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16. Abstract The freeway signing guidelines in the <i>Manual on Uniform Traffic Control Devices</i> (MUTCD) are general in nature and leave room for interpretation. As a result, there are some variations in the way that freeway signing information is presented to road users. This project was conducted to evaluate key aspects of freeway signing in Texas and develop guidelines for improving the quality and consistency of freeway signing. The major efforts of this research included an evaluation of existing freeway signing in Texas by photographing signing in several urban areas, evaluating driver information needs by conducting focus groups with freeway drivers in selected Texas cities, and developing a <i>Freeway Signing Handbook</i> . The handbook is the implementation product for the research effort. The six chapters in the handbook address: related documents that also contain freeway signing information, the basic principles of freeway signing, when it is appropriate to use different types of freeway signs, the design (or layout) of exit direction and advance guide signs, the placement of freeway advance guide and exit direction signs approaching roadway interchanges and freeway-to-freeway interchanges, and signing for freeway frontage roads.					
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**URBAN FREEWAY GUIDE SIGNING:
FINAL REPORT**

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DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation. The engineer in charge was H. Gene Hawkins, Jr., P.E., (TX, # 61509).

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CHAPTER 1: INTRODUCTION

Freeway guide signing is designed primarily for the benefit of road users who are not familiar with a particular route or area. Freeway signing should be consistent and furnish road users clear instructions for orderly progress to their destinations. Excessive or inconsistent signing should be avoided since it tends to confuse road users and diminish the effectiveness of freeway guide signs. Since freeway guide signs are primarily for the benefit of unfamiliar drivers, it is important that these signs are consistent throughout rural and urban areas in Texas.

Few existing guidelines for the selection, design, and placement of freeway guide signs exist. The guiding documents for freeway guide signing are the *Manual on Uniform Traffic Control Devices: Millennium Edition* (national MUTCD) and the *Texas Manual on Uniform Traffic Control Devices* (Texas MUTCD). These documents, however, address a limited number of conditions and only establish the basic principles for freeway signing. This lack of guidance leaves general freeway signing practices for the application of engineering judgment.

The Texas Department of Transportation (TxDOT) research project 0-4170, “Improved Signing for Urban Freeway Conditions,” is intended to develop a *Freeway Signing Handbook* that will provide guidelines to help TxDOT and the engineering profession in the selection and design of freeway guide signs.

This report summarizes the major activities associated with the conduct of the research project. These activities include:

- identifying and reviewing existing freeway signing guidelines and previous research related to driver needs for freeway signing (described in research report 4170-1),
- evaluating existing freeway signing in selected Texas cities (described in [Chapter 2](#)),
- conducting focus groups with drivers in several Texas cities (described in [Chapter 3](#)), and
- developing the *Freeway Signing Handbook* (described in [Chapter 4](#)).

CHAPTER 2: EVALUATION OF EXISTING FREEWAY SIGNING

To assist in the development of the *Freeway Signing Handbook*, Texas Transportation Institute (TTI) researchers conducted an evaluation of existing freeway signing in Texas to identify current practices and needs for improved guidelines. The objectives of the evaluation were to:

- document existing freeway guide signing and related geometric data;
- identify differences and variations of freeway guide signing between the national and Texas MUTCD standards; and
- identify inconsistencies for survey content and emphasis in the *Freeway Signing Handbook*.

EVALUATION OF EXISTING SIGNING

An evaluation of existing TxDOT freeway guide signing identified inconsistencies between current practices and the standards provided by the Texas MUTCD and TxDOT signing documents. The freeway and expressway guide sign sections in the national and Texas MUTCD cover many types of freeway signing. An evaluation of all types of freeway signing would be impractical; therefore, the most common freeway sign types were evaluated. These sign types are included in the following categories:

- Interchange Guide signs (including advance guide and exit direction signs),
- Interchange Sequence Series signs, and
- NEXT X EXITS signs.

Researchers conducted the evaluation by taking digital photographs of freeway guide signing and geometric data in eleven TxDOT districts. The eleven districts were:

- Austin (AUS),
- Corpus Christi (CRP),

- Dallas (DAL),
- Fort Worth (FTW),
- Houston (HOU),
- Laredo (LAR),
- Odessa (ODA),
- Pharr (PHR),
- San Antonio (SAT),
- Waco (WAC), and
- Yoakum (YKM).

Over 2900 photographs were taken in rural and urban areas in these districts. Since there are more types of signing and signing practices in urban areas, the majority of the photographs were taken in the cities of Austin, Corpus Christi, Dallas, Fort Worth, Houston, and San Antonio.

Researchers collected freeway signing data on various types of freeways, including Interstate Highways, US and State Highways, and Loop freeway sections. The digital photographs contained the freeways guide sign panel(s), sign structure, and associated lane geometry. [Figure 1](#) depicts a typical example of a photograph. Digital photographs of various types of freeway signing (i.e., interchange signs, general services signs, recreation and cultural interest signs, etc.) were taken during the data collection.

The general sign legend, placement, exit and gore panels, arrow layouts, and proper use of these signs were evaluated in this task. Time limitations prevented evaluation of other specific design criteria, such as message choice, sign lettering, and sign installation. Some of the signs collected and evaluated in this study have been in place for a number of years, and may be out of date. While these signs may not be consistent with current guidelines, the inconsistencies were felt to be worth noting as potential subject areas for the *Freeway Signing Handbook*.



Figure 1. Typical Photograph Used in Evaluation of Existing Freeway Signing.

COMPARISON OF EXISTING FREEWAY SIGNING TO THE NATIONAL AND TEXAS MUTCDS

After documenting existing freeway signing, researchers compared the existing signing practices to national and Texas MUTCD guidelines. This comparison allowed the researchers to identify inconsistencies in the manuals' practices with consideration of certain complications such as simultaneous exits, close interchange spacing, limitations on placement of overhead sign bridges, and other complex geometric situations. Inconsistencies were then summarized and recommendations for survey content and emphasis in the *Freeway Signing Handbook* were given.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The intent of this project task was to document existing freeway guide signing and identify inconsistencies between existing signing and the national and Texas MUTCDs. Based

on these findings, recommendations were given for survey content and emphasis in the *Freeway Signing Handbook*.

Summary of Findings

The researchers collected digital photographic data of existing freeway guide signing in Texas. Researchers collected over 2900 digital photographs and archived them in a database. Interchange Guide signs, Interchange Sequence Series signs, and NEXT X EXITS signs were evaluated by comparing existing signing to national and Texas MUTCD standards. Researchers noted inconsistencies for each category and/or type.

Interchange Guide Signs

No major inconsistencies were observed for the single right-lane exit and the single and double right-lane drop. The minor inconsistencies observed include exit number panel placement and when to sign auxiliary lanes as lane drops. For optional right-lane exits, inconsistencies were found for the exit direction sign. The directional arrow orientation on the exit direction sign was inconsistent with the Texas MUTCD and not uniform throughout the state. It was also observed that a vertical broken white line was used to separate multiple destinations for one exit or lane drop. The national and Texas MUTCDs specify different sign panels for each destination.

In general, existing freeway guide signing for the left exits was found to be inconsistent with the Texas MUTCD. For the single left-lane exit, inconsistencies included the exclusion of the left exit panel(s) on advance guide and/or exit directions signs, and simply not signed to Texas MUTCD standards. For single and multiple left-lane drops, the left exit panel was used in advance guide and/or interchange sequence series signs, and for some left exits, as many as six advance guide signs were used.

The majority of freeway-to-freeway interchanges are not signed in accordance to national and Texas MUTCD standards. The signs associated with a freeway-to-freeway interchange or freeway split are signed as an exit or lane drop. Many freeway-to-freeway interchanges present unique challenges in signing; however, only a few existing interchanges in Texas are signed like the typical interchanges presented in the national and Texas MUTCDs.

Interchange Sequence Series Signs

Interchange Sequence Series signs generally supplement Advance Guide signs where interchanges are closely spaced. A horizontal white line was uniformly used to separate a multiple destination interchange; however, no guidance on its use is in the national or Texas MUTCD.

NEXT X EXITS Signs

The use of NEXT X EXITS signs varies across Texas. This variance can be attributed to the lack of guidance in the national and Texas MUTCDs.

Recommendations

In conducting this research, researchers identified various inconsistencies with freeway guide signing in Texas. Maintaining consistent and uniform freeway guide signing helps to reinforce driver expectancy. This evaluation revealed several areas where improved guidance would be beneficial. Specifically, further research and guidance is needed in the following areas:

- placement of the exit number panel on advanced guide and exit direction signs,
- signing a single right-lane drop on an auxiliary lane,
- the effectiveness and applicability of supplemental lane use guide signs and regulatory signs for multiple left- and right-lane exits,
- the use of one sign panel for multiple destinations (including the use of a vertical white separator line),
- signing a double right-lane drop located upstream of an entrance ramp,
- the use of downward and/or upward arrows on exit direction signs (for all types of exits),
- the use of diagrammatic signs in Texas,
- alternatives to diagrammatic signs for signing left-lane exits and freeway splits,
- the use of left EXIT ONLY panels on the initial advance guide sign or interchange sequence series sign for a left-lane drop,
- signing strategies for freeway-to-freeway interchanges, and
- proper use of NEXT X EXITS signs.

CHAPTER 3: FOCUS GROUPS

During the development of the individual chapters of the handbook, researchers identified several issues concerning sign design elements for which there was no previous research. For some of the design elements in question, such as the orientation of directional arrows, a simple sign comprehension test (survey) could have been constructed. Indeed, the research team initially planned such a survey. All of the topics selected for further research were those that are currently being implemented in multiple ways based on the photo log of existing guide signs. Upon further examination, it became clear that there was no “right” answer to some of the design decisions which needed to be made. The research team elected to use a focus group technique, which would allow for a better understanding of driver expectations and errors.

Seven focus group sessions were held to collect input from Texas drivers regarding key issues in urban guide signing. The research team held the sessions in Houston, Dallas, San Antonio, and College Station. In total, 61 people participated in the focus groups. Overall, 93 percent of our sample reported doing some driving each day, and 54 percent of the drivers in this sample reported driving on urban freeways 20 or more days a month. [Table 1](#) provides information about the demographics and driving history of the sample.

Participants were recruited by contacting community service agencies and by placing flyers in office complexes and other major employers. Sessions were held at various times of day in an effort to accommodate people who worked at various times. The College Station session was held in the TTI Gibb Gilchrist building. In Houston, one session was held in the TTI office, and the other session was held at the Ripley House community center. In Dallas, one session was held at the TTI office and another at the Jeffery Learning Center. In San Antonio, one session was held at the TTI office and the other at the Benavides Learning Center. All participants were paid \$25.00 for their participation in the two-hour session.

Table 1. Demographic Characteristics of Focus Group Sample.

Demographic Category		College Station	Houston	Dallas	San Antonio	Entire Sample
Number of People		16	16	20	17	61
Sex	Men	5	5	8	6	23
	Women	11	11	12	11	38
Age	Minimum Age	20	20	18	24	20.5
	Maximum Age	54	54	70	82	67.3
	Median Age	38.5	38.5	43.5	46	42.9
Marital Status	Single / Divorced	11	11	14	12	41
	Married	5	5	6	5	20
Race	White	1	1	8	2	18
	African-American	8	8	12	3	23
	Asian / Pacific Islander	0	0	0	0	0
	Hispanic	7	7	0	12	20
	Other	0	0	0	0	0
Employment	Full-Time Job	11	11	12	4	31
	Part-Time Job	2	2	4	6	12
	Retired	1	1	0	2	5
	Student	0	0	2	3	5
	Homemaker	1	1	2	2	7
	Unemployed	0	0	0	0	0
Education	Some High School	0	0	3	0	3
	High School Graduate	4	4	4	7	17
	Some College / Vocational School	8	8	5	8	24
	College Graduate	3	3	2	1	6
	Some Graduate work	0	0	3	1	5
	Graduate degree	1	1	3	0	6
Residence	City	15	15	11	16	50
	Suburb	0	0	9	0	9
	Rural	1	1	0	1	2
Number of people driving more than 20 days a month on freeway		1	12	5	11	29
Percent driving 20 or more days a month on freeway		13%	75%	25%	65%	44%
Number of people who drive daily		8	15	17	16	56
Percent driving daily		100%	94%	85%	94%	93%

After reading and signing an informed consent form, the facilitator began the session with a discussion of a photograph of speed limit signs unrelated to the current project. This served as a warm-up period so participants would relax and be willing to talk openly. All sessions were audio-taped, and at least one note-taker from the TTI staff was present as well. [Figure 2](#) shows the focus group held at the Ripley House in Houston.



Figure 2. Focus Group in Houston.

The facilitator presented large photographs on poster board to provide a discussion aide. She posed specific questions for each photograph as noted in the description which follows. The photos were created by starting with actual photographs completed in the photo log task on this project. Researchers modified these photos to create alternate versions of the signs. The use of actual photographs, rather than just line drawings, helped place the signs in context, and focus group participants found them easy to understand. In cases where more than one version of a

sign was to be presented, each one was presented individually in the order listed. After each was discussed individually, all versions were then shown simultaneously to encourage direct comparisons.

EXIT NUMBER PLAQUE POSITION AS A CUE FOR AN UPCOMING LEFT EXIT

For simple cross-street interchanges, where the exit is an option, the advance sign for a left exit is only required to have the exit number panel on the left. The team was curious as to how many drivers were aware of this cue. [Figure 3](#) displays a three-lane freeway with three overhead panels that was used to evaluate the left exit situation. The panel over the far left lane indicates an exit for Carson St. and Memorial Dr. in 2 miles. The exit number panel is attached at the top, left corner of the sign.



Figure 3. Advance for a Single Left-Lane Roadway Interchange Exit.

When asked which lane they would get in to go to Carson Street, 25 percent of the subjects said they would get in lane 1. But, upon further probing by the facilitator, only one person said they would be in lane 1 because they believed the exit would be a left exit. The others would stay under the sign and believed it would move over to the right with each exit. Many of the subjects said they would drive in lane 2 as long as possible to avoid exiting and incoming traffic, and in case the exit would be to the left.

When asked why they did not think it was a left exit, a couple of subjects stated that there are never any left exits. Other subjects believed that left exits were very few and only happened in downtown areas or when there was construction or a detour. There was also discussion on how it would be possible to have a left exit when there is a median and oncoming lanes on the left. All of the groups stated that if it was a left exit, then the sign would say so.

The groups were asked how the sign could be improved if Carson was truly a left exit. Suggestions included adding an arrow, the text “Left Exit” to the sign, or putting an “L” or “R” on the corner of the sign.

ADVANCED SIGNING FOR A FOUR-LEG DIRECTIONAL INTERCHANGE

Freeway-to-freeway interchange signing was one of the areas of inconsistency noted during the review of existing freeway signing (see [Chapter 2](#)). The focus group effort focused on one of the issue of how to sign a multilane exit that splits into separate connections to a freeway (typically ramps to the opposing directions of the freeway). This situation is common in Texas, and two versions of the sign were presented for discussion.

[Figure 4](#) shows a five-lane freeway with two overhead guide signs. The left sign points to three lanes going to Springfield on I-42. The right sign points to two lanes going to Miami and Portland via I-17. The Miami/Portland Advance Guide sign does not indicate which lanes drivers need to position the vehicle in to exit to Miami or Portland. Fictitious names and route numbers were used here because the researchers felt that familiarity with the specific location of the photograph would have affected the results.



Figure 4. None-Specific Lane Assignments for Exiting Traffic.

When asked which lane they would get in to exit to Portland, 12.8 percent of the subjects who responded said lane 5, 74.5 percent said lane 4 or 5, 19.1 percent said lane 4, and 2.1 percent said lane 3. When asked why they made the decision they made, most said that they knew for sure that they would need to be in either lane 4 or 5 and would be able to tell better further up the road.

The subjects were split between those who thought both Miami and Portland were in the same direction, and those who thought the road would split and go in different directions. When given the scenario that the lanes would split and go in opposite directions, the groups were again divided on whether or not Miami or Portland would exit first. Some said the top city listed on the sign would exit first, and some thought the bottom would exit first.

Figure 5 shows the same section of freeway as Figure 4. This time, there are three overhead guide signs. The left sign is unchanged and points to three lanes going to Springfield on I-42. The center sign points to the second from the right side lane with the destination of Portland by I-17 South. The far right sign points to the right lane with a destination of Miami via I-17 North. Cardinal directions are present, and each exit has its own exit number panel.



Figure 5. Separate Exit Signing with Cardinal Directions and Individual Exit Numbers.

When asked which lane they would get in to exit to Portland everyone answered lane 4. When asked which sign they preferred, Figure 4 or Figure 5, all subjects answered Figure 5. The subjects believed that Figure 5 was clearer, it left no surprises, and it no longer looked like lanes 4 and 5 both would take you toward Miami and Portland.

When asked which exit would be the first to exit, 36A or 36B, most said 36A because they would be in alphabetical order, until with help from the facilitator, they realized that the farthest lane to the right will always exit first.

LEFT EXIT ADVANCE SIGNING FOR FREEWAY-TO-FREEWAY INTERCHANGE

Left exits pose a special signing need because they are rare and violate drivers' expectations. This series of questions served to explore which of these alternatives was preferable. [Figure 6](#) shows a five-lane freeway with three overhead guide signs. The far left guide sign displays a yellow EXIT ONLY panel for Laredo on I-35 South. This [figure](#) illustrates the current TxDOT practice of placing an EXIT ONLY panel over the left exiting lane advance sign.



Figure 6. Current MUTCD Style LEFT EXIT Plaque.

When asked which side of the road the exit to Laredo would be on, all subjects said the left. When asked what about the sign was keying them into this, most said the yellow EXIT ONLY panel. The arrow pointing to the lane, and also that the sign was on the left side of the road were also factors they mentioned in making their decision.

Two subjects stated they thought that if the exit number panel was on the left then the exit would be to the left, but they were unsure. When the facilitator informed the groups they were correct, the rest of the subjects were surprised and had not known this.

When asked how researchers could make the left exit more obvious, subjects suggested adding the words “Left Lane” to the sign or putting arrows on the ground. [Figure 7](#) shows the same freeway photo as [Figure 6](#), but word “LEFT” has been added before “EXIT ONLY” in the yellow panel.



Figure 7. Addition of the Word “LEFT” to the EXIT ONLY Panel.

When asked if they preferred sign [Figure 7](#) (LEFT EXIT ONLY) over sign [Figure 6](#) (EXIT ONLY), most subjects answered yes, but there were a couple in each group that thought the EXIT ONLY sign was obvious enough, or that LEFT EXIT ONLY was overkill. Half of the Houstonians preferred [Figure 6](#).

Reasons stated that subjects preferred the LEFT EXIT ONLY sign included: it is more obvious, more information is better, and it is helpful if you are not familiar with the area. A few believed that if this type of sign were to be used, that the arrow needed to point to the center of the lane.

The MUTCD was recently modified to include the option of adding the word LEFT to the exit number panel on advance exit signs to denote an upcoming exit located on the left side (as shown in sign [Figure 8](#)). The photograph in [Figure 8](#) is the same as that in [Figure 6](#) except that the exit panel on the left guide sign has the word “LEFT” added above the exit number. When asked for their opinions of this version of the sign, most did not like it and preferred [Figure 7](#) better, although some still thought [Figure 6](#) was sufficient. Only three subjects stated they preferred [Figure 8](#).

The reasons that subjects gave for not liking [Figure 8](#) included: the message was too high, the text was too small to notice, the yellow is the most noticeable, and unless you’re traveling with a map or specific directions you don’t look at the exit number. Two of the subjects expressed confusion as to whether the left exit text was the same thing as the exit only text. There was a suggestion to use this method of signing a left exit when it is not a lane drop (such as that shown in [Figure 3](#)).



Figure 8. Addition of the Word “LEFT” to the Exit Number Plaque.

FREEWAY-TO-FREEWAY INTERCHANGE WITH PRIMARY ROUTE CONTINUING LEFT AT THE SPLIT

In reviewing photographs of guide signs from across the state, the research team noted a inconsistencies in the manner in which arrows were used in signs for freeway-to-freeway splits. The team felt that improvements might be achieved through the use of downward pointing pull-through arrows (Figure 9) or upward diagonal arrows used for exit signs (Figure 10). Many examples of both of these applications were noted in the review of existing signing, although neither example is consistent with MUTCD guidelines. In the case where one diverging leg is the primary route, a third version could use pull-through arrows for the through movement and upward diagonal arrows for the secondary route (Figure 11). This series of photos prompted discussion of lane assignment arrows, but also showed a broad misunderstanding of the EXIT ONLY panel.

Figure 9 displays a five-lane section of freeway where I-35E and US 67 are concurrent. At the interchange, I-35E continues to the left. The EXIT ONLY panel indicates that the two right-most lanes exit onto US 67 and those lanes cannot continue on the through route (I-35E). The center lane has the option of going left or right. The left overhead guide sign has three white down arrows showing I-35E South continues to Waco. The right overhead guide sign has three down arrows indicating that traffic exiting to US 67 South will be going to Cleburne. The far right two lanes are indicated as lane drops (exit only lanes) by a yellow EXIT ONLY panel.



Figure 9. Freeway Split with Down Arrows for All Lanes.

When asked what will happen to the center lane ahead, all subjects stated that the lane would split, and you'd have a choice of the route you could take. Most people did not find it confusing that there are five lanes and six arrows. When the facilitator inquired about the yellow EXIT ONLY panels, about half of the subjects believed that the panels meant that the far right two lanes would be exiting off of US 67, and that you must stay in the middle lane if you wanted

to stay on US 67 after exiting. Of those who believed the right lanes exited off US 67, some believed you exited to a side street, and some believed you exited to the town of Cleburne.

When asked, all but a few of the subjects decided that the left branch was a continuation of I-35E, and the right branch was an exit. Two subjects asked why there were not EXIT ONLY panels on the two far left lanes. Upon discussion, many concluded that EXIT ONLY panels were not needed on either leg and that the presence of the signs on the right leg were unnecessarily confusing. The subjects suggested the following improvements to this interchange when asked by the facilitator: orange buckets (i.e., crash cushions), yellow and black striped signs with reflectors (i.e., object markers), and pavement markings with arrows and route numbers.

[Figure 10](#) shows the same interchange as [Figure 9](#) except the exit direction arrows are used, which point up at 45 degrees, rather than the pull-through arrows, which point down.

When asked, most of the subjects preferred [Figure 10](#) over [Figure 9](#) and [Figure 11](#) because the arrows best directed you in the shape of the road, although a few preferred [Figure 11](#) because it better represented that I-35E was the major highway.

Once the groups were informed by the facilitator that the EXIT ONLY panels meant you were exiting off of I-35 and not off of US 67, many suggested removing the panels. It was also suggested to create one large sign with the center lane represented by one split arrow, and add arrows onto the roadways with reflectors.



Figure 10. Freeway Split with Diagonal Up Arrows for All Lanes.

Figure 11 shows the same interchange as Figure 9 and Figure 10 except that downward pull-through arrows are used for the primary route on the left and upward diagonal arrows are used to indicate the exit for the secondary route.



Figure 11. Freeway Split with Downward Pull-Through Arrows for the Through Lanes and Diagonal Up Arrows for Exiting Lanes.

When asked, most subjects preferred [Figure 11](#) over [Figure 9](#) because of the directional arrows that help to tell you where the road is going. They expressed [Figure 11](#) better represented that the left branch was a continuation, and the right was an exit. Several people noted that for the drivers in the center lane, it may be confusing to have one down arrow and one up arrow. Also, some subjects still believed that the exit only lanes would be exiting off of US 67 onto side streets.

Suggestions for improving the interchange signing included: a caution sign saying the road splits, and several believed both sets of arrows should be angled upward. In general, the presence of the EXIT ONLY panel caused a great deal of disagreement and confusion.

FRONTAGE ROAD LANE-USE SIGNS

Drivers on a frontage road approaching an intersection are sometimes required to make decisions on which lane to be in without knowing which turning movements are permitted from specific lanes at the intersection. The challenge is how to best communicate to a driver the number of lanes at the intersection and the turning movements that are permitted from each, and to provide this information sufficiently in advance to allow the driver to position his/her vehicle in the proper lane.

This situation was addressed in the focus groups through the use of several photographs depicting lane-use assignment signs on a frontage road. Although the signs in this series used the same base photo, they were not meant to be direct alternatives marking the same scenario, and this was indicated to the focus group participants. Each sign was addressed independently, although participants did make some comparisons between the scenarios.

[Figure 12](#) illustrates a two-lane, one-way frontage road with a right side-mounted sign displaying the text “Right Lane Must Turn Right.” The double white line in the foreground marks an area where traffic has just exited the freeway and weaving is prohibited. When asked how many lanes there will be at the intersection, most subjects said two, but a high percentage said three. A few said there would be four lanes. When asked to indicate the side of the road where the lane would be added, the subjects who said there would be three lanes believed that a small right turn lane would be added.

When asked which lane they would get in to make sure they go straight, all of the participants said the left lane. With further discussion, all of the subjects agreed that at this point in the road with this particular sign, there is no way of knowing how many lanes are ahead.



Figure 12. Frontage Road Sign with RIGHT LANE MUST TURN RIGHT Sign.

Figure 13 illustrates a two-lane, one-way frontage road with signs on either side of the road indicating that there will be a far left turn-only lane, and two through lanes. When asked how many lanes will there be ahead at the corner, all the subjects said three. When asked which approach lane you should be in to go straight, most subjects said either, believing the extra lane will be added to the left, although there was a small debate in the College Station group on whether or not the lane would be added to the right. When the facilitator inquired why there was no debate on the number of lanes at the intersection, all subjects agreed that the arrows were easier to understand than the text shown in Figure 12. Some believed it is necessary to have signs on both sides of the road in case one of them was blocked from the driver's view. Many participants commented on the small vertical separator lines as being an important sign component. They felt that it created "slots" that matched the lanes on the road.



Figure 13. Frontage Road with Symbol Lane Assignment Sign.

Figure 14 illustrates a two-lane, one-way frontage road with a left-mounted sign indicating a U-turn to I-10 South, and a right-mounted sign indicating that there will be four lanes, all with varying options. When asked how many lanes there will be ahead at the corner, all subjects said four because of the number of arrows on the sign. Each group initially expressed how confusing the sign was. When asked which approach lanes will go straight, the subjects said both, believing a lane will be added on the right and left sides.



Figure 14. Frontage Road with Complex Lane Assignment Sign.

When asked what the 300 ft meant, some subjects believed the 300 ft was the distance to the intersection, while some believed it was the distance to where the new lanes were added. Upon a follow-up question, most agreed that they did not have a good feel for how far 300 ft was while driving, since their odometers measured miles.

When asked how to make the signs clearer, several suggested, and others agreed, that the U-turn indication on the right sign was not needed if there was a blue U-turn sign on the left. Another suggestion made by several was to break the sign up into two signs and put one on the left, and one on the right. Many liked this idea until it was brought up that a sign could easily be blocked by a large vehicle. One subject mentioned that splitting the signs might make it look like the two signs provide contradictory information. Other suggestions for improving lane-use assignment signs included:

- Lengthen the added lanes.
- Use a series of several signs.
- Use overhead signs.
- Widen the street earlier.
- Use arrows on the road near the intersection.
- Get rid of the blue U-turn sign, or move it closer to the intersection. The theory is that a person knows they have to be in the far left lane if they want to do a U-turn.
- Use a green and white guide sign.
- Make the sign larger.
- Elongate the lines of the arrows on the sign to make it easier to read.

CHAPTER 4: FREEWAY SIGNING HANDBOOK

The Texas *Manual on Uniform Traffic Control Devices* (MUTCD) establishes the basic guidelines for the design and placement of freeway guide signing and frontage road signing. However, the MUTCD permits variation in the design and placement of these signs. TxDOT staff have often had to make independent decisions on the best layout and placement of these signs, leading to variations from one area of the state to another. This *Freeway Signing Handbook* is intended to provide TxDOT staff and design consultants with information beyond that contained in the Texas MUTCD or the TxDOT Traffic Control Standard Sheets so that freeway signing can be designed and installed in a more uniform manner. This handbook is specifically intended for use by TxDOT designers and consultants and emphasizes the use of figures to explain various design issues.

Freeway signing guidelines were first added to the national MUTCD with the 1961 edition. This portion of the MUTCD was updated significantly in the 1971 MUTCD, but has remained essentially the same since. The 2000 MUTCD, which was published after this research project began, introduced a new format and some refined guidelines for freeway signing. Even with these latest changes, it is fair to say that the freeway signing guidelines in the MUTCD have remained essentially the same for over 30 years.

The MUTCD is not the only source of information for designing and placing freeway signs. Other TxDOT documents that address freeway signing issues include the *Traffic Engineering Standard Sheets*, *Standard Highway Sign Designs for Texas*, and the *Traffic Operations Manual, Signing and Marking Volume*. The multiple sources of information create the potential for difficulties in designing and placing freeway signs. Because of the wide variety of information that needs to be presented in guide signs, combined with the variation in highway geometrics that provides the context for the information, freeway guide signing principles are general in nature. This generality has led to some differences in signing practices between regions and jurisdictions. The evaluation of existing freeway signing (see [Chapter 2](#) of this report) identified some of the differences in signing between TxDOT districts.

This handbook provides engineering personnel with information that addresses the selection and design of freeway guide signs used on urban freeways and signs used on frontage roads. To the extent possible, the handbook reflects the findings and recommendations of this research effort. However, it was not possible to evaluate, in this project, all the possible issues that the handbook needed to address. Therefore, the researchers relied significantly upon the input and contributions of the panel in developing the content and guidelines for the handbook. The *Freeway Signing Handbook* was developed to provide a single document that presents freeway signing guidelines and links to guidelines in other documents where appropriate. By providing guidance information from a variety of references together in one document, and adding additional guidelines to address issues not covered in other documents, the consistency of freeway signing should be improved. The *Freeway Signing Handbook* was developed with the following purposes in mind:

- Provide design personnel with information that will help them to layout and place freeway signing in the design stage to be more consistent and effective.
- Provide freeway guide signing that will help road users find their way in a more effective and efficient manner.
- Address guide signing situations that are not covered in the Texas MUTCD or other TxDOT documents.

The handbook was developed over the course of the third year of the research project. TTI researchers developed an outline for the handbook and then began to develop initial material for the handbook. The researchers met with a panel of TxDOT and FHWA staff on four occasions during the third year of the project (September 25, 2002; December 16, 2002; June 4, 2003; and August 7, 2003). The current draft of the handbook was distributed to the panel members approximately two weeks prior to each of these meetings. During the all-day panel meetings, the researchers presented new material, indicated revisions that had been made to previous material, and identified changes that needed to be made in the future. The input provided by the panel was instrumental in developing guidelines that were consistent with TxDOT signing needs and also helped to improve the usability of the handbook. The individuals that participated in the panel meetings are listed in the acknowledgments of this report.

The handbook describes various aspects of freeway signing, with an emphasis on the design elements of freeway guide signs. The chapters of the handbook address the following topics:

- Chapter 1 – This chapter describes the handbook and its relation to other freeway signing documents.
- Chapter 2 – This chapter describes the basic principles of freeway signing.
- Chapter 3 – This chapter describes when it is appropriate to use different types of freeway signs. It focuses upon the application of freeway signs.
- Chapter 4 – This chapter describes the design (or layout) of exit direction and advance guide signs. It focuses upon the spacing relationships between various elements of a freeway sign legend.
- Chapter 5 – This chapter describes the placement of freeway advance guide and exit direction signs approaching roadway interchanges and freeway-to-freeway interchanges.
- Chapter 6 – This chapter describes signing for freeway frontage roads.

The handbook addresses the following types of signs used on freeways and frontage roads:

- interchange exit signing,
- entrance ramp signing from frontage road,
- exit ramp signing to frontage road, and
- frontage road signing at intersections.

