65 +	32	7.5%	13.6%	12.0%
Family Background	African Amer.	6	1.4%	11.6%	---
	Anglo	377	89.8%	60.6%	---
	Asian	2	0.5%	N/A[1]	---
	Hispanic	27	6.4%	25.6%	---
	Other	8	1.9%	2.2%	---
Years of Education	< High School	18	4.3%	28.1%	---
	High School Grad	99	23.7%	25.9%	---
	Tech/Trade School	21	5.0%	N/A[2]	---
	Some College	130	31.1%	27.8%	---
	College Graduate	102	24.4%	12.6%	---
	Graduate School	48	11.5%	5.5%	---
Area Where Living	Large City (> 50,000)	97	23.1%	---	---
	Medium City (5,000 - 50,000)	153	36.4%	---	---
	Small City (< 5,000)	78	18.6%	---	---
	Rural Area	92	21.9%	---	---
Texas Resident	Yes	396	94.3%	100.0%	100.0%
	No	24	5.7%	0.0%	0.0%
Years Driving	< 1 year	9	2.1%	---	---
	1 - 5	20	4.8%	---	---
	> 5	391	93.1%	---	---
Type of Vehicle Driven	Car or Pick-up	417	99.3%	---	---
	Large Truck	27	6.4%	---	---
	RV	48	11.4%	---	---
	Other	15	3.6%	---	---
Percent of Driving on:	Very familiar roads		70.0%	---	---
	Somewhat familiar roads	413	20.0%	---	---
	Unfamiliar roads		10.0%	---	---
Sample Size	---	428	100%	---	---

Note: [1]For the statewide proportion, Asians are included in the other category.
[2]Statewide proportion not available.
[3]Percentages represent percent of those responding to a question. Not all socio-demographic questions were answered by all respondents.

A total of 428 drivers took the survey. The response summaries for each question are reported as a percentage of the total sample.

1. On a trip to an unfamiliar area, which of the following do you typically do? (Check **ALL** that apply.)

   82.7% Use a map to plan the trip before you leave

   80.6% Use a map during the trip for directions

   20.1% List the cities that you are supposed to travel through

   26.4% Call friends or relatives that are familiar with the area to ask for directions

   8.9% Call a business or organization in the unfamiliar area to ask for directions

   32.7% Drive to the general area and stop to ask for directions

   79.9% Follow highway signs

   3.7% Other (please describe)

2. What sources of information do you use to guide you on trips? (Check **ALL** that apply.)

   79.4% a. City names

   36.2% b. Landmarks

   88.8% c. Maps

   26.4% d. Directions from a passenger in the car

   58.9% e. Directions prepared before leaving

   34.8% f. Directions obtained during the trip

   90.4% g. Highway signs

   3.3% h. Other (please describe)

3. Which **ONE** of the responses to Question 2 do you rely on most.

   3.9% a. City names

   2.2% b. Landmarks

   58.6% c. Maps

   2.7% d. Directions from a passenger in the car

   8.2% e. Directions prepared before leaving

   1.0% f. Directions obtained during the trip

   23.1% g. Highway signs

   0.5% h. Other (please describe)

4. What is important to you when you are planning a trip between cities? (Choose only **TWO** responses in each column.)

	BUSINESS TRIP	PLEASURE TRIP
Travel time	67.5%	26.1%
Ease of access	23.5%	14.2%
Distance traveled	21.6%	12.6%
Attractions along the way	4.2%	43.4%
Scenery	5.9%	47.2%
Quality of highway	36.9%	26.8%
Number of lanes on the highway	8.7%	8.5%
Avoiding traffic	31.1%	20.6%
Other (Please explain)	0.3%	0.5%

5. What types of highways use the sign shown below? (Check **ALL** that apply.)

68.2% Farm-to-Market Road
4.0% U.S. Highway
34.3% State Highway
20.1% Ranch-to-Market Road
3.3% Interstate

6. What types of highways use the sign shown below? (Check **ALL** that apply.)

4.2% Farm-to-Market Road
62.6% U.S. Highway
25.2% State Highway
2.3% Ranch-to-Market Road
19.6% Interstate

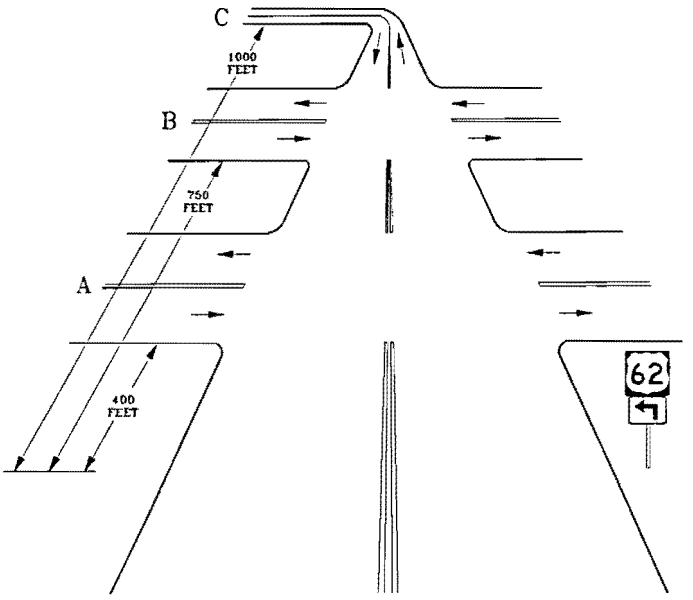
7. What types of highways use the sign shown below? (Check **ALL** that apply.)

0.9% Farm-to-Market Road
15.0% U.S. Highway
34.3% State Highway
1.4% Ranch-to-Market Road
63.8% Interstate

8. What types of highways use the sign shown below? (Check ALL that apply.)

36.4% Farm-to-Market Road
6.5% U.S. Highway
45.8% State Highway
23.8% Ranch-to-Market Road
4.2% Interstate

9. To stay on Highway 62, what road should you turn onto?



74.9% Road A, which is 400 feet from the sign.
7.6% Road B, which is 750 feet from the sign.
17.5% Road C, which continues through the intersections and curves to the left 1000 feet from the sign.

10. Please indicate the order in which you would see the signs on the highway pictured below. Place a 1 by the first sign, a 2 by the second sign, and so on.

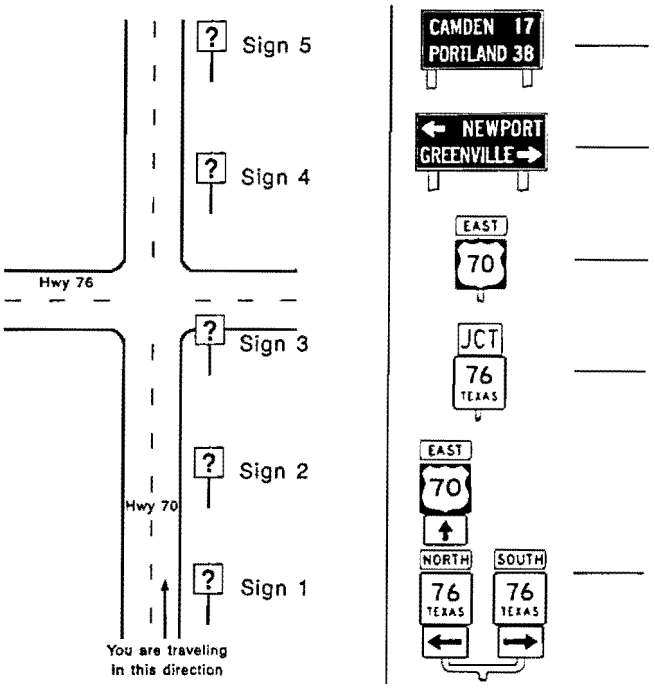


Table D-2. Summary of Responses for Driver Survey Question 10

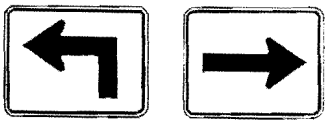
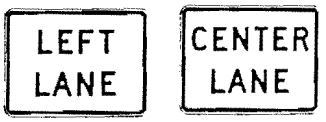
Sign	Percent Placing Sign in Indicated Position						Composite
	#1	#2	#3	#4	#5	Unknown	
Distance	6.7	3.4	2.4	15.9	69.7	1.9	4.328
Destination	9.1	28.4	30.3	23.3	7.5	1.4	2.875
Reassurance	21.2	9.1	8.4	47.6	12.5	1.2	3.175
Junction	40.9	34.1	13.2	7.2	3.4	1.2	1.945
Turn Assembly	22.1	23.8	44.9	4.3	4.8	0.0	2.456

11. Do you have any comments or suggestions about the order or placement of these signs?

28 individual responses

12. Please indicate the importance of the following groups of signs in terms of their value to you when you travel.

Table D-3. Summary of Responses for Driver Survey Question 12

Sign	Percent Selecting Each Category		
	Very Important	Somewhat Important	Not Important
	74.8	21.1	4.0
	65.3	27.8	6.9
	73.4	23.5	3.1
	66.0	26.2	7.9
	49.0	41.9	9.0
	75.8	23.0	1.2
	48.7	46.1	5.2
	42.4	43.8	13.7

13. Do you have difficulty seeing the numbers or letters on some guide signs?

Table D-4. Summary of Responses for Driver Survey Question 13

Response	Letters	Numbers
Yes	15.0 percent	15.0 percent
Sometimes	30.0 percent	30.0 percent
No	55.0 percent	55.0 percent

14. Please indicate the **THREE** most important types of information provided by rural guide signs. (Place a 1 by the most important, 2 by the second in importance, and 3 by the third most important.)

Table D-5. Summary of Responses for Driver Survey Question 14

Type of Information	Percent Selecting Each Ranking		
	1	2	3
Name of next city or town	19.7	11.2	13.1
Distance to next city or town	8.4	20.7	18.7
Number of the highway	45.6	16.3	17.0
Direction the highway is headed	9.1	23.8	13.1
Advance notice of intersecting highway	11.8	14.4	19.7
Arrows at intersection	5.5	13.6	17.5
Other	0.0	0.0	0.7

15. Please check the characteristics which apply to each type of highway. (Each characteristic may apply to more than one highway.)

Table D-6. Summary of Responses for Driver Survey Question 15

Characteristic	Type of Highway			
	Interstate	U.S. Hwy	State Hwy	F.M. Road
Has two lanes (one in each direction)	16.0%	38.5%	57.9%	73.7%
Has four or more total lanes	86.6%	45.2%	25.8%	1.4%
Has 55 mph or higher speed limit	74.6%	60.3%	52.9%	28.7%
Connects small towns and rural areas	10.8%	24.6%	58.4%	79.4%
Connects large cities	77.8%	66.3%	44.3%	5.5%
Located in small cities	12.7%	30.9%	67.9%	64.8%
Located in large cities	72.2%	73.9%	53.6%	13.9%
Crosses state lines	82.3%	63.9%	10.5%	4.3%
Must use entrance ramp to get on highway	85.6%	40.7%	20.6%	4.8%

16. On a scale of 1 to 10 (with 1 being very poor, 5 being average, and 10 being very good), how would you rate the quality of guide signs on Texas highways? (Circle one.)

Table D-7. Summary of Responses for Driver Survey Question 16

Score	1	2	3	4	5	6	7	8	9	10
Percent	0.5	0.5	1.9	3.3	12.4	7.7	17.7	29.2	12.2	14.6
Composite	7.419									

17. Please indicate the highway number and closest town of any places where you had a problem finding your way. A brief description of the problem will be helpful. Feel free to indicate more than one location. (Please do not include places in large cities or on Interstate highways.)

    181 responses - see Chapter V for additional information.

18. Is there anything else you would like the Texas Department of Transportation to know about rural guide signs?

    102 responses

APPENDIX E

SUMMARY OF FOCUS GROUP FINDINGS

The following pages summarize the findings of the three focus groups that were conducted to solicit driver opinions and comments about conventional guide signing. The focus groups were conducted in three different Texas cities, and each group represented a specific type of driver. The cities and driver types included:

- Rockport - older drivers.
- Somerville - small town drivers.
- Bryan/College Station - typical drivers who rely upon the conventional highway network.

The tables in this appendix summarize the findings for the following subject areas:

- Table E-1
  - Driving Patterns
  - Trip Planning
- Table E-2
  - Navigational Aids
- Table E-3
  - Highway Classification System
  - Urban versus Rural Signing
  - General Adequacy of the System

Table E-1. Major Findings of the Focus Group Sessions

Subject Area	Discussion Topic	Focus Group		
		Rockport	Somerville	College Station
Driving Patterns	Time of Day to Travel	Avoid nighttime and inclement weather	Prefer night and early morning	Drive at all hours and in all conditions
	Type of Highway to Travel	Drive all types of highways; avoid Interstates, particularly in large urban areas	Drive all types of highways; prefer Interstates because faster and fewer stops	Drive all types of highways; prefer Interstates in general; some prefer "back roads"
	Familiarity With Roads Traveled	Drive unfamiliar highways 20% of the time average	Most rarely travel unfamiliar highways; some travel unfamiliar roads extensively, but have little trouble	Most driving occurs on familiar highways
Trip Planning	Tools	Maps most common; also AAA TripTek	Maps most common	Maps most common
	Map Elements	Select scenic routes or locations they wish to visit; less traffic a factor	Rely on cities and route numbers for reference points; mark routes and time to destination on map	Distances between towns important; also shortest route, town names, type of road, route number; some look for Interstates and landmarks
	Directions From Others	Do not use	Rarely use	Occasionally use; county road numbers, landmarks, accurate estimate of distance important
	Importance of Signs	Route numbers	Route numbers and city name guide signs	Cardinal directions, Interstate shields, color of signs all important

Table E-2. Major Findings of the Focus Group Sessions

Subject Area	Discussion Topic	Focus Group		
		Rockport	Somerville	College Station
Navigational Aids	Route Numbers	Essential	Essential	Very important
	Cardinal Direction Signs	Essential; more frequent use in conjunction with route markers recommended	Essential	Very important
	City Name Guide Signs	Important; more destination signs needed	More needed	Destination and distance signs very important; more frequent presentation needed
	Number of Names Per Sign	Three alright if all in the same direction; list next small city and next major city on destination sign	Display next three cities if not too far from each other; list closest city first and furthest last	Three alright if two are small towns and one is larger town; two names on a sign good
	Location of Mileage Numbers	To right of city name	To right of city name	To right of city name

Table E-3. Major Findings of the Focus Group Sessions

Subject Area	Discussion Topic	Focus Group		
		Rockport	Somerville	College Station
Highway Classification System	Highway Classification System	Fine as is, needs no improvement; set of numbers more important than shape or road classification	Numbers, shapes, and shades useful, help to inform of different types of highways	Interstate - go really fast F.M. - no center strip or a gravel road, be careful U.S. Highway - long distance, major highway Park Road - dead ends into park or lake; some confusion over Texas route markers
Urban Versus Rural Signing	Urban Versus Rural Signing	More urban type guide signs mounted overhead needed on rural roads, especially at intersections	Look for different information on rural signs than on urban signs; bigger lettering; more guide signs on rural roads	Look for different information on rural signs than on urban signs; overhead signs should be used in rural areas; more frequent rural signs also might help
General Adequacy of the System	General Adequacy of the System	Generally adequate	Texas has one of best sign systems; need more guide signs in rural areas, more of every type of sign	Current system is good, best state to drive in; some signs could be displayed better; sometimes too much information on signs; need better signing before entering a loop