

**DEVELOPMENT OF STANDARD SIGNING FOR  
TYPICAL HIGH-OCCUPANCY VEHICLE ENTRANCES**

Prepared for

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## **SUMMARY**

There is little research addressing the information requirements of motorists interacting with HOV facilities. As a result, signing for HOV facilities is developed on a project-by-project basis. Recently, the Texas Transportation Institute studied these information requirements. As a result of that research, the Metropolitan Transit Authority of Harris County requested that TTI develop signage which will be directly applicable to a typical transitway.

This report suggest proposed signing layouts for two typical HOV entrances in Houston and addresses some of the key issues related to HOV signing. The proposed signing layouts are based on previous research, signing practices used by other HOV agencies in the United States, and the application of MUTCD signing principles.

The report identifies HOV signing issues as they relate to the facility name, the Manual on Uniform Traffic Control Devices (MUTCD), sign classifications, guide signing, the diamond symbol, sign legend, sign mounting, information requirements, changeable message signs, sign clutter, and HOV education. The report also describes the signing principles used as a basis in developing the proposed signing, and several suggested changes in the MUTCD related to HOV signing.

## **DISCLAIMER**

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration, the Texas State Department of Highways and Public Transportation, or the Metropolitan Transit Authority of Harris County. This report does not constitute a standard, specification, or regulation.



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## **INTRODUCTION**

Throughout the course of automobile transportation history, drivers have had to adopt to new and changing technologies. Concepts such as signing, traffic signals, and freeways have all had to be explained to drivers and the general public. In the future, the public will have to be educated about vehicular automation. But in today's world, one of the challenges facing transportation professionals is educating the public about HOV facilities.

High-occupancy vehicles (HOV) have become an attractive alternative for increasing freeway corridor capacity and improving the ability to move commuters through congested corridors during peak periods. The use of the HOV concept began in the United States during the 1970's. At the present time, a number of major urban areas are using HOV's to help meet commuter demands. However, HOV technology is relatively new to the transportation field, and has not developed national standards for design and operations. The success of the HOV commitment is partially dependant on developing standards for design and operations of HOVs. The motorist information system is a critical component of HOV operations.

Introducing new technology to an uneducated or unfamiliar group is at best, a difficult proposition. Even after HOV facilities are completed and in operation, many motorists do not have a thorough understanding of their purpose and the guidelines for its use. Often times, education comes only with the presence of flashing lights behind a vehicle in violation of the operating requirements.

By their nature, HOV facilities are complicated. Limitations on hours of use, vehicle types, and vehicle occupancy all require transmitting information to not only the HOV users, but also the motorists who interact with the HOV users. The media can only go so far in informing the public about HOV facilities. The brunt of the responsibility falls on the shoulders of the transportation professional who must provide the needed information in the field and see that drivers receive the proper education about the operation of HOV facilities.

Fulfilling these responsibilities presents some major hurdles. Like many new concepts, HOV facilities are still in their infancy. Experience is restricted to a few locations, and is limited in breadth. There is no national standard for the design and operation of these facilities, leading to the development of different practices in different cities, and even on different facilities within the same city. The HOV user who feels comfortable on a Houston HOV lane may be thoroughly confused if placed on the Shirley HOV lane outside Washington, D.C. The focal point of this confusion lies in the use of signing. Signing is the key to transmitting the needed information to motorists.

This report suggest proposed signing layouts for two typical HOV entrances in Houston and addresses some of the key issues related to HOV signing. The proposed signing layouts are based on previous research, signing practices used by other HOV agencies in the United States, and the application of MUTCD signing principles. They are not intended to represent a standard, specification, or regulation.



## **STUDY BACKGROUND**

There is little research addressing the information requirements of motorists interacting with HOV facilities. As a result, signing for HOV facilities is developed on a project-by-project basis. Recently, the Texas Transportation Institute (TTI) studied these information requirements. The research effort was sponsored by the Texas State Department of Highways and Public Transportation (SDHPT) and the report resulting from this study is entitled "Evaluation of Motorist Information Requirements for Transitways (1)."

The Metropolitan Transit Authority of Harris County (METRO) received a copy of this report and, after review, requested that TTI expand the results of the study and develop signage which will be directly applicable to a typical transitway. The METRO work plan had the following objectives.

- Develop typical signage for a high-speed freeway entrance and low-speed arterial entrance to a transitway.
- Include signs for speed limit restrictions, vehicle restrictions, occupancy requirements, regulatory signing, lane control signal designations, and transitway operating hours. Signing will concentrate on informational requirements of users desiring to enter the transitway.
- Include special operating instructions required by transitway motorists.
- Prepare a draft report to document the findings of the study. The signing layouts will be illustrated in separate drawings detailing signing and placement.

This report is the result of the METRO work order and describes the signing proposed for use on two typical transitway entrances, the philosophy behind selecting the signs, and other concerns related to meeting the transitway motorists informational requirements.



## HOV SIGNING THEORY

HOV signing is unique, and effective signing is difficult to provide due to the fact that it has specialized information requirements and is located within a parallel facility (normally a freeway) which possesses its own information requirements. In addition, HOV facilities are new to society and only exist in a few major urban areas. The following paragraphs describe some of the dilemmas associated with HOV signing.

### Facility Name

Various names have been used to describe the different types of HOV facilities. The TTI study (1) report described a laboratory study which found that "Authorized Vehicle Lane" and "High Occupancy Vehicle Lane" were the preferred names of those participating in the survey. Both of these names have been used in Houston, Texas. The term "Transitway" had an acceptance level approximately half of the two terms mentioned. A Virginia DOT study (2) found that virtually everyone on the I-66 HOV facility understood the "HOV" abbreviation. However, surveys indicated that a large percentage favored the inclusion of the term "Carpool" in HOV signs. A report for the Orange County Transit District (3) uses the term HOV in its technical publications, but uses the terms "Buses and Carpools" and "Transitway" in its signing.

This study uses HOV to describe the facility. The reasons for using HOV are:

- The HOV term is used across the nation more than any other term to describe facilities which accommodate carpools, vanpools, buses, or any combination of these vehicle types.
- The HOV abbreviation is short enough to be used in signing. A three letter word requires less space than longer descriptions and, more importantly, requires less time to comprehend.
- The HOV abbreviation can be combined with occupancy requirements (i.e. HOV-3 or HOV-2+) to provide an indication of occupancy requirements of the facility.

## Manual on Uniform Traffic Control Devices Requirements

The term HOV does not appear in the 1988 national Manual on Uniform Traffic Control Devices (MUTCD) (4). Instead, the MUTCD addresses traffic control devices for HOVs in two sections (Section 2B-20, Preferential Lane Signing and Section 3B-22, Preferential Lane Markings). These sections were approved for inclusion in the MUTCD in 1974 and have been amended once in 1985. The MUTCD refers to HOV facilities as "Preferential or Restricted Lanes." The signing section defines a preferential lane as "*lanes where usage is limited according to class of vehicle occupancy.*" However, the section on preferential lane pavement markings defines a preferential lane as a lane assigned full or part time to a particular class or classes of vehicles. The Texas MUTCD contains the same preferential lane sections as the national Manual. However, the 1980 Texas MUTCD edition does not include the 1985 revisions.

### HOV Sign Classifications

The MUTCD identifies three general sign classes -- regulatory, warning, and guide signs. In general, regulatory signs give notice of traffic laws or regulations, warning signs call attention to conditions that are potentially hazardous to traffic operations, and guide signs show route designations, destinations, directions, distances, and other general information.

All signs proposed in this study are classified into one of these three categories according to the intent of the sign message. The signs are then designed according to the guidelines of that classification. However, the lack of broad HOV signing guidelines in the MUTCD permits some allowance in developing HOV signs.

### HOV Guide Signing

The MUTCD does not address the use of guide signs with HOV facilities. However, in 1984, the FHWA solicited comments from the National Committee on Uniform Traffic Control Devices (NC) on specific proposed changes. One of these changes included

language relative to guide signs placed over preferential lanes. This specific proposal was not adopted due to the NC's position that the proposal went beyond what was necessary. Guide signs were already covered in the MUTCD, and need not be additionally addressed in the Preferential Lane section (5). This action can be interpreted to imply that HOV guide signing should utilize a white legend on a green background, with the diamond symbol used to identify the sign as an HOV sign.

The white on green HOV guide sign is used in the United States, as is the black on white HOV guide sign. The basis for the black on white sign is found in the preferential lane signing section which states: *"Signing for these lanes should follow the standard regulatory signing principles: black legend on white background, rectangular shape, and reflectorized or illuminated if applicable during periods of reduced visibility."* This issue in question revolves around whether the word "regulatory" is an implied first word in the sentence, as this section appears in the regulatory signs part of the MUTCD.

#### Diamond Symbol

The MUTCD states that the diamond lane marking symbol used to designate preferential lanes should be incorporated in the body of the signs, as a white symbol on a black background. Unfortunately, the MUTCD also states that the diamond symbol should be used with preferential bicycle lanes. As a result, the diamond symbol is not reserved solely for use on HOV lanes.

#### Sign Legend

The legend of the sign is the major communicative device of the sign. HOV facilities are designed to operate at high speed and require sign legends which can be easily and quickly comprehended. Therefore, signs should have a minimal legend. Multiple signs are preferable to signs with a large amounts of information.

## Sign Mounting

The TTI report (1) and the Orange County Transit District report (3) both identify potential confusion between HOV and general use signs. Both recommend using an overhead location for HOV signs whenever possible to eliminate confusion to nearby general use lanes.

## HOV Information Requirements

The TTI (1) and Orange County (3) reports identify the primary information needs of HOV signs. The two conditions which are needed by all potential HOV users are:

- Is the HOV facility open for use?
- Who is eligible to use the HOV facility? (Particularly important if occupancy requirements are not constant throughout the day.)

HOV facility status at an entry point is provided by signing and barricades. Changeable message signs (CMS) should clearly state if it is open or closed. When closed, barricades should be used to form a physical obstruction to entry. Lane-use signals are used to convey the status of the facility once within it.

HOV eligibility is defined by vehicle type and minimum occupancy. In some cases, the occupancy requirements may change with time. In these cases, CMS should be used to identify the occupancy requirement in advance of the entrance.

In addition to the above mentioned primary information requirements, other information is useful to HOV users. It includes:

- How to use the HOV facility.
- What to do in case of an accident or blockage.
- Existing traffic conditions on the facility.
- Scheduled activities that might require the HOV facility to be closed.

- Rideshare or other user information.

This information can be displayed with CMS signs near the entrance or with other signing located downstream of the entrance. This information should not be located upstream of the entrance, unless that upstream location is critical to HOV operation.

### Changeable Message Signs

Changeable message signs can be used to provide variable information to HOV motorists. CMS can be classified into two groups: those CMS that have the appearance of a standard sign, but in which all or a part of the message can be changed, and the electronic, dot matrix CMS which can display any message.

The issues associated with the use of CMS include the following:

- The appearance of the CMS during power outages (blank or with a message).
- The default message of the CMS during power outages.
- The enforceability of dot matrix CMS.

The standard appearance CMS utilized flip panels to change the sign legend. These signs have been used in a variety of applications in the United States, both on HOV and non-HOV facilities. Flexibility of these signs are limited, as they typically can display only two alternate legends. They can be operated in such a way that the legend can be manually changed during power outages. The size and cost of these signs are much lower than dot matrix CMS.

Dot matrix CMS are utilized in several HOV-freeway corridors in the United States. These signs are normally used to provide information to drivers, and not as regulatory signs. Virginia determined that regulatory CMS should be white discs on a black background. However, due to visibility reasons, they have now changed to yellow discs on black. Apparently, the legality of this message has not been tested. The size and cost

of these signs restrict the use of these signs. Traffic speeds in these corridors require that the message be short and easily read.

#### Sign Clutter at Entry Locations

Care should be taken not to overload the HOV user with information prior to gaining access to the facility. Studies have shown that motorists ignore information beyond a certain comprehension level. Therefore, signs should be located in minimum conflict areas where the motorist can devote attention to the sign message. Signs which do not address the two primary information requirements should not be placed at the entrance, if possible. These signs can be placed downstream of the entrance after the HOV motorist has negotiated the entry maneuver and relaxed.

#### HOV Education

The proper use of HOV facilities is dependant on the education of motorists who come in contact with these facilities. The Virginia study (2) showed that most motorists received the needed HOV information from direct contact with the facility. This finding indicates that all HOV information should be provided in the field. Restrictions on HOV use must clearly and concisely be stated at and in advance of the entrance.

Obviously, HOV publicity is desirable in order to make the concept well understood by the public. It requires a long term commitment and efforts to reach all drivers. The TTI report (1) suggested the inclusion of HOV concepts in the Texas Driver Manual. An alternative would be to provide an HOV brochure to all drivers when they renew their drivers license.



## HOV SIGNING PRINCIPLES USED IN THIS STUDY

In developing the proposed signing for this study, several basic signing assumptions were made to provide consistency with the MUTCD and national HOV practice. In some cases, the proposed signing represents a departure from Houston HOV signing practice. The assumptions used in developing the signing are listed below, along with the basis for the assumptions.

- **The HOV abbreviation and diamond symbol (in upper left corner) are used at the top of all signs to identify the sign as applicable to the HOV lane.** An alternative would be to include only the diamond symbol. These identification measures are taken to reduce confusion between HOV signing and signing for other facilities.
- **Speed limits signs are located at the edge of the HOV lane.** In theory, HOV speed limit signs are preferably located over the HOV lane to reduce confusion with the adjacent freeway. However, the overhead location conflicts with current practice for locating speed limit signs, although overhead speed limit signs have been used in Texas to a limited extent.
- **The term "BUSES VANS CARS" is used to describe vehicles which are eligible to use the HOV facility.** Alternatives to this term include "BUSES CARS", "BUSES VANPOOLS CARPOOLS", or "BUSES CARPOOLS". Many different terms can be, and are, used to describe vehicles in the HOV lane. Other terms may be substituted as desired.
- **Occupancy requirements are identified by the phrase "2 OR MORE OCCUPANTS ONLY".** Obviously, any occupancy level could be used. It is proposed that the part of the sign providing the occupancy number be a changeable message. Also, the term "OCCUPANTS" could be replaced with "RIDERS" or "PERSONS".
- **This study uses the term entrance to describe all access points where a vehicle enters the HOV lane, even when leaving or exiting the freeway or street to do so.** The point at which a vehicle gains access to the HOV lane can

be described as either an HOV entrance or a freeway exit. Entrance is used to provide consistency in application.

- **All speed limits, ramp exit speed, HOV periods of operation, and other similar constraints are shown for illustrative purposes only and are not to be construed as recommended values.** This study proposed HOV signing for several typical access points. The application of the proposed signing contained in this report should be adopted to the particulars of the situation.

It should be noted that the proposed signing shown in this report should be reviewed by the appropriate agencies prior to implementation. Future editions of the MUTCD may address HOV signing in greater detail and eliminate some of the confusion surrounding this issue. In the meantime, the most appropriate signing schemes can be determined only with input and agreement from a variety of agencies.

## **FUTURE RESEARCH NEEDS**

The subject of HOV signing is still in its infancy and requires much more research before standardization and consistency will be acquired. The research should attempt to resolve, on a national basis, the issues previously discussed. Many of the issues could be resolved by minor changes in the MUTCD. Suggested MUTCD changes are listed below. Additional research would likely identify other changes which would be appropriate.

- Change the identification term from "preferential lane" to "HOV lane".
- Identify appropriate name terms (such a HOV lane, commuter lane, transitway) for use in signing.
- Reserve the diamond symbol exclusively for use on HOV facilities.
- Add the word "regulatory" at the beginning of the fourth sentence of Section 2B-20, Preferential Lane Signing.
- Add language to the effect that HOV regulatory signs are those signs that impose a restriction on use. Other sign messages should follow the appropriate signing guidelines (such as warning and guide signs).
- Address the use of pavement markings in reversible HOV lanes and as buffers for HOV lanes.
- Allow all HOV related signs to be placed over the HOV lane, whenever practical.
- Include a typical HOV signing layout which addresses vehicle and occupancy restriction, guide signing, standard regulatory signs, and standard warning signs.



## **HIGH SPEED SLIP RAMP HOV ENTRANCE**

The typical high speed HOV entrance consist of two slip ramps in close proximity for entry and exit access. The particular layout used in this study is the Gessner slip ramps on the Katy Freeway Transitway in Houston, Texas.

### **General Description of Study Area**

The HOV lane is located in the center of the I-10 Katy Freeway. It is a one-lane reversible HOV facility. The HOV lane travels eastbound (inbound) to the CBD in the morning and westbound (outbound) in the evening. The stationing increases in a westerly direction. The entry slip ramp is located at station 321 and can only be accessed during the morning operation. The exit slip ramp is located at station 329, to the west of the entry point. The exit slip ramp is used only during the evening operation.

### **Morning Inbound HOV Signing**

Appendix A - AM describes each of the signs proposed for use near a typical slip ramp entrance for the morning or inbound operation. For each sign information is provided about the location, mount, classification, legend, and rationale behind the sign location. Sign color is indicated by the letter of the legend color followed by the background color (i.e. B/W is black legend on white background). Signs for the morning HOV operation are labeled with a capital letter.

### **Evening Outbound HOV Signing**

Appendix A - PM describes each of the signs proposed for use near a typical slip ramp entrance for the evening or outbound operation. For each sign information is provided about the location, mount, classification, legend, and rationale behind the sign location. Sign color is indicated by the letter of the legend color followed by the background color (i.e. B/W is black legend on white background). Signs for the evening HOV operation are labeled with a small letter.



## **LOW SPEED ARTERIAL HOV ENTRANCE**

The typical low speed HOV entrance consist of some type of ramp which connects the HOV lane to an arterial street, frontage road, or HOV terminal. The particular layout used in this study is the elevated "T" ramp located near State Highway 6 on the Katy Freeway Transitway in Houston, Texas.

### **General Description of Study Area**

The HOV lane is located in the center of the I-10 Katy Freeway. It is a one-lane reversible HOV facility. The HOV lane travels eastbound (inbound) to the CBD in the morning and westbound (outbound) in the evening. The stationing increases in a westerly direction. Access to the HOV lane is provided in this vicinity by an elevated ramp. The ramp connects an elevated portion of the HOV lane to a Park and Ride facility outside the freeway rights-of-way. The HOV access is located at station 642. Approximately one mile to the west of this access point is the terminal of the HOV lane. The elevated ramp is reversible, carrying traffic from the Park and Ride lot to the HOV lane in the morning and vice versa in the evening.

### **Morning Inbound HOV Signing**

Appendix B - AM describes each of the signs proposed for use near a typical arterial HOV entrance for the morning or inbound operation. For each sign information is provided about the location, mount, classification, legend, and rationale behind the sign location. Sign color is indicated by the letter of the legend color followed by the background color (i.e. B/W is black legend on white background). Signs for the morning HOV operation are labeled with a capital letter.

### **Evening Outbound HOV Signing**

Appendix B - PM describes each of the signs proposed for use near a typical arterial HOV entrance for the evening or outbound operation. For each sign information is

provided about the location, mount, classification, legend, and rationale behind the sign location. Sign color is indicated by the letter of the legend color followed by the background color (i.e. B/W is black legend on white background). Signs for the evening HOV operation are labeled with a small letter.

#### Arterial Connection HOV Signing

Appendix C describes the signs proposed for use on the ramp connection between the arterial and the HOV lane. Signs applicable to both the morning (inbound) and evening (outbound) operation are described. For each sign, information is provided about the mount, classification, legend, and rationale behind the sign location. Sign color is indicated by the letter of the legend color followed by the background color (i.e. B/W is black legend on white background). The operational period for the sign is indicated by a capital letter for morning operation and a small letter for evening operation. The location of these signs are not provided in this report as the location is very dependant on the local geometry. Additionally, sign location is not as critical on the HOV connection as the speeds are significantly lower. However, a distance of at least 5 seconds should be provided between signs.

The layout of signs on the arterial approach and connection to the HOV lane is largely dependant on the geometrics of the approach. The needed information should be visible to vehicles approaching from all directions. This may not always be practical however. Multiple signs on several approaches may confuse drivers and lead to inefficient operation of the HOV lane. Therefore, it is desirable to locate critical signs so that they will be viewed on the connection to the HOV lane. HOV guide signs can then be used to direct vehicles from the arterial approaches to the HOV connection. This requires including an escape ramp for those drivers on the HOV connection who find they are not eligible for HOV use. The escape ramp signing format is used in this report.



## REFERENCES

1. Hawkins, H.G., Mounce, J.M., Albert, S., Evaluation of Motorist Information Requirements for Transitways. Texas State Department of Highways and Public Transportation, Research Report 1113-1F, 1989
2. Perfater, M.A., Final Report -- Motorist's Impression of the HOV Signs on I-66. Virginia Highway and Transportation Research Council, 1984
3. Parsons, Brinckerhoff Quade & Douglass, Inc., Orange County Transitway Concept Design, "Working Paper No. C.8 Communications, Signage, and Passenger/User Information System". Orange County Transit District, 1988.
4. Federal Highway Administration, Manual on Uniform Traffic Control Devices for Streets and Highways, 1988.
5. Robinson, Jim, Background on Signing and Markings for HOV Lanes, Prepared for ITE Committee 5C-11, April 1989.



**APPENDIX A - AM**

**PROPOSED HOV SIGNAGE FOR**

**HIGH SPEED SLIP RAMP HOV ENTRANCE**



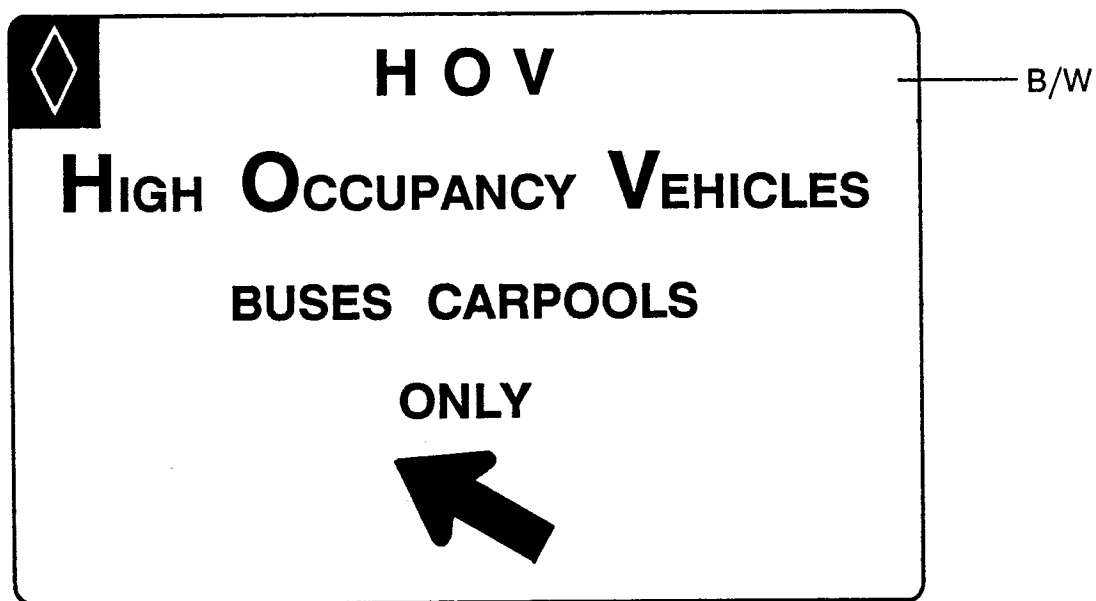
**SIGN A**

**LOCATION:** HOV Freeway Entrance Ramp

**MOUNT:** Double Post Mount in Outer Separation

**TYPE:** Regulatory

**COMMENTS:** Larger size letters are used in the term "High Occupancy Vehicle to enhance motorists understanding of the HOV abbreviation. The minimum occupancy requirement is not necessary on this sign as it is not critical to the operation of the HOV facility.



**SIGN B**

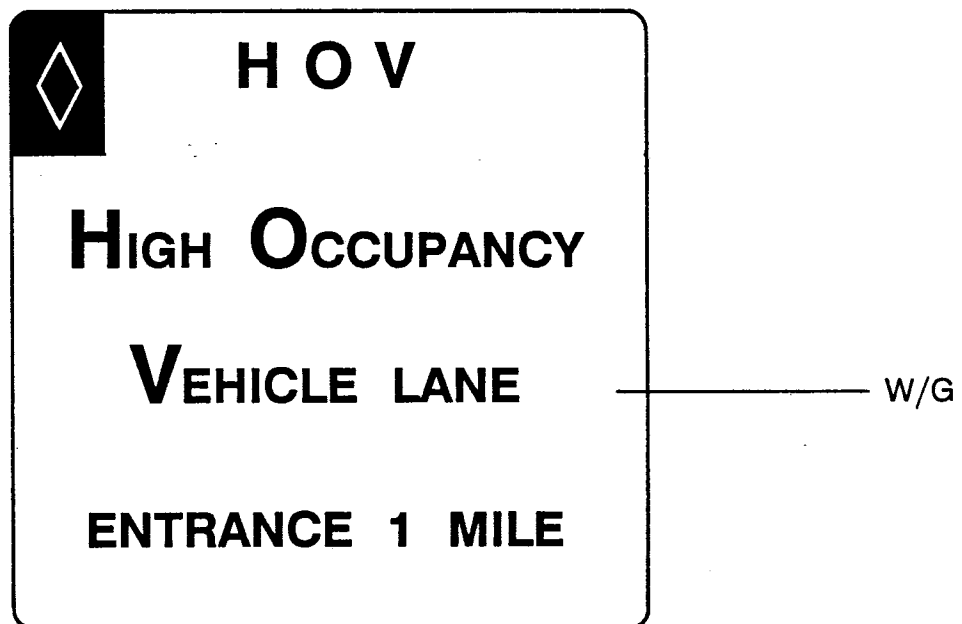
**LOCATION:** Sta 380

**ACCEPTABLE MOUNT:** Overhead Right Mount at Outside Freeway Separation

**DESIRABLE MOUNT:** Overhead Left Mount at Inside Freeway Shoulder

**TYPE:** Guide

**COMMENTS:** The desirable location for this sign is above the inside travel lanes of the freeway. This location implies the HOV entrance is located on the left side of the freeway. Currently, a similar sign is located at the outside shoulder of the freeway. If the existing location is maintained, the legend should be changed to read "LEFT ENTRANCE 1 MILE".



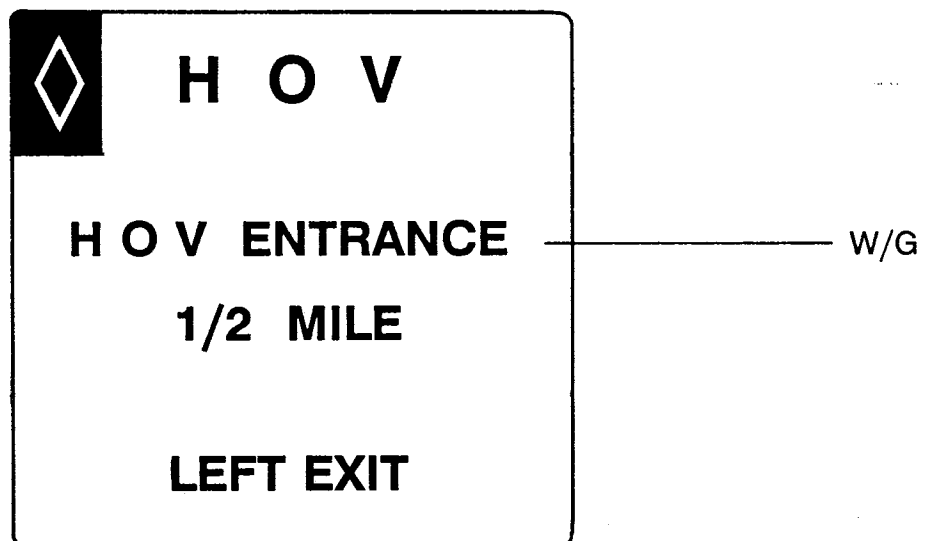
**SIGN C**

**LOCATION:** Sta 347

**MOUNT:** Overhead Left Mount at Inside Freeway Shoulder

**TYPE:** Guide

**COMMENTS:** This sign is used in the same manner as a freeway guide sign to indicate to the motorist that the HOV access point is a short distance ahead and is located on the left side of the freeway. The yellow "LEFT EXIT" panel is used as described in the MUTCD for freeway guide signs.



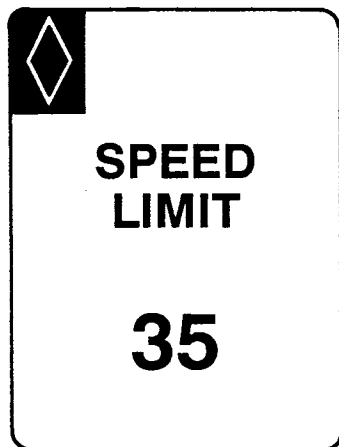
**SIGN D**

**LOCATION:** Sta 339

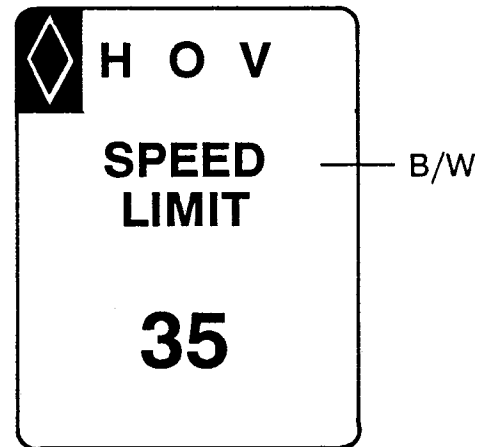
**MOUNT:** Post Mount at Right HOV Shoulder

**TYPE:** Regulatory

**COMMENTS:** The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed on the HOV lane.



OR





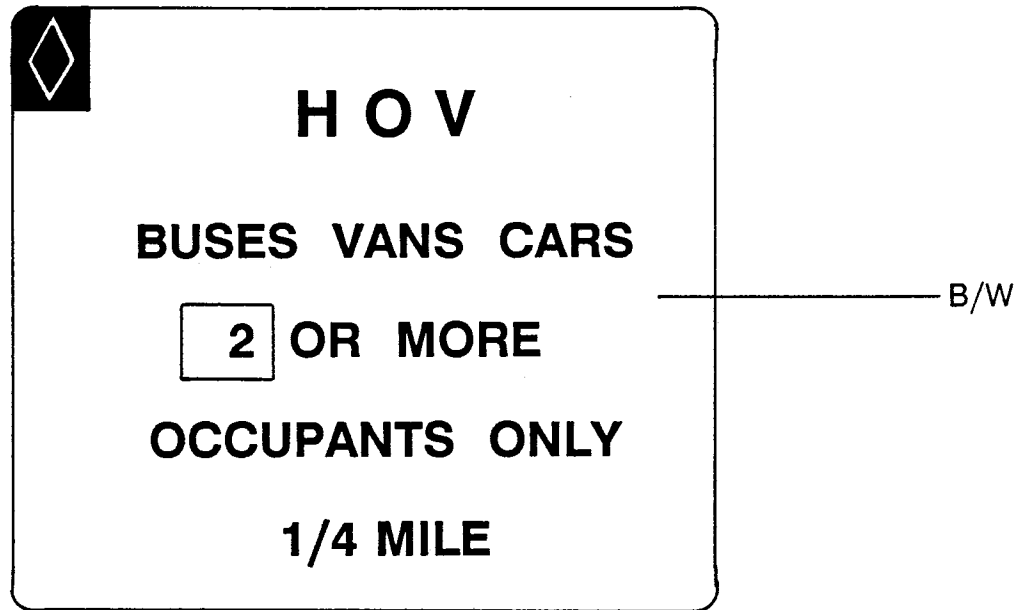
**SIGN E**

**LOCATION:** Sta 334

**MOUNT:** Overhead Mount at Inside Freeway Shoulder

**TYPE:** Regulatory

**COMMENTS:** A changeable message sign is used to indicate the occupancy requirements in effect. The occupancy requirement shown on this sign is for illustrative purposes only and is not intended to reflect the actual occupancy requirements.



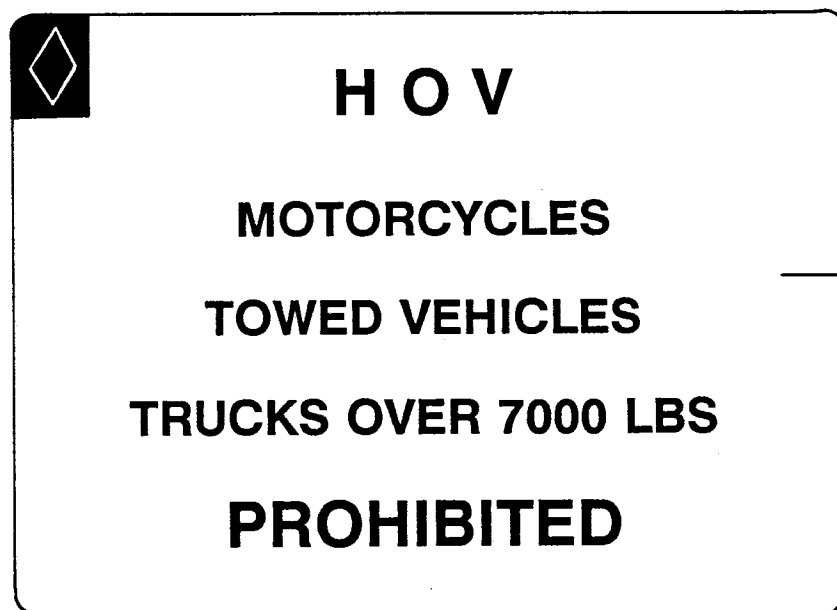
**SIGN F**

**LOCATION:** Sta 330

**MOUNT:** Overhead Mount at Inside Freeway Shoulder

**TYPE:** Regulatory

**COMMENTS:** This sign is used to indicate vehicle types which are not permitted to use the HOV lane. The truck weight limit shown here is used as an example and does not suggest the recommended limit for HOV use. However, some form of indicating what trucks are prohibited is necessary in order to distinguish between heavy trucks and light trucks such as pickups and Suburbans.



B/W

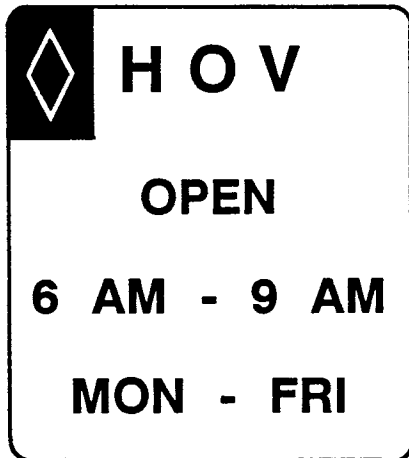
**SIGN G**

**LOCATION:** Sta 325

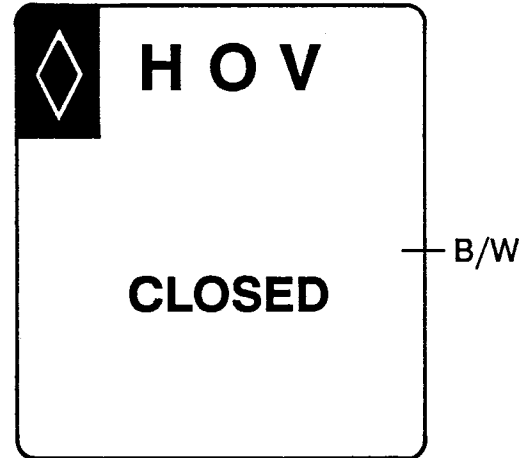
**MOUNT:** Overhead Left Mount at Inside Freeway Shoulder

**TYPE:** Regulatory

**COMMENTS:** This sign should be located at the beginning of the transition lane to indicate whether the HOV lane is open for use. The sign should be a changeable message sign and several choices exist for the design of the sign. The least complicated is a flip sign similar to that used to indicate when a truck weigh station is open. Electronic signs could also be used. The times shown on this sign are for illustrative purposes only and are not intended to reflect the recommended or actual times of HOV operation.



**CMS  
TO**



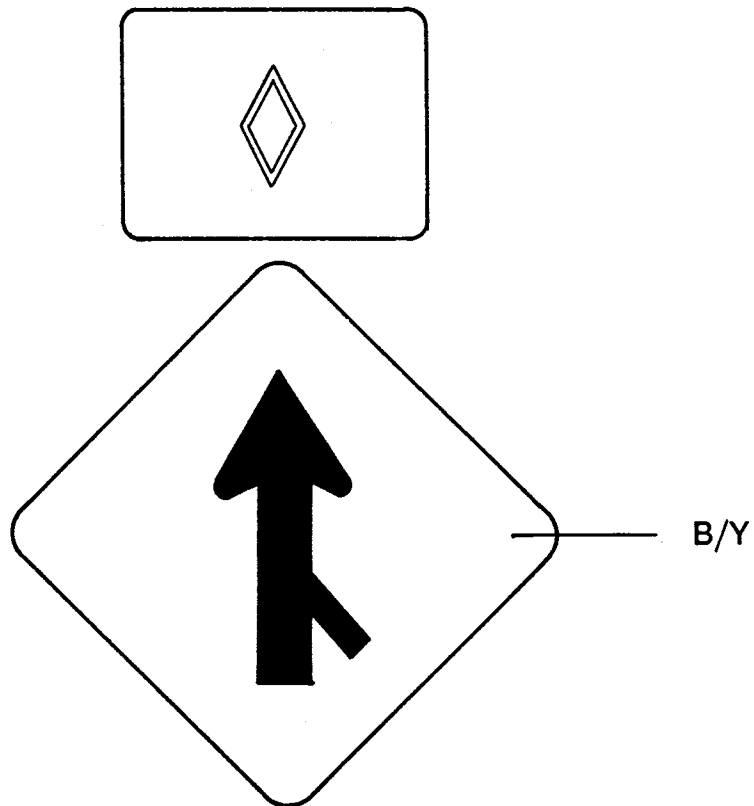
**SIGN H**

**LOCATION:** Sta 321, HOV Entrance

**MOUNT:** Overhead Sign Bridge Mount

**TYPE:** Warning (W4-1)

**COMMENTS:** This sign is used to warn the vehicles already in the HOV lane that other vehicles will be merging into the HOV lane.



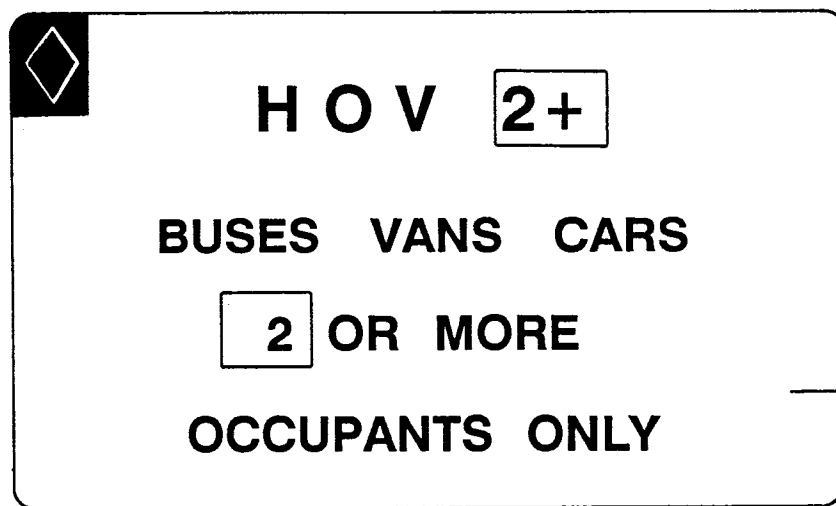
**SIGN I**

**LOCATION:** Sta 321, HOV Entrance

**MOUNT:** Overhead Sign Bridge Mount

**TYPE:** Regulatory

**COMMENTS:** This sign is the primary sign used to indicate entry requirements for the HOV lane and the entry location. Therefore it is vital that the sign be large enough to be easily read and easily comprehensible. A CMS can be used to indicate the occupancy requirement. The occupancy requirement shown on this sign is for illustrative purposes only and is not intended to reflect the occupancy requirements to be shown on this sign.



— B/W

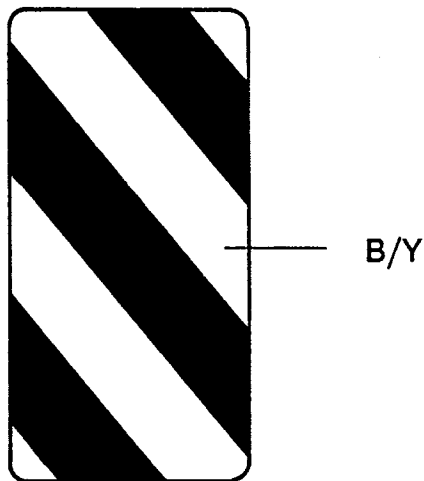
**SIGN J**

**LOCATION:** Sta 321, HOV Entrance

**MOUNT:** End of Barrier Safety Treatment

**TYPE:** Type 3 Object Marker (OM-3L)

**COMMENTS:** This sign is placed at the end of the impact attenuator to help drivers identify the end of the barrier and avoid it.



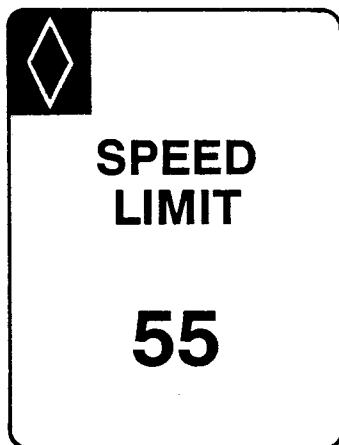
**SIGN K**

**LOCATION:** Sta 312

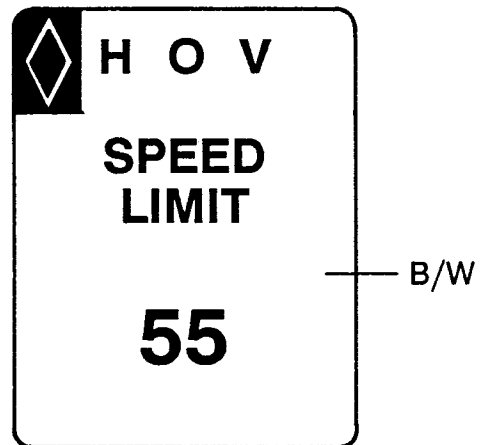
**MOUNT:** Post Mount on Right HOV Shoulder.

**TYPE:** Regulatory

**COMMENTS:** The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed on the HOV lane.



OR



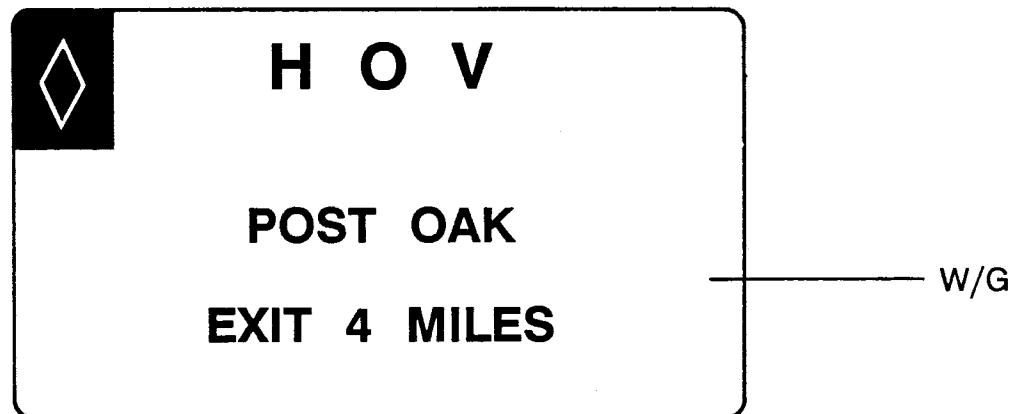
**SIGN L**

**LOCATION:** Sta 295

**MOUNT:** Overhead Right Mount at Right HOV Shoulder

**TYPE:** Guide

**COMMENTS:** This sign is used to provide the driver with information about the location of the next exit point.





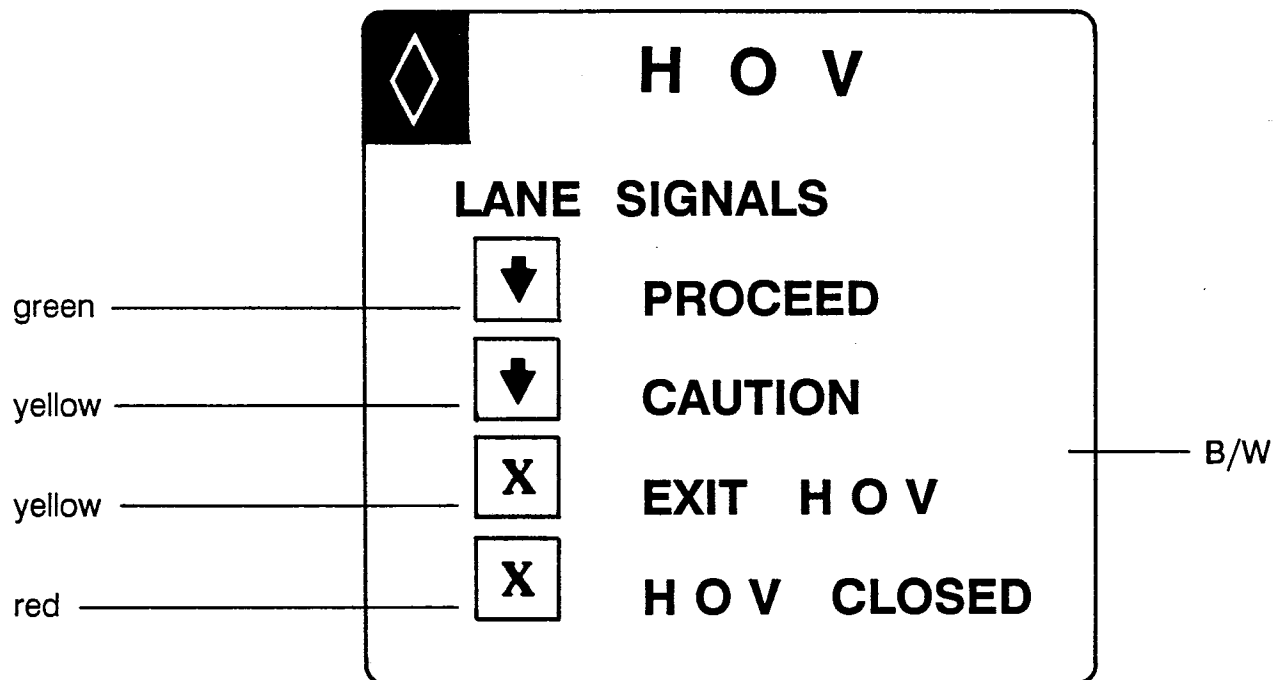
**SIGN M**

**LOCATION:** Sta 290

**MOUNT:** Overhead Right Mount on Right HOV Shoulder

**TYPE:** Regulatory

**COMMENTS:** This sign is used to provide the motorist with the information needed to interpret the lane-use control signals located in the HOV lane. This sign should be located downstream of the entrance in an area with low demand on the driver. The sign legend should indicate the appropriate meaning for each of the lane-use control signal indications in use. The four indications shown below are those that are recommended in the TTI study. Indications appropriate to those actually in use should be used.





**APPENDIX A - PM**

**PROPOSED HOV SIGNAGE FOR**

**HIGH SPEED SLIP RAMP HOV EXIT**



SIGN a

LOCATION: Sta 279

MOUNT: Overhead Right Mount at Right HOV Shoulder

TYPE: Guide

COMMENTS: This sign is used to provide the driver with information about the location of the next exit point.



W/G

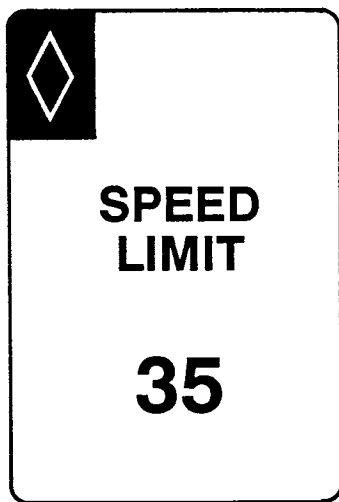
SIGN b

LOCATION: Sta 312

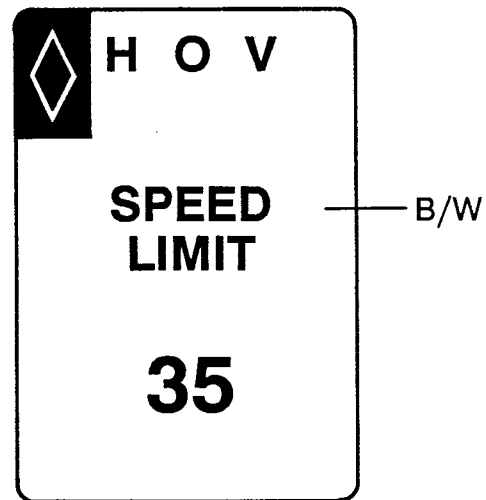
MOUNT: Post Mount at Right HOV Shoulder

TYPE: Regulatory

COMMENTS: The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed on the HOV lane.



OR



SIGN c

LOCATION: Sta 321

MOUNT: Overhead Sign Bridge Mount

TYPE: Guide

COMMENTS: This sign is used to provide the driver with information about the location of the next exit point.



W/G

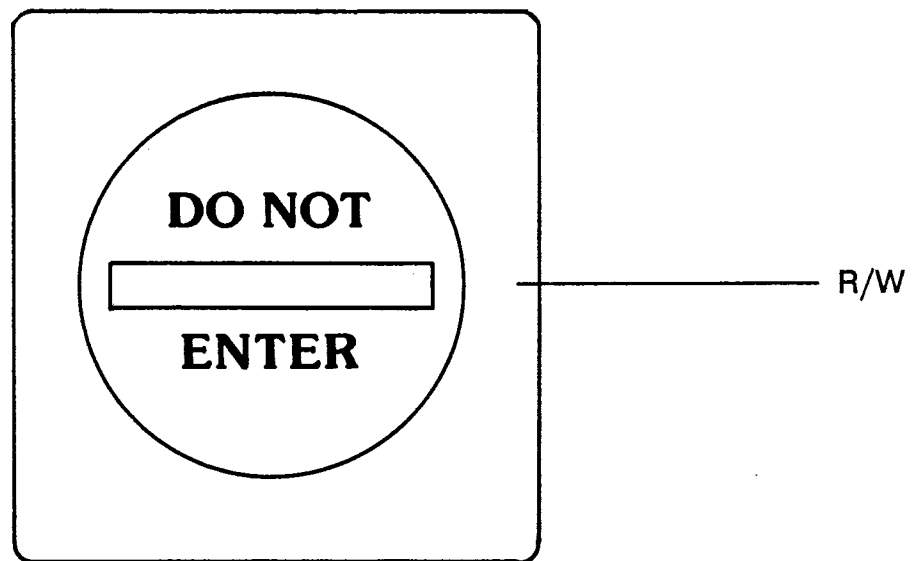
SIGN d

LOCATION: Sta 321

MOUNT: Overhead Sign Bridge Mount

TYPE: Regulatory (R5-1)

COMMENTS: This sign is used to inform motorist that they should not attempt to exit the HOV lane at this point. Exiting at this point would carry them headon into eastbound freeway traffic





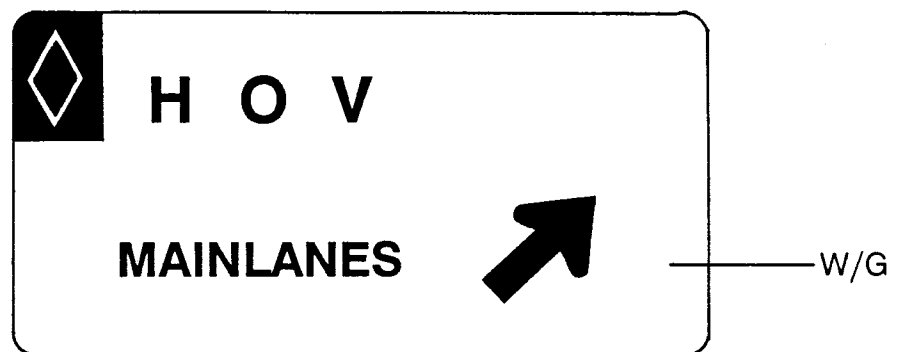
**SIGN e**

**LOCATION:** Sta 329

**MOUNT:** Overhead Sign Bridge Mount

**TYPE:** Guide

**COMMENTS:** This sign is used to indicate that the motorist should exit at this point for the West Belt freeway exit ramp.



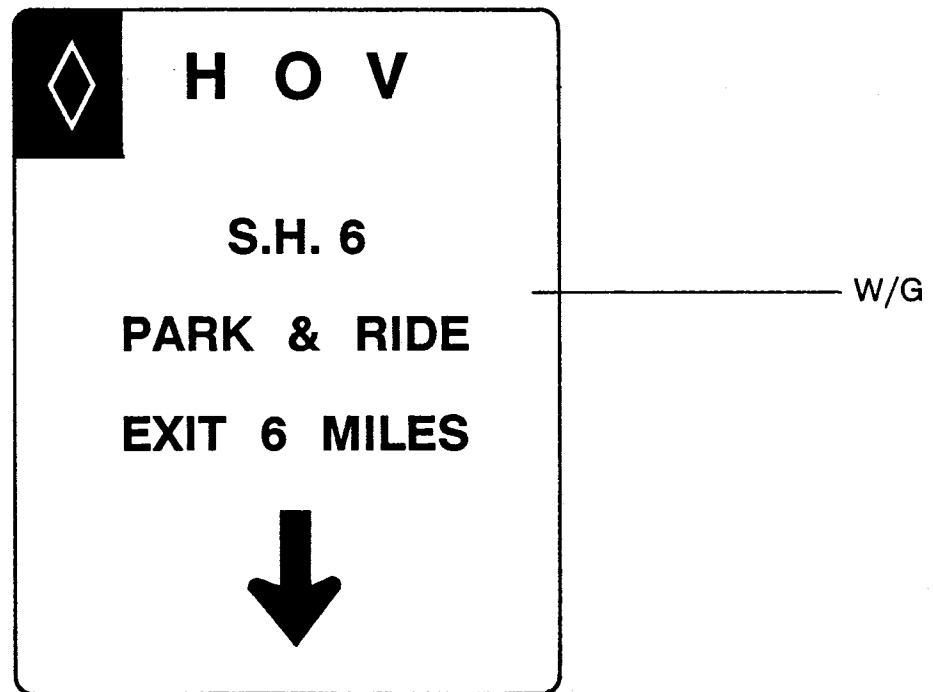
SIGN f

LOCATION: Sta 329

MOUNT: Overhead Sign Bridge Mount

TYPE: Guide

COMMENTS: This sign is used to provide the driver with information about the location of the next exit point and the maneuver needed to travel to that exit.



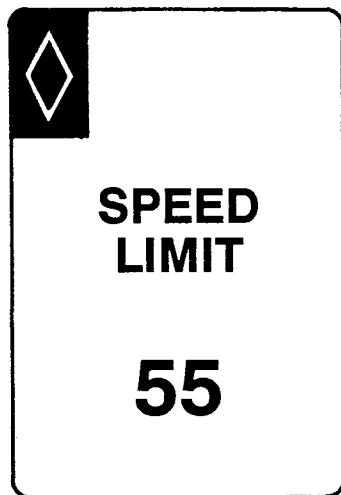
**SIGN g**

**LOCATION:** Sta 339

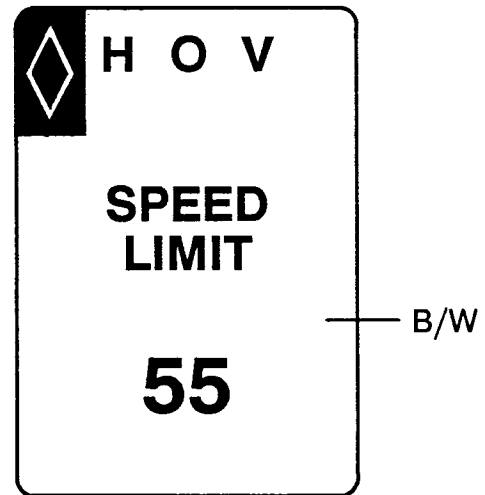
**MOUNT:** Post Mount on Right HOV Shoulder.

**TYPE:** Regulatory

**COMMENTS:** The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed on the HOV lane.



OR





**APPENDIX B - AM**

**PROPOSED HOV SIGNAGE FOR**

**LOW SPEED ARTERIAL HOV ENTRANCE**



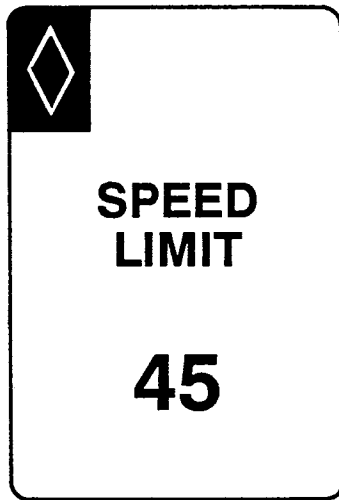
**SIGN A**

**LOCATION:** Sta 650

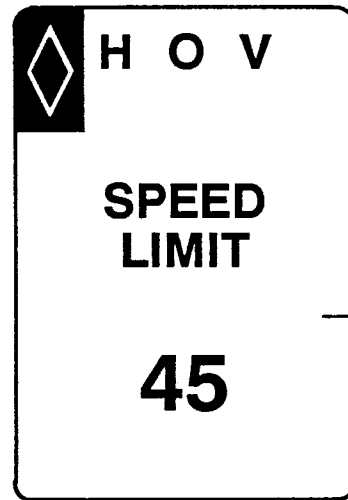
**MOUNT:** Post Mount on Right HOV Shoulder.

**TYPE:** Regulatory

**COMMENTS:** The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed on the HOV lane.



OR



B/W

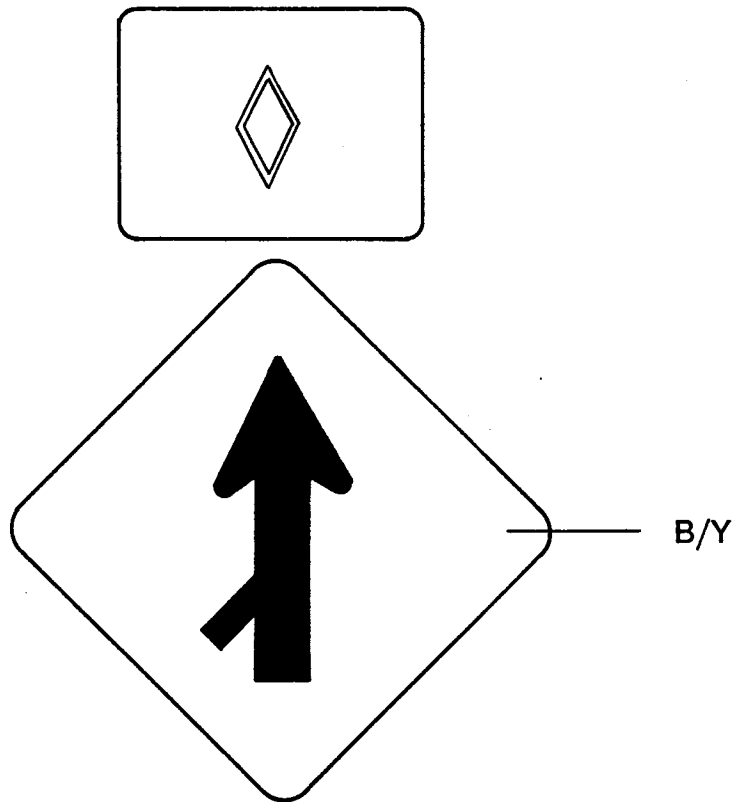
**SIGN B**

**LOCATION:** Sta 321, HOV Entrance

**MOUNT:** Overhead Sign Bridge Mount

**TYPE:** Warning (W4-1)

**COMMENTS:** This sign is used to warn the vehicles already in the HOV lane that other vehicles will be merging into the HOV lane.





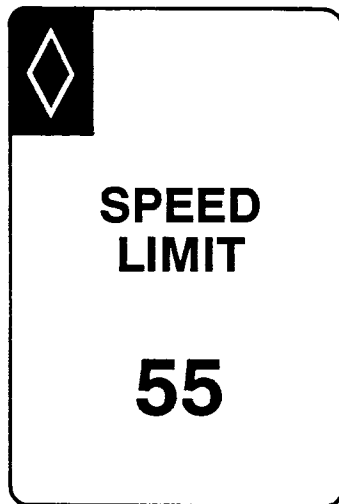
**SIGN C**

**LOCATION:** Sta 650

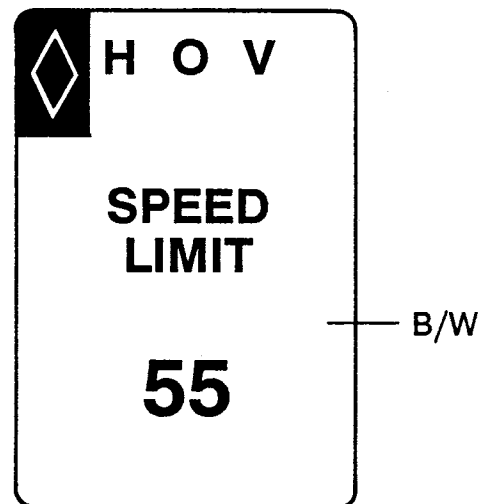
**MOUNT:** Post Mount on Right HOV Shoulder.

**TYPE:** Regulatory

**COMMENTS:** The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed on the HOV lane.



OR





**APPENDIX B - PM**

**PROPOSED HOV SIGNAGE FOR**

**LOW SPEED ARTERIAL HOV EXIT**



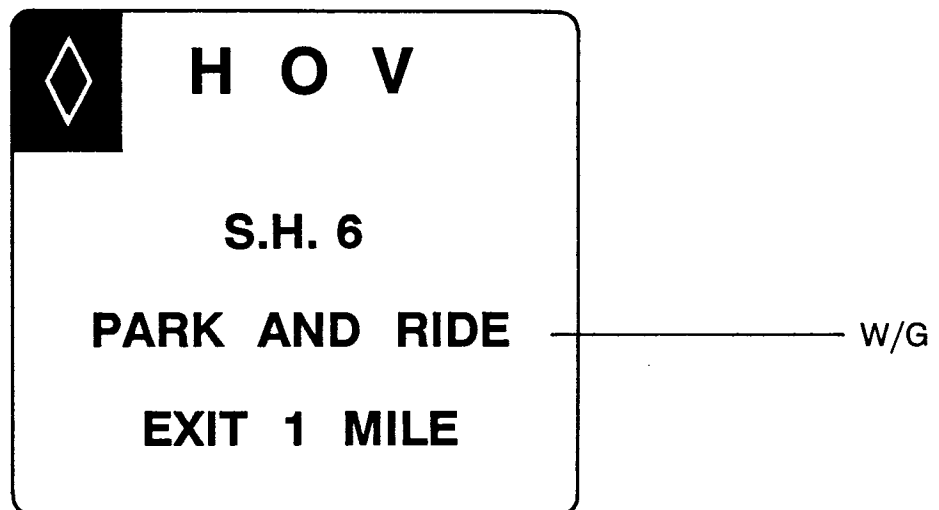
SIGN a

LOCATION: Sta 589

MOUNT: Overhead Right Mount at Right HOV Shoulder

TYPE: Guide

COMMENTS: This sign is used to provide the driver with information about the location of the next exit point.



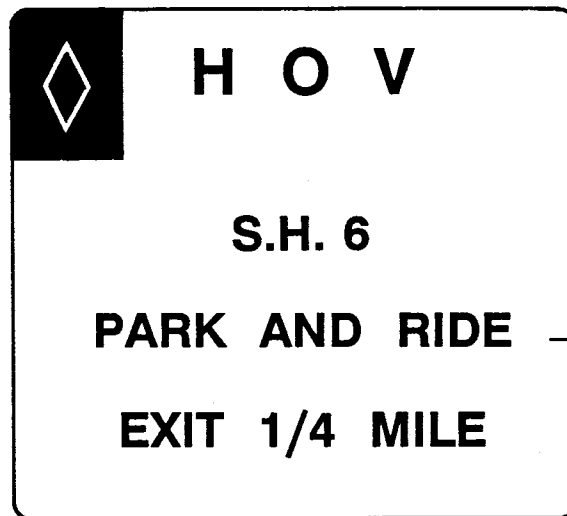
**SIGN b**

**LOCATION:** Sta 629

**MOUNT:** Overhead Right Mount at Right HOV Shoulder

**TYPE:** Guide

**COMMENTS:** This sign is used to provide the driver with information about the location of the next exit point.



W/G

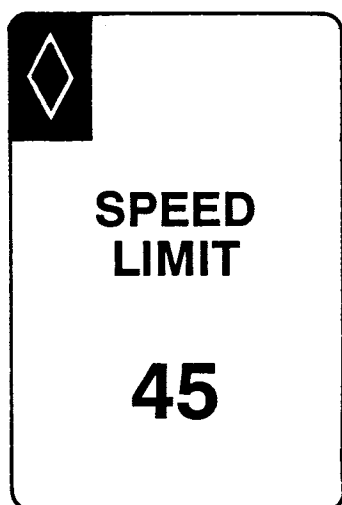
**SIGN c**

**LOCATION:** Sta 636

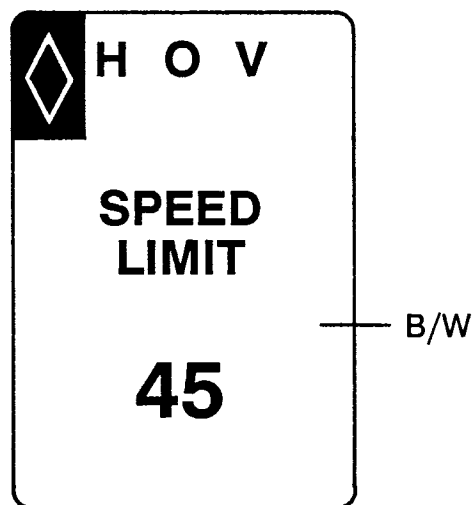
**MOUNT:** Post Mount on Right HOV Shoulder.

**TYPE:** Regulatory

**COMMENTS:** The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed on the HOV lane.



OR



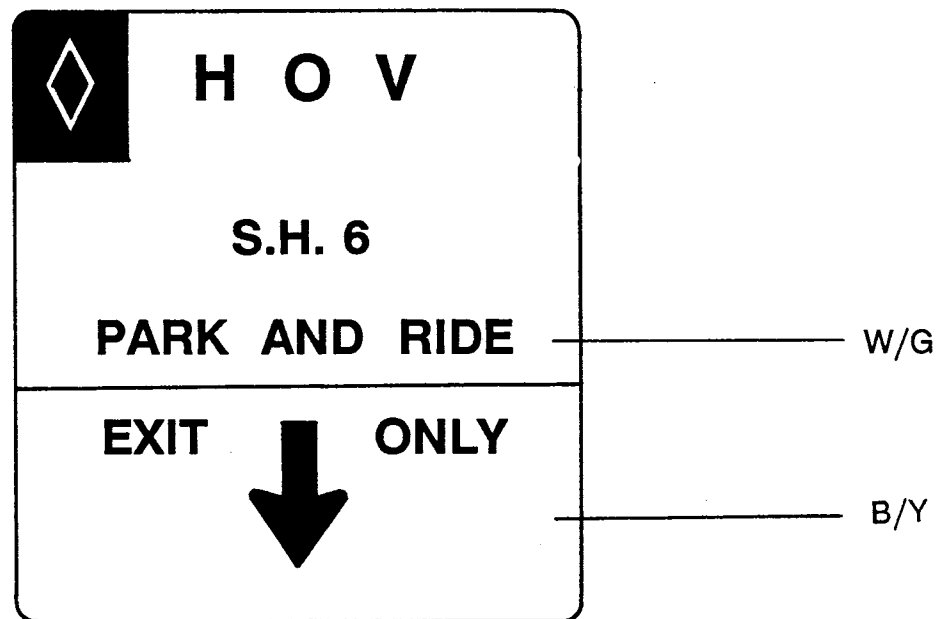
SIGN d

LOCATION: Sta 637

MOUNT: Overhead Right Mount at Right HOV Shoulder

TYPE: Guide

COMMENTS: This sign is used to provide the driver with information about the appropriate lane to use to exit the HOV facility.





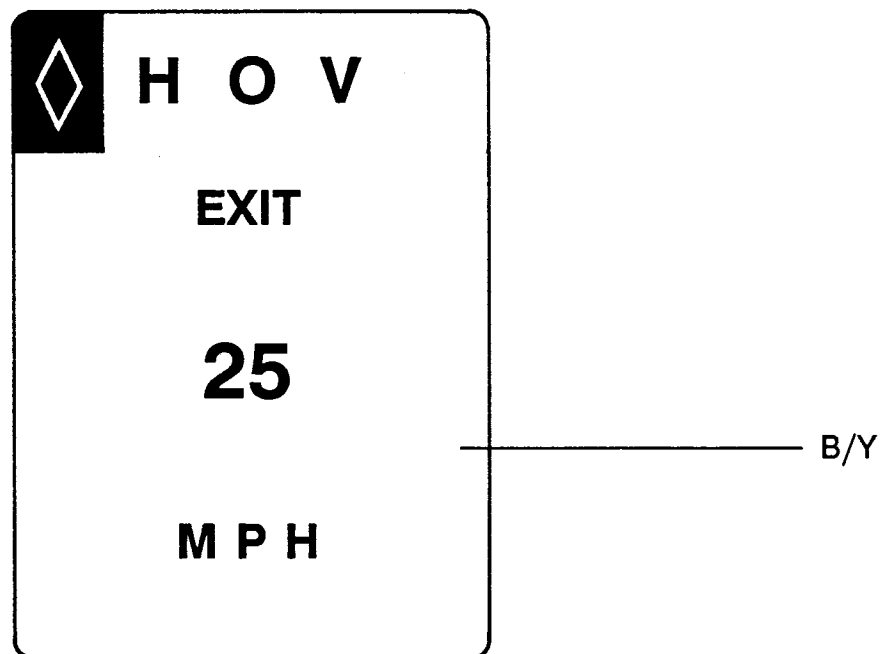
**SIGN e**

**LOCATION:** Sta 640

**MOUNT:** Post Mount on Right HOV Shoulder.

**TYPE:** Warning (similar to W13-4)

**COMMENTS:** This sign is used to indicate the maximum recommended speed on the exit ramp. The actual location of this sign is dependant on the distance needed to decelerate from the speed limit to the recommended exit speed. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed of the exit ramp.



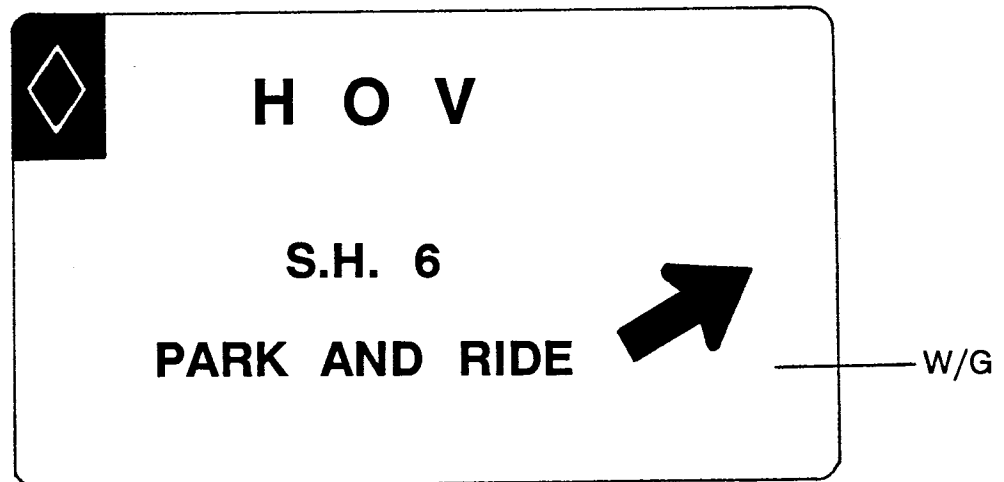
**SIGN f**

**LOCATION:** Sta 642

**MOUNT:** Overhead Sign Bridge Mount

**TYPE:** Guide

**COMMENTS:** This sign is used to indicate that the motorist should exit at this point for the Park and Ride exit ramp.



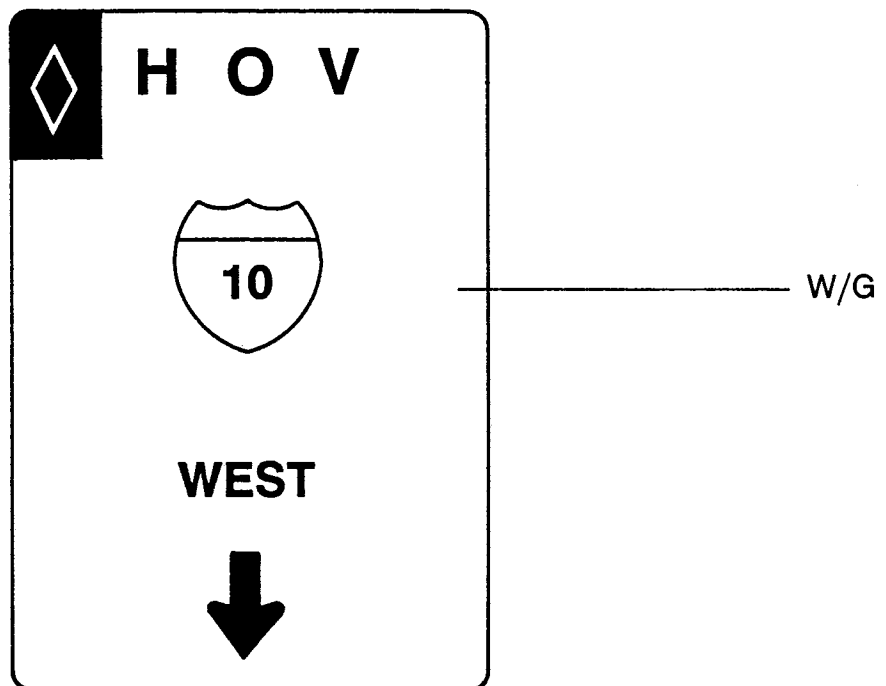
SIGN g

LOCATION: Sta 642

MOUNT: Overhead Sign Bridge Mount

TYPE: Guide

COMMENTS: This sign is used to provide the driver with information about the location of the next exit point and the maneuver needed to travel to that exit.



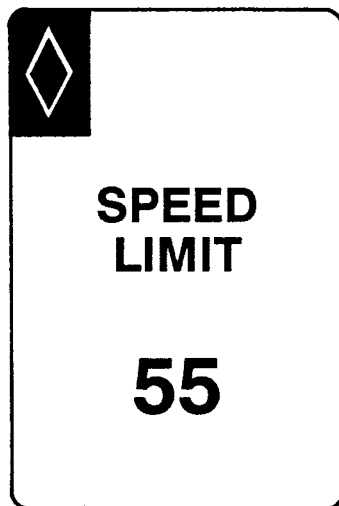
**SIGN h**

**LOCATION:** Sta 650

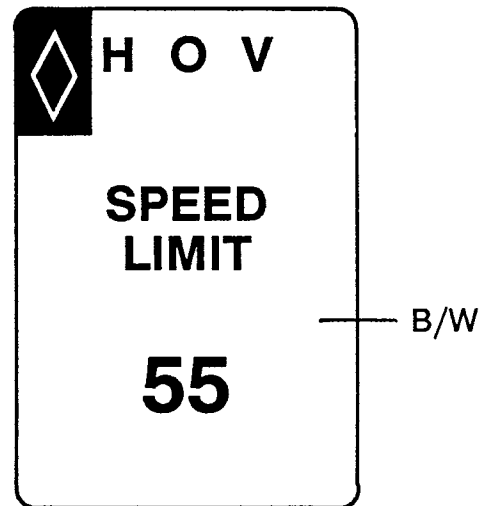
**MOUNT:** Post Mount on Right HOV Shoulder.

**TYPE:** Regulatory

**COMMENTS:** The speed limit sign is used when geometric or operational conditions require a slower traveling speed. The sign should be located on the right side of the HOV lane. Either of the signs shown below are acceptable for use. The speed shown on this sign is for illustrative purposes only and is not intended to reflect the actual speed of the HOV lane.



OR



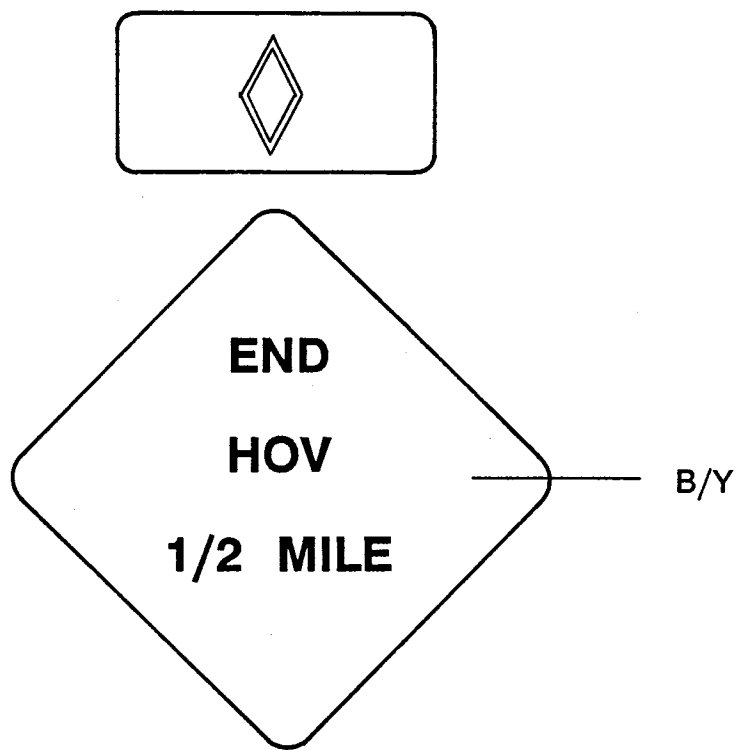
**SIGN i**

**LOCATION:** Sta 661

**MOUNT:** Overhead Right Mount at Right HOV Shoulder

**TYPE:** Warning (similar to W6-4)

**COMMENTS:** This sign is used to warn HOV vehicles that the HOV lane ends ahead.



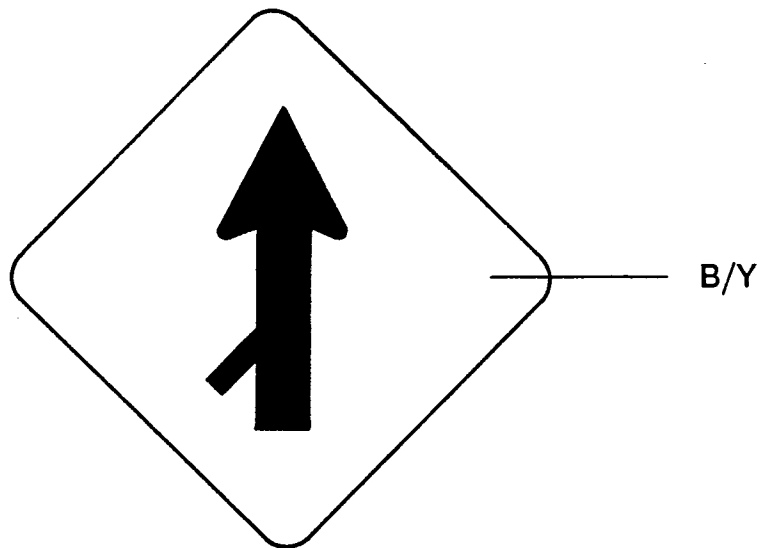
**SIGN j**

**LOCATION:** Sta 685

**MOUNT:** Single Post Mount at Left Freeway Shoulder

**TYPE:** Warning (W4-1)

**COMMENTS:** This sign is used to warn freeway vehicles that HOV vehicles will be merging with freeway traffic from the left side.



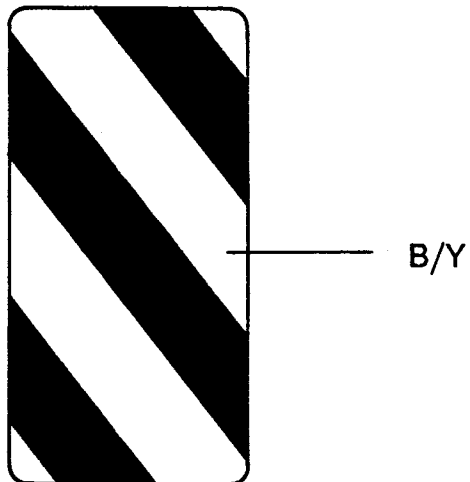
**SIGN k**

**LOCATION:** Sta 687

**MOUNT:** End of Barrier Safety Treatment

**TYPE:** Type 3 Object Marker (OM-3L)

**COMMENTS:** This sign is placed at the end of the impact attenuator to help drivers identify the end of the barrier and avoid it.



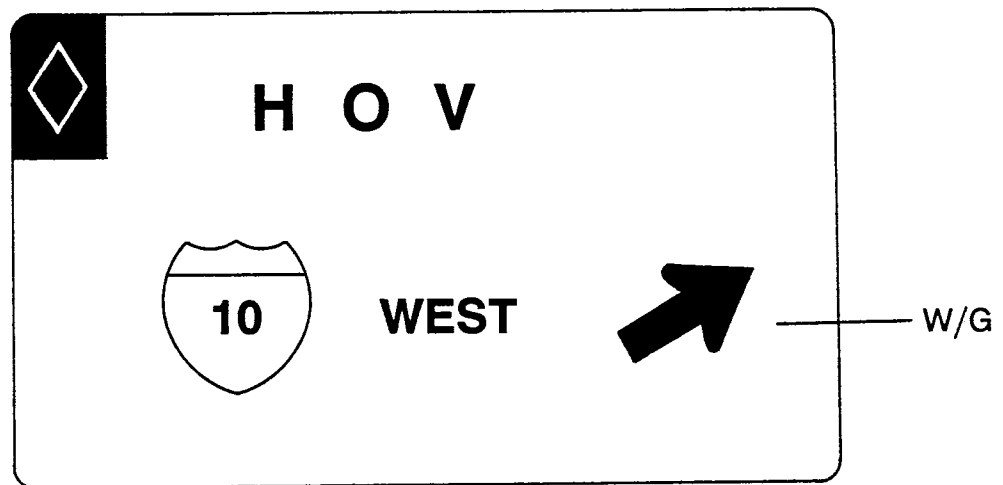
**SIGN I**

**LOCATION:** Sta 687

**MOUNT:** Overhead Sign Bridge Mount

**TYPE:** Guide

**COMMENTS:** This sign is used to indicate that the motorist should exit at this point to get on the I-10 WEST freeway.





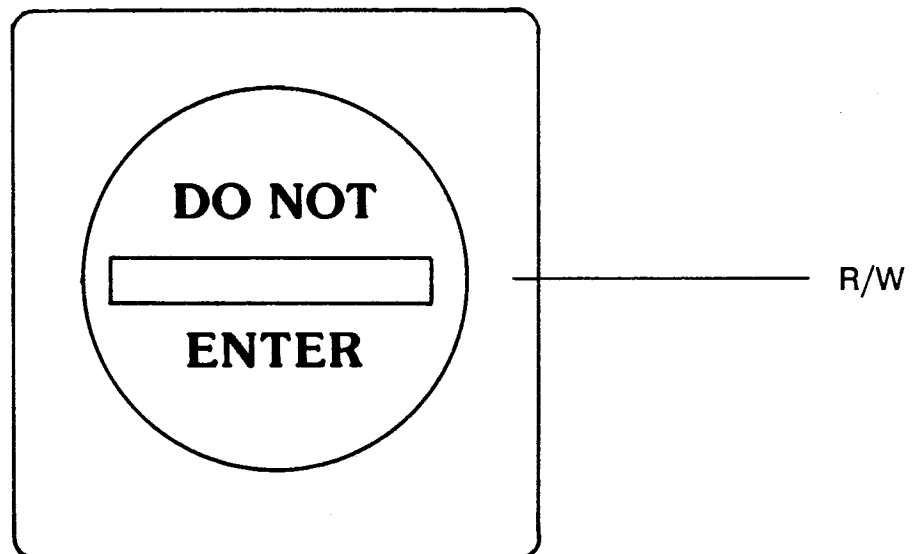
SIGN m

LOCATION: Sta 687

MOUNT: Overhead Sign Bridge Mount

TYPE: Regulatory (R5-1)

COMMENTS: This sign is used to inform motorists that they should not attempt to exit the HOV lane at this point. Exiting at this point would carry them headon into eastbound freeway traffic





**APPENDIX C**

**PROPOSED HOV SIGNAGE FOR**

**ARTERIAL CONNECTION**

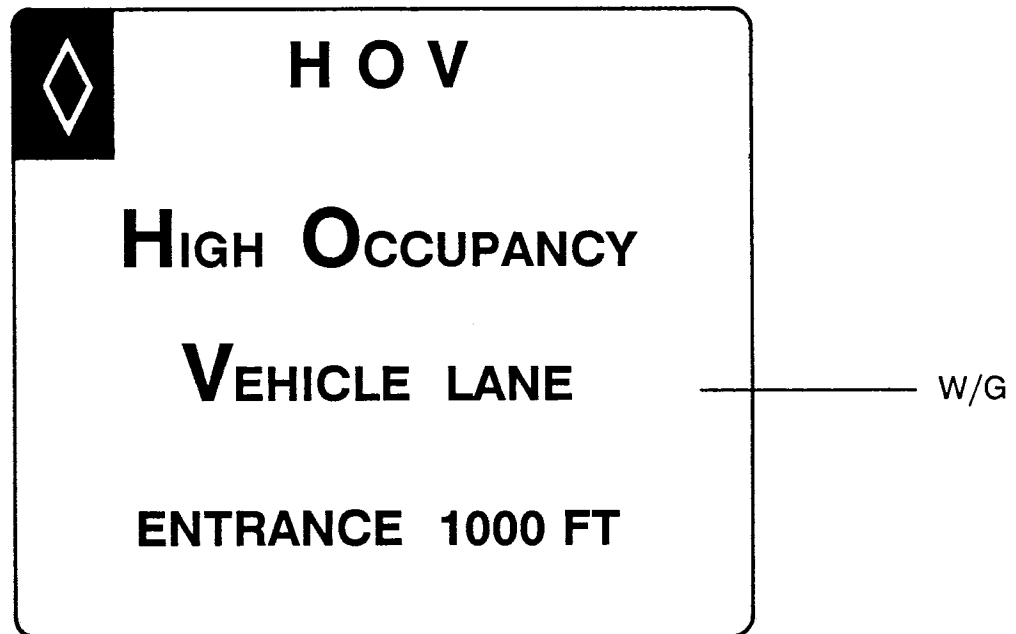


**SIGN A**

**MOUNT:** Double Post Mount on Arterial Approach

**TYPE:** Guide

**COMMENTS:** This sign is used to inform the motorist of the location of the HOV connection ramp. It should be located sufficiently in advance of the entrance to provide adequate maneuvering time for the motorist wishing to use the HOV lane.

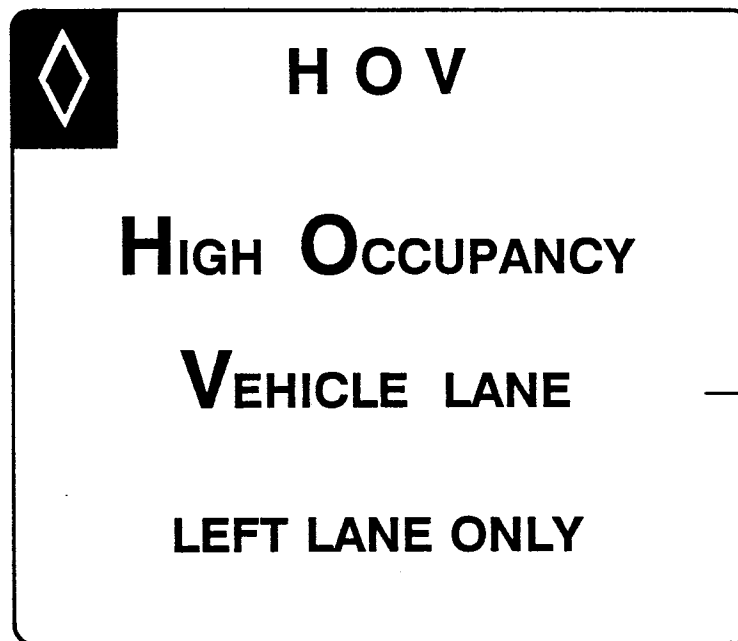


**SIGN B**

**MOUNT:** Double Post Mount on Arterial Approach

**TYPE:** Regulatory

**COMMENTS:** This sign notifies the HOV motorist that they should position the vehicle in the left lane in order to enter the HOV lane. The need for this sign is dependant on the geometric conditions at the HOV entrance. It should be located sufficiently in advance of the entrance to provide adequate maneuvering time for the motorist to change to the appropriate lane.



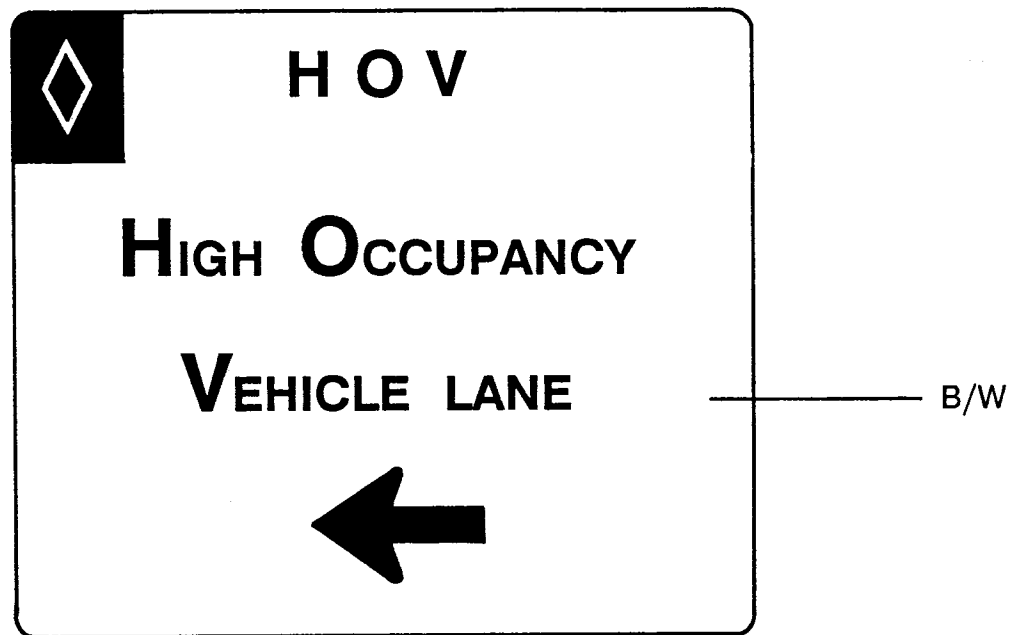
— B/W

**SIGN C**

**MOUNT:** Double Post Mount on Arterial Approach

**TYPE:** Regulatory

**COMMENTS:** This sign is used to instruct HOV motorists how to enter the HOV connection. The occupancy requirement need not be shown if it is at 2 occupants per vehicle. The exact location of this sign is dependant on the geometric conditions at the intersection.

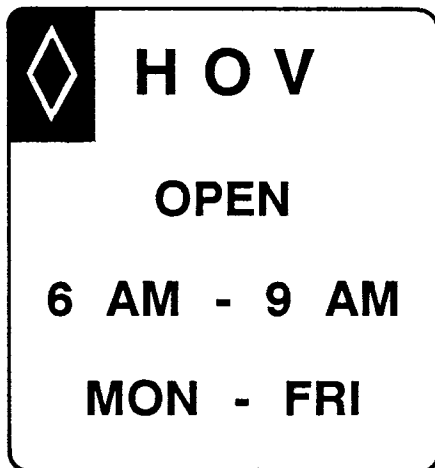


## SIGN D

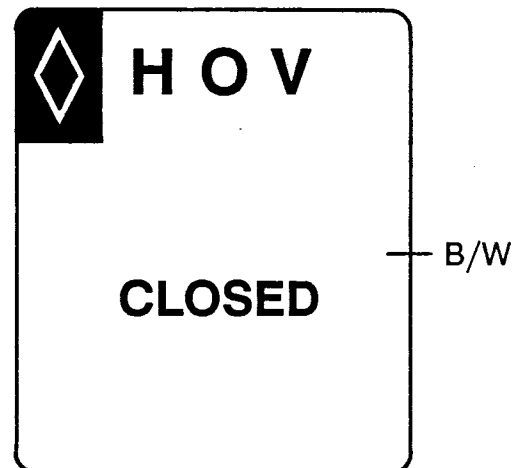
MOUNT: Overhead Right Mount

TYPE: Regulatory

COMMENTS: This sign should be located at the beginning of the HOV connection to indicate whether the HOV lane is open for use. The sign should be a changeable message sign and several choices exist for the design of the sign. The least complicated is a flip sign similar to that used to indicate when a truck weigh station is open. Electronic signs could also be used. The times shown on this sign are for illustrative purposes only and are not intended to reflect the recommended or actual times of HOV operation.



CMS  
TO



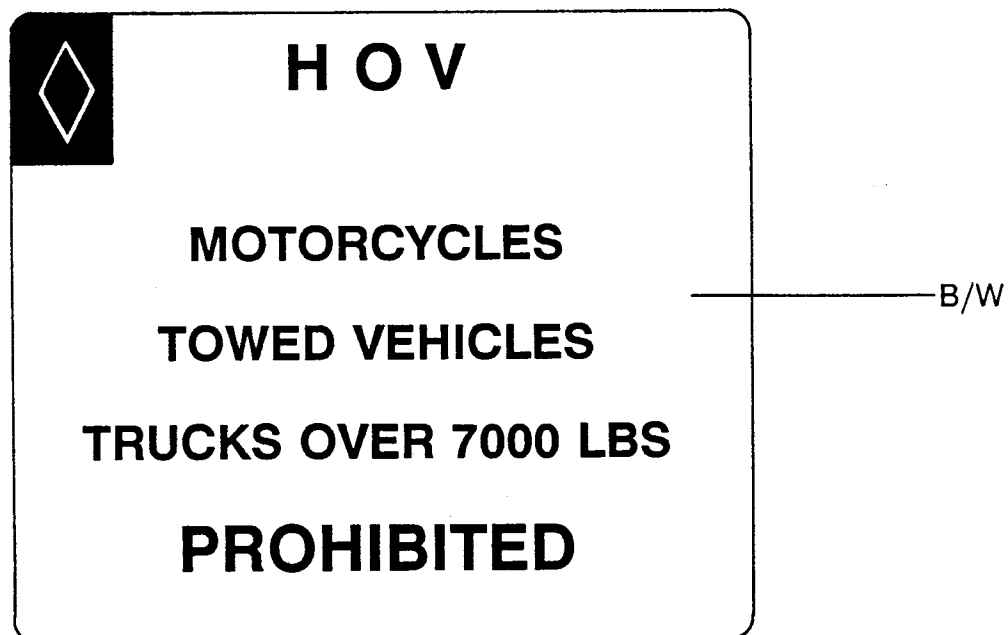


**SIGN E**

**MOUNT:** Overhead Mount

**TYPE:** Regulatory

**COMMENTS:** This sign is used to indicate vehicle types which are not permitted to use the HOV lane. The truck weight limit shown here is used as an example and does not suggest the recommended limit for HOV use. However, some form of indicating what trucks are prohibited is necessary in order to distinguish between heavy trucks and light trucks such as pickups and Suburbans.

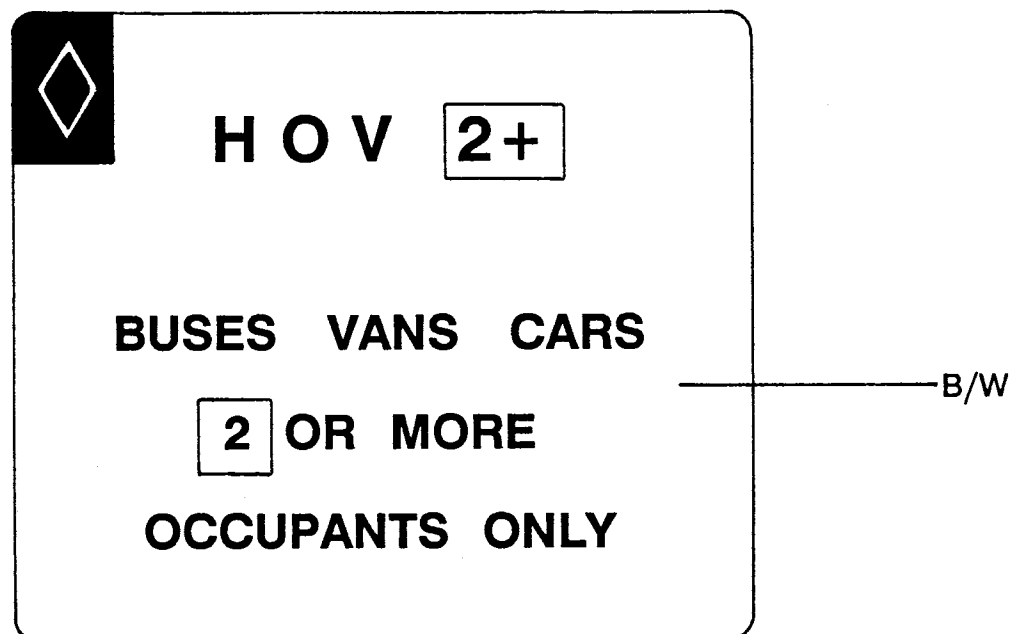


## SIGN F

**MOUNT:** Overhead Sign Bridge Mount

**TYPE:** Regulatory

**COMMENTS:** This sign is the primary sign used to indicate entry requirements for the HOV lane and the entry location. Therefore it is vital that the sign be large enough to be easily read and easily comprehensible. A CMS can be used to indicate the occupancy requirement. The occupancy requirement shown on this sign is for illustrative purposes only and is not intended to reflect the occupancy requirements to be shown on this sign. This sign should be mounted so that motorists not eligible for the HOV lane can use the escape ramp to reenter general purpose traffic.



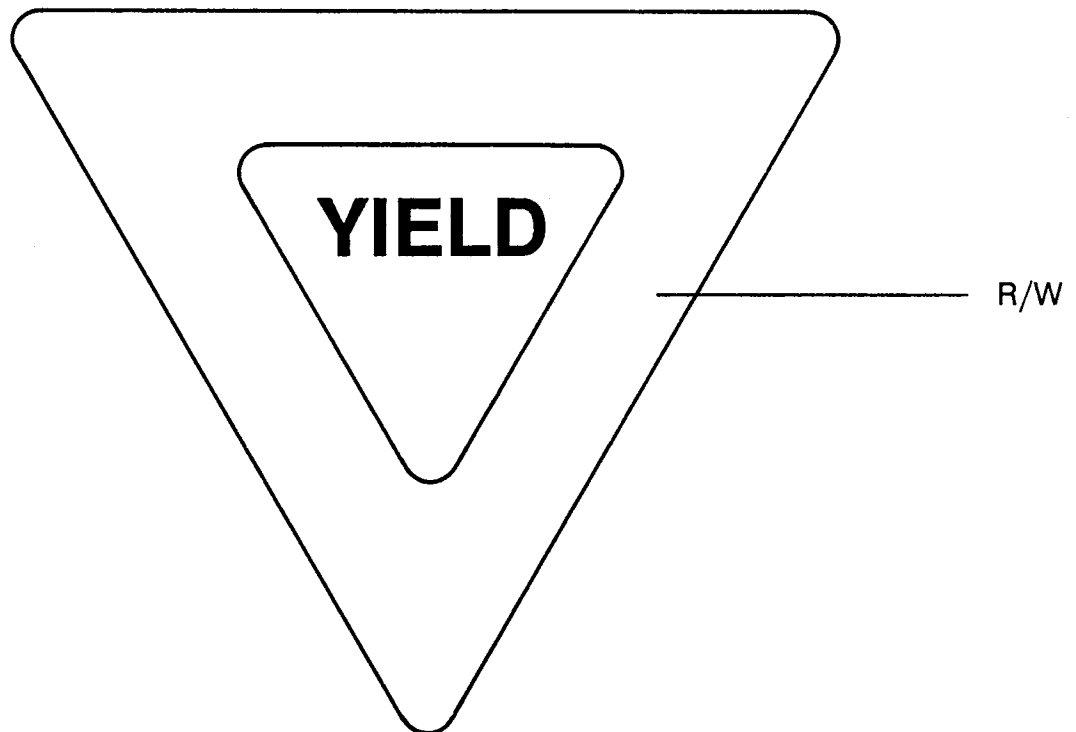
**SIGN G**

**LOCATION:** at intersection of connecting ramp and HOV lane

**MOUNT:** Post Mount

**TYPE:** Regulatory (R1-2)

**COMMENTS:** The YIELD sign is used to provide control between vehicles on the HOV connecting ramp and the HOV lane. Other types of control signs may be more appropriate.



**SIGN a**

**LOCATION:** at intersection of connecting ramp and arterial

**MOUNT:** Post Mount

**TYPE:** Regulatory (R1-1)

**COMMENTS:** The STOP sign is used to provide control between vehicles on the HOV connecting ramp and the arterial. Other types of control signs may be more appropriate.

