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16. Abstract <p>Airport users consist of many types of travelers. Many of those using an airport may never leave the airport terminal(s), passing through the airport when transferring from one flight to another. Others may arrive at or depart from the airport by some mode of travel that does not require them to make travel decisions (such as public transit, taxi, or shuttle). Many airline passengers travel in a vehicle (personal, business, or rental vehicle) on the airport roadway network in order to arrive at or depart from the airport. Providing the drivers of these vehicles with the information and guide signing needed to successfully navigate into, through, and out of the airport property presents several unique challenges. Based on discussions with planning personnel at Dallas/Fort Worth International Airport, providing drivers with information and guide signing was judged to be one of the major challenges facing the airport.</p> <p>In an effort to address the challenges associated with airport roadway guide signing, the Southwest Region University Transportation Center (SWUTC) at Texas A&M University supported a research study to develop a generalized procedure that could be used by airports to assess the effectiveness of the signing at an airport. The procedure was developed and refined through application of the principles to roadway signing at DFW Airport. This report represents the analysis of the roadway signing at the international airport.</p>					
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**IDENTIFICATION AND EVALUATION OF GUIDE SIGNING
FOR AIRPORT ROADWAYS
WITH SPECIFIC APPLICATION TO THE DALLAS/FORT
WORTH INTERNATIONAL AIRPORT**

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ABSTRACT

Airport users consist of many types of travelers. Many of those using an airport may never leave the airport terminal(s), passing through the airport when transferring from one flight to another. Others may arrive at or depart from the airport by some mode of travel that does not require them to make travel decisions (such as public transit, taxi, or shuttle). Many airline passengers travel in a vehicle (personal, business, or rental vehicle) on the airport roadway network in order to arrive at or depart from the airport. Providing the drivers of these vehicles with the information and guide signing needed to successfully navigate into, through, and out of the airport property presents several unique challenges. Based on discussions with planning personnel at Dallas/Fort Worth International Airport, providing drivers with information and guide signing was judged to be one of the major challenges facing the airport.

In an effort to address the challenges associated with airport roadway guide signing, the Southwest Region University Transportation Center (SWUTC) at Texas A&M University supported a research study to develop a generalized procedure that could be used by airports to assess the effectiveness of the signing at an airport. The procedure was developed and refined through application of the principles to roadway signing at DFW Airport. This report represents the analysis of the roadway signing at the international airport.

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- Andy Kahn, DFW Airport Manager Business Planning

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EXECUTIVE SUMMARY

Air travel is an important and steadily increasing element of the transportation system. Commercial airlines provide vital and timely links between widely separated locations. Even though air travel is increasing, airports remain one of the more unique elements of the worldwide transportation system. They are true intermodal facilities, connecting, at a minimum, road and air modes. In many cases, they also interconnect with rail and public transit modes. Airports also attract large numbers of unfamiliar travelers onto the airport property and the surrounding area. Finally, they have their own design and operational characteristics that are often different from the characteristics of other transportation modes with which users are most familiar.

Airport users consist of many types of travelers. Many of those using an airport may never leave the airport terminal(s), passing through the airport when transferring from one flight to another. Others may arrive at or depart from the airport by some mode of travel that does not require them to make travel decisions (such as public transit, taxi, or shuttle). Many airline passengers travel in a vehicle (personal, business, or rental vehicle) on the airport roadway network in order to arrive at or depart from the airport. Providing the drivers of these vehicles with the information and guide signing needed to successfully navigate into, through, and out of the airport property presents several unique challenges. Some of the most significant challenges for airport guide signing are listed below:

- There are a large number of destinations within a relatively small area,
- A significant proportion of airport roadway users are drivers that are unfamiliar with the airport or that are infrequent travelers on the airport roadway system,
- Users are often under stress resulting from being late, uncertain about his/her destination, or lost,
- International travelers may present a communication challenge,
- Flight arrivals and departures may take place at any number of terminals and gates, and drivers need to know to which terminal and or gate they need directions,
- There is inconsistent terminology from one airport to another for similar types of traffic generators,
- Changes in airlines, freight providers, service providers, and other factors at a specific airport require signing to be somewhat flexible to accommodate changes, and
- The geometrics of the airport roadway network can present confusing situations to drivers.

In an effort to address the challenges associated with airport roadway guide signing, the Southwest Region University Transportation Center (SWUTC) at Texas A&M University supported a research study to develop a generalized procedure that could be used by airports to assess the effectiveness of the signing at an airport. The procedure was developed and refined through application of the principles to roadway signing at the Dallas/Fort Worth International Airport. This report represents the analysis of the roadway signing at DFW Airport. DFW Airport officials have indicated that roadway guide signing is one of the major challenges facing them and welcomed the opportunity to be used as a testing bed for the evaluation procedure.

APPLICABLE AIRPORT SIGNING GUIDELINES

One of the difficulties in providing effective airport roadway guide signing is there is little information available that provides specific guidelines that address the unique characteristics of airports. The defining document for traffic control devices is the *Manual on Uniform Traffic Control Devices for Streets and*

Highways (MUTCD). The MUTCD contains the basic principles that govern the selection, design, application, and operation of traffic signs, pavement markings, and traffic signals used in a variety of situations on streets and highways. There are both United States (1) and Texas (2) versions of this document. The Texas MUTCD is the governing document in Texas, but it is in substantial conformance with the federal MUTCD. Appendix A contains some of the pertinent sections from the Texas MUTCD that affect general aspects of sign design. The federal version is currently being revised by the Federal Highway Administration (FHWA). Once the revision of the federal version is complete, Texas will begin revising the Texas MUTCD. A companion document to the MUTCD is the *Standard Highway Sign Designs* book (3). This publication contains the design details for the signs addressed in the MUTCD. It addresses sign size, legend size, sign colors, and sign layout.

In Texas, the Texas MUTCD is issued by the Texas Department of Transportation under the authority of the “*State of Texas Uniform Act Regulating Traffic on Highways*,” codified as Article 6701d Vernon’s Civil Statutes. Section 27 of this statute states that all traffic control devices placed by local authorities on roadways in their jurisdictions shall conform to the Texas MUTCD. The FHWA requires the Texas MUTCD to substantially comply with the federal MUTCD. As a result, the Texas MUTCD is very similar to the federal MUTCD, with only minor differences that accommodate state law and specific state practices.

As noted above, the FHWA is currently in the process of preparing a new edition of the federal MUTCD. The portion of the MUTCD relating to guide signing was published in the June 19, 1998 *Federal Register* as a notice of proposed rulemaking. Proposed rulemaking on regulatory and warning signs is expected later in 1998. An airport considering a major renovation of its signing system should consider the language in the proposed signing portions of the Manual and the potential impact on an airport signing system, recognizing that the proposed language is subject to change in the final rule.

Unfortunately, the MUTCD does not address many of the special characteristics related to airport guide signing. Publications that specifically address guide signing on airport roadways are *Airport Roadway Guide Signs* (4), a recommended practice from the Institute of Transportation Engineers (ITE), and *Guidelines for Airport Signing and Graphics: Terminals and Landside* (5), from the Air Transportation Association of America (ATA). The Federal Aviation Administration (FAA) recently issued an Advisory Circular that recommends the use of the ATA publication for terminal signing and terminal related roadways and airport thoroughfares. The text of the circular is contained in Appendix B. These two documents were relied upon heavily during the assessment of DFW Airport signing and the development of recommendations.

RESEARCH ACTIVITIES

The process of evaluating the roadway guide signing at the DFW Airport addressed both an individual and system viewpoint of airport signs. In conducting the evaluation, the researchers conducted the following tasks:

- Definition of the roadway network
- Identification of airport traffic generators
- Identification of types of airport road users
- Establishment of airport roadway travel paths
- Photography of existing signing on International Parkway
- Evaluation of existing signing on International Parkway
- Development of recommendations for International Parkway roadway guide signing

CONCLUSIONS

The unique characteristics of airports provide many challenges in developing a roadway signing system that effectively meets the information needs of the road users. The key factor to consider in developing an airport signing system is that every sign relates to each of the other signs. The information must be presented in a consistent manner. Information should also be presented in a structured manner that provides users with the information they need when they need it.

The DFW Airport is no exception, and the challenges are compounded by three factors: the potential for future terminal additions, the geometrics of the main access roadway, and the large number of gates that serve the major airline (44 gates in two terminals for American Airlines). The analysis of the DFW Airport roadway guide signing system found that most of the information needed by the road users on International Parkway is presented in the existing signs. However, there are numerous inconsistencies in the signs that may hamper drivers in obtaining the information they need.

CHAPTER 1

DALLAS/FORT WORTH INTERNATIONAL AIRPORT

The Dallas/Fort Worth International Airport is located approximately halfway between Dallas and Fort Worth, as shown in Figure 1. Opened to commercial airline service in January 1974, aviation experts predict that it will be the world's busiest airport by the year 2000. The airport has more than 2,300 daily flights to more than 200 worldwide destinations. The airport represents a major transportation hub with local, state, national, and international significance.

There are several physical characteristics of the DFW Airport that have an impact on the guide signing for its roadway network. These characteristics include airport access to the surrounding roadway network, the airport roadway network itself, and the traffic generators located on the airport property.

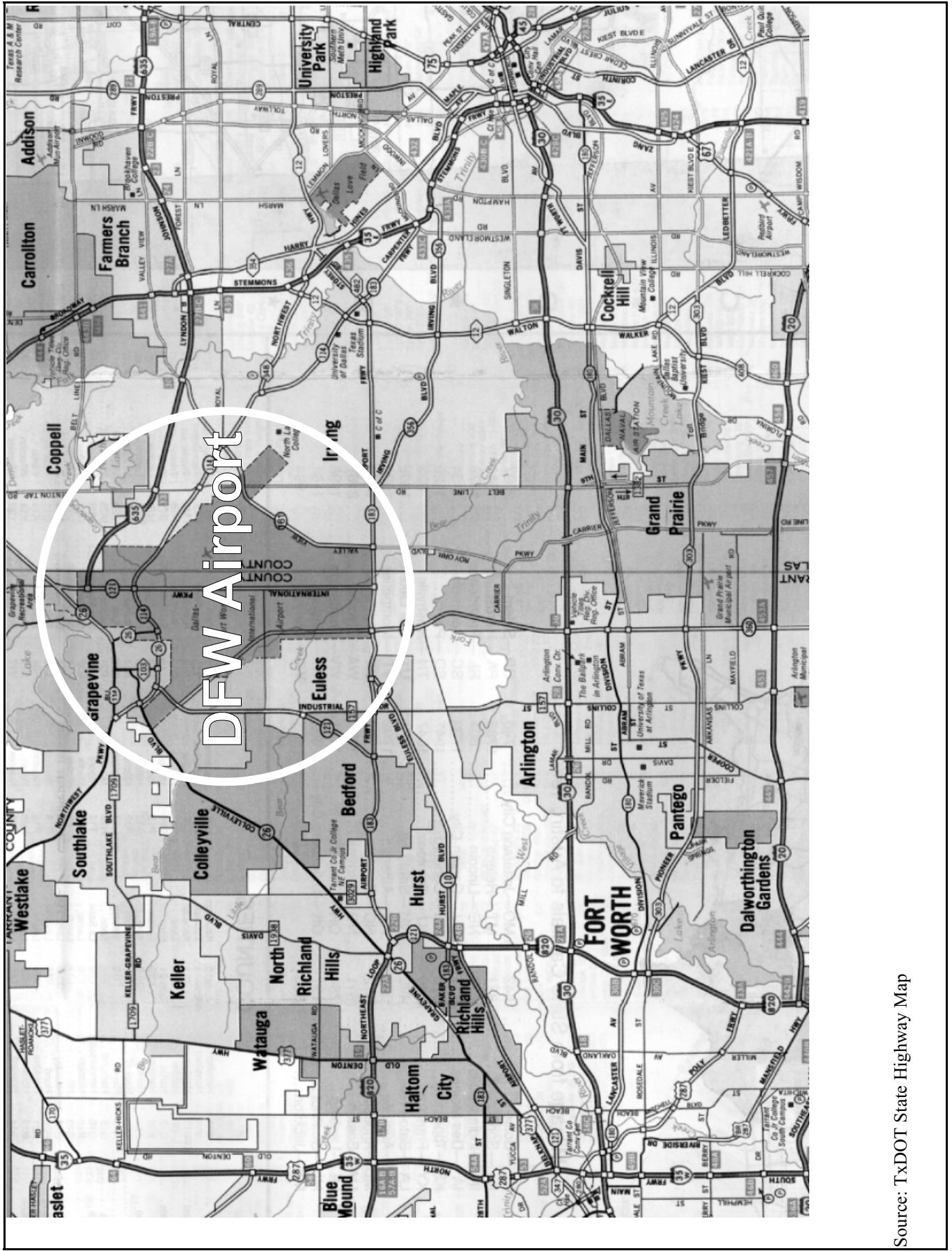
SURROUNDING ROADWAY NETWORK

The DFW Airport is surrounded by a circle of freeways as seen in Figure 1. These freeways include SH 114 on the north side of the airport, SH 183 to the south, SH 121 and SH 360 to the west, and SH 161 to the east. IH 30 is five miles south of the airport and IH 635 is on the airport property, 1.5 miles north of SH 114. These freeways provide access to various locations in the Dallas-Fort Worth Metroplex.

AIRPORT ROADWAY NETWORK

All access to the DFW Airport is provided through the air or the roadway network. The circle of freeways around the DFW Airport is bisected by the main arterial through the center of the airport. This arterial, International Parkway, provides access to all areas of the airport, either directly or through other roadways. All of the terminal buildings are situated on International Parkway, as are the two hotels, on-premise rental car companies, and several parking areas. All travelers on International Parkway must pass through parking control plazas at the north or south sides of the airport. The cost to the traveler depends upon the amount of time spent in the airport. Northbound and southbound service roads are located on either side of International Parkway. These roads provide access to non-traveler service facilities. Users of the service roads do not pass through the parking gates. Figure 2 presents the layout of International Parkway between the north and south Airfield Drive interchanges. This figure also indicates the location of the four airline terminals (2W, 2E, 3E, and 4E), the car rental lots, the reduced rate parking areas, and the shuttle parking areas.

There is also an inner ring road, Airfield Drive, on airport property that encircles about three-fourths of the airport. This road provides access to the airport administrative offices, airport observation area, the golf course and racquet club, airline maintenance facilities, air cargo/air freight, and the foreign trade zones. Users of Airfield Drive do not pass through the parking control plazas on International Parkway. Airfield Drive intersects with International Parkway at grade-separated interchanges at both the north and south sides of the airport, just outside of the parking control plazas.



Source: TxDOT State Highway Map

Figure 1. Location of DFW International Airport

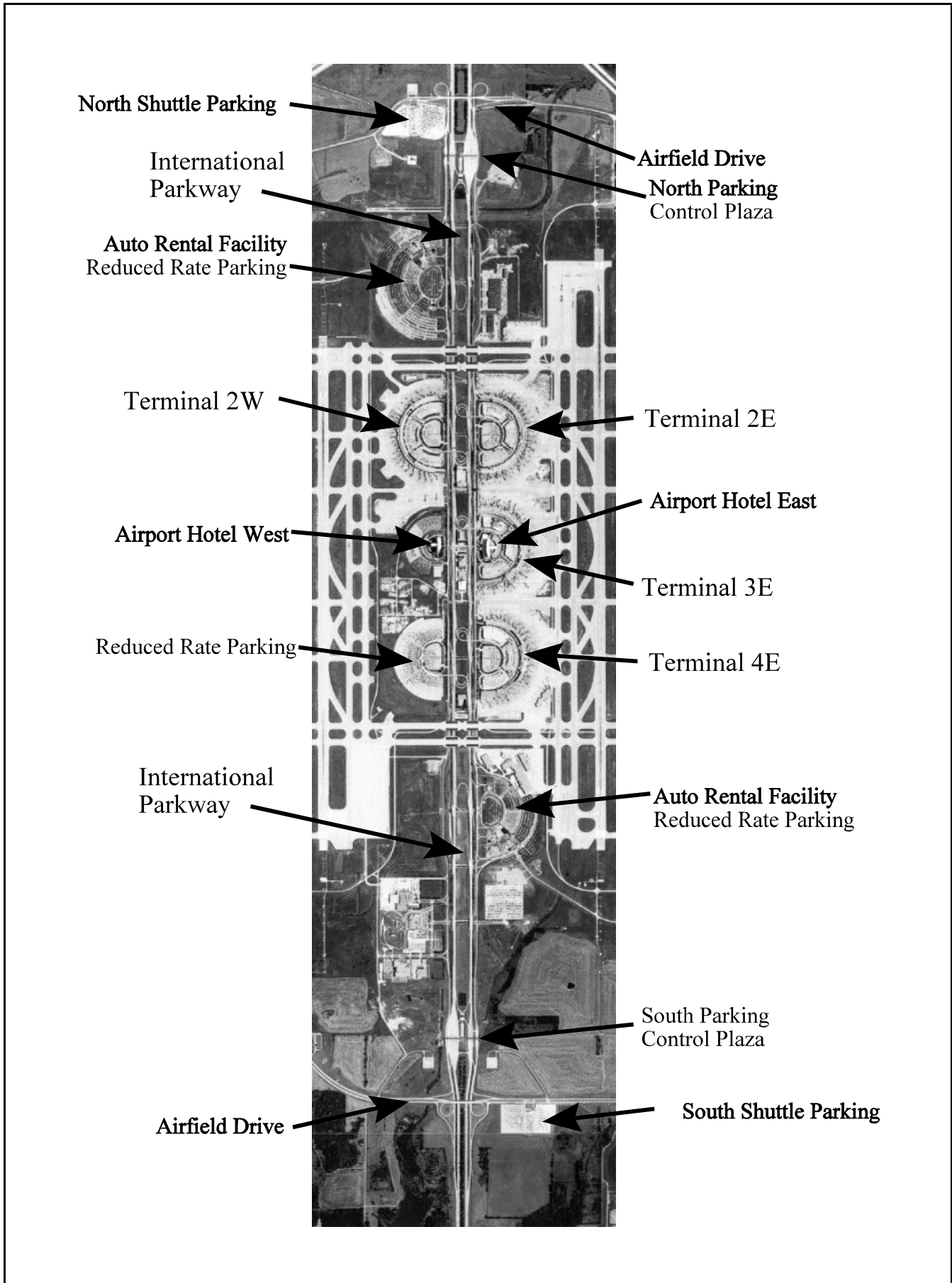


Figure 2. Destinations on International Parkway

In addition to the access to the airport from International Parkway, there are several arterial streets that provide access to the airport. All of these arterials connect to and terminate at Airfield Drive.

Given the roadway network, the majority of airport users enter the airport on International Parkway at the north or south side of the airport. All destinations within the airport can be reached from the north or south entrance, either directly from International Parkway, or by connecting to Airfield Drive or the Service Roads. This evaluation of guide signing in and around the DFW Airport centers on the signing on International Parkway.

AIRPORT TRAFFIC GENERATORS

On the DFW Airport property, there are numerous locations that serve as traffic generators for the roadway network. Table 1 indicates the most significant of these generators, according to the roadway that provides access.

Table 1. DFW Airport Traffic Generators

Access Category	Roadway Providing Access		
	International Parkway	Airfield Drive	Service Roads
General Access	Airline travel related	All activity centers except for terminals	Airport and airline support facilities
Specific Traffic Generators	Airline Terminals (4) Terminal Parking Areas (4) Reduced Rate Parking Areas (3) Car Rental Lots (2) Hotel (2) Gas stations (2)	Shuttle Parking (2) Foreign trade zones (3) Air cargo areas (2) Airport administrative buildings Golf course and racquet club Maintenance facilities GTE Simuflite Observation Area	Employee parking (3) Catering Post Office Maintenance Areas FAA facilities General Aviation Limo, bus, and taxi queue
Typical Daily Traffic Volume	60,000 vehicles per day	6,000 vehicles per day	24,000 vehicles per day

Terminals

The terminals are the most significant of all the traffic generators at the airport. There are currently four airline terminals, with future capability to expand to a total of ten terminals. Terminal 2W serves 16 different airlines. Terminals 2E and 3E serve American, American Eagle, Canadian, Qantas, and Grupo Taca airlines. Terminal 4E serves Aeromexico, ASA, Delta, Grand, and Sun Jet. Each of these four terminals is served by a semi-circular roadway infrastructure. Various forms of semi-circular roadway infrastructure are also present at four of the future terminal sites (1W, 3W, 4W, and 5E).

Parking Areas

There are more than 30,000 parking spaces at the DFW Airport. These are divided into shuttle, reduced rate, infield, and terminal spaces. Shuttle parking is available at both the north and the south end of the airport. Buses provide continuous service from the shuttle lots to all airport terminals. Reduced rate parking is located at three locations on the airport property. Transportation is provided by airport train to and from the north and south reduced rate lots. The north lot is intended to serve Terminal 2W and the south lot is intended to serve Terminal 4E. The west lot is intended to serve Terminals 2E and 3E. Transportation is provided by buses. Infield parking is located behind the terminal garages. Infield parking at Terminal 3E is in a multi-level parking garage and also serves the airport hotel. All other infield parking is located in open parking lots. Terminal parking is located directly in front of each terminal in a multi-level parking garage

Car Rental Locations

On-premise rental car facilities are located in both the north and south reduced rate parking lots. The same four rental car companies are located in each lot. All on-airport rental car transactions and returns occur in these lots. The airport train or rental car courtesy buses provide transportation to/from the terminals.

AIRPORT USERS AND TRIP CATEGORIES

There are numerous users of the DFW Airport and its facilities. Table 2 summarizes the key user groups and provides subcategories of each group. These users gain access to the airport facility

Table 2. Type of Airport Users

Type of User	Means of Access ¹	Subcategories
Airline traveler	Airplane or road	Arriving, departing, connecting
Chauffeur	Road	Drop-off or pick-up airline traveler
Pass-through traffic	Road	None
Employees	Road	Airline, airport, FAA
Users of business facilities	Airplane or road	Business center, hotels, post office
Air cargo	Road	Delivery, pick-up
Car rental	Road	Airline traveler , non-airline traveler

Notes: ¹Road access can be through personal/business car, rental car, truck, taxi, shuttle, or other.

through two modes of transportation: 1) by vehicle on the surface roadway network or 2) by plane. It is the users that access the airport through the roadway network that are the intended audience of the roadway guide signs. There are four travel possibilities for those individuals who utilize the roadway network at some point in their trip.

The possible actions are shown below.

- Arrive by using the road network and depart by air,
- Arrive by air and depart by using the road network,
- Arrive by using the road network and depart by using the road network, or
- Circulate within the airport road network without entering or leaving the airport.

AIRPORT TRAVEL PATHS

The information identified in the previous parts of this chapter was used to identify the various travel paths of the airport roadway system users. Because the focus of the signing evaluation is on International Parkway, the identification of travel paths also focused upon travel paths originating on International Parkway. For each type of trip, the destination was identified, along with the information that a road user would need to reach the destination, as shown below.

Road users entering the airport property on International Parkway and continuing to travel on one of three airport roads:

- ▶ International Parkway
- ▶ Airfield Drive
- ▶ Either service road

Table 3 describes the major trips that relate to the need to provide road users with guidance information in the roadway signing. It is recognized that there are many other possible travel paths for users to travel on, especially for those that access the airport from one of the surrounding arterial streets and travel on Airfield Drive to their destination. However, this signing analysis is primarily concerned with meeting the information needs of unfamiliar drivers. Unfamiliar drivers are most likely to follow the primary travel routes. Those drivers that access the airport through the arterial road network are probably familiar users and need less information assistance.

All travelers leaving the airport have essentially the same information needs. Those road users want to know how to leave the origin of their trip and reach the desired airport exit.

Table 3. Primary Travel Paths for Traffic Entering the Airport from a Freeway with Initial Travel on International Parkway

Secondary Rd Segment	Type of User	User Familiarity	Trip Purpose	Destination	Information Needs
Int'l Parkway	Departing Passenger	Either	Departing passenger dropped off	Terminal	Where is the terminal or airline? What is departure gate and where is it? What level to go on? Where is curbside drop-off?
			Departing passenger parking car	Terminal parking Infield parking Reduced rate parking Shuttle parking	Where is the desired parking area? How to get there? How much does it cost? Is it full?
			Departing passenger returning rental car	Rental car lot	Where are return areas for specific companies? How to get there?
			Attend meeting at hotel or business center	Hotel Business center	Where is the hotel or business center? How to get there? Where to park?
Service Road	Commuter	Familiar	Pass-through commute trip	Beyond airport	No information needed.
			Drop-off or pick-up mail	Post Office	Where is the Post Office? How to get there?
			Attend meeting at hotel or business center	Hotel Business center	Where is the hotel or business center? How to get there? Where to park?
			Commute	Employee parking	No information needed.
			Delivery or service related to airline activities	Delivery or service location	Where is the delivery/service location? How to get there?
			Return to queue	Taxi queue	No information needed.
			Work at or visit	FAA facility	Where is the FAA facility and parking?
			Cargo drop-off or pick-up	Air cargo areas	Where is the needed air cargo provider?
			Cargo drop-off or pick-up	Air cargo areas	Where is the needed air cargo provider?
			Meeting	Administrative buildings	Where are the administrative buildings?
Airfield Drive	Visitor	Either	Watch planes	Observation area	Where is the observation area? How to get there?
			Golf/racquet sports	Golf course/recreational	Where is the golf course? How to get there?

CHAPTER 2

INFORMATION NEEDS OF AIRPORT ROAD USERS

Airport road users entering and exiting the airport property need a variety of information to successfully reach the desired destinations. The amount and complexity of the needed information depends upon the airport, the number of destinations, and the design of the roadway network. The difficulty of presenting the needed information increases as the airport size and number of traffic generators increase. However, there are three basic questions that must be answered for all users of the roadway network:

1. Where am I?
2. Where is my destination?
3. How do I get there?

As simple as these questions are, communicating the required information can present challenges and the actual application sometimes falls short of the road user needs. The development of an airport roadway guide signing plan must occur at two levels: 1) the overall system level where all the signs are designed to relate to one another so that the road user gets the “big picture” of airport destinations, and 2) the individual sign level where each sign must be designed so that its information is effectively communicated to the road user.

SYSTEM SIGNING LEVEL

Signing at the system level should be designed so that information provides the road user with an orderly decision-making process. The actions described below provide for a system approach to signing for traffic entering and exiting the airport. The majority of these recommendations are taken from the ITE recommended practice (4), with some modifications and explanatory detail added.

1. **Provide trailblazer signing on major roadways or freeways leading to the airport** - For commercial airports in large metropolitan areas, the airport general information sign (I-5) from the MUTCD (I-5 sign, section 2D-4, shown in Figure 3) should be used to indicate freeways leading to the airport. This sign should be installed above freeway guide signs at interchanges to indicate the proper exit. Where there is a potential for confusion with another airport in the area, the name or airport code can be provided (DFW for the DFW Airport). TxDOT Traffic Control Standard Sheet 1E(2)-95M provides details on the installation of this sign above freeway guide signs. The Texas MUTCD states that the sign can be used on intersecting roadways up to five miles from the airport in major metropolitan areas.
2. **Provide exit signing from the freeway(s) and/or roadway(s) feeding the airport entrance(s)** - Generally, there are one or two main entrances into an airport. The exit guide signs from the freeway/roadway should indicate the specific exit(s) that provides the major access to the airport entrance.
3. **Provide airport identification sign(s) at the airport entrance** - Airport identification signs should inform the road user when he/she has entered the airport property. This sign may be a general welcome sign or it may indicate specific airport information. For larger airports, indicating the



Figure 3. I-5 Sign

distance to the terminal area(s) may be helpful to users so that they have a sense of the travel needed to reach the terminals.

4. **Separate terminal traffic from non-terminal traffic** - Traffic headed to airport locations other than the terminals should be provided with destination information so that drivers do not have to read the more difficult signs associated with terminal traffic. This traffic includes:
 - a. *Traffic for non-airline related users* - This typically includes air cargo, airport and airline related service, airport administrative offices, hotel, and other destinations.
 - b. *Rental car return traffic* - The on-premise locations for returning rental cars should be indicated. This information should distinguish between different rental car companies if they are located in different areas of the airport.
 - c. *Traffic destined for parking areas* - There are several different parking options available at most airports, generally associated with pricing options. Signing should indicate the locations for terminal, remote, and satellite parking that are available on the airport property.
5. **Sign for terminal traffic** - The terminals are the primary traffic generator for the entire airport. Roadway signing should indicate which airlines are operating out of each terminal (if the airport has more than one terminal) and the location of each terminal. Upon entering the terminal roadway network, signing should indicate the following, if applicable:
 - a. *Terminal-parking split* - Separate traffic destined for the terminal curbside from traffic destined for the terminal parking area(s).
 - b. *Arrival-departure split* - Separate traffic destined for departing passengers from that for arriving passengers.
6. **Sign for traffic leaving the airport** - Getting road users to the desired airport location is only half of the trip. Airport signing must also provide road users with clear directions to leave the airport property at the desired location. The exiting signs should address two areas:
 - a. *Exiting from the terminal area to the major airport roadway(s)* - Signing should indicate how to leave the terminal and which direction to travel on the major airport roadway.
 - b. *Transition from airport roadway network to the surrounding roadway network* - Signing on the major airport roadway should provide directions to the major highways/roadways that provide access to the airport.

INDIVIDUAL SIGNING LEVEL

There are several key steps that should be followed in the development and design of individual airport roadway guide signs. These factors include:

- **Define information needs for a particular location** - The information needs should consider all road users whose travel path may take them through the location where a sign will be located.
- **Establish an information hierarchy** - Once the information needs have been identified, the relative priority/importance of the information should be established. The design of the information presentation should reflect the information hierarchy, giving more emphasis on the information that has greater importance.
- **Define driver expectancy** - For the sign location, the expectations of road users passing that point should be identified. These expectations should consider the following factors:
 - ▶ *Percentage of unfamiliar road users at the location* - Is there a significant proportion of road users who may not be familiar with the airport and the characteristics of the particular location?
 - ▶ *Characteristics of the location relative to the preceding locations* - Is some characteristic of this location different from what drivers have experienced upstream?

- ▶ *Characteristics of the location relative to other locations in the general area* - Are there characteristics of the airport that are different from those of the surrounding area and highway and street network?
- **Avoid information overload** - The amount of information that should be presented at a given location should be carefully evaluated. If there is a large amount of information that must be presented, one or more of the following actions may be necessary:
 - ▶ *Sign spreading* - The information should be spread out over several signs separated by adequate distance to allow road users to assimilate the information.
 - ▶ *Information shedding* - Lower priority information may be dropped from the sign(s).
 - ▶ *Alternate communication means* - Other means of communicating the desired information to road users may be used, such as Highway Advisory Radio.
- **Provide adequate legibility** - Each sign should be designed to provide adequate legibility. Two factors affect the legibility of the sign:
 - ▶ *Sign size* - The overall sign size must be large enough to accommodate the required legend size and to provide sufficient target value so that it will be seen by the road user.
 - ▶ *Legend size* - The sign legend must be designed to provide adequate legibility. The required legend size is a function of the roadway speed and the amount of information presented in the sign.
- **Ensure proper sign placement** - The sign must be located so that it will be seen and read by road users in sufficient time to allow the desired response.
 - ▶ *Cone of vision* - The sign should remain within a 10 to 20 degree cone of vision during the time that it must be read by the road user. In some cases, this will require an overhead placement.
 - ▶ *Decision sight distance* - The sign placement should allow adequate time for the desired response. The more complicated the response or the more it violates driver expectancy, the further back the sign should be placed from the reference location.
 - ▶ *Clearance* - The sign should be placed so that it provides sufficient height and lateral clearance. The height clearance is necessary so that signs can be seen over adjacent vehicles, to prevent mud splatter, and to be above the height of vehicles and pedestrians. The lateral clearance is needed to provide a recovery area for errant vehicles leaving the travel lane.

COMPLIANCE OF AIRPORT SIGNING WITH THE MUTCD

Many airports around the country, in an effort to create a “unique airport identity,” have installed signing, particularly guide signing, which departs from some of the basic principles of the MUTCD. While aesthetically pleasing, the departure from MUTCD principles can create difficulties. Most commonly, these “unique” airport signs use color combinations, alphabet designs, and arrows that are different from those specified in the MUTCD. Other MUTCD design principles that may not be present in airport signs are: sign shapes; fully retroreflectorized legends and backgrounds; appropriate longitudinal, lateral, and height placement; abbreviations; gore signing; and sign spreading. These departures from basic roadway signing practices can reduce legibility, create confusion or uncertainty, and/or cause information to be overlooked. Although non-conforming signs can have a visually pleasing impact on an individual basis, they can lead to confusion on the part of drivers due to the inconsistencies with the signing used on public roadway where road users do most of their driving.

Furthermore, recent federal activity by two agencies has broadened the application of the MUTCD to public roadways, including airports. In one action, the FHWA revised the federal MUTCD to encourage states to adopt legislation that requires traffic control devices on all roadways open to public travel to comply with the provisions of the MUTCD. Because the Texas MUTCD is required to comply with the federal MUTCD, there is a strong possibility that Texas will follow the recommendation to apply MUTCD requirements to all roads open to public travel. In the second action, the FAA issued an Advisory Circular that indicates airport roadway signing should comply with the MUTCD. Text from both of these actions is provided in Appendix B.

CHAPTER 3

EVALUATION OF DFW AIRPORT SIGNING

The majority of the existing roadway signing on International Parkway has been in place since the airport opened nearly 25 years ago. Over that time period, the signing has undergone continual modifications. Most of the information that is needed by road users is available, but in many cases, it is presented in a manner that makes it difficult for road users to efficiently assimilate. The two major weaknesses of the signing system are inadequate sign design characteristics and inconsistent presentation of information from one sign to another. These weaknesses are compounded by roadway geometric characteristics that present a signing challenge. The evaluation of the existing airport signing on International Parkway considered the following factors:

- Ability to meet the information needs of airport road users.
- Design elements of individual signs.
- System level consistency of signing.

The majority of the evaluation was based on a photographic inventory of roadway guide signs located on International Parkway. Other items that supported the evaluation included plan drawings of International Parkway, aerial photographs of the airport property, and a drive-through video of International Parkway. The primary evaluation was conducted by someone unfamiliar with the airport roadway system without asking questions to clarify the meaning of the existing signs. This provided an analysis that more accurately represents how an unfamiliar user interprets the existing signs.

Although a factor in the overall effectiveness of an airport sign system and individuals signs, the following factors were not considered in the evaluation of the existing DFW roadway guide signing:

- Sign and legend size.
- Sign lighting and retroreflectivity.
- The adequacy of sign support structures.

EVALUATION OF INDIVIDUAL SIGNS

The evaluation began with an assessment of the information presented in individual signs. These evaluations were primarily based on the sign photographs. Signs on International Parkway were photographed in both the northbound and southbound directions. Photocopies of these sign photographs are presented in Volume II of this report. Each sign was evaluated for the information presented, the effectiveness of the sign design for presenting the information, and the consistency of the sign design with other signs presenting similar information. The results of the individual sign analysis are presented in Appendix C. Some of the key findings from the evaluation of individual signs are summarized in the following statements.

- There is significant inconsistency between various signs that should be presenting similar information. Examples include:
 - ▶ Northbound and southbound signs for the same exit have different designs and contain different information.

- ▶ The listings of airlines in a specific terminal are not the same in every sign. The most apparent example of this is for terminals 2E and 3E. Some signs show only American and American Eagle in these terminals and leave out Canadian, Qantas, and Grupo Taca. The Grupo Taca airline is missing from many of the signs for these terminals.
- ▶ The manner in which terminal numbers and colors is presented varies from one sign to another. Sometimes the terminal number is on the top of the sign within a colored background representing the terminal color. In other cases, the terminal number is at the bottom of the sign without the terminal color. Some airlines are shown within the color coding, while other airlines in the same terminal do not have the color coding.
- Regulatory messages are contained within some of the guide signs.
- Signs for remote parking areas associated with a particular terminal list the airline names. Road users may interpret these signs as indicating the terminal exit for those airlines.
- When shown in signs, distances are presented inconsistently. Both MILE and mi. are used as units. Distances in miles are presented in both fractions and tenths.

EVALUATION OF OVERALL SYSTEM

Following the evaluation of individual signs, the overall system was evaluated for its ability to meet the information needs of airport road users. The key elements of the system evaluation were: compliance with the MUTCD, use of terminal designations, and roadway geometrics.

Desirable Characteristics of Existing Signing

Despite some of the weaknesses identified in the existing signing system at the DFW Airport, the system does have some desirable attributes. A few of the most important are listed below:

- The information needed by airline travelers is provided in some usable form.
- Information is repeated in most cases.
- Important information is located in overhead signs.

MUTCD Compliance

The signing at the DFW Airport is typical of that found at many large commercial air carrier airports. Many of the signs do not comply with the MUTCD principles for roadway signs. Since the time that these signs were installed, the pressure upon airports to comply with the MUTCD has increased.

The existing airport signing varies from MUTCD principles in many respects. The most significant of these are listed below.

- Design characteristics of the guide signs:
 - ▶ Existing signs are light brown instead of green.
 - ▶ Existing signs use the Helvetica Medium alphabet instead of the Series E (Modified) alphabet.

- Use of arrows:
 - ▶ Existing sign arrows are of the wrong design.
 - ▶ Existing sign arrows are often located in the wrong area of the sign (i.e., left exit arrow on the right side of the sign).
 - ▶ Existing signs use up arrows to indicate advance exit information instead of the distance to the exit. MUTCD principles do not provide for the use of up arrows.

Terminal Designations

The current terminal numbering scheme is shown in Figure 4. The terminals currently used by airlines are 2W, 2E, 3E, and 4E. Table 4 contains a listing of the airlines that are in each terminal. The terminal information is the most important information that is presented to road users on International Parkway. Unfortunately, the terminal numbering scheme is one that is probably confusing to drivers (although no driver data was collected as part of this effort to confirm or reject this assumption). This assumption is based on other research that has shown that most drivers do not related to compass directions in navigational/directional tasks. Furthermore, the absence of terminal numbers 1W, 1E, 3W, 4W, 5W, and 5E may create another potential source of confusion. DFW officials appear to have recognized this shortcoming, as the use of airline terminals numbers is not a prominent feature of the guide signs. Instead, the signs emphasize a three-color coding system for the four terminals. However, as mentioned previously, the terminal numbers and the color codes are used inconsistently from one sign to another throughout the system.

Geometric Considerations

Between the parking control plazas on International Parkway, all entrances and exits are located on the left side of the road. The use of left exits is contrary to driver expectancy and is an additional challenge to the signing system to inform road users of the location of exits and entrances. Road users need continuous reinforcement of the left exit message. The existing signing system does not consistently provide the continual left exit reminder needed by road users. On both the northbound and southbound approaches, there is a sign after the parking control plazas that indicates all exits are from the left lane. The arrows in the exit direction signs also indicate the exit to the left. However, the left exit arrow is generally on the right side of the sign, when it should be on the left side.

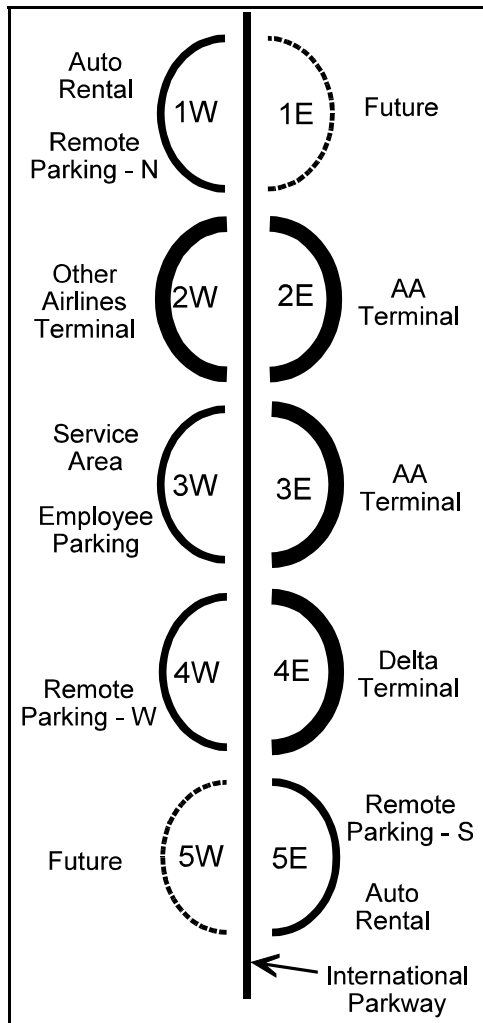


Figure 4. Terminal Arrangement

Table 4. Airlines in Terminals

Terminal and Color	Airlines	Photo of Sign
2W Green	Air Canada AirTran American West British Airways Continental Korean Air Lone Star/Aspen Lufthansa Midwest Express Northwest/KLM Sun Country TWA United/SAS US Airways Vanguard Western Pacific	NB 7 ^a , 34, 35, 41 ^c SB 8 ^a , 20, 22, 23 ^d
2E and 3E Red	American American Eagle Canadian ^b Grupo Taca ^b Qantas ^b	NB 2, 7 ^c , 17 ^c , 18 ^c , 22, 24, 28 ^c , 30 ^c , 31 ^c , 32 ^c , 33 ^c , 36 ^c , 37 ^c , 38 ^c , 39 ^c SB 7 ^c , 8, 12, 13 ^c , 16 ^c , 17 ^c , 18 ^c , 19, 21, 24 ^c , 26 ^c , 27 ^c , 31, 32
4E Blue	ASA Aeromexico Delta Grand ^b Sun Jet ^b	NB 7, 20 ^c , 21 ^c , 25, 26 SB 8, 29, 30, 35

Notes:

^aListed as "All Other Airlines."

^bAirline not shown in some signs.

^cSome airlines missing from sign.

^dList as "To Airline Terminal."

CHAPTER 4

RECOMMENDATIONS FOR DFW AIRPORT SIGNING

Using the information, evaluation results, and principles that have been identified in the preceding chapters, the following recommendations are suggested to improve the effectiveness of airport roadway guide signing at DFW Airport. All of the recommendations are intended to provide the user of an airport roadway network with a clearer picture of the available destinations and the path to get to those destinations.

It should be noted that one of the most difficult aspects of designing an airport roadway signing system is the ability to look at the system from the eyes of the unfamiliar road user. This includes determining what information the road user needs and identifying alternative interpretations of the information being presented. The task of assessing the effectiveness of an airport's signing is particularly difficult for those associated with the operation of the airport due to their familiarity with the roadway system. Therefore, it would be helpful to test any proposed guide signing system on groups of unfamiliar road users in a focus group or other similar format. A computer simulation of roadway sign use in an individual testing situation could be useful.

TERMINOLOGY

In order to present navigation information to road users in an effective manner, a basic set of terminology that the road user can clearly understand must be established. For airports, this is a challenging undertaking due to the wide range of terms currently used at various airports. Similar types of facilities are referred to by various names depending upon local preference, airport identity, and historical usage. The two major terminology recommendations relate to the terminals and the parking areas. There are also other terminology recommendations that are included.

Terminal Designations

The biggest signing challenge at DFW Airport is the development of a scheme for labeling the terminals that can be easily understood by road users. The current use of compass directions and numbers is believed to be confusing.

The recommended terminal identification scheme uses an alphabetic scheme (letters A-K) to identify the terminals with a color associated with each letter/terminal. The letter "I" is not used because it is easily interpreted as a "1" when presented as part of an alphanumeric code (i.e., I7, I13, I23 are misinterpreted as 17, 113, 123). Table 5 indicates the recommended scheme and Figure 5 illustrates it. The colors were chosen from the eight standard sign colors identified in the MUTCD, plus two of the unassigned colors. The use of standard sign colors was made so that terminal signs could be fabricated in a cost-effective manner using standard sign materials. The current red, blue, and green color assignments for Terminals 2W, 2E, and 4E were kept for those terminals. However, the red that is currently assigned to Terminal 3E was changed so that each terminal would have a unique color.

Table 5. Proposed Terminal Designations

Current Terminal	Current Use	Proposed Designation	
		Color	Letter
1W	Auto Rental Remote Parking - North	Yellow	A
1E	Empty	Black	B
2W	Other Airlines Terminal	Green	C
2E	American Terminal	White	D
3W	Employee Parking Service Area	Orange	E
3E	American Terminal	Red	F
4W	Remote Parking - West	Light Blue	G
4E	Delta Terminal	Blue	H
5W	Empty	Brown	J
5E	Auto Rental Remote Parking - South	Purple	K

As presented in Table 5, the terminal letters increase from west to east (left to right) for each terminal pair. This pattern should be maintained for all terminal pairs. Another option for assigning terminal letters would be to increase the terminal letters from east to west. However, it should be noted that such a pattern is contrary to the reading direction when a map is viewed in its customary position with north at the top (i.e., reads from right to left).

The design of the terminal designations is a color block with one letter. Black letters are used for white, yellow, orange, and light blue. White letters are used for the other six colors. Because these terminal designations are intended to be mounted on green roadway guide signs (in order to comply with MUTCD color requirements for guide signs), the green terminal color is surrounded by a white border to separate it from the sign background.

When used in road signs, the terminal letter with the corresponding color block is used whenever there is an association with the terminal. More specific information about the terminal, such as the airline names or gate numbers, would be presented beside or below the terminal letter block.

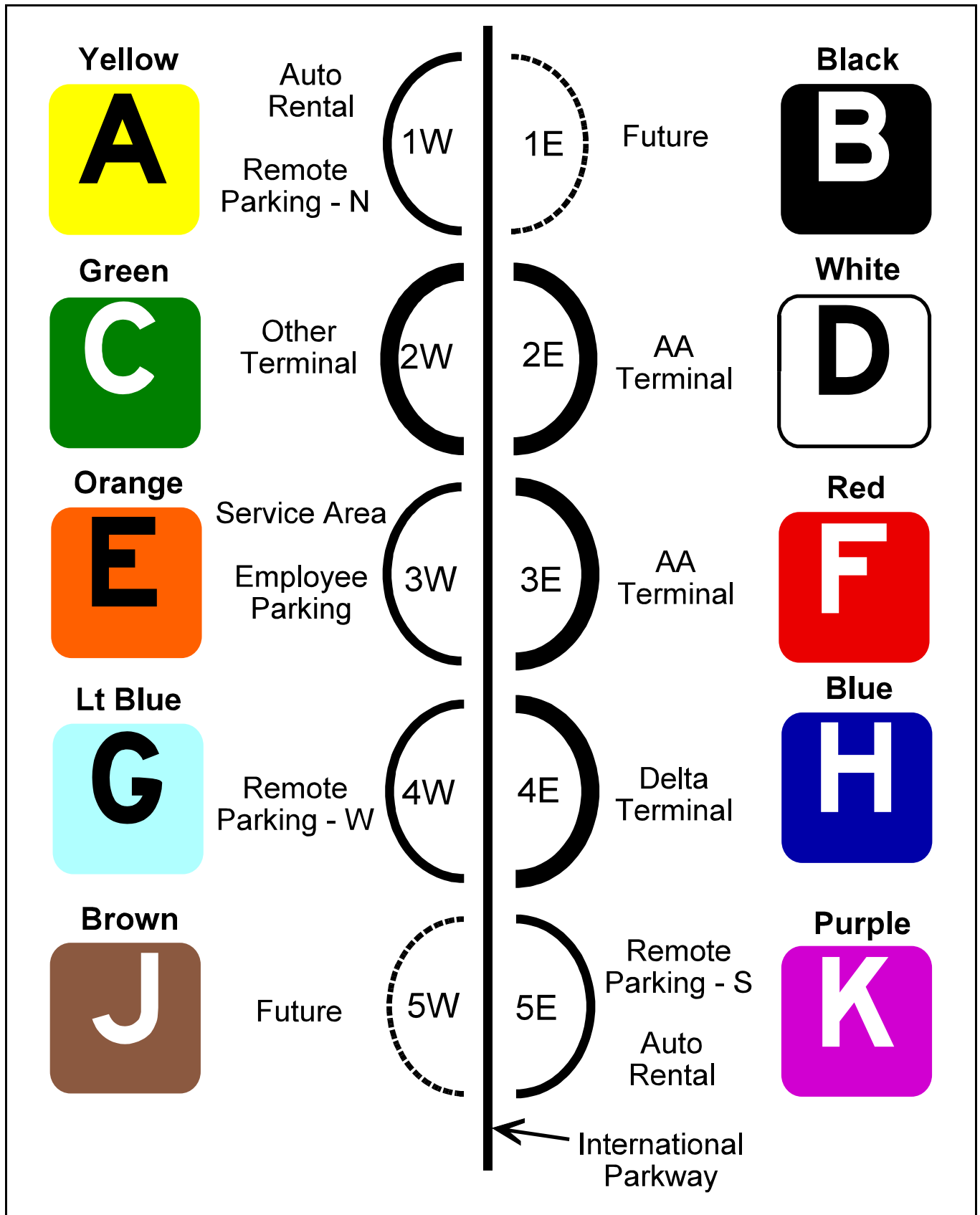


Figure 5. Proposed Terminal Designations

Parking Area Designations

There is a wide range of terms used to describe types of parking at airports. Table 6 indicates the current DFW Airport terms, recommended parking terms from the ATA and ITE publications, and the terms recommended for DFW to use.

Table 6. Variations in Parking Terminology

DFW Parking	ITE Guidelines¹	ATA Guidelines²	Recommended
Shuttle	Long Term	Remote/Satellite	Satellite
Reduced Rate		Daily	Remote
Infield	Short Term	Hourly	Terminal ³
Terminal			
N/A	N/A	Valet	Valet
		Metered	N/A
		Garage	N/A

Notes: ¹Source: Reference (4).

²Source: Reference (5).

³Distinction between infield and terminal parking should be made after exiting from the arterial.

The use of the term “shuttle parking” as it is currently used at DFW Airport is not recommended because shuttle service is provided from both the shuttle and reduced rate lots. Furthermore, the term “reduced” is ambiguous as it does not indicate the point of comparison. Some road users may compare the reduced to the shuttle parking and assume that the reduced rate parking is lower because it does not have shuttle service. While there is an existing sign that indicates the relative daily parking fees for each type of lot, this information is provided only once near the entrance to the airport. There is currently no signing for infield and terminal parking on International Parkway. It is recommended that both types be signed as terminal parking on International Parkway, and the distinction between terminal and infield parking can be made after the exit from International Parkway. If pricing information is provided for parking areas, that information should be supplemental and located in a separate sign(s) located in areas where there are a minimal number of road signs.

Although not included as part of these recommendations, consideration should be given to providing real-time information to road users on the availability of parking in each of the parking locations. This information should indicate where a lot is full or that spaces are available.

Other Terminology Issues

Other terms that should be used consistently in the DFW Airport signing relate to rental cars, air cargo, arriving and departing areas of the terminal, and the airport exit.

Rental Car Return

There are two rental car return areas off of International Parkway. Both lots service the same rental car companies. Therefore, it is not necessary to distinguish between the two lots on International Parkway. Rental car drivers should be signed to the first location when approaching the airport. The rental car companies can provide more specific information at the time the car is rented if necessary.

At the present time, DFW Airport is in the process of constructing a new facility that will house all the on-site and seven of the off-site rental car companies. It will be built just south of the south shuttle lot, east of International Parkway. The opening date is set for April 2000. Once open, all signing on the airport property related to rental car facilities should be modified to reflect the location of the facility and the rental car companies operating out of the facility.

Air Cargo/Air Freight

The air cargo and air freight areas at DFW Airport are located on Airfield Drive and the service roads for International Parkway. The ATA publication (5) recommends that the term “air cargo” be used to represent all air freight and air cargo locations. Therefore, the term “air cargo” is used for the International Parkway signing for the exit to Airfield Drive.

Arriving and Departing Information

Once road users leave International Parkway for the terminal roadway network, they should be directed to the proper area of the terminal. Although not addressed in this analysis, the terms “arriving passengers” and “departing passengers” should be used in the terminal roadway network to route vehicles to the proper area.

Airport Exit

The current signing on International Parkway does not provide road users with information on leaving the airport until they are almost off of the airport property. Signs should be provided at periodic intervals on International Parkway indicating the travel direction to exit the airport. Although the sign may only indicate to remain on International Parkway to exit the airport, to the unfamiliar road user, this is valuable information.

Airport exiting information should also be provided as road users leave the terminal roadway network so that they will know whether to travel north or south to reach the desired exit area.

RECOMMENDATIONS FOR INDIVIDUAL SIGNS

Roadway traffic signs have been in use for over 70 years. During that time, traffic engineers have continually refined the principles for the design of those signs. These principles are contained in the MUTCD. Because of the proven effectiveness of these principles over time and the expectation that all roads open to public travel will be required to conform to the MUTCD, the sign design principles in the MUTCD are the basis for the sign design recommendations for the DFW Airport roadway guide signing system.

Individual Sign Design

The basic sign design parameters for the guide signs on International Parkway are listed below:

- **Color combinations** - White legend on green background.
- **Legend Alphabet** - The Series E (Modified) alphabet should be used for all legends (6).
- **Sign location** - Overhead position for all major exiting information.
- **Advance exit signs** - All signs providing advance notice of an exit ramp should indicate the distance to the exit gore.
- **Exit directional signs** - Exit signs at the location of the exit ramp should use an upward sloping diagonal arrow to indicate the exit.
- **Left exits** - Black on yellow LEFT EXIT panels at the bottom of all guide signs where the exit ramp is on the left side of the roadway.
- **Compass directions** - Compass directions are not used in signs to convey primary navigational information.
- **Destination and airline information** - All listings of destinations and airlines should list them in alphabetical order so that road users can anticipate the location of a particular destination/airline within a list. By listing destinations alphabetically, a road user can zero in on the portion of the list where they expect their destination to be. They should be arranged one above the other. The only exception is the listing for the airlines in Terminal G (current 2W), where the airlines should be listed in three column due to the large number of airlines.
- **Arrows** - Three types of arrow should be used in the guide signs. A downward pointing arrow should be used to indicate a through movement to the destination indicated in the sign. Upward sloping diagonal arrows should be used to indicate an exit maneuver to the left or right. These arrows should be placed on the side of the sign to which the exit occurs (left side for left exit, right side for right exit). Upward pointing arrows should not be used.

Sign Consistency

In order to be effective, signs must adhere to a basic design style that is consistent from one sign to another. This includes legend size, terminology, symbols, and colors. Figures 6 and 7 present the basic design for the advance exit and exit directional signs for a typical airline terminal. These signs are presented against a grey background so that the white sign border is evident. Similar design characteristics are used for the other exit locations.

Not only is it important to have signs that have a consistent appearance, the information presented in the signs should also be consistent. Signing for the northbound and southbound directions on International Parkway should be basically the same, except for sequential differences. The guide signs for any particular location in one direction should contain the same information as the sign from the other direction.

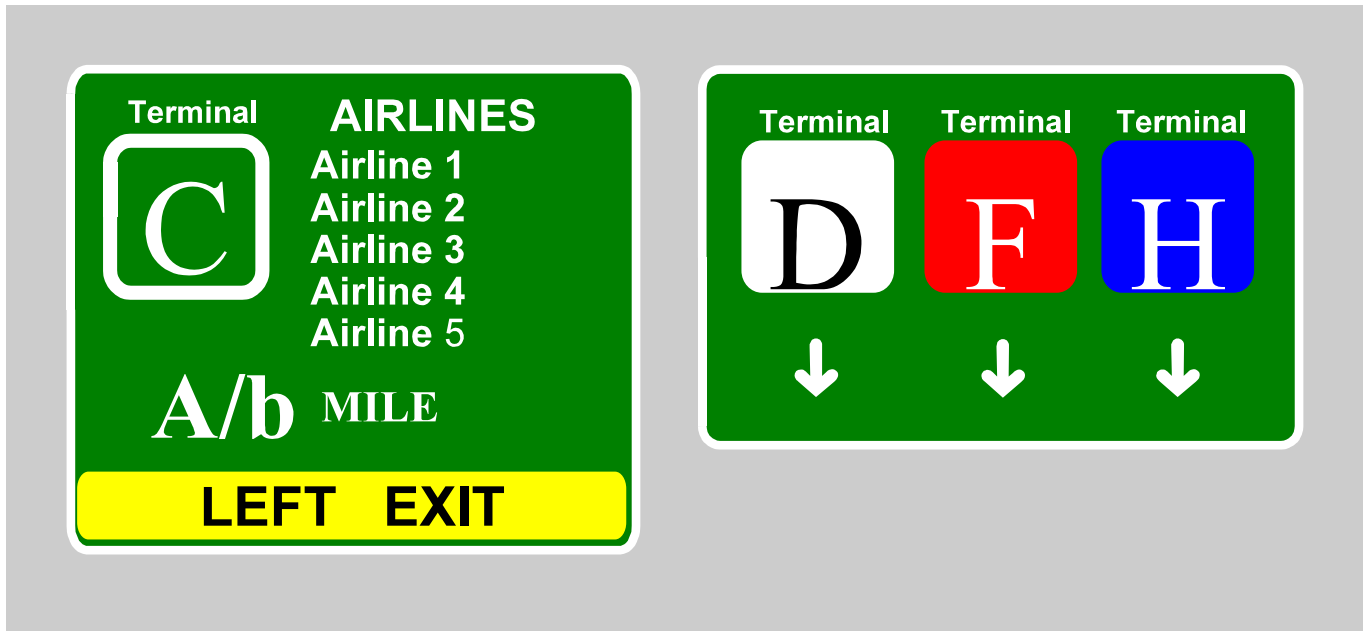


Figure 6. Typical Advance Exit Sign

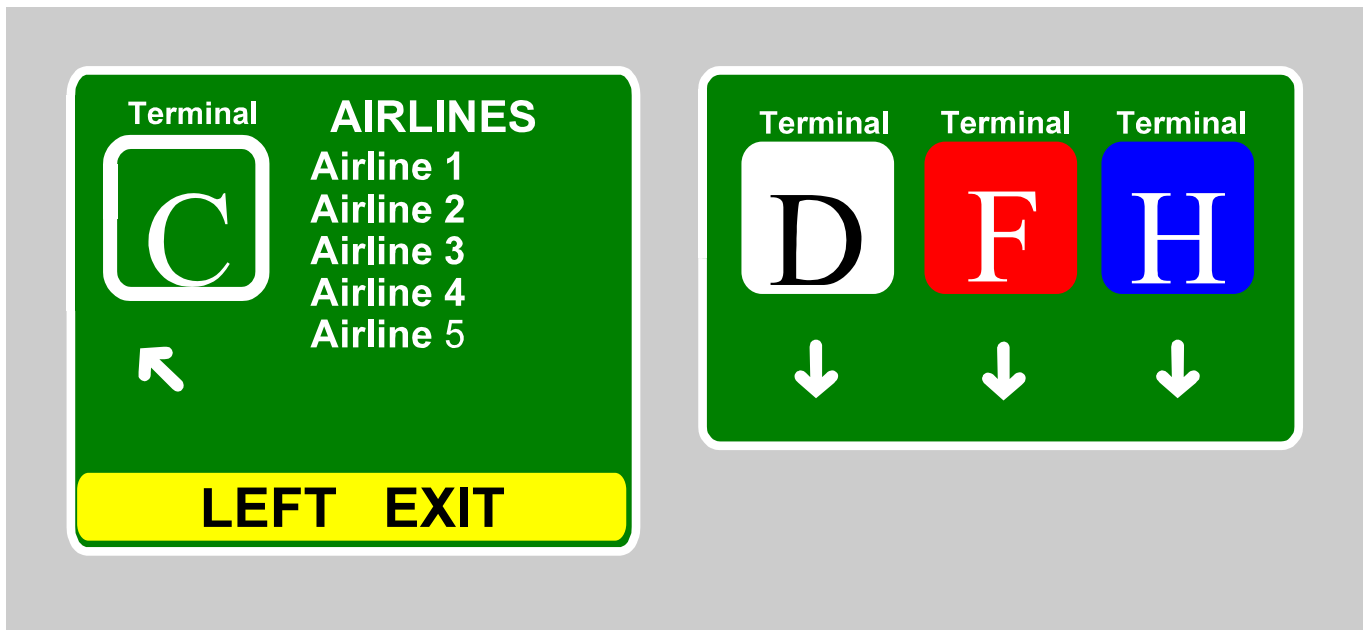


Figure 7. Typical Exit Direction Sign

Other Sign Recommendations

There are a few other sign improvement that can increase the overall effectiveness of the airport roadway guide signs. These improvements include:

- The banners on the approach of International Parkway into the airport should be removed as they interfere with the road users' ability to identify and assimilate the information in the roadway guide signs. At a minimum, if the banners are not removed, they should be located only on the left side of the road and should not be placed within 300 feet before or after a roadway sign.

- Develop a new design for signs that identify the airport observation area. The new sign should consist of text only of at least four-inch letter heights in a standard highway alphabet. The text and graphic design in the current sign are not legible at roadway speeds.
- Airport officials should coordinate signing with the rental car companies to make sure their maps provide the right information for exiting the airport and returning to the rental car return. Another option is for the airport to provide exiting maps to the rental car companies.
- There should be signs within the terminal roadway network that indicate how to return to the terminal. There should also be signs within the terminal roadway network that indicate which direction to exit the airport.
- In August 1998, new federal standards for the performance of sign support structures and roadside safety hardware will become effective. The existing sign support structures should be evaluated in light of these requirements.
- Before undertaking a major sign renovation program, various alternatives for providing adequate nighttime performance of roadway signs should be considered. These alternatives are listed below. All three alternatives have been found by state departments of transportation to be effective means of providing adequate nighttime legibility.
 - ▶ Use of high retroreflective materials for the sign legend and possibly the sign background.
 - ▶ Various types of exterior sign illumination.
 - ▶ Internally illuminated signs.

Recommended Signing Sequences

Appendix D contains recommendations for the sign sequences that should be presented to road users on International Parkway as they enter the airport and travel to the first terminal exit.

CHAPTER 5

CONCLUSIONS

The unique characteristics of airports provide many challenges in developing a roadway signing system that effectively meets the information needs of the road users. The key factor to consider in developing an airport signing system is that every sign relates to each of the other signs. The information must be presented in a consistent manner. Information should also be presented in a structured manner that provides users with the information they need when they need it.

The DFW Airport is no exception, and the challenges are compounded by three factors: the potential for future terminal additions, the geometrics of the main access roadway, and the large number of gates that serve the major airline (44 gates in two terminals for American Airlines). The analysis of the DFW Airport roadway guide signing system found that most of the information needed by the road users on International Parkway is presented in the existing signs. However, there are numerous inconsistencies in the signs that may hamper drivers in obtaining the information they need.

CHAPTER 6

REFERENCES

1. *Manual on Uniform Traffic Control Devices for Streets and Highways*, 1988 Edition plus Revisions 1-5. U.S. Department of Transportation, Washington, D.C., 1988, revised through January 1997.
2. *Texas Manual on Uniform Traffic Control Devices for Streets and Highways*, 1980 Edition plus Revisions 1-6. Texas Department of Transportation, Austin, Texas, 1980, revised through January 1996.
3. *Standard Highway Sign Designs for Texas*. Texas Department of Transportation, Austin, Texas, 1980, revised through February 1995.
4. *Airport Roadway Guide Signs: A Recommended Practice*. Publication Number RP-014, Institute of Transportation Engineers, Washington, D.C., 1988.
5. *Guidelines for Airport Signing and Graphics: Terminals and Landside, Second Edition*. Air Transportation Association of America, Washington, D.C., July 1994.
6. *Standard Alphabets for Highway Signs*. U.S. Department of Transportation, Washington, D.C., English units - 1966 edition, Metric units - 1977 edition.

APPENDIX A

AIRPORT RELATED SECTIONS OF THE MUTCD

The *Manual on Uniform Traffic Control Devices* (MUTCD) establishes the basic principles for the selection, design, application, and operation of traffic control devices on streets and highways. There are both federal (1) and state (2) versions of the MUTCD. Texas state law specifies that traffic control devices on streets and highways in Texas comply with the Texas MUTCD.

The pages in this appendix list some of the key sections and provisions of the Texas MUTCD that might be pertinent to the use of guide signs on airport roadways. The text provided does not list all the pertinent sections, nor does it always include the complete language for any given section. Items of particular significance are indicated by an underline.

It should be noted that the FHWA is currently in the process of preparing a new revision of the federal MUTCD. The portion of the MUTCD relating to signing is expected to be published in the *Federal Register* as a notice of proposed rulemaking in late spring or early summer of 1998. An airport considering a major redesign of its signing system should consider the language in the proposed signing part of the Manual and the potential impact on an airport signing system.

PART 1. GENERAL PROVISIONS

1A-1 Purpose of Traffic Control Devices

Guide and information signs are solely for the purpose of traffic control and are not an advertising medium.

1A-2 Requirements of Traffic Control Devices

This Manual sets forth the basic principles that govern the design and usage of traffic control devices.

The Manual presents traffic control device standards for all streets and highways open to public travel regardless of type or class or the governmental agency having jurisdiction. Where a device is intended for limited application only, or for a specific system, the text specifies the restrictions on its use.

To be effective, a traffic control device should meet five basic requirements:

1. Fulfill a need.
2. Command attention.
3. Convey a clear, simple meaning.
4. Command respect of road users.
5. Give adequate time for proper response.

Five basic considerations are employed to insure that these requirements are met: design, placement, operation, maintenance, and uniformity.

Design of the device should assure that such features as size, contrast, colors, shape, composition, and lighting or reflectorization are combined to draw attention to the device; that shape, size, colors, and simplicity of message combine to produce a clear meaning; that legibility and size combine with placement to permit adequate time for response; and that uniformity, size, legibility and reasonableness of the regulation combine to command respect. Except for symbols on traffic control devices, minor modifications in the design of specific design elements of a device may be necessary, provided that the essential appearance characteristics are met. All symbols must be adopted using the procedures described in section 1A-6. All symbols shall be unmistakably similar to or mirror images of those shown herein.

Placement of the device should assure that it is within the cone of vision of the viewer so that it will command attention; that it is positioned with respect to the point, object, or situation to which it applies to aid in conveying the proper meaning; and that its location, combined with suitable legibility, is such that a driver traveling at normal speed has adequate time to make the proper response.

Operation or application should assure that appropriate devices and related equipment are installed to meet the traffic requirements at a given location. Furthermore, the device must be placed and operated in a uniform and consistent manner to assure, to the extent possible, that vehicle operators can be expected to properly respond to the device, based on their previous exposure to similar traffic control situations.

Maintenance of devices should be to high standards to assure that legibility is retained, that the device is visible, and that it is removed if no longer needed. Clean, legible, properly mounted devices in good working condition command the respect of vehicle operators and pedestrians. In addition to physical maintenance, functional maintenance is required to adjust needed traffic control devices to current conditions and to remove unnecessary traffic control devices. The fact that a device is in good physical condition should not be a basis for deferring needed replacement or change. Furthermore, carelessly executed maintenance can destroy the value of a group of devices by throwing them out of balance. For example, replacement of a sign in a group or series by one that is disproportionately large may tend to depreciate others in the vicinity.

Uniformity of traffic control devices simplifies the task of the road user because it aids in recognition and understanding. It aids road users, police officers, and traffic courts by giving everyone the same interpretation. It aids public highway and traffic officials through economy in manufacture, installation, maintenance, and administration.

Simply stated, uniformity means treating similar situations in the same way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a nonstandard device; in fact, this may be worse, in that such misuse may result in disrespect at those locations where the device is needed.

1A-4 Engineering Study Required

The decision to use a particular device at a particular location should be made on the basis of an engineering study of the location. Thus, while this Manual provides standards for design and application of traffic control devices, the Manual is not a substitute for engineering judgment. It is the intent that the provisions of this Manual be standards for traffic control devices installation, but not a legal requirement for installation.

Qualified engineers are needed to exercise the engineering judgment inherent in the selection of traffic control devices, just as they are needed to locate and design the roads and streets which the devices complement. Jurisdictions with responsibility for traffic control, that do not have qualified engineers on their staffs, should seek assistance from the State highway department, their county, a nearby large city, or a traffic consultant.

PART 2. SIGNS

2A-8 Standardization of Signs

In situations where messages are required other than those herein provided for, the signs shall be of the same shape and color as standard signs of the same functional type.

The term “legend” as used in this Manual includes all word messages and symbol designs that are intended to convey specific meanings. For purposes of design, borders are included as part of the sign legend.

The basic requirements of a highway sign are that it be legible to those for whom it is intended and that it be understood in time to permit a proper response. This means high visibility, lettering or symbols of adequate size, and a short legend for quick comprehension by a driver approaching a sign at high speed. Standardized colors and shapes are specified so that the several classes of traffic signs can be promptly recognized. Simplicity and uniformity in design, position, and application are important.

2A-9 Design

Uniformity in design includes shape, color, dimensions, legends, and illumination or reflectorization. This Manual shows many typical standard signs approved for use on streets and highways. Detailed drawings of these and other approved signs are available to State and local highway and traffic authorities, sign manufacturers, and similarly interested agencies*. All symbols shall be unmistakably similar to those shown, and where a word message is applicable, the wording shall be as herein provided. Most standard symbols are oriented facing left; however, this does not preclude the use of mirror images of these symbols where the reverse orientation might better convey to vehicle operators a direction of movement. Standardization of these designs does not preclude further improvement by minor changes in the proportion of symbols, width of borders, or layout of word messages, but all shapes and colors shall be as indicated.

In the specifications for individual signs, the legend, color, and size are shown in the accompanying illustrations, and are not always detailed in the text.

*Available from the Texas Department of Transportation.

2A-10 Shapes

Standard sign shapes are:

- The octagon shall be reserved exclusively for the STOP sign.
- The equilateral triangle, with one point downward, shall be reserved exclusively for the YIELD sign.
- The round shape shall be used for the advance warning of a railroad crossing and for the civil defense evacuation route marker.
- The pennant shape, an isosceles triangle, with its longest axis horizontal, shall be used to warn of no passing zones.
- The diamond shape shall be used only to warn of existing or possible hazards either on the roadway or adjacent thereto.
- The rectangle, ordinarily with the longer dimension vertical, shall be used for regulatory signs, with the exception of STOP signs and YIELD signs.
- The rectangle, ordinarily with the longer dimension horizontal shall be used for guide signs, with the exception of certain route markers and recreational area guide signs.
- The trapezoid shape may be used for recreational area guide signs.
- The pentagon, point up, shall be used for School Advance and School Crossing signs.

Other shapes are reserved for special purposes; for example, the shield or other characteristics design for route markers and crossbuck for railroad crossings.

2A-11 Sign Colors

The colors to be used on standard signs shall be as follows:

- Red is used only as a background color for STOP signs, multiway supplemental plates, DO-NOT-ENTER messages, WRONG WAY signs and on Interstate route markers; as a legend color for YIELD signs, parking prohibition signs, and the circular outline and diagonal bar prohibitory symbol.
- Black is used as a background on ONE WAY signs, certain weigh station signs and night speed limit signs as specified herein. Black is used as a message on white, yellow and orange signs.
- White is used for the legend on brown, green, blue, black, and red signs, and as the background for route markers, guide signs, the Fallout Shelter Directional sign, and regulatory signs, except STOP signs.
- Orange is used as a background color for construction and maintenance signs and shall not be used for any other purpose.
- Yellow is used as a background color for school signs and for warning signs, except where orange is specified herein.
- Brown is used as a background color for guide and information signs related to points of recreational or cultural interest.
- Green is used as a background color for guide signs (other than those using brown or white), mileposts, a legend color with a white background for permissive parking regulations, and the circular outline permissive symbol.
- Blue is used as a background color for information signs related to motorist services (including police services and rest areas) and the Evacuation Route Marker.

Four other colors - purple, light blue, coral, and strong yellow-green - have been identified as suitable for highway use and are being reserved for future needs.

2A-13 Symbols

Symbol designs shall in all cases be essentially like those shown in this Manual and Standard Highway Sign Designs for Texas publication.

2A-14 Word Messages

Where applicable, standard wordings as shown in this Manual shall be used for sign legends. Word messages should be as brief as possible and the lettering should be large enough to provide the necessary legibility distance.

Abbreviations should be kept to a minimum, and should include only those that are commonly recognized and understood, such as Ave., Blvd., N. (for north), R. R., or Jct. Since long names can often be partially recognized by their length, it is sometimes permissible to put them in slightly smaller lettering than would otherwise be required.

2A-15 Lettering

Sign lettering shall be in upper-case letters of the type approved by the Federal Highway Administration, except that destination names may be in lower-case lettering, with initial upper-case. Standard upper-case and lower-case alphabets have been prepared*.

Use of the Series B alphabet is restricted to street-name signs, parking signs, and other similar signs where limited breadth and stroke widths are required for design purposes.

As a guide to choice of alphabets, tests have shown that, for any given legend, better legibility can be obtained by using a relatively wide spacing between letters than by using wider and taller letters with a cramped space.

2A-16 Illumination and Reflectorization

Regulatory and warning signs, unless excepted in the standards covering a particular sign or group of signs, shall be reflectorized or illuminated to show the same shape and color both by day and night. All overhead sign installations should be illuminated where an engineering study shows that reflectorization will not perform effectively. Reflectorization, non-reflectorization, or illumination of guide signs shall be as provided in subsequent sections.

2A-21 Standardization of Location

Standardization of position cannot always be attained in practice; however, the general rule is to locate signs on the right-hand side of the roadway, where the driver is looking for them. On wide expressways, or where some degree of lane-use control is desirable, or where space is not available at the roadside, overhead signs are often necessary. Signs in any other locations ordinarily should be considered only as supplementary to signs in the normal locations. Under some circumstances signs may be placed on channelizing islands or (as on sharp curves to the right) on the left-hand shoulder of the road, directly in front of approaching

*Available from the Federal Highway Administration, (HTO-20), Washington, D.C. 20590.

vehicles. A supplementary sign located on the left of the roadway is often helpful on a multi-lane road where traffic in the right-hand lane may obstruct the view to the right.

Normally, signs should be individually erected on separate posts or mountings except where one sign supplements another or where route or directional signs must be grouped. In general, signs should be located to optimize nighttime visibility and minimize the effects of mud spatter and in conformance with safety factors related to fixed obstacles near the roadway. Signs should be located so that they do not obscure each other or are hidden from view by other roadside objects. Signs requiring different decisions by the vehicle operator must be spaced sufficiently far apart for the required decisions to be made safely. The spacing shall be determined in units of time as determined by the expected vehicle approach speed.

2A-22 Overhead Sign Installations

The operational requirements of our present highway system are such that overhead signs will have value at many locations. The factors justifying the erection of overhead sign displays are not definable in specific numerical terms, but the following conditions deserve consideration:

1. Traffic volume at or near capacity
2. Complex interchange design
3. Three or more lanes in each direction
4. Restricted sight distance
5. Closely spaced interchanges
6. Multi-lane exits
7. Large percentage of trucks
8. Street lighting background
9. High speed traffic
10. Consistency of sign message location through a series of interchanges
11. Insufficient space for ground mounted signs
12. Junction of an Interstate route with another freeway
13. Left exit ramps

The existence of any one or more of the conditions listed does not automatically justify the use of overhead signs. Some of the elements listed above can be made less critical by close coordination between design and operation.

2A-23 Height

The height requirements for ground installations on expressways vary somewhat from those on conventional streets and highways. Directional signs on expressways shall be erected with a minimum height of 7 feet (from the level of the near edge of the pavement to the bottom of the sign). If, however, a secondary sign is mounted below another sign, the major sign shall be at least 8 feet and the secondary sign at least 5 feet above the level of the pavement edge. All route markers and warning and regulatory signs on expressways shall be at least 6 feet above the level of the pavement edge. However, where signs are placed 30 feet or more from the edge of the nearest traffic lane for increased roadside safety, the height to the bottom of such signs may be 5 feet above the level of the pavement edge.

Overhead signs shall provide a vertical clearance of not less than 17 feet over the entire width of the pavement and shoulders except where a lesser vertical clearance is used for the design of other structures. The vertical clearance to overhead sign structures or supports need not be greater than 1 foot in excess of the

minimum design clearance of other structures. In special cases it may be necessary to reduce the clearance still further because of substandard dimensions in tunnels and other major structures such as double-deck bridges.

2F-2 Freeway Signing Principles

The development of a signing system for freeways must be approached on the premise that the signing is primarily for the benefit and direction of drivers who are not familiar with the route or area. The signing must furnish drivers with clear instructions for orderly progress to their destinations.

Sign installations are an integral part of the freeway facility and, as such, must be planned concurrently with the development of highway location and geometric design. Plans for signing must be analyzed during the earliest stages of preliminary design and details correlated as final design is developed.

APPENDIX B

TRAFFIC CONTROL DEVICES ON PRIVATE PROPERTY

The *Manual on Uniform Traffic Control Devices* (MUTCD) establishes the basic principles for the design and use of traffic control devices. State and local jurisdictions are required by law to comply with the provisions of the MUTCD. In Texas in the past, owners of private property were not required to comply with the MUTCD. Many airports in Texas have assumed that they were not required to comply because they were not governmental agencies. However, recent changes to the federal MUTCD may lead to changes in Texas law that requires all traffic control devices on all roads open to public travel, regardless of whether they are privately or publicly owned, to comply with the MUTCD. The change reinforces the language in the Uniform Vehicle Code relating to the use of traffic control devices on all roads open to public travel. In addition, the FAA has published an Advisory Circular that recommends that airports comply with the MUTCD. The pertinent language from all three of these documents are provided below. Emphasis has been added with underline to indicate the most important provisions.

FROM THE JANUARY 6, 1997 FEDERAL REGISTER

Vol. 62, No. 6, Page 1364, National Standards for Traffic Control Devices; Revision of the Manual on Uniform Traffic Control Devices; Final Rule

This document contains amendments to the MUTCD which have been adopted by the FHWA for inclusion therein. The MUTCD is incorporated by reference in 23 CFR Part 655, Subpart F and recognized as the national standard for traffic control devices on all public roads. The amendments affect various parts of the MUTCD and are intended to expedite traffic, improve safety and provide a more uniform application of highway signs, signals, and markings.

Request I-10(C)--Standardization of Traffic Control Devices on Private Property

This amendment to the MUTCD adds language to Section 1A-3 to encourage each State to adopt Section 15-117 of the Uniform Vehicle Code (UVC). This section of the UVC states that traffic control devices used on private property (e.g. shopping center, business complex or sports arena) open to the public shall be installed and maintained pursuant to the standards contained in the MUTCD. Although adoption of this amendment as a vehicle code is a State decision, we believe that it is in the interest of the public's safety that we strongly encourage the use of standard traffic control devices on private property open to public travel.

FROM THE UNIFORM VEHICLE CODE

Section 15-117 — Installation of traffic signs, signals, and markings on private property

No person shall install or maintain in any area of private property used by the public any sign, signal, marking, or other devices intended to regulate, warn, or guide traffic unless it conforms with the State manual and specifications adopted under Section 15-104.

Section 15-104 — (State highway commission) to adopt sign manual

1. The (State highway commission) shall adopt a manual and specifications for a uniform system of traffic control devices consistent with the provisions of this code for use upon highways within this State. Such uniform system shall correlate with, and so far as possible conform to, the system set

forth in the most recent edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways* and other standards issued or endorsed by the Federal Highway Administration.

2. The manual adopted pursuant to Subsection (a) shall have the force and effect of law.

FROM FEDERAL AVIATION ADMINISTRATION ADVISORY CIRCULAR

U.S. Department of Transportation, Federal Aviation Administration, Advisory Circular

Subject: AIRPORT SIGNING AND GRAPHICS

Date: 3/20/95

Initiated by: AAS-100

AC No: 150/5360-12A

Change:

1. **PURPOSE.** This advisory circular provides guidance on airport related signs and graphics.
2. **CANCELLATION.** Advisory Circular (AC) 150/5360-12, Airport Signing and Graphics, dated December 23, 1985 is canceled.
3. **BACKGROUND.** The American Association of Airport Executives, the Airports Council International - North America, the Air Transport Association of America, and the Airport Consultants Council have jointly published a manual "Guidelines for Airport Signing and Graphics" (latest revision July 1994). This publication is the result of research and development work by an Airport Signing and Graphics Task Force composed of members from these organizations, supported by professionals in the design community, sign manufacturers, the Society of Environmental Graphics Designers, the American Institute of Graphics Arts, the Institute of Transportation Engineers, the Institute of Transportation Studies, the Aerospace Industries Association of America, and the Federal Aviation Administration.
4. **GENERAL.** The industry manual includes chapters on signing philosophy, standard terminology, lettering styles, color coding, aviation symbols, arrow graphic applications, sign locations, material selections, and maintenance and repair procedures. Major elements from the Department of Transportation (DOT) Graphic Standards Manual (1981), developed by the American Institute of Graphic Arts, in cooperation with the DOT Office of Facilitation, have been included in the industry manual. The current edition of the industry manual now provides guidance on dynamic signing and an emphasis on signing for persons with disabilities.
5. **RECOMMENDATIONS.**
 - a. Use of "Guidelines for Airport Signing and Graphics" in designing airport terminal signing systems is recommended. At international airports, designers and airport authorities may also wish to consult the International Civil Aviation Organization (ICAO) Document 9430-C/1080, "International Signs to Provide Guidance to Persons at Airports (1984)," for assurance that information for international travelers is satisfactorily presented.
 - b. The preparation and location of signing for terminal related roadways and other thoroughfares should comply with the Federal Highway Administration's "Manual on Uniform Traffic Control Devices for Streets and Highways."
6. **HOW TO OBTAIN THE MATERIAL REFERRED TO IN THIS CIRCULAR.** The joint industry manual, the ICAO document, and the Federal Highway Administration publication may be obtained, respectively, as follows:
 - a. ATA Distribution Center; PO Box 511; Annapolis Junction, MD 20701. Telephone Numbers: 1-800-497-3326 (USA and Canada) or (301) 490-7951. FAX (301) 206-9789.
 - b. International Civil Aviation Organization (Attention: Distribution Office), Box 400; 1000 Sherbrooke Street West; Montreal, Quebec; Canada H3A 2R2.
 - c. Superintendent of Documents; U.S. Government Printing Office; Washington, DC 20402.

APPENDIX C

EVALUATION OF INDIVIDUAL DFW AIRPORT SIGNS

The sign evaluations were based on the photographs of airport guide signs on International Parkway taken in October and November, 1997 and presented in a supplement to this report. Each photograph is sequentially numbered. The signs are listed in northbound sequential order. Signs are listed together where two signs are essentially similar. Recommended signs are identified with the MUTCD label (i.e., R3-8U, E5-1).

NB Signs	NB Comment	SB Signs	SB Comment
1	Sign should use a U-turn regulatory sign (R3-8U) with distance (instead of Next Left) and No Trucks (instead of truck message in yellow portion) plaques.	41	Sign should use a U-turn regulatory sign (R3-8U) with distance (instead of Next Left) and No Trucks (instead of truck message in yellow portion) plaques.
2	If the travel information applies to American and American Eagle only, the "D/FW Travel Information" heading should be removed from the sign. If it applies to other airlines as well, the sign needs to indicate which additional airlines it applies to. Regardless, the top of the sign should read Gate Information.	7	If the travel information applies to American and American Eagle only, the sign is okay. If it also applies to Canadian, Grupo Taca, and Qantas airlines, or airlines in other terminals, those airlines should be added to the list. The sign does not say DFW Travel Information as it does in NB 2. It should read Gate Information.
3	The three signs in this photo should be rearranged. The first sign should be the U-turn warning sign with an advisory speed plate. It should be followed by the U-turn regulatory sign. An exit gore sign (E5-1) with U-TURN replacing EXIT should be used in the gore area. SLOW should not be used in signs. It has an ambiguous meaning.	42	See comments for NB 3.
4	NB 4, 5, and 9 are for the same exit. This sign should list Airfield Drive and Service Road as other exit destinations.	3	This sign should list Airfield Drive and Service Road as other exit destinations.
5	Most of these destinations are on Airfield Drive. Airfield Drive should be larger and followed by a TO and the destinations should be listed below in a smaller letter size. The sign should list all destinations on Airfield Drive. The service road exit information should be the same size as Airfield Drive. This should be an overhead sign as it is in SB 1	1	This sign should also indicate that it is the exit to Airfield Drive.
6	The only parking terms that appears in later signs are shuttle and reduced rate. The terminal exit signs do not indicate the location of infield and terminal parking. The recommendations suggest how parking terminology should be presented.	5	Same comments as NB 6.
---	---	6	This sign presents no guidance information. It should be moved to the very beginning of the airport where there is lower probability of information overload.
7	The airlines are not listed in alphabetical order and are not listed in single column for each terminal. There is no mention of terminal numbers.	8	Same comment as NB 7.

NB Signs	NB Comment	SB Signs	SB Comment
8	HERE is not necessary in the sign. Unless users are informed of the north shuttle lot at the south entrance, the SOUTH identifier is not needed.	---	---
9	This information should be included in the sign in NB 5.	---	See SB 4.
10	Destinations are not listed in the same order as they are in NB5. Post Office is not listed in NB5. Post Office does not need to have U.S. The same information should be presented in both NB and SB signs.	4	This sign does not contain the same information as the advance sign in SB 1. This should be an overhead sign. The same information should be presented in both NB and SB signs.
11	The Stop - Take Parking Ticket is a regulatory message and should be a black on white sign.	2	Same comment as NB 11.
12	Speed Limits signs should be mounted on a stand-alone post. Users will not see the Speed Limit sign if they are trying to get information from the larger overhead sign. This sign is probably not needed. If it is needed, a regulatory sign should be used.	---	---
13	This sign should be replaced with a Low Clearance sign (W13-2T).	8, 9	The clearance sign should be replaced with a Low Clearance sign (W13-2T).
14	The standard regulatory U-turn signs should be used (R3-8U) prior to the U-turn exit. The gas station sign should be moved beyond the U-turn exit. The Next Left should be replaced by a distance.	10	Same comments as NB 14.
15	Same comments as NB 12.	---	---
16	This is an important message but is provided only in this sign and NB 23. Only use of Left Exit terminology.	11	This is an important message but is provided only in this sign and SB 18. Only use of Left Exit terminology.
17	Sign needs to indicate that all passengers for American, American Eagle, Canadian, Grupo Taca, and Qantas airlines need to use the radio or cell phone to get gate information for correct exit. The top of the sign should read Gate Information. It is good that this information is repeated. Only the AA airlines are shown in the red box. Grupo Taca is missing from the sign.	12	Sign needs to indicate that all passengers for American, American Eagle, Canadian, Grupo Taca, and Qantas airlines need to use the radio or cell phone to get gate information for correct exit. The top of the sign should read Gate Information. It is good that this information is repeated. Only the AA airlines are shown in the red box.
18	Only the AA airlines are shown in the red box. Grupo Taca is missing from the sign.	13	Canadian, Qantas, and Grupo Taca are missing. They should be in the red portion of the sign.
19	South, West, and North have little meaning to the unfamiliar road user. The remote lots should be tied to the terminal that they serve.	14	Same comments as NB 19.
20	It is not clear that the mention of airlines only relates to the reduced rate parking for those airlines. Road users may think this indicates the exit for these airlines. Sign does not list Grand and Sun Jet airlines. Sign indicates that all rentals returns should exit here while SB 15 indicates that there are two rental car returns.	34	Sign does not indicate the names of airlines for the Reduced Rate Parking. It does not indicate the names of the rental car companies as SB 35 does. The sign is probably an advance exit sign and should use a distance instead of arrows.

NB Signs	NB Comment	SB Signs	SB Comment
21	Same comments as NB 20.	35	It is not clear that the mention of airlines only relates to the reduced rate parking for those airlines. Road users may think this indicates the exit for these airlines. Sign does not list Grand and Sun Jet airlines.
22	It is not clear that the mention of airlines only relates to the reduced rate parking for those airlines. Road users may think this indicates the exit for these airlines. The check-in note on a red background implies this is the red terminal. This is the first mention of Grupo Taca for the red terminals.	31	It is not clear that the mention of airlines only relates to the reduced rate parking for those airlines. Road users may think this indicates the exit for these airlines. The check-in note on a red background implies this is the red terminal.
23	The All Exits signs can be interpreted to mean the lane for exiting from the airport and not that all exits to terminals are from the left lane.	18	Same comment as NB 23.
24	It is not clear that the mention of airlines only relates to the reduced rate parking for those airlines. Mention of airline names here implies this is the terminal exit for these airlines. The check-in note on a red background implies this is the red terminal.	32	Same comment as NB 24.
---	---	33	This sign does not include the airline association that was present in SB 31 and SB 32. Therefore, road users may not associate this sign with the previous signs.
25	This is the first mention of a terminal number (4E) in a NB sign. Airlines should be listed one below the other in alphabetical order.	29	The listing of airlines one below the other is desirable for drivers. However, they should be in alphabetical order. The terminal number is on top within a blue color code. This is different than the use of the terminal number in the signs for the other airlines.
26	Same comments as NB 25.	30	Airlines should be listed one below the other in alphabetical order as it is in SB 29.
27	It is not clear whether the Hyatt Hotel West and the U-turn are separate exits or the same.	---	---
---	---	25	SB 28 implies that there is a different exit for the Hyatt West.
28	The use of distances to exits is good. This practice is not followed in signs for the other exits. This sign does not mention the other airlines that are located in these terminals. It also implies that American Eagle is located in both terminals. The terminal number is not used in this sign.	---	---
29	What happened to the U-turn?	---	---
30	The large signs should be removed if they are not used. The terminal number is on the bottom of the sign. This sign does not mention the other four airlines that use this terminal.	24	Same comment as NB 30.
31	Same comment as NB 30.	26	Same comment as NB 30.

NB Signs	NB Comment	SB Signs	SB Comment
32	Hotel name should not be color coded as it is not part of the terminal. Terminal number is on bottom, where in NB23, it is on top. The terminal number is not color coded as it was in NB23. Canadian and Qantas are missing from the sign. The terminal number is on the bottom of the sign.	---	---
---	---	27	The bottom half of the sign should be separated by a horizontal white line. The West can be assumed to apply to Hyatt Hotel West or West Reduced Rate Parking. Black on red provides poor legibility due to poor contrast. The letter size of the Reduced Rate Parking is too small. Due to the different color and letter size, road users will assume the West applies to the hotel.
33	First sign - Canadian and Qantas should also be in the red portion of the sign. Grupo Taca is missing from the sign. The terminal number is not presented in the sign. Second sign - Canadian and Qantas are missing. The terminal number is on bottom.	---	---
34	Should not be using abbreviations for Midwest Express. Different airlines should not be combined together (Lone Star/Aspen, Northwest/KLM, United/SAS). If a driver is looking for KLM, they would not see it unless they knew it was associated with Northwest. Terminal number is on bottom, where in NB23, it is on top. The terminal number is not color coded as it was in NB23.	20	Same comments as NB 34.
---	---	23	Road users may interpret this sign to indicate the terminal for all airlines. This sign should have an up diagonal arrow.
35	Same comments as NB 34.	22	Same comments as NB 34.
36	Same comments as NB 30.	16	Same comment as NB 30.
37	Same comments as NB 30.	17	Same comment as NB 30.
---	---	18	Canadian, Qantas, and Grupo Taca are not in the sign. They should be in the red area. The West Reduced Rate Parking is not associated with an airline as it is in NB 22.
38	Terminal number is on the bottom. Qantas Airline may be overlooked by road users because it is on the right side of the sign. Grupo Taca is missing from the sign.	19, 21	Letter size for Canadian, Qantas, and Grupo Taca is too small. They should be listed one below the other. Terminal number should be on the top of the sign. SB 19, and SB 21 should not be the same. The sign with the diagonal arrow should be located at the exit ramp. The advance sign should indicate the distance to the exit, not have an diagonal up arrow.
39	Canadian and Qantas are missing from the sign.. Terminal number is on the bottom. This sign, with the down arrow, should come before NB 38, with the up diagonal arrow and should have a distance.	---	---

NB Signs	NB Comment	SB Signs	SB Comment
40	Reduced rate parking is not associated with Terminal 2W as it is in NB 41. Rental car companies are not shown in the sign. Both this sign and NB 41 use diagonal arrows, although this sign is probably the advance sign.	---	---
41	Only the terminal number is shown for the parking area. Airlines and terminal color are not used. This requires the user to know the terminal numbers, which have not been emphasized in previous signs.	15	The sign does not associate the parking area with Terminal 2W as NB 41 does.
42	First mention of airport exit information. Reduce Speed is a regulatory message and should be in a regulatory sign. Sign should show distance instead of using Ahead.	36	First mention of airport exit information. South Airport Exit should all be on one line. Bear Creek Center should all be on one line. Reduce Speed is a regulatory message and should be in a regulatory sign. Sign should show distance instead of using Ahead.
43	The is a regulatory message and should be in a black on white regulatory sign. Ahead is an unnecessary message.	37	Same comment as NB 43
44	This is a regulatory message and should be on a white sign.	38	Same comment as NB 44.
45	This sign implies that the exit is for the gas station only and not the U-turn.	39	Same comment as NB 45.
46	These signs are using the wrong route markers. The ones in the sign are for independent mounting. They should be route markers for guide sign mounting.	40	This sign is good if it is followed by later signs that identify which highways go to Fort Worth and Dallas as NB 46 does.

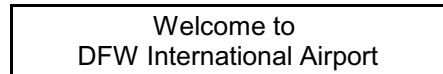
APPENDIX D

RECOMMENDED DFW AIRPORT SIGNING

The following present the recommended sequence of guide signs that should be presented on International Parkway at the DFW Airport to meet the information needs of road users. The following sign illustrations are intended to indicate the information that should be considered for each type of sign. These illustrations are not intended to be representative of the actual layout of any guide signs.

Sign #1 - Airport Identification

Location: Airport boundary



Note: Ground-mounted sign.

Sign #2 - Airline Traveler General Information

Location: 4000 feet before Airfield Drive exit gore

Satellite Parking	C/d
Rental Car Return	2 C/d
Remote Parking	2 C/d - 4 C/d
Terminal Areas	3 A/d - 4 A/d

Notes: Overhead sign bridge.

Sign #3 - Specific Information for Airline Travelers

Location: 3000 feet before Airfield Drive exit gore

<table style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="4" style="text-align: center; border-bottom: 1px solid black;">ALL AIRLINE TERMINALS</th> </tr> <tr> <td style="text-align: center; border-right: 1px solid black; padding: 5px;">Terminal</td> <td colspan="2" style="text-align: center; border-right: 1px solid black; padding: 5px;">Terminals</td> <td style="text-align: center; padding: 5px;">Terminal</td> </tr> <tr> <td style="text-align: center; border: 1px solid black; font-size: 2em; font-weight: bold;">H</td> <td style="text-align: center; border: 1px solid black; font-size: 2em; font-weight: bold;">D</td> <td style="text-align: center; border: 1px solid black; font-size: 2em; font-weight: bold;">F</td> <td style="text-align: center; border: 1px solid black; font-size: 2em; font-weight: bold;">C</td> </tr> <tr> <td style="padding: 5px;">ASA Aeromexico Delta Grand Sun Jet</td> <td style="padding: 5px;">American American Eagle Canadian Grupo Taca Qantas</td> <td colspan="2" style="padding: 5px;">All Other Airlines</td> </tr> <tr> <td style="text-align: center; padding: 5px;">Terminal Parking</td> <td colspan="2" style="text-align: center; padding: 5px;">Terminal Parking</td> <td style="text-align: center; padding: 5px;">Terminal Parking</td> </tr> <tr> <td colspan="4" style="text-align: center; padding: 10px;">LEFT 3 LANES</td> </tr> </table>	ALL AIRLINE TERMINALS				Terminal	Terminals		Terminal	H	D	F	C	ASA Aeromexico Delta Grand Sun Jet	American American Eagle Canadian Grupo Taca Qantas	All Other Airlines		Terminal Parking	Terminal Parking		Terminal Parking	LEFT 3 LANES				<p style="font-size: 1.2em; font-weight: bold;">RENTAL CAR RETURN</p> <p>Avis Budget Hertz National</p> <p style="font-weight: bold;">LEFT 3 LANES</p>	<p style="font-size: 1.2em; font-weight: bold;">PARKING</p> <p>Satellite NEXT RIGHT</p> <p>Remote 2 A/d</p> <p>Terminal 2 C/d</p>
ALL AIRLINE TERMINALS																										
Terminal	Terminals		Terminal																							
H	D	F	C																							
ASA Aeromexico Delta Grand Sun Jet	American American Eagle Canadian Grupo Taca Qantas	All Other Airlines																								
Terminal Parking	Terminal Parking		Terminal Parking																							
LEFT 3 LANES																										

Notes: Overhead sign bridge.
Left exit panels are black on yellow.

Sign #4 - Non-Airline Traveler Information

Location: 2500 feet before Airfield Drive exit gore

Satellite Parking	A/b
Service Road	A/b
Airfield Drive	A/b

Notes: Overhead cantilever sign on right side.
List airline related information first, if any.


Sign #5 - Advance Exit Information for Non-Airline Traffic

Location: Beginning 2000 feet from Airfield Drive exit gore

<p>Airfield Drive</p> <p>TO Airport Administration Airport Public Safety Golf Course GTE SimuFlite Center West Air Cargo</p> <p>EXIT A/d MILE</p>	<p>Service Road</p> <p>TO DFW Business Center FAA Visitors General Aviation Post Office</p> <p>EXIT A/d MILE</p>	<p>Satellite Parking</p> <p>For All Airlines</p> <p>EXIT A/d MILE</p>
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Notes: Ground-mounted sign on right side.
Should be three separate signs. Signs must be at least 300 feet apart.
Road names should use taller letters than destinations.
Extra space should be provided on signs to accommodate future destinations.

Sign #6 - Airfield Drive Exit Directional Sign

<p>All Terminals</p> <p>Rental Car Return</p> <p>Remote Parking</p> <p>↓ ↓ ↓</p>	<p>Satellite Parking</p> <p>Service Road </p> <p>Airfield Drive</p>
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Notes: Overhead sign bridge.

Sign #7 - Repeat Airline Terminal Information

Location: After Airfield Drive exit gore and before Airfield Drive structure

Alternative Location: On the Airfield Drive bridge structure

ALL AIRLINE TERMINALS			RENTAL CAR RETURN Avis Budget Hertz National 1 C/d MILES LEFT EXIT	PARKING Remote Parking 2 MILES LEFT EXIT
Terminal H	Terminals D F	Terminal C		
ASA Aeromexico Delta Grand Sun Jet Terminal Parking 2 MILES	American American Eagle Canadian Grupo Taca Qantas Terminal Parking 2 A/b MILES 3 MILES	All Other Airlines Terminal Parking 2 C/d MILES	LEFT EXITS	

Notes:

Overhead sign bridge.

Left exit panels are black on yellow.

Sign #8 - Gate Information for Terminals R and W

Location: After gas station and prior to Remote Parking South

Terminals	Gate Information
R F	Departures 1640 AM Arrivals 1680 AM Cellular #AA

Note:

If gate information is provided for airlines other than American and American Eagle, those airlines should also be listed in the sign.

Sign #9 - List of Terminal G Airlines

Location: After gas station and prior to Terminal B

Terminal C Airlines		
Air Canada AirTran American West Aspen British Airways Continental KLM	Korean Air Lone Star Lufthansa Midwest Express Northwest SAS	Sun Country TWA United US Airways Vanguard Western Pacific
X MILES LEFT EXIT		

Notes: Airlines should be listed in alphabetical order.
 Only 1 airline per line. Partner airlines should be listed separately to ease driver search patterns.
 Additional space should be provided to accommodate future airline additions.

Sign #10 - Remote Parking and Rental Car Return Advance Exit Sign

Location: Quarter mile before exit.

Terminal	H	Remote Parking
Rental Car Return		
↖	A/d MILE	
LEFT EXIT		

Notes: Left exit panel is black on yellow.

Sign #11 - Remote Parking and Rental Car Return Exit Direction Sign

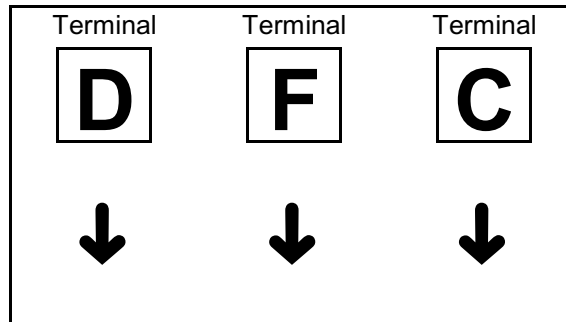
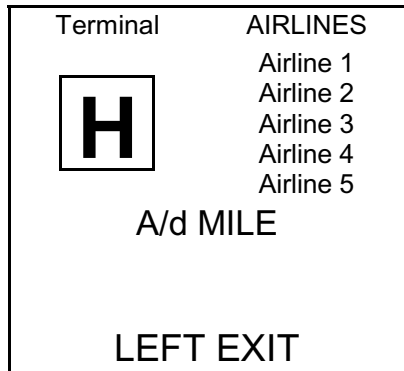
Location: At exit gore.

↖	Remote Parking for Terminal B	H
Rental Car Return		

ALL AIRLINE TERMINALS			
H	D	F	C
↓	↓	↓	↓

Typical Airline Terminal Advance Exit Sign

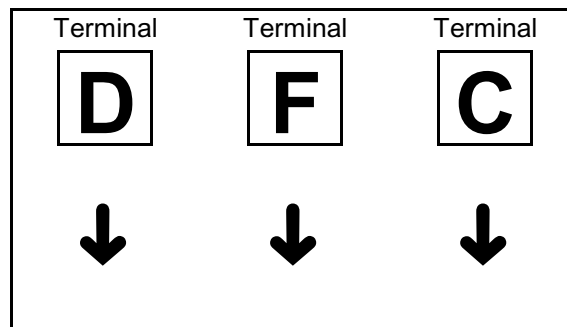
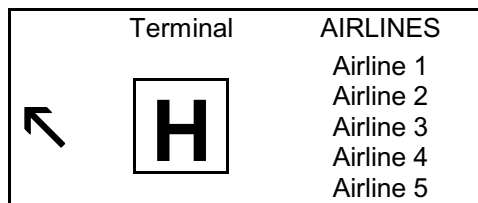
Location: Quarter mile from exit gore.



Notes: Overhead sign bridge.
LEFT EXIT panel is black on yellow.

Sign Airline Exit Direction Sign

Location: At terminal exit gore



Notes: Overhead sign bridge.
LEFT EXIT panel is black on yellow.

Typical Airport Exit Sign

Location: At periodic intervals on International Parkway on the right side of the road.



Notes: It may be desirable to indicate the difference between the north and south exits, although this is not necessary.