



TEXAS
TRANSPORTATION
INSTITUTE

STATE DEPARTMENT
OF HIGHWAYS AND
PUBLIC TRANSPORTATION

COOPERATIVE
RESEARCH

**OPERATIONAL GUIDELINES
FOR SHORT-TERM TOTAL
FREEWAY CLOSURES**

in cooperation with the
Department of Transportation
Federal Highway Administration

**RESEARCH REPORT 292-5
STUDY 2-18-81-292
TRAFFIC AT WORK ZONES**

1. Report No. FHWA/TX-85/56+292-5		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Operational Guidelines for Short-Term Total Freeway Closures				5. Report Date August 1984	
				6. Performing Organization Code	
7. Author(s) Robert C. Wunderlich and Conrad L. Dudek				8. Performing Organization Report No. Research Report 292-5	
9. Performing Organization Name and Address Texas Transportation Institute Texas A&M University College Station, TX 77843				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. Study No. 2-18-81-292	
12. Sponsoring Agency Name and Address Texas State Department of Highways and Public Transportation; Transportation Planning Division P.O. Box 5051 Austin, TX 78763				13. Type of Report and Period Covered Interim Report (September 1981-August 1984)	
				14. Sponsoring Agency Code	
15. Supplementary Notes Research performed in cooperation with DOT, FHWA Study Title: Handling Traffic in Work Zones					
16. Abstract <p>Maintenance or construction work which requires closing all the main lanes of an urban freeway creates a need for special traffic management techniques. Field studies were conducted at three freeway closures in Houston to observe traffic operations and identify problem areas and successful management strategies: 1) IH-610 (East Loop) at SH-225 was closed on a Saturday for repair work on the bridge connecting SH-225 West with IH-610 South. The bridge required reconstruction as a result of damage sustained during a severe truck accident and fire. 2) The northbound lanes of IH-45 (Gulf Freeway) was closed between IH-610 (South Loop) and downtown Houston on a Saturday to move portable concrete barriers. 3) The construction of a "flyover" ramp for an Authorized Vehicle Lane necessitated the closure of westbound IH-10 (Katy Freeway) at IH-610 (West Loop) during a weekend. All three closures were done as part of the sequence of work on construction projects.</p> <p>This report presents general operational guidelines and recommendations based on the findings of the three field studies. The guidelines are not intended to provide information on all aspects of traffic control at freeway closure work zones. Rather, they were intended to supplement standard work zone traffic control procedures.</p> <p>The guidelines are organized into four broad categories: Advance Planning; Advance Notification; Traffic Management; and Law Enforcement.</p>					
17. Key Words Highway Maintenance and Construction Work Zones, Traffic Control, Law Enforcement, Changeable Message Signs, Traffic Management, Ramp Closures, Freeway Closures			18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 21	22. Price

ACKNOWLEDGEMENTS

The authors wish to thank Blair Marsden and Lewis Rhodes (D-18T, SDHPT) for their constructive comments and suggestions during the course of the research documented herein. The research direction was guided by a Technical Advisory Committee. The contributions of this Committee, whose members are listed below, are gratefully acknowledged:

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INTRODUCTION

Since closing an urban freeway has a dramatic effect on so many people, it has until recently been avoided. With the increased need for traffic handling in reconstruction and major maintenance projects, it has become necessary on occasion to close an urban freeway for short time periods. Alternatives to total closure should be sought before accepting the need for total closure. If chosen, the freeway should be closed as briefly as possible, and all detours must be constantly inspected to insure that no activity results in a failure to meet traffic demand and control objectives.

GUIDELINES

Advance Planning

The success of a short-term total freeway closure traffic management strategy is dependent upon the plans made prior to the actual closure. The following recommendations are offered to aid in this process.

- 1) **A pre-closure meeting of all the involved agencies should be held two to four weeks prior to the actual closure.** Freeway closures require the cooperation of many entities such as city traffic departments, law enforcement agencies, and contractors, as well as the various SDHPT sections which will be involved. Once the basic traffic control strategy has been developed, the agencies whose assistance will be required to implement the closure should be involved in the planning process. The pre-closure meeting can serve both to inform and to promote new ideas and suggestions.
- 2) **One individual should be designated as the Department's Traffic Control Coordinator.** This person's primary responsibility should be to insure that the traffic control plan is implemented properly and coordinate traffic control efforts during the closure. An individual should be selected who has the knowledge and authority to implement changes in traffic control. A chain of command should be established to maintain supervision in the absence of the Traffic Control Coordinator.
- 3) **A meeting which includes personnel directly involved in traffic management should be held just prior to the closure.** This meeting

would typically include law enforcement officers, contractors' personnel, SDHPT staff, and city staff. The purpose of the meeting is to insure that all personnel directly involved in traffic management are aware of the objectives of the Traffic Control Plan and familiar with their responsibility in carrying it out. The Traffic Control Coordinator should conduct the meeting.

- 4) **Local special events should be considered in the scheduling of freeway closures.** Sporting events, fairs, and concerts which attract great numbers of people can cause severe congestion at freeway closures. Care should be taken to avoid scheduling freeway closures at the same time a special event is occurring in the vicinity.
- 5) **Traffic volumes must be considered in planning a detour.** The selected detour should have enough capacity to handle the expected freeway volume. Often, the closure must be planned for a weekend so that the traffic volume can be accommodated. Some delays may be inevitable, but every effort should be made to provide the required amount of capacity.
- 6) **The closure should be coordinated with the local traffic management team.** The local traffic management team (corridor management team) is an excellent forum for coordination of many activities involved with a freeway closure. This multidisciplinary team can also provide a critical review of the overall traffic management plan.

Advance Notification

Every effort should be made to publicize the upcoming closure so that motorists can avoid the freeway closure area or take alternate routes to their destinations.

- 1) **A press release should be prepared for distribution to the local media.** Television stations, newspapers, and radio stations are all excellent ways of informing motorists. The press release in Figure 1 provides an example of the information such a press release may contain. In addition to the press release, a diagram of the traffic control strategy, such as the one shown in Figure 2, can be prepared for publication in newspapers. Communication should be maintained with radio stations during the closure, since this medium can provide motorists with up-to-date information.
- 2) **Conspicuous signs that give notice of the upcoming closure should be installed along the freeway at least one week prior to the closure.** These signs should inform the motorist what is going to happen, when it will occur, and what action they should take. A trailer-mounted sign used for this purpose is shown in Figure 3. The sign should be changed to reflect current conditions during the closure (e.g., IH-610 CLOSED AT SH-225, USE ALT. ROUTE).
- 3) **An effort should be made to notify local service agencies prior to the actual closure.** The operations of Bus Services, Emergency Medical Services, Fire Departments, Postal Services, and Police



MEDIA INFORMATION

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

RELEASE NO.10-82 DATE 7-19-82 DISTRICT 12
CONTACT R. J. Kabat TELEPHONE 869-4571

FOR IMMEDIATE RELEASE

TRAFFIC ALERT

HOUSTON - Repairs to the IH 610/SH 225 interchange, which was severely damaged as a result of a tragic truck accident and fire in March of this year, are scheduled to begin on July 24, 1982.

The \$1,060,000.00 repair will be done by Trinity Construction Company under contract to the State Department of Highways and Public Transportation and will take several months to complete. Regretably, the repair work will require several closures of IH 610 at SH 225, which is currently carrying some 100,000 vehicles per day.

The worst of the closures, which will affect both north and southbound traffic on the East Loop (IH 610), is scheduled to begin at 6:00 AM, Saturday, July 24, 1982, and will remain in effect until no later than 6:00 AM Monday, July 26, 1982. Detours will be provided via SH 225.

This first closure will allow the contractor to remove the remaining portion of the structure that was damaged by the fiery accident. Motorists should make every effort to avoid the area.

Figure 1. SDHPT Press Release

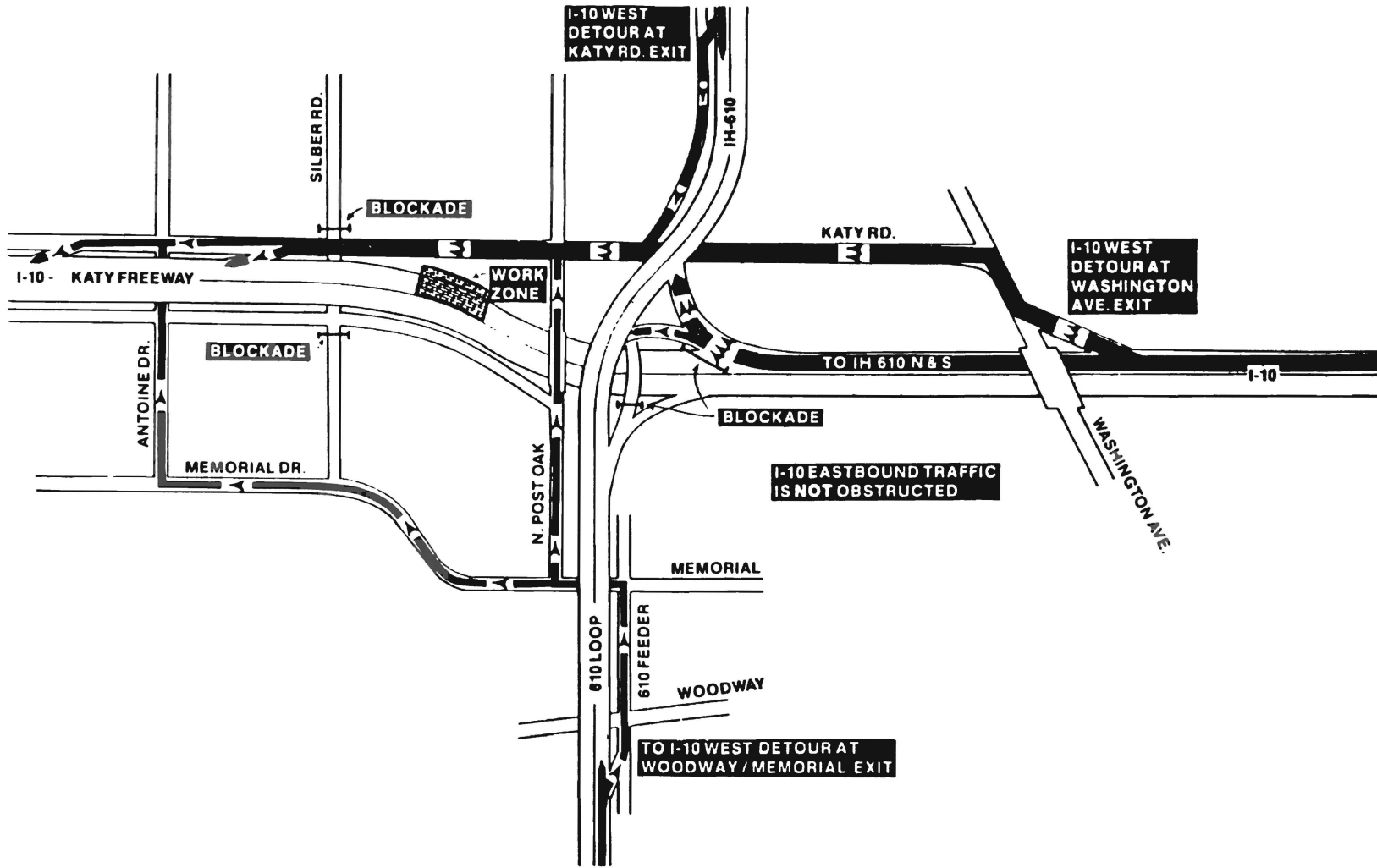


Figure 2. Traffic Control Diagram for Public Information



Figure 3. Advance Notification Signing for a Freeway Closure



Figure 4. Advance Notification Signing for a Ramp Closure

Departments may be negatively impacted by a freeway closure. These service agencies should be contacted to minimize the potential adverse effects of a freeway closure.

- 4) **Advance notification of any ramp closures should begin one week in advance of a freeway closure.** Entrance and exit ramps are often closed in conjunction with freeway closures. Informing local motorists prior to the closure will allow them to pre-plan alternate routes. An example of the type of notice is shown in Figure 4.

Traffic Management

The guidelines for traffic management during the closure are discussed in five sections: In Advance of the Detour; At the Point of Detour; Along the Detour; At the End of the Detour; and General Considerations.

In Advance of the Detour

- 1) **Motorists should be informed that the freeway is closed ahead.** CMSs or static signing can be used for this purpose. This information should be located far enough in advance of the closure to allow drivers the option of diverting to alternate routes.
- 2) **Motorists should be informed that they will be required to detour off the freeway.** It is important that the driver realize that a detour route is available. Otherwise, motorists may believe they are just being required to leave the freeway.
- 3) **Signing which encourages motorists to take alternate freeway routes should be provided.** This signing should specify the alternate route

and be positioned so that motorists have sufficient time to respond before the diversion point is reached. Figure 3 showed a trailer-sign used for this task.

At the Point of Detour

- 1) **Every effort should be made to have the point of detour coincide with the physical closure of the freeway.** Problems arise if drivers have the choice of staying on the freeway beyond the selected detour point. Motorists are very hesitant to leave the freeway voluntarily, and many drivers who actually desire to go where the detour route is leading will stay on the freeway only to be re-routed downstream. If a destination is accessible from the freeway downstream of the detour point, it is better to require all motorists to leave the freeway and allow only those who do actually desire the downstream destination to reenter the freeway. The other motorists can then be directed to the selected detour route. An example of a detour before the physical closure was shown in Figure 2.
- 2) **Provisions should be made for motorists who miss the detour route.** If there is a possibility that drivers can miss the detour route, a "forgiving" sign system (1) which redirects drivers to the detour route should be installed.
- 3) **Two-lane exit ramps should be provided at the point of detour whenever physically possible.** The increased capacity provided by a second ramp lane will minimize queing and congestion on the freeway mainlanes. However, a flagger or law enforcement officer may be required to encourage motorists to utilize both exit ramp lanes. A

minimum ramp width of 18 ft. is recommended in order to provide two lanes, but two successive exit ramps can be used where the physical characteristics of the ramp preclude providing a two-lane ramp. These two techniques are shown in Figures 5 and 6.

Positive guidance should be given to motorists at the two-lane exit ramp. Abbreviated pavement markers are recommended, but caution should be exercised to insure that exiting lane markings or paint do not present a confusing message to motorists.

Two eleven-foot lanes should be the minimum desirable width of the ramp. Exceptions could be made for short duration where speeds are suitably low for the available width.

Along the Detour

- 1) **Trailblazer signs clearly denoting the detour route should be placed along the detour.** The combination of a Detour Marker (MUTCD section 6B-38) with a Trailblazer type sign (MUTCD section 2D-33) is appropriate for use, since the function of a freeway closure detour is to return motorists to the freeway. The inclusion of a Directional Arrow is critical at turning points. In tangent sections, Directional Arrows reassure drivers that they are on the correct route. This type of signing is illustrated in Figure 7a.
- 2) **Advance warning of any exits or turns along the detour should be provided.** Conspicuous signing giving notice of changes in the detour

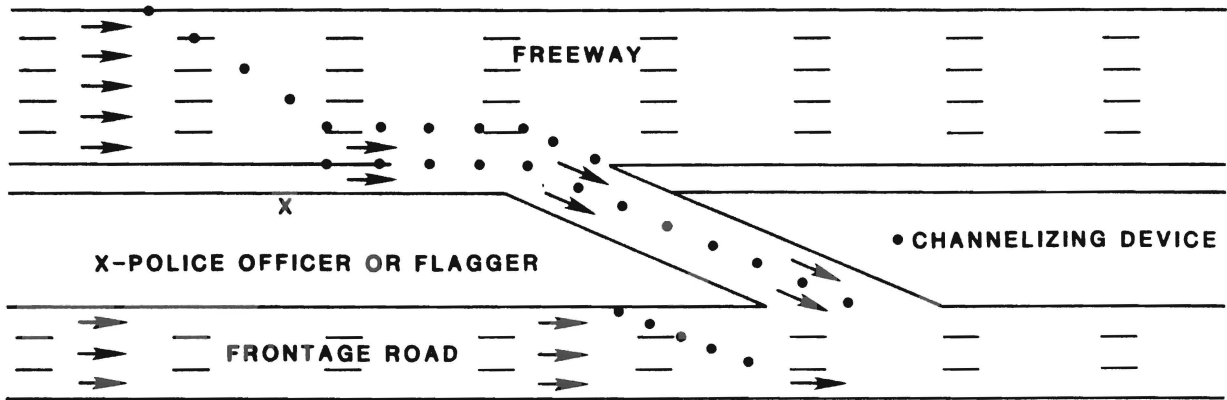
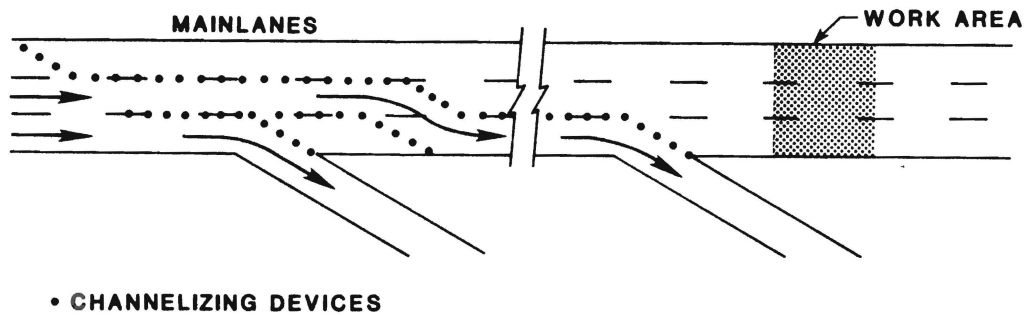


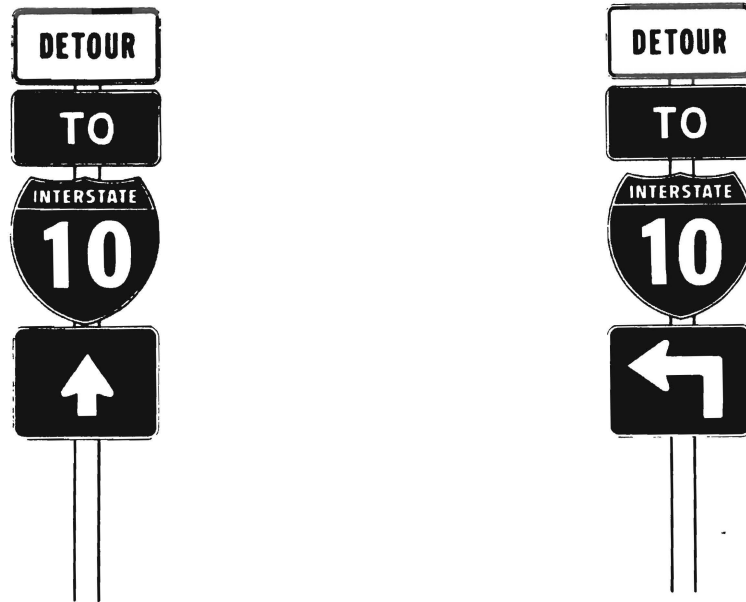
Figure 5. Traffic Control for a Two-Lane Exit Ramp



Note: Appropriate signing, arrowboards, etc., should be installed at work zone, depending on site conditions.

Figure 6. Traffic Control for Two Successive Exit Ramps

direction should be used to reduce driver uncertainty and to provide adequate time to prepare for the change in direction. Advance Turn Arrows (MUTCD section 2D-26) can be used with Trailblazer signing, as shown in Figure 7b, to achieve this objective.



a. Typical Assembly

b. In Advance of an Interseccion

Figure 7. Detour Trailblazer Assemblies

- 3) **"Forgiving" signs should be used to inform drivers who have missed exits or turns along the detour.** The messages shown in figure 5 can also be used to redirect motorists who have strayed from the detour route. These signs may only be necessary on complicated detours with major intersections where the occurrence of wrong turns is likely.

- 4) **The use of Non-Standard signing for denoting the detour route should be avoided.** The novelty of a Non-Standard sign may gain the motorist's attention, but this benefit must be balanced against the long-term effects of using symbols, colors or messages not intended for use at work zone detours, especially if a standard sign exists for that purpose. Many times, the unique nature of freeway closures will call for the use of special signs. However, the principles of good signing should be adhered to. Information on appropriate messages can be found in Reference 1.
- 5) **Traffic Signals on the detour route should be re-timed to favor the detoured traffic.** The detour route functions as a temporary "freeway" and traffic movement should be facilitated along it. In some cases, re-timing the signals will be sufficient. At high-volume intersections with substantial cross-street traffic, manual signal operation may be necessary for adequate traffic control.

At the End of the Detour

- 1) **Two successive entrance ramps may be necessary to return traffic to the freeway.** When traffic demands exceed the capability of a single entrance ramp to handle the freeway traffic without causing problems on the frontage road or adjoining intersections, it is advisable to use two successive entrance ramps. It may be desirable to force some motorists to the second ramp by the use of channelizing devices and traffic direction by police officers. This strategy is shown in Figure 9.

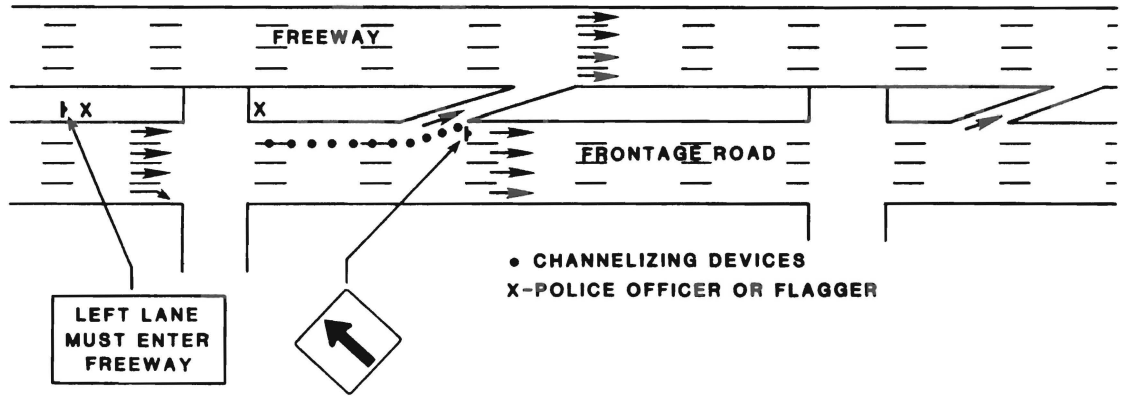


Figure 9. Traffic Control for Two Successive Entrance Ramps

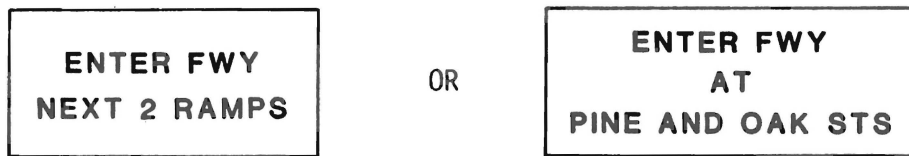


Figure 10. Typical Reentry Messages

- 2) **Signing which informs motorists where they will reenter the freeway should be provided.** Messages such as those listed in Figure 10 can be used in advance of the entrance ramps to promote orderly traffic flow by increasing motorist awareness of where the freeway may be reentered.

General Considerations

- 1) **Existing signing which is Inappropriate or Non-applicable should be removed or covered.** To reduce confusion, misleading existing guide signing should be covered. To promote efficiency, regulatory signing such as stop signs may be covered if precautions are taken to avoid hazardous situations.
- 2) **Avoid placing two Changeable Message Signs (CMSs) opposite one another at the same point along the roadway.** Message effectiveness is reduced since drivers cannot comprehend messages from two CMSs at one time. Two CMSs can be used in succession to provide important information twice, or to supplement information given on the first CMS.
- 3) **Flaggers should be used to promote efficient traffic flow and to provide pedestrian access along the route.** Flaggers can be used to direct traffic at turning points and entrance and exit ramps. Additionally, high detour traffic volumes along the route may make it difficult for pedestrian traffic to cross the roadway. Flaggers can be used to stop detoured traffic at pedestrian crossings.
- 4) **Temporary lighting used during nighttime operations should be positioned so that drivers are not blinded.** Temporary lighting can

be used to illuminate potentially hazardous roadway locations. However, this lighting should be positioned overhead, so it is shining down on traffic, not at oncoming vehicles. If overhead positioning is impossible, the lights should face perpendicular to traffic. This is true of lights used for the work as well as those used to illuminate the roadway.

Law Enforcement

The authority and credibility of law enforcement officers make them valuable assets during freeway closures. The following guidelines are offered to help utilize law enforcement resources effectively:

- 1) **Law enforcement efforts should be coordinated by a law enforcement supervisor who is knowledgeable in traffic management.** Law enforcement traffic management works well when there is central coordination of the effort. The law enforcement supervisor and the Traffic Control Coordinator should cooperate in making traffic control decisions.
- 2) **A relief rotation should be implemented for law enforcement officers. Directing traffic is a physically demanding task.** Enough officers should be present so that rest periods, or rotation from low to high activity locations, can be provided. Law enforcement personnel will take rest periods, and provisions for replacements are critical to the success of traffic management efforts.
- 3) **All law enforcement officers should understand the objectives of each traffic control task.** Law enforcement officers are trained traffic controllers and should be allowed some flexibility in carrying out

their duties. However, their actions should fall within the general framework provided by the Traffic Control Plan. A pre-closure meeting with the officers and close cooperation with the law enforcement supervisor can be used to insure maximum effectiveness.

IMPLEMENTATION AND CONCLUSIONS

This report provides a reference guide for use by District and Division personnel who plan and implement traffic control at freeway work zones. The report discusses operational guidelines for short-term total freeway closure. It is intended to assist the user in identifying several operational considerations based on actual field experience in Houston.

REFERENCES

1. C.L. Dudek, R.D. Huchingson, et al. Human Factors Requirements for Real-Time Motorist Information Displays, Vol. 1 - Design Guide. Texas Transportation Institute, Report No. FHWA-RD-78-5, September 1978.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

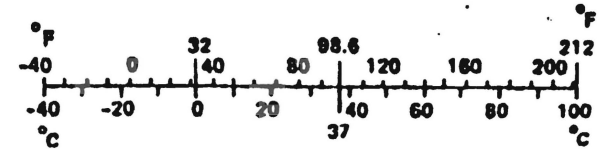
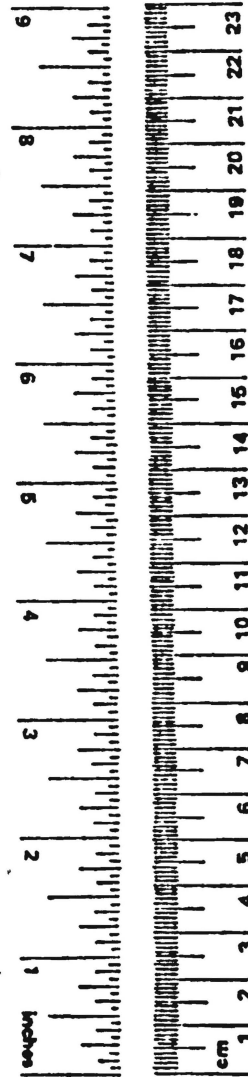
Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³

TEMPERATURE (exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



* 1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.26, SD Catalog No. C13.10:286.