HUMAN FACTORS REQUIREMENTS FOR REAL-TIME
MOTORIST INFORMATION DISPLAYS

Vol. 3 SUMMARY OF SYSTEMS IN THE UNITED STATES

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a report
from the Texas A&M
RESEARCH FOUNDATION
College Station, Texas

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This report contains a summary of real-time motorist information systems in the United States up through 1975.
PREFACE

This document is part of a seventeen-volume report entitled, Human Factors Requirements For Real-Time Motorist Information Displays. Titles of all volumes are shown below.

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<td>78-14</td>
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<td>Human Factors Evaluation of Route Diversion and Guidance Variables</td>
</tr>
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<td>78-16</td>
<td>Supplement to Traffic State Descriptors and Route Diversion and Guidance Studies</td>
</tr>
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<td>78-17</td>
<td>Human Factors Evaluation of Audio and Mixed Modal Variables</td>
</tr>
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ACKNOWLEDGMENTS

In assembling data on real-time information display systems, the author received a great deal of cooperation from many individuals and organizations throughout the country. The author is indebted to the many individuals who provided the necessary information to prepare this report.

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G. L. Gordon, Sperry Systems Management
R. Green, California Department of Transportation
A. Grover, California Department of Transportation
R. Hauslen, Port Authority of New York and New Jersey
T. Heinly, Florida Department of Transportation
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D. Hoffman, Washington State Department of Highways
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J. Kraft, New Jersey Turnpike Authority
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J. McDermott, Illinois Department of Transportation
J. Murphy, City of Boston, Department of Public Works
G. Schoene, District of Columbia Department of Transportation
D. Shaffer, Colorado Department of Transportation
T. Young, City of Cincinnati

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<td>68</td>
</tr>
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INTRODUCTION

During the early phases of the research contract several individuals and agencies were contacted in an attempt to determine activities or plans relative to variable message signs. Contacts were made with known sources who in turn provided additional leads to other sources. The information presented in this report hopefully covers most of the major activities in the United States up through February 1975. There is a possibility that there may be installations unknown to the author and thus have been inadvertently omitted from the report. Table 1 summarizes the agencies and individuals that were contacted. The remaining portion of the report provides additional information on existing installations in the United States involving the use of real-time information displays in freeway corridors.
# TABLE 1

ACTIVITIES INVOLVING USE OF DYNAMIC INFORMATION DISPLAYS IN THE UNITED STATES*

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CONTACT</th>
<th>ORGANIZATION</th>
<th>FACILITY LOCATION</th>
<th>STATUS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Baltimore</td>
<td>Hugo Liem</td>
<td>City of Baltimore</td>
<td>Jones Falls Expressway</td>
<td>X</td>
<td>Preliminary engineering report prepared. System will include warning beacons, lamp matrix freeway advisory signs, and blank-out corridor routing signs</td>
</tr>
<tr>
<td>4. Chicago</td>
<td>Joseph M. McDermott</td>
<td>Chicago Area Expressway Surveillance Project</td>
<td></td>
<td>X</td>
<td>Plans to purchase one matrix sign for experiments on the freeway.</td>
</tr>
<tr>
<td>5. Cincinnati</td>
<td>E. Nels Burns</td>
<td>Ohio Dept. of Transportation</td>
<td>I-75</td>
<td>X</td>
<td>Traffic control system for events at Riverfront Stadium &amp; for peak periods in southbound direction. Nineteen lamp matrix signs &amp; inserts.</td>
</tr>
<tr>
<td>6. Cincinnati-Covington</td>
<td>B. R. Flener</td>
<td>Kentucky D.O.T.</td>
<td>I-75</td>
<td>X</td>
<td>Five lamp matrix signs to provide advance warning of congestion, incidents, slippery conditions. Maintenance problems reduced the use and effectiveness of system.</td>
</tr>
</tbody>
</table>
TABLE 1 (Cont.)
ACTIVITIES INVOLVING USE OF DYNAMIC INFORMATION DISPLAYS IN THE UNITED STATES*

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CONTACT</th>
<th>ORGANIZATION</th>
<th>FACILITY LOCATION</th>
<th>STATUS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Dallas</td>
<td>Conrad L. Dudek</td>
<td>Texas Transportation Institute</td>
<td>Skillman Ave.</td>
<td>X</td>
<td>Three rotating drum signs on inbound Skillman an arterial parallel to North Central Exp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>North Central Expressway</td>
<td>X</td>
<td>Telephone call-in system should be operational in early 1975.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>North Central Expressway</td>
<td>X</td>
<td>Two miles of linear radio system.</td>
</tr>
<tr>
<td>9. Detroit</td>
<td>Herb Crane</td>
<td>Michigan Dept. of State Highways</td>
<td></td>
<td>X</td>
<td>No immediate plans.</td>
</tr>
<tr>
<td>10. Houston</td>
<td>Conrad L. Dudek</td>
<td>Texas Transportation Institute</td>
<td>Gulf Freeway</td>
<td>X</td>
<td>Three matrix signs adjacent to Gulf Freeway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gulf Freeway</td>
<td>X</td>
<td>Three safety warning signs consisting of static message sign and flashing beacons automatically operated by digital computer.</td>
</tr>
<tr>
<td>11. Louisville</td>
<td>B. R. Flener</td>
<td>Kentucky D.O.T.</td>
<td>I-65</td>
<td>X</td>
<td>Warning sign consisting of static message and flashing beacons to warn of slow traffic ahead controlled by time clock corresponding with routine back-up of exit ramp traffic.</td>
</tr>
</tbody>
</table>
TABLE 1 (Cont.)

ACTIVITIES INVOLVING USE OF DYNAMIC INFORMATION DISPLAYS IN THE UNITED STATES

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CONTACT</th>
<th>ORGANIZATION</th>
<th>FACILITY LOCATION</th>
<th>STATUS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Los Angeles</td>
<td>Richard Green</td>
<td>California D.O.T.</td>
<td>Santa Monica Freeway</td>
<td>X</td>
<td>Thirty-five lamp matrix signs on Santa Monica Freeway.</td>
</tr>
<tr>
<td></td>
<td>Al Grover</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Miami</td>
<td>Tom Heinly</td>
<td>Florida D.O.T.</td>
<td>7th Ave.</td>
<td>X</td>
<td>Changeable message signs will be used in a demonstration program for bus and carpool lanes. Signs should be operational in early 1975.</td>
</tr>
<tr>
<td>18. New Jersey</td>
<td>Jerry Kraft Robert Dale</td>
<td>New Jersey Turnpike Authority</td>
<td>New Jersey Turnpike</td>
<td>X</td>
<td>103 speed limit signs; 100 speed warning signs; 68 rotating drum signs used to divert traffic around congestion.</td>
</tr>
<tr>
<td>LOCATION</td>
<td>CONTACT</td>
<td>ORGANIZATION</td>
<td>FACILITY LOCATION</td>
<td>STATUS</td>
<td>COMMENTS</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------</td>
<td>-------------------------------</td>
<td>-------------------</td>
<td>--------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>19. New York City</td>
<td>Vinson Hoddinott</td>
<td>N.Y. City Dept. of Transportation</td>
<td>Long Island Expressway</td>
<td>X</td>
<td>Will use changeable message signs and arrows and X's for bus contra-flow lanes on Long Island Exp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Van Wyck Expressway</td>
<td>X</td>
<td>Implementation about two years away.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Penn-Lincoln Parkway</td>
<td>X</td>
<td>Implementation expected in one year.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I-5</td>
<td>X</td>
<td>Surveillance, control, and information system planned on 17 miles of I-5. Motorist aid changeable message signs expected in 1976-77.</td>
</tr>
</tbody>
</table>


**TABLE 1 (Cont.)**

ACTIVITIES INVOLVING USE OF DYNAMIC INFORMATION DISPLAYS IN THE UNITED STATES

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CONTACT</th>
<th>ORGANIZATION</th>
<th>FACILITY LOCATION</th>
<th>STATUS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9th Street</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>I-95 Tunnel between 2nd and 3rd Streets</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

*This table includes the listing of activities based on personal contacts throughout the country. It is possible that some systems may have been inadvertently omitted from the table.*
System

The recommended system includes surveillance, warning beacons, freeway advisory message signs, corridor routing signs, computer, control display, and one-television camera system.

Objectives of Signs

The warning beacons will be used to warn motorists of impending congestion ahead. Freeway advisory message signs will advise motorists of reasonable speeds, indicate delays, and warn of maintenance operations and environmental conditions. Corridor routing signs will advise motorists of alternate routes when the freeway is heavily congested.

Display Description

Suggested displays are as follows:

1. Warning beacons - standard amber
2. Freeway advisory signs - matrix (See Figures 1 - 4).
3. Corridor routing signs - blank-out as shown in Figure 5.

Location of Signs

Suggested locations are as follows:

1. Warning beacons - to be installed on freeway at approximately 1/5 mile spacings (total of 58 beacons)
2. Freeway advisory signs - to be installed overhead on freeway (total of 10 signs)
3. Corridor routing signs - to be located at major decision points within corridor (total of 44 signs)
Figure 1 - Suggested Advisory Messages to Indicate Reduction in Speed - Baltimore (1)
Figure 2 - Suggested Advisory Messages for Advance Warning of Maintenance Work - Baltimore (1)
Figure 3 - Suggested Advisory Messages to Indicate Abnormal Delays - Baltimore (1)
Figure 4 - Suggested Warning Messages for Environmental Conditions - Baltimore (1)
Messages

Beacons and corridor routing signs are to be blank-out. Freeway advisory signs will have the following message capabilities (See Figures 1-4).

<table>
<thead>
<tr>
<th>UPPER LINE</th>
<th>MIDDLE LINE</th>
<th>LOWER LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW</td>
<td>1</td>
<td>MPH</td>
</tr>
<tr>
<td>WORK</td>
<td>2</td>
<td>MI</td>
</tr>
<tr>
<td>DELAY</td>
<td>3</td>
<td>MIN</td>
</tr>
<tr>
<td>WET</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>FOG</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>ICE</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>AHEAD</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Signs will have capabilities for flashing operations.

Status

Proposed
Electronic freeway surveillance and motorist information signs.

Objectives of Signs

The objective is to inform motorists of freeway incidents, downtown parking availability, and stadium parking availability, and to divert freeway traffic if necessary, and/or to direct traffic to available downtown and stadium parking.

Display Description

Lamp matrix changeable message signs with 12-inch letters. Displays are shown in Figure 6. Photographs of signs at specific locations are shown in Figures 7 through 10.

Location of System

The location of the signs are identified in Figure 6.

Operation

The system was designed to operate the signs automatically by a computer.

Messages

Messages are automatically selected based on specific status conditions. A matrix of status and messages for the signs are shown in Figure 11.

Status

Operational, currently being evaluated.
Figure 6 - Location of Changeable Message Signs on Southbound I-75 - Cincinnati
Figure 7 - Signs 1(b), (c), and (d) - Cincinnati
Figure 8 - Sign 50(a) - Cincinnati
Figure 9 - Sign 12-1 - Cincinnati
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>SIGN NO.</th>
<th>STATUS 1</th>
<th>STATUS 2</th>
<th>STATUS 3</th>
<th>STATUS 4</th>
<th>STATUS 5</th>
<th>STATUS 6</th>
<th>STATUS 7</th>
<th>STATUS 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. B. 6TH ST. EXPwy.</td>
<td>200b</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>E. B. 6TH ST. EXPY. at I-71, US-50</td>
<td>209b</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>AT HOPPLE</td>
<td>71-1</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>S. OF MARSHALL</td>
<td>64a</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>AT FINGALY</td>
<td>50a</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>FREEMAN AVE. GORE (EXIT 16)</td>
<td>45c</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>SEVENTH ST. GORE (EXIT 1)</td>
<td>33c</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>FT. WASHINGTON WAY</td>
<td>12-1</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>FIFTH ST. GORE (EXIT 1E)</td>
<td>21a</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>OVERHEAD IN ADVANCE OF SEVENTH ST.</td>
<td>41b</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>OVERHEAD (EXIT 1D)</td>
<td>39a</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>OVERHEAD (EXIT 1D)</td>
<td>39b</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>IN ADVANCE OF (EXIT 1D)</td>
<td>39c</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>E. B. 6TH ST. EXPwy.</td>
<td>201-3</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>E. B. 6TH ST. EXPwy.</td>
<td>209a</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>E. B. 6TH ST. EXPwy.</td>
<td>209b</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>E. B. 5TH ST. EXIT</td>
<td>209b</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
</tr>
<tr>
<td>E. B. 5TH ST. EXIT</td>
<td>209a</td>
<td>blank</td>
<td>blank</td>
<td>blank</td>
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Figure 11 - Messages for Changeable Signs in Cincinnati
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Figure 11 (Cont.) - Messages for Changeable Signs in Cincinnati

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Figure 11 (Cont.) - Messages for Changeable Signs in Cincinnati
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<td>ALT 1-75 CONGESTED ALT 75</td>
<td>STADIUM EXIT 1C</td>
<td>DOWNTOWN</td>
<td>DOWNTOWN</td>
<td>DOWNTOWN</td>
<td>DOWNTOWN</td>
<td>DOWNTOWN</td>
</tr>
<tr>
<td>AT HOPPLE</td>
<td>LINE 1 LINE 2</td>
<td>ALT 1-75 CONGESTED ALT 1-75</td>
<td>STADIUM EXIT 1C</td>
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<tr>
<td>EAST BOUND SIXTH ST EXPRESSWAY</td>
<td>200 b</td>
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<td>USE EXITS 2A,2B</td>
<td>(blank)</td>
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<td>E 6th ST EXPRESSWAY</td>
<td>209 A</td>
<td>ALT 1-75</td>
<td>USE EXIT 3N</td>
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<tr>
<td>E 6th ST EXPRESSWAY</td>
<td>209 C</td>
<td>(blank)</td>
<td>USE EXIT 2A</td>
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Figure 11 (Cont.) - Messages for Changeable Signs in Cincinnati
<table>
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<tr>
<th>LOCATION</th>
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<tr>
<td>OUT</td>
<td>1 a</td>
<td>ONTOWN</td>
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<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
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<tr>
<td>STADIUM</td>
<td>1 d</td>
<td>ONTOWN</td>
<td>ONTOWN</td>
<td>ONTOWN</td>
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<td>OVERHEAD EXIT 1b</td>
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<td>ONTOWN</td>
<td>ONTOWN</td>
<td>ONTOWN</td>
<td>ONTOWN</td>
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<td>ONTOWN</td>
</tr>
<tr>
<td>EXIT 1b</td>
<td>3 c</td>
<td>ONTOWN</td>
<td>ONTOWN</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
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<tr>
<td>EXIT 1b</td>
<td>3 d</td>
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<td>ALT 75</td>
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<td>EASTBOUND FT. WASHINGTON WAY</td>
<td>12-1</td>
<td>STADIUM EXIT 1b</td>
<td>ONTOWN EXITS IP-E-D-C</td>
<td>STADIUM EXIT 1b</td>
<td>ONTOWN EXITS IP-E-D-C</td>
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<td>ONTOWN</td>
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<tr>
<td>SEVENTH ST.-GORE (EXIT 1F)</td>
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<td>ONTOWN</td>
<td>ONTOWN</td>
<td>ONTOWN</td>
<td>ONTOWN</td>
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<td>ONTOWN</td>
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<td>OVERHEAD IN ADVANCE OF SEVENTH</td>
<td>41 b</td>
<td>STADIUM EXIT 1b</td>
<td>ONTOWN EXITS IP-E-D-C</td>
<td>STADIUM EXIT 1b</td>
<td>ONTOWN EXITS IP-E-D-C</td>
<td>STADIUM EXIT 1b</td>
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<td>(blank)</td>
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<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
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<tr>
<td>LING PK DR.-GORE (EXIT 1H)</td>
<td>49 a</td>
<td>USE EXIT 1G</td>
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<td>ALT 75</td>
<td>ALT 75</td>
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<tr>
<td>AT FINDLAY</td>
<td>50 a</td>
<td>EXIT 1H</td>
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<td>ALT 75,71</td>
<td>USE EXIT 1H</td>
<td>RIGHT LANE CONGESTED</td>
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<td>WESTERN GORE (EXIT 3A)</td>
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<tr>
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<td>64 a</td>
<td>EXIT 1M</td>
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<td>USE EXIT 2A</td>
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<td>STADIUM PRIME ONLY</td>
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<td>USE EXIT 3A</td>
<td>LEFT LANE CONGESTED</td>
<td>ALT 75,71</td>
<td>USE EXIT 3A</td>
<td>RIGHT LANE CONGESTED</td>
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<td>EASTBOUND 6TH ST. EXPRESSWAY</td>
<td>201 b</td>
<td>(blank)</td>
<td>(blank)</td>
<td>(blank)</td>
<td>STADIUM VIA NEW MILLING WAY</td>
<td>ONTOWN PRIME EXIT TAKE</td>
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<td>(blank)</td>
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<td>(blank)</td>
<td>ONTOWN PRIME</td>
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Figure 11 (Cont.) - Messages for Changeable Signs in Cincinnati
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<tr>
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<th>STATUS 35</th>
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<td>ON TOWN</td>
<td>ON TOWN</td>
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<tr>
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<td>EXIT 1C</td>
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<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>(N/A)</td>
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<td>STADIUM</td>
<td>STADIUM</td>
<td>STADIUM</td>
<td>(N/A)</td>
<td></td>
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<td>OVERHEAD IN ADVANCE OF VINE 2ND EXIT</td>
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<td>ON TOWN</td>
<td>ALT 75</td>
<td>(N/A)</td>
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<tr>
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<td>EXIT 1C</td>
<td>STADIUM</td>
<td>STADIUM</td>
<td>STADIUM</td>
<td>STADIUM</td>
<td>(N/A)</td>
<td></td>
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<td>EXIT 1B</td>
<td>STADIUM</td>
<td>STADIUM</td>
<td>STADIUM</td>
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<td>STADIUM</td>
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<td>ALT 75</td>
<td>EXIT 1C</td>
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<td>STADIUM</td>
<td>STADIUM</td>
<td>STADIUM</td>
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<td>FIFTH ST-GORE EXIT 1E</td>
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<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
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<td>EXIT 1G</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ALT 75</td>
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<td>OVERHEAD IN ADVANCE OF SEVENTH</td>
<td>EXIT 1G</td>
<td>FREEWAY OCCUPIED EXIT IF ONLY</td>
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<td>I-75 CONGESTED 1 MILE</td>
<td>FOG AHEAD</td>
<td>REDUCE SPEED (blank) (blank)</td>
</tr>
<tr>
<td>FREEMAN AVE-GORE EXIT 1G</td>
<td>EXIT 1G</td>
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<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
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<td>LINC PK DR-GORE EXIT 1H</td>
<td>EXIT 1G</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ON TOWN</td>
<td>ALT 75</td>
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<td>AT FINDLEY</td>
<td>EXIT 1G</td>
<td>FREEWAY OCCUPIED EXIT IF USE EXIT IF</td>
<td>FREEWAY OCCUPIED EXIT IF USE EXIT IF</td>
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<td>FOG AHEAD</td>
<td>REDUCE SPEED (blank) (blank)</td>
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<td>ALT 75</td>
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<td>SOUTH OF MARSHALL</td>
<td>EXIT 1G</td>
<td>FREEWAY OCCUPIED EXIT IF</td>
<td>FREEWAY OCCUPIED EXIT IF</td>
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<td>I-75 CONGESTED 3 MILES</td>
<td>FOG AHEAD</td>
<td>REDUCE SPEED (blank) (blank)</td>
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<td>EXIT 1G</td>
<td>FREEWAY OCCUPIED EXIT IF</td>
<td>FREEWAY OCCUPIED EXIT IF</td>
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<td>I-75 CONGESTED 4 MILES</td>
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<td>REDUCE SPEED (blank) (blank)</td>
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<td>EXIT 1G</td>
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<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>(N/A)</td>
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<td>EB SIXTH ST EXPRESSWAY I-71-US-50</td>
<td>EXIT 1G</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>(N/A)</td>
</tr>
<tr>
<td>EB SIXTH ST EXPRESSWAY FIFTH ST EXIT</td>
<td>EXIT 1G</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
<td>ALT 75</td>
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Figure 11 (Cont.) - Messages for Changeable Signs in Cincinnati

25
<table>
<thead>
<tr>
<th>Special Message #1</th>
<th>Special Message #2</th>
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<tr>
<td><strong>SIGN 71-1</strong></td>
<td><strong>SIGN 71-1</strong></td>
</tr>
<tr>
<td>FOG AHEAD</td>
<td>FOG AHEAD</td>
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<tr>
<td>REDUCE SPEED</td>
<td>REDUCE SPEED</td>
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<tbody>
<tr>
<td><strong>SIGN 71-1</strong></td>
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<tr>
<td>ACCIDENT AHEAD</td>
</tr>
<tr>
<td>REDUCE SPEED</td>
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<th>Special Message #4</th>
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<tr>
<td><strong>SAME AS SPECIAL MESSAGE #3</strong></td>
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<tr>
<td><strong>EXCEPT USE &quot;CONGESTION&quot; IN-STEAD OF &quot;ACCIDENT&quot;</strong></td>
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<th>Special Message #5</th>
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</thead>
<tbody>
<tr>
<td><strong>SAME AS SPECIAL MESSAGE #3</strong></td>
</tr>
<tr>
<td><strong>EXCEPT USE &quot;ROAD WORK&quot; IN-STEAD OF &quot;ACCIDENT&quot;</strong></td>
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<th>Special Message #6</th>
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<tbody>
<tr>
<td><strong>FREEWAY OPEN</strong></td>
</tr>
<tr>
<td><strong>DRIVE CAREFULLY</strong></td>
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<th>Special Message #7</th>
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<tr>
<td><strong>SIGN 71-1, 2016</strong></td>
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<tr>
<td>SYSTEMS BEING TESTED</td>
</tr>
<tr>
<td>IGNORE ELECTRIC SIGNS</td>
</tr>
</tbody>
</table>

Figure 11 (Cont.) - Messages for Changeable Signs in Cincinnati
CINCINNATI - COVINGTON (3)

System

Five variable signs.

Objectives of Signs

To provide advance warning of congestion, accidents or slippery conditions on a high-volume, hilly and curvy section of I-75 and to provide either warning messages or alternate routing instructions.

Display Description

Signs are lamp matrix changeable message signs.

Location of Signs

Installed in I-75 northbound approaching the Cincinnati-Covington area.

Operation

Signs are controlled by direct wire from a nearby Police facility with a monitor in a nearby Highway District office. Criteria for the use of the signs are shown in Table 2.
Table 2
CRITERIA FOR THE USE OF THE VARIABLE MESSAGE SIGNS ON I-75 IN KENTON COUNTY

<table>
<thead>
<tr>
<th>MESSAGE</th>
<th>WHEN TO USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. &quot;ACCIDENT AHEAD–PREPARE TO STOP&quot;</td>
<td>To be used when an accident occurs that causes a minor stoppage of traffic on I-75. (One or less lanes of traffic blocked)</td>
</tr>
<tr>
<td>2. &quot;ACCIDENT AHEAD–USE MARKED EXIT&quot;</td>
<td>To be used when an accident occurs that causes a major stoppage of traffic on I-75. (Two or more lanes of traffic blocked)</td>
</tr>
<tr>
<td>3. &quot;ACCIDENT AHEAD–EXIT HERE ➤&quot;</td>
<td>Automatically displayed with &quot;ACCIDENT AHEAD–USE MARKED EXIT.&quot;</td>
</tr>
<tr>
<td>4. &quot;CONGESTION AHEAD–PREPARE TO STOP&quot;</td>
<td>(A) To be used when very heavy, but &quot;Moving&quot; traffic occurs such as on holiday weekends. (B) To be used during heavy congestion when one lane of traffic is blocked due to road repairs.</td>
</tr>
<tr>
<td>MESSAGE</td>
<td>WHEN TO USE</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 5. "CONGESTION AHEAD-USE MARKED EXIT" | (A) To be used when extremely heavy traffic occurs which causes a major bottleneck on I-75.  
                              | (B) To be used if I-75 is closed to traffic for any reason other than an accident. |
| 6. "CONGESTION AHEAD-EXIT HERE ➔" | Automatically displayed with "CONGESTION AHEAD-USE MARKED EXIT".              |
| 7. "CURVES HILL-REDUCE SPEED"        | To be used when slick roadway conditions exist on I-75, such as during a heavy rainstorm or when snow or ice are present. |
Messages

The messages are as follows:

Sign "A" located in advance of the Maple Avenue Interchange:

ACCIDENT AHEAD
CONGESTION AHEAD
CURVES-HILL

PREPARE TO STOP
PREPARE TO STOP
REDUCE SPEED

USE MARKED EXIT
USE MARKED EXIT

Sign "B" located on the Maple Avenue Interchange bridge structure:

ACCIDENT AHEAD
CONGESTION AHEAD
CURVES-HILL

PREPARE TO STOP
PREPARE TO STOP
REDUCE SPEED

EXIT HERE ↩
EXIT HERE ↩

Sign "C" located in advance of the Kyles Lane Interchange:

ACCIDENT AHEAD
CONGESTION AHEAD
CURVES-HILL

PREPARE TO STOP
PREPARE TO STOP
REDUCE SPEED

USE MARKED EXIT
USE MARKED EXIT

Sign "D" located on the Kyles Lane Interchange bridge structure:

ACCIDENT AHEAD
CONGESTION AHEAD
CURVES-HILL

PREPARE TO STOP
PREPARE TO STOP
REDUCE SPEED

EXIT HERE ↩
EXIT HERE ↩

Sign "E" located between Kyles Lane Interchange and Jefferson Street:

ACCIDENT AHEAD
CONGESTION AHEAD
CURVES-HILL

PREPARE TO STOP
PREPARE TO STOP
REDUCE SPEED

Status

Equipment has not been reliable (either by design or from lack of adequate maintenance) so that the operating agency has not been able to fully utilize the capabilities of the system.
DALLAS–SKILLMAN AVENUE

System

Freeway corridor control system. System has limited television coverage. Pilot changeable message sign subsystem is integrated with surveillance and control system.

Objective of Signs

Objectives are to inform motorists of freeway conditions while they are traveling on Skillman and to advise motorists to use the alternate route up to a selected cross street in order to by-pass heavy congestion.

Display Description

Signs are rotating drum having four 4-sided drums on each sign. (See Figure 12). Signs are green. Sign panels are color coded for specific messages.

Location of Signs

The signs are located along Skillman Ave. as shown in Figure 13.

Operation

Each sign and drum is individually controlled remotely from the surveillance center. Messages are changed based on information displayed on a teletype and observations from television monitors.

Messages

Static message above drums: SOUTHBOUND CENTRAL EXP. All sign panels on drums have white lettering on green background except as noted.
Figure 12 - Changeable Message Sign - Dallas
Figure 13 - Location of Changeable Message Signs in N. Central Expressway Corridor
<table>
<thead>
<tr>
<th></th>
<th>SIGN A</th>
<th>SIGN B</th>
<th>SIGN C</th>
</tr>
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<tbody>
<tr>
<td>Upper Drum</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>SLOW*</td>
<td>SLOW*</td>
<td>SLOW*</td>
</tr>
<tr>
<td></td>
<td>LANE BLOCKED**</td>
<td>LANE BLOCKED**</td>
<td>LANE BLOCKED**</td>
</tr>
<tr>
<td></td>
<td>(blank)</td>
<td>(blank)</td>
<td>(blank)</td>
</tr>
<tr>
<td>2nd Drum</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>1 MILE</td>
<td>1 MILE</td>
<td>1 MILE</td>
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<tr>
<td></td>
<td>3 MILES</td>
<td>2 MILES</td>
<td>2 MILES</td>
</tr>
<tr>
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<td>5 MILES</td>
<td>3 MILES</td>
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</tr>
<tr>
<td></td>
<td>(blank)</td>
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<td>(blank)</td>
</tr>
<tr>
<td>3rd Drum</td>
<td>USE SKILLMAN</td>
<td>USE SKILLMAN</td>
<td>USE SKILLMAN</td>
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<td></td>
<td>(blank)</td>
<td>(blank)</td>
<td>(blank)</td>
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<tr>
<td></td>
<td>(blank)</td>
<td>(blank)</td>
<td>(blank)</td>
</tr>
<tr>
<td>Bottom Drum</td>
<td>TO NORTHWEST HWY</td>
<td>TO LOVERS LANE</td>
<td>TO MOCKINGBIRD</td>
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<td></td>
<td>TO LOVERS LANE</td>
<td>TO MOCKINGBIRD</td>
<td>TO DOWNTOWN</td>
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<td></td>
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<td></td>
<td>(blank)</td>
<td>(blank)</td>
<td>(blank)</td>
</tr>
</tbody>
</table>

* Black lettering on yellow background
** White lettering on red background

** Status
Operational but not yet evaluated.**
System

Freeway corridor control system. System has limited television coverage. Telephone call-in subsystem will be integrated with surveillance and control system.

Objectives of Telephone System

Objective is to provide motorists with pre-trip planning information concerning conditions on the North Central Expressway so that they can decide whether to take alternate routes.

Display Description

Audio

Location of System

Central unit housed in the N. Central Corridor Surveillance and Control Center.

Operation

Motorists can dial a specific telephone number and receive pre-recorded information concerning conditions on the North Central Expressway. Messages are updated whenever conditions change significantly.

Messages

The telephone call-in system offers considerable flexibility. However, consistency is important to assure that basic information needs are available to the motorists. The following are message packages recommended as standard format for nine commonly occurring traffic situations:
I. No Incident—AM Peak Period

1. Traffic inbound is heavy and traveling about _____ miles an hour between LBJ Freeway and Downtown.

2. Traffic in the outbound direction is moderate, light and traveling about _____ miles an hour between Downtown and the LBJ Freeway.

3. There are no accidents or stalled vehicles on the freeway.

II. Inbound Incident—AM Peak

1. There is an unidentified blockage, stalled car, accident inbound on the Expressway at (location) blocking the right, middle, left lane(s).

2. Traffic is backed up to (location).

3. We expect that the incident, stalled car, accident will block the lane(s) for another (number) minutes.

4. We advise that if you are heading for the downtown area that you
   a. Still use the expressway because it will be the quickest route.
   b. Use Skillman to (name).
   c. Use the toll road.
   d. If you can, use one of the following entrance ramps to avoid the congestion (list).

5. Traffic outbound is moderate, light and traveling at about _____ miles per hour between Downtown and the LBJ Freeway.

III. Outbound Incident—AM Peak

1. There is an unidentified blockage, stalled car, accident outbound on the expressway at (location) blocking the right, middle, left lane(s).

2. Traffic is backed up to (location).

3. We expect that the incident, stalled car, accident will block the lane(s) for another ______ minutes.

4. We advise that if you are heading for north Dallas that you
   a. Still use the expressway because it will be the quickest route.
   b. If you can, use one of the following entrance ramps (list).
   c. If you use the expressway, leave the expressway at (location) ramp and use the frontage road until you pass the incident.
5. Traffic inbound is moderate, light and traveling at about ____ miles per hour between LBJ Freeway and Downtown.

IV. Incident Removed—AM Peak Period

1. The stalled car, accident on the inbound, outbound Expressway at (location) that blocked the right, middle, left lane(s) has been removed.

2. Traffic is still backed up to (location), but should be clearing in a few minutes.

3. Traffic outbound, inbound is moderate, light and is traveling at about ____ miles per hour.

V. No Incident—Off Peak

1. Traffic inbound and outbound is light and traveling about ____ miles an hour between LBJ Freeway and Downtown.

2. There are no incidents on the expressway.

VI. Outbound Incident—PM Peak

1. There is an unidentified blockage, stalled car, accident outbound on the North Central Expressway at (location) blocking the right, middle, left lane(s).

2. Traffic is backed up to (location).

3. We expect that the stalled car, accident will block the lane(s) for another (number) minutes.

4. We advise that if you are heading for north Dallas that you
   a. Still use the expressway because it will be the quickest route.
   b. If you can, use one of the following entrance ramps (list).

5. Traffic inbound is moderate, light and traveling about ____ miles per hour.

VII. Inbound Incident—PM Peak

1. There is an unidentified blockage, stalled car, accident inbound on the expressway at (location) blocking the right, middle, left lane(s).
2. Traffic is backed up to (location).

3. We expect that the incident, stalled car, accident will block the lane(s) for another (number) minutes.

4. We advise that if you are heading for the downtown area that you 
   a. Still use the expressway because it will be the quickest route. 
   b. If you can, use one of the following entrance ramps (list). 
   c. If you use the expressway, leave the expressway at (location) ramp and use the frontage road until you pass the incident.

5. Traffic outbound is moderate, light and traveling ____ miles per hour.

VIII. Outbound Incident Removed-PM Peak Period

1. The stalled car, accident on the outbound North Central Expressway at (location) that blocked the right, middle, left lane(s) has been removed.

2. At the moment, traffic is still backed up to (location), but should be clearing in a few minutes.

3. Traffic inbound is moderate, light and is traveling at about ____ miles per hour.

IX. Construction or Maintenance-Off Peak

1. There is some construction, maintenance work on right, middle, left lane(s) of the inbound, outbound expressway at (location).

2. Causing traffic to back up to (location).

3. The expressway is still the quickest route to downtown, north Dallas.

4. We advise you to 
   a. Use added caution as you are approaching the maintenance, construction area. 
   b. Exit the expressway at (location) ramp and use the frontage road until you have passed the maintenance, construction area.

5. Traffic outbound, inbound is moderate, light and traveling at about ____ miles per hour.

Status

The system should become operational in early 1975.
System

The system consists of 4 variable message signs, loop vehicle detectors, control console, and computer and peripheral equipment.

Objective of Signs

The objective is to advise freeway motorists of the freeway conditions in specific zones and the distance to or length of such condition.

Display Description

Signs are bulb matrix having two lines of messages with 12 in. letter height and 20 characters per line.

Location of Signs

The signs are located on the freeway as shown in Figure 14.

Operation

The signs have considerable flexibility in operation and message selection. The system is designed such that 10 messages per line are stored in the computer. The computer automatically displays one of the first 8 messages on each line based on data analyzed from the traffic detectors. The remaining two messages on each line are displayed manually. Any of the messages can also be displayed manually. Any of the stored messages can be reprogrammed from the control console. Flashing operation is an added feature.
Figure 14 - Changeable Message Signs - Denver
Messages

Typical messages are as follows:

Upper Line:  FREE FLOWING TRAFFIC
             MODERATE CONGESTION
             HEAVY CONGESTION
             STOP AND GO TRAFFIC
             LEFT LANE BLOCKED
             RIGHT LANE BLOCKED
             CENTER LANE BLOCKED
             ROAD WORK
             ICY ROAD

Lower Line:  NEXT MILE
             NEXT 2 MILES
             NEXT 3 MILES
             NEXT 4 MILES
             1 MILE AHEAD
             2 MILES AHEAD
             3 MILES AHEAD
             5 MILES AHEAD
             ALT ROUTE ADVISED
             BE PREPARED TO STOP

Status

Operational
HOUSTON-GULF FREEWAY CHANGEABLE MESSAGE SIGNS

System

Freeway surveillance and controls on 6 miles of inbound Gulf Freeway surveillance consists of sensors and closed circuit television. Three changeable message signs are installed and presently being evaluated.

Objectives of Signs

To inform motorists of freeway conditions and to advise of some recommended actions.

Display Description

Signs are lamp matrix having three lines per sign. Signs on freeway have 14 in letters. Signs at ramp and intersection have 6 in letters. A typical design is shown in Figure 15.

Location of Signs

Sign A is located adjacent to the freeway downstream of the Wayside entrance ramp. Sign B is located overhead on the frontage road at the Griggs entrance ramp. Sign C is situated at the intersection of the N.B. frontage road and Telephone Road.

Operation

Signs are currently controlled manually and remotely from the control center based on special digital computer algorithm developed for sign operation. Operator uses information from teletype and visual inspection from television monitors. In addition to verbal messages, a letter rating system (A, B, C, D, F, X) are used in an attempt to reduce message requirements on signs.
Figure 15 - Sign on Gulf Freeway in Houston
<table>
<thead>
<tr>
<th>Messages</th>
<th>SIGN A</th>
<th>SIGN B</th>
<th>SIGN C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Line</td>
<td>FWY CONDITION</td>
<td>FWY CONDITION</td>
<td>FWY CONDITION</td>
</tr>
<tr>
<td></td>
<td>FWY CONDITION A</td>
<td>FWY CONDITION A</td>
<td>FWY CONDITION A</td>
</tr>
<tr>
<td></td>
<td>FWY CONDITION B</td>
<td>FWY CONDITION B</td>
<td>FWY CONDITION B</td>
</tr>
<tr>
<td></td>
<td>FWY CONDITION C</td>
<td>FWY CONDITION C</td>
<td>FWY CONDITION C</td>
</tr>
<tr>
<td></td>
<td>FWY CONDITION D</td>
<td>FWY CONDITION D</td>
<td>FWY CONDITION D</td>
</tr>
<tr>
<td></td>
<td>FWY CONDITION F</td>
<td>FWY CONDITION F</td>
<td>FWY CONDITION F</td>
</tr>
<tr>
<td></td>
<td>FWY CONDITION X</td>
<td>FWY CONDITION X</td>
<td>FWY CONDITION X</td>
</tr>
<tr>
<td>Middle Line</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>SLOW TRAFFIC</td>
<td>SLOW TRAFFIC</td>
<td>SLOW TRAFFIC</td>
</tr>
<tr>
<td></td>
<td>LANE BLOCKED</td>
<td>LANE BLOCKED</td>
<td>LANE BLOCKED</td>
</tr>
<tr>
<td></td>
<td>KEEP LEFT</td>
<td>USE</td>
<td>RAMP CLOSED</td>
</tr>
<tr>
<td></td>
<td>(blank)</td>
<td>(blank)</td>
<td>(blank)</td>
</tr>
<tr>
<td>Lower Line</td>
<td>1 MI AHEAD</td>
<td>1 MI AHEAD</td>
<td>1 MI AHEAD</td>
</tr>
<tr>
<td></td>
<td>2 MI AHEAD</td>
<td>2 MI AHEAD</td>
<td>2 MI AHEAD</td>
</tr>
<tr>
<td></td>
<td>3 MI AHEAD</td>
<td>3 MI AHEAD</td>
<td>3 MI AHEAD</td>
</tr>
<tr>
<td></td>
<td>KEEP RIGHT</td>
<td>FRONTAGE ROAD</td>
<td>USE NEXT RAMP</td>
</tr>
<tr>
<td></td>
<td>(blank)</td>
<td>(blank)</td>
<td>(blank)</td>
</tr>
</tbody>
</table>

**Status**

Experimental signs are being evaluated.
HOUSTON-GULF FREEWAY SAFETY WARNING SYSTEM

System

Freeway surveillance and controls on 6 miles of inbound Gulf Freeway surveillance consists of sensors and closed circuit television. Warning devices at three overpasses are integrated with existing operations.

Objectives of Warning System

The objective is to reduce rear-end accidents and increase freeway efficiency by alerting motorists to stoppage waves on freeway sections having restricted sight distances.

Display Description

Black on yellow static sign with message CAUTION-SLOW TRAFFIC-WHEN FLASHING. Amber beacons on left and right sides of sign. Amber beacon also mounted on guard rail at the crest of the overpass. (See Figures 16 and 17).

Location of System

Warning devices are mounted on the inbound Gulf Freeway at the following overpasses:

1. Griggs
2. S HB & T Railroad
3. N HB & T Railroad

Operation

Flashing beacons are automatically activated by a digital computer when stoppage waves are detected moving across loop sensors downstream of the overpass. The beacons are deactivated when the stoppage wave propagates upstream of the crest. Manual override features are built in the system.
CAUTION
SLOW TRAFFIC
WHEN FLASHING

Figure 16 - Warning Sign on Gulf Freeway in Houston

CULLEN ST.
NEXT EXIT

Figure 17 - Flashing Beacon Mounted on Crest
Messages

See "Display Description" above.

Status

Operational
LINCOLN AND HOLLAND TUNNELS—TRAFFIC RESTRAINING SIGNS

System

Automatic surveillance for stoppage detection, closed circuit television, police response system, bus priority, automatic vehicle identification pilot system, changeable message signs.

Objectives of Changeable Message Signs

To regulate traffic flow into the tunnel and to advise motorist of conditions in the tunnel.

Display Description

3-M Varicom scroll signs. Messages color coded as shown in Table 3.

Location of System

One Varicom sign located at portal to Lincoln Tunnel. New Varicom signs will replace existing matrix lamp signs at other portals to Lincoln and Holland Tunnels (See Figures 18-20).

Operation

(No information available)

Messages

See Table 3

Status

Experimental, soon to be operational
### TABLE 3
LINCOLN AND HOLLAND TUNNELS
PROPOSED VARICOM SIGN - SCROLL MESSAGES

<table>
<thead>
<tr>
<th>Scroll Location Number</th>
<th>Sign Legend</th>
<th>Letter Size</th>
<th>Letter Color</th>
<th>Background Color</th>
<th>Traffic Signal State</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>STOP</td>
<td>12&quot;</td>
<td>White</td>
<td>Red</td>
<td>Red</td>
<td>TTCS - Congestion</td>
</tr>
<tr>
<td>2</td>
<td>PAUSE HERE THEN GO</td>
<td>8&quot;</td>
<td>Black</td>
<td>Yellow</td>
<td>Amber (flashing)</td>
<td>TTCS - Anticipated Congestion</td>
</tr>
<tr>
<td>3</td>
<td>KEEP IN LANE</td>
<td>8&quot;</td>
<td>Black</td>
<td>White</td>
<td>Green</td>
<td>Free Flowing Traffic</td>
</tr>
<tr>
<td>4</td>
<td>KEEP IN LANE/ MEN WORKING</td>
<td>8&quot;</td>
<td>Black</td>
<td>Yellow</td>
<td>Amber</td>
<td>Complement to No. 8 when one lane is closed for maintenance</td>
</tr>
<tr>
<td>5</td>
<td>PAUSE HERE THEN GO/ To Reduce Stops in Tunnel</td>
<td>6&quot;</td>
<td>Black</td>
<td>Yellow</td>
<td>Amber (flashing)</td>
<td>Alternate to #2 may eventually be controlled by ATFC Program</td>
</tr>
<tr>
<td>6</td>
<td>STOP/ Accident Ahead</td>
<td>12&quot;</td>
<td>White</td>
<td>Red</td>
<td>Red</td>
<td>Fire, two lane blockage total tunnel closure due to emergency</td>
</tr>
<tr>
<td>7N</td>
<td>LANE CLOSED/ Stoppage in Tunnel</td>
<td>8&quot;</td>
<td>White</td>
<td>Red</td>
<td>Amber</td>
<td>All tunnel stoppages on jeep and tractor calls</td>
</tr>
<tr>
<td>7F</td>
<td>PROCEED WITH CAUTION/ Stoppage in Tunnel</td>
<td>6&quot;</td>
<td>Black</td>
<td>Yellow</td>
<td>Amber</td>
<td>Same as 7N and complementary for one lane feed</td>
</tr>
<tr>
<td>8</td>
<td>LANE CLOSED</td>
<td>12&quot;</td>
<td>White</td>
<td>Red</td>
<td>Red</td>
<td>Complement to #4 either message in adjacent lane, also both lanes when tube is closed.</td>
</tr>
</tbody>
</table>
Figure 18 - Changeable Message Signs for Test Comparison at Portal to Lincoln Tunnel
Red Beacon

STOP

White on Red

Figure 20 - Varicom Sign at Portal to Lincoln Tunnel Mode 2
The following paragraphs were reproduced from a report entitled, "Traffic Control at the Lincoln Tunnel," by Robert S. Foote, dated November, 1973.

A most important part of the flow control system is the configuration of control devices to actually restrain traffic entering the tunnel. Again this required development, and the present configuration is still not entirely optimal. In the early stages, traffic was stopped completely for seven to thirty seconds each minute, depending on the extent of restraint needed. While effective, this resulted in separation of the traffic stream into gaps and platoons, and tended to promote significant speed differences in the traffic stream. For the prototype system at the Lincoln Tunnel in the mid-1960's, changeable message signs reading "Pause Here Then Go" were used. At first these were augmented with swinging gates capable of adjusting the width of lane. The greater degree of restraint desired, the more the lane would be narrowed. This was very effective, but to preclude any adverse relations with motorists the configuration was augmented with explanatory signs advising the purpose of the control. These read (in conjunction with the Pause Here Then Go legend) "To Reduce Stops In Tunnel." The need to install gates between the two lanes entering each tube presented some hazard, and soon high-intensity lights were mounted flush in the pavement to determine whether they would have the same lane-narrowing effect. These became a significant problem to keep clean, and encouraged by a satisfactory degree of motorist compliance with the changeable message legends we decided to rely solely on these.

The main problem with the changeable message signs was lack of visibility in bright sunlight. The conventional blankout type of sign proved difficult to read in many peak traffic conditions. Therefore an experimental installation of rolling screen changeable message signs has been installed at the New Jersey portal of the Lincoln Tunnel South Tube. These "Varicom" signs have proven definitely effective, with internal illumination for dusk and nighttime operation. The main problem with the present experimental units for this operation are the size of the sign, and the need to assure inappropriate messages are not displayed. Smaller units are needed for installation at other portals, and we understand these are likely to be available in the near future. Unlike the blankout sign which is simply extinguished in case of a power failure, the rolling screen type of sign will remain in whatever position it was when the power failed. Some method of concealing the message during failure conditions is needed, and several possibilities exist. Experience to date, however, confirms the desirability of developing the rolling screen signs to achieve the considerably greater legibility and impact they offer compared with blankout and matrix signs.
System

Freeway surveillance and control project on 42 miles of freeway located on the Santa Monica, San Diego, and Harbor Freeways. Closed circuit television surveillance from police helicopter. California D.O.T. patrols on freeway system. Thirty-five changeable message signs. Teletype traffic information from surveillance center to nine radio stations.

Objectives of Signs

To warn motorists of incidents and to inform them of conditions on the Santa Monica Freeway.

Display Description

Signs are lamp matrix changeable message signs. Each sign contains a static message "FREEWAY CONDITION" and two matrix line inserts containing 18 inch letters with 16 characters per line (See Figure 21).

Location of Signs

Santa Monica Freeway inbound and outbound.

Operation

One-hundred messages are stored in a minicomputer. Each message can be manually selected through an operator's console. Since each message has a specific store location in the computer, any or all of the messages can be changed within the computer via a teletype.

The operators select messages based on data displayed on a freeway display map or on a CRT. The map displays color coded lane occupancy information.
Figure 21 - Matrix Changeable Message Sign - Santa Monica Freeway
from the computer. The following color codes are used:

- Occupancy <17 - green
- Occupancy 17-27 - yellow
- Occupancy >27 - red

In addition to the map display, a CRT displays lane occupancy and travel time information. Messages are selected by the operators using standardized procedures published in a manual.

Unusual freeway conditions indicated in the control room are verified by roving CALTRANS patrols that have radio contact with the center. At time, a police helicopter will also transmit video information via CCTV.

**Messages**

The set of messages stored in the computer on October 2, 1974, are shown in Table 4. Table 5 is a listing of messages that are most frequently used in day-to-day operations.

**Status**

Operational and presently being evaluated.
TABLE 4
MESSAGES USED ON SANTA MONICA FREEWAY (OCTOBER 2, 1974)

<table>
<thead>
<tr>
<th>MSG. TEXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 STALLED.VEHICLE./.3.MILES.AHEAD..</td>
</tr>
<tr>
<td>2 STALLED.VEHICLE./.1.MILE.AHEAD..</td>
</tr>
<tr>
<td>3 STALLED.VEHICLE./.MIDDLE.LANE...</td>
</tr>
<tr>
<td>LANE...1.2.3.4/BLOCKED...@@@</td>
</tr>
<tr>
<td>4 STALLED.VEHICLE./.MIDDLE.LANE...</td>
</tr>
<tr>
<td>LANE...1.2.3.4/BLOCKED...@@</td>
</tr>
<tr>
<td>5 STALLED.VEHICLE./...AHEAD.....</td>
</tr>
<tr>
<td>6 STALLED.VEHICLE./LEFT.LANE.AHEAD.</td>
</tr>
<tr>
<td>7 STALLED.VEHICLE./RIGHT.LANE.AHEAD</td>
</tr>
<tr>
<td>8 ...SLOWING.../...AHEAD.....</td>
</tr>
<tr>
<td>9 ........................./@............</td>
</tr>
<tr>
<td>10 ..........USE.................../...CAUTION...</td>
</tr>
<tr>
<td>11 ......ACCIDENT.../...3.MILES.AHEAD..</td>
</tr>
<tr>
<td>12 ......ACCIDENT.../...1.MILE.AHEAD..</td>
</tr>
<tr>
<td>13 ......ACCIDENT.../...AHEAD.....</td>
</tr>
<tr>
<td>14 .ACCIDENT.AHEAD./...LEFT.LANES...</td>
</tr>
<tr>
<td>15 .ACCIDENT.AHEAD./...LEFT.LANE....</td>
</tr>
<tr>
<td>16 .ACCIDENT.AHEAD./...RIGHT.LANES...</td>
</tr>
<tr>
<td>17 .ACCIDENT.AHEAD./...RIGHT.LANE...</td>
</tr>
<tr>
<td>18 ....SLOWING....../...1.MILE.AHEAD..</td>
</tr>
<tr>
<td>19 ....RIGHT.LANES.../...SLOW.AHEAD..</td>
</tr>
<tr>
<td>20 USE.CAUTION.../...AHEAD.....</td>
</tr>
<tr>
<td>21 .SPILLED LOAD./...3.MILES.AHEAD..</td>
</tr>
<tr>
<td>22 .SPILLED LOAD./...1.MILE.AHEAD..</td>
</tr>
<tr>
<td>23 .SPILLED LOAD./...AHEAD.....</td>
</tr>
<tr>
<td>24 .SPILLED LOAD./LEFT.LANES.AHEAD</td>
</tr>
<tr>
<td>25 .SPILLED LOAD./RT.LANES.AHEAD.</td>
</tr>
<tr>
<td>26 .HEAVY TRAFFIC./...2.MILES.AHEAD.</td>
</tr>
<tr>
<td>27 ...ALL LANCES...........OPEN......</td>
</tr>
<tr>
<td>28 .TRAFFIC.CLEARS./...AHEAD.....</td>
</tr>
<tr>
<td>29 ...LEFT.LANES.../...SLOW.AHEAD...</td>
</tr>
<tr>
<td>30 USE.CAUTION.../...AHEAD.....</td>
</tr>
<tr>
<td>31 .HEAVY TRAFFIC.TO/VERMONT.AVE.EXIT</td>
</tr>
<tr>
<td>32 .HEAVY TRAFFIC./...NEXT.MILE.....</td>
</tr>
<tr>
<td>33 .HEAVY TRAFFIC./...NEXT.2.MILES..</td>
</tr>
<tr>
<td>34 .HEAVY TRAFFIC./...NEXT.3.MILES..</td>
</tr>
<tr>
<td>35 .HEAVY TRAFFIC./...NEXT.4.MILES..</td>
</tr>
<tr>
<td>36 .HEAVY TRAFFIC./...NEXT.5.MILES..</td>
</tr>
<tr>
<td>37 ...RIGHT LANCES.../...CLOSED.AHEAD...</td>
</tr>
<tr>
<td>38 .TRAFFIC.CLEARS./...1.MILE.AHEAD.</td>
</tr>
<tr>
<td>39 .TRAFFIC.CLEARS./1.5.MILES.AHEAD.</td>
</tr>
<tr>
<td>40 ...RIGHT.LANE.../...SLOWS.AHEAD...</td>
</tr>
<tr>
<td>41 .HEAVY TRAFFIC.TO/...OVERLAND.AVE..</td>
</tr>
<tr>
<td>42 .HEAVY TRAFFIC.TO/...NATIONAL.BLVD.</td>
</tr>
<tr>
<td>43 .HEAVY TRAFFIC.TO/...ROBERTSON.BLVD.</td>
</tr>
<tr>
<td>44 .HEAVY TRAFFIC.TO/...LA.CIENEGA.BLVD.</td>
</tr>
<tr>
<td>45 .HEAVY TRAFFIC.TO/...WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>46 .HEAVY TRAFFIC.TO/...FAIRFAX.AVE...</td>
</tr>
<tr>
<td>47 .HEAVY TRAFFIC.TO/...LA.BREA.AVE...</td>
</tr>
<tr>
<td>48 .HEAVY TRAFFIC.TO/...CRENSHAW.BLVD.</td>
</tr>
<tr>
<td>49 .HEAVY TRAFFIC.TO/...ARLINGTON.AVE..</td>
</tr>
</tbody>
</table>

57
TABLE 4 (Cont)
MESSAGES USED ON SANTA MONICA FREEWAY (OCTOBER 2, 1974)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>.HEAVY.TRAFFIC./.TO.WESTERN.AVE.</td>
</tr>
<tr>
<td>51</td>
<td>.10.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>52</td>
<td>.12.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>53</td>
<td>.14.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>54</td>
<td>.16.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>55</td>
<td>.18.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>56</td>
<td>.20 MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>57</td>
<td>.22.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>58</td>
<td>.24 MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>59</td>
<td>.26.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>60</td>
<td>.28.MINUTES.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>61</td>
<td>.30.MINUTES.TO./.WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>62</td>
<td>.32.MINUTES.TO./.WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>63</td>
<td>.34.MINUTES.TO./.WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>64</td>
<td>.36.MINUTES.TO./.WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>65</td>
<td>.38.MINUTES.TO./.WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>66</td>
<td>.40.MINUTES.TO./.WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>67</td>
<td>.42.MINUTES.TO./.WASHINGTON.BLVD.</td>
</tr>
<tr>
<td>68</td>
<td>.HEAVY.TRAFFIC.TO./.HARBOR.FWY...</td>
</tr>
<tr>
<td>69</td>
<td>.RIGHT.LANE./.CLOSED.....</td>
</tr>
<tr>
<td>70</td>
<td>CARPOOL.IS.THREE/OR MORE.PER.AUTO</td>
</tr>
<tr>
<td>71</td>
<td>.8.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
<tr>
<td>72</td>
<td>.10.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
<tr>
<td>73</td>
<td>.12.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
<tr>
<td>75</td>
<td>.16.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
<tr>
<td>76</td>
<td>.18.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
<tr>
<td>77</td>
<td>.20.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
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<td>78</td>
<td>.22.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
<tr>
<td>79</td>
<td>.24.MINUTES.TO./.SAN.DIEGO.FWY..</td>
</tr>
<tr>
<td>80</td>
<td>..........................</td>
</tr>
<tr>
<td>81</td>
<td>.405.FWY.NORTH./.HEAVY.TRAFFIC.</td>
</tr>
<tr>
<td>82</td>
<td>.405.FWY.SOUTH./.HEAVY.TRAFFIC.</td>
</tr>
<tr>
<td>83</td>
<td>.405.FWY.NORTH./.EXIT.CONGESTED.</td>
</tr>
<tr>
<td>84</td>
<td>.405.FWY.SOUTH./.EXIT.CONGESTED.</td>
</tr>
<tr>
<td>85</td>
<td>.405.SOUTH..HEAVY/TRAFFIC.FOR.3.MI</td>
</tr>
<tr>
<td>86</td>
<td>.ROAD.WORK./.1.MILE.AHEAD..</td>
</tr>
<tr>
<td>87</td>
<td>.ROAD.WORK./.AHEAD.....</td>
</tr>
<tr>
<td>88</td>
<td>.LEFT.LANE./.CLOSED.AHEAD.</td>
</tr>
<tr>
<td>89</td>
<td>.RIGHT.LANES./.CLOSED.AHEAD.</td>
</tr>
<tr>
<td>90</td>
<td>END.OF./.ROAD.WORK.</td>
</tr>
<tr>
<td>91</td>
<td>HARBOR.FW.NORTH./.HEAVY.TRAFFIC.</td>
</tr>
<tr>
<td>92</td>
<td>HARBOR.FW.SOUTH./.HEAVY.TRAFFIC.</td>
</tr>
<tr>
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</tr>
<tr>
<td>94</td>
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<td>.SAN.DIEGO.FW./.HEAVY.TRAFFIC.</td>
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<td>96</td>
<td>ROAD.WORK.AHEAD./.LEFT.SHOULDER.</td>
</tr>
<tr>
<td>97</td>
<td>.CAUTION./.AHEAD.....</td>
</tr>
<tr>
<td>98</td>
<td>.TRUCK.AHEAD./.LEFT.SHOULDER.</td>
</tr>
<tr>
<td>99</td>
<td>..................................</td>
</tr>
<tr>
<td>100</td>
<td>..................................</td>
</tr>
<tr>
<td>Message</td>
<td>Average Usage Per Month</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>SLOWING AHEAD</td>
<td>C-AM/PM</td>
</tr>
<tr>
<td>SLOWING AHEAD/X MILES AHEAD</td>
<td>C-AM/PM</td>
</tr>
<tr>
<td>HEAVY TRAFFIC/NEXT X MILES</td>
<td>C-AM/PM</td>
</tr>
<tr>
<td>HEAVY TRAFFIC/TO (street)</td>
<td>C-AM/PM</td>
</tr>
<tr>
<td>X MINUTES TO/HARBOR FWY</td>
<td>C-AM</td>
</tr>
<tr>
<td>X MINUTES TO/SAN DIEGO FWY</td>
<td>C-PM</td>
</tr>
<tr>
<td>HARBOR FWY NORTH/EXIT CONGESTED</td>
<td>C-AM</td>
</tr>
<tr>
<td>405 FWY SOUTH/HEAVY TRAFFIC</td>
<td>C-AM/PM</td>
</tr>
<tr>
<td>405 FWY SOUTH/EXIT CONGESTED</td>
<td>C-AM/PM</td>
</tr>
<tr>
<td>USE CAUTION AHEAD</td>
<td>** 74</td>
</tr>
<tr>
<td>MEN WORKING AHEAD/LEFT SHOULDER</td>
<td>50</td>
</tr>
<tr>
<td>STALLED VEHICLE/RIGHT LANE AHEAD</td>
<td>28</td>
</tr>
<tr>
<td>ACCIDENT AHEAD</td>
<td>13</td>
</tr>
<tr>
<td>SAN DIEGO FWY/HEAVY TRAFFIC</td>
<td>10</td>
</tr>
<tr>
<td>ALL LANES OPEN</td>
<td>10</td>
</tr>
<tr>
<td>ROAD WORK AHEAD (Night construction)</td>
<td>10</td>
</tr>
<tr>
<td>LEFT LANES/SLOW AHEAD</td>
<td>8</td>
</tr>
<tr>
<td>TRAFFIC CLEARS AHEAD</td>
<td>8</td>
</tr>
<tr>
<td>HEAVY TRAFFIC TO/HARBOR FWY</td>
<td>5</td>
</tr>
<tr>
<td>TRAFFIC CLEARS/1 MILE AHEAD</td>
<td>5</td>
</tr>
<tr>
<td>ACCIDENT/X MILES AHEAD</td>
<td>4</td>
</tr>
<tr>
<td>HARBOR FWY SOUTH/EXIT CONGESTED</td>
<td>4</td>
</tr>
<tr>
<td>CLOVERFIELD OFF/EXIT CONGESTED</td>
<td>4</td>
</tr>
<tr>
<td>STALLED VEHICLE/RIGHT LANE AHEAD</td>
<td>3</td>
</tr>
<tr>
<td>ACCIDENT AHEAD/RIGHT LANES</td>
<td>3</td>
</tr>
<tr>
<td>LINCOLN EXIT/HEAVY TRAFFIC</td>
<td>2</td>
</tr>
<tr>
<td>SPILLED LOAD/AHEAD</td>
<td>1</td>
</tr>
</tbody>
</table>

* C-AM = Continuous 7-9:30 a.m.; C-PM = Continuous 4-5 p.m.

** Message is generally used until the incident is verified by CALTRANS patrol
System

The system consists of buried Halstaad cable A.M. radio system operating at a power level requiring FCC licensing. The system is owned by the L.A. Airport Authority but operated by RTV International Systems. A CCTV system with one camera provides surveillance of area. Broadcasts are transmitted via 530 Khz. Signs on airport road advise motorists to tune to station for airport information.

Objectives of Radio System

The problem addressed with the system is to minimize the number of circuitous trips around the terminal loop that results in severe congestion on the airport grounds. Basic messages guide motorists to terminal parking and to specific terminals.

Display Description

Audio messages via car radio.

Location of System

Over 1 mile of cable is buried on the approach road (Century Blvd.), and approximately 6,000 feet of cable is buried on the terminal loop road. This provides capabilities for two separate radio systems that operate on the same frequency.

Operation

A CCTV camera mounted on the airport tower provides visual surveillance of terminal and approach roads. In addition, parking lot attendants radio
parking information to operators. Pre-recorded tapes, depending upon conditions, are selected and played. Tapes are recorded by a commercial radio announcer.

**Messages**

Over 100 pre-recorded messages are available. The messages range in length between 20 and 120 seconds.

**Status**

Operational
LOUISVILLE - I 65 (3)

System
Warning sign

Objective of Warning Sign
To reduce rear-end accidents and near misses by warning drivers of congestion on a section of freeway having restricted sight distance. Traffic backs-up from an exit ramp onto the main lanes.

Display Description
Static sign with flashing beacons

Location of System
I 65 south of Louisville

Operation
Sign is controlled by a time clock to correspond with routine backup of traffic from a ramp onto the main lanes

Message
CONGESTION AHEAD/WHEN FLASHING

Status
Operational
System

A system of vehicle detectors, lane control signals, changeable message signs and closed circuit television camera are installed on I-94 in Minneapolis.

Objective of Signs

This system is used to detect accidents or incidents in the Lowry Hill Tunnel area and to warn approaching drivers of problems in the area. The system is needed because of a 9-degree curve near the south portal of the 1500 ft., six-lane twin tube tunnel. Curvature restriction of sight distance and projected high volumes when I-94 is extended to the north can create potentially serious problems in the tunnel.

Display Description

Changeable message signs are bulb matrix. Each sign has two message lines with 14-inch letters. Lane control units are incandescent standard 18-inch type.

Location of Signs

The location of the changeable message and lane control signs are shown in Figure 22.

Operation

System operators manually operate signs based on information received from the detectors, analysis of the situation on CCTV, and input from other sources such as the State Patrol. Software is being developed for computer operation of the signs.
Figure 22 - Minneapolis - I-94 Surveillance and Control System
### Messages

<table>
<thead>
<tr>
<th>Upper Line</th>
<th>Sign A</th>
<th>Sign B</th>
<th>Sign C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONGESTION AHEAD</td>
<td>CONGESTION AHEAD</td>
<td>CONGESTED</td>
<td></td>
</tr>
<tr>
<td>MAINTENANCE WORK</td>
<td>MAINTENANCE WORK</td>
<td>(blank)</td>
<td></td>
</tr>
<tr>
<td>STALLED VEHICLE</td>
<td>STALLED VEHICLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUNNEL CLOSED</td>
<td>TUNNEL CLOSED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACCIDENT AHEAD</td>
<td>ACCIDENT AHEAD</td>
<td>(blank)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(blank)</td>
<td>(blank)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lower Line</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>REDUCE SPEED</td>
<td>REDUCE SPEED</td>
<td>DO NOT ENTER</td>
<td></td>
</tr>
<tr>
<td>PREPARE TO STOP</td>
<td>PREPARE TO STOP</td>
<td>(blank)</td>
<td></td>
</tr>
<tr>
<td>EXIT RIGHT</td>
<td>TAKE NEXT EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-10 MIN. DELAY</td>
<td>5-10 MIN. DELAY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-20 MIN. DELAY</td>
<td>OBEY LANE SIGNALS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(blank)</td>
<td>(blank)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Status

Operational.

### Criteria for Message Selection

Messages were selected after an analysis of the typical problems encountered in the operation of the tunnel, and anticipated problems that could arise in the future. Basically, the upper line of the sign is used to indicate the nature of the problem (e.g., "CONGESTION AHEAD") and the lower line is used to indicate the desired driver response (e.g., "REDUCE SPEED").

Two basic concepts were utilized for the signs at the entrance ramps. The upper line is used to inform motorists when the freeway is congested.
This serves as a warning to entering traffic that reduced speeds and stop-and-go conditions may be encountered. Also, drivers may elect to use an alternate route although admittedly there is not enough detailed information to make this decision. The lower line is used to force diversion when major incidents occur on the freeway and it would definitely be advantageous to use an alternate route.

Status

Operational
MINNEAPOLIS—I-35 (8)

System

The I-35W traffic surveillance and control system includes traffic detectors, ramp control (or meter) signals, changeable message signs, a telemetry/communication subsystem, a CCTV subsystem, a map display panel, an operators console, and a process control digital computer subsystem. The system extends along I-35W from downtown Minneapolis south to Dakota County Highway 42 in Burnsville, a distance of approximately 17 miles.

Objectives of Signs

Signs provide motorists with information on freeway flow conditions to enable them to decide whether to use the freeway or a parallel arterial.

Display Description

Signs are bulb matrix with 10-inch letters.

Location of Signs

Signs are installed at the inbound ramps at 35th Street and 46th Street.

Messages

CONGESTED
DO NOT ENTER
(blank)

Status

Operational
System

One hundred three speed limit signs. An equal number of speed warning signs. A total of 68 variable message signs on the northern thirty-five miles of roadway of which 24 are fully operational and 34 soon to be operational.

Objectives of Signs

To warn drivers of traffic problems and to reroute traffic along the dual-dual section of the Turnpike.

Display Description

Speed limit signs are 5' x 6' and employ a fluorescent back lighted messages SPEED LIMIT and a normal numerical message 55 in red neon. As the speed is reduced, the lower messages are displayed in incandescent bulb matrices. The speed warning signs are internally illuminated and are shown in Figure 23 along with the speed limit sign.

The variable message signs are rotating drum signs. Letters are white 12", 15", and 18" capital copy and 18" upper case with 12" lower case copy. Drum background colors are either green or red depending on message. Figure 24 is a photograph of the drum signs.

Location of Signs

Speed limit and speed warning signs are spaced at 2 to 5 miles. The rotating drum signs are located at each interchange and service area in the dual-dual roadway.

Operation

Operation of the speed limit and speed warning signs can either be
Figure 23 - Incandescent Bulb Matrix Signs - New Jersey Turnpike

Figure 24 - Variable Message Drum Signs - New Jersey Turnpike
manual or automatic. The future operation of the rotating drum variable
message signs will be by automatic surveillance and control which is sche­
duled for operation in early 1976.

Messages

Speed limit signs can display speeds ranging from 55 to 30 in 5 mph
increments. Speed warning signs read REDUCE SPEED AHEAD with one of the
following messages

   FOG
   ICE
   SNOW
   ACCIDENT
   CONGESTION
   CONSTRUCTION

Older signs read

   DRIVE SLOW AHEAD

followed by one of the following

   FOG
   ICE
   SNOW
   ACCIDENT

Messages on the rotating drum variable message signs are illustrated
in Figures 25 and 26.

Status

   Operational
### Signs for Contract R-246

<table>
<thead>
<tr>
<th>No.</th>
<th>Drum No.</th>
<th>Drum Face 1</th>
<th>Drum Face 2</th>
<th>Drum Face 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 3</td>
<td>1</td>
<td>Thru Traffic</td>
<td>Thru Traffic</td>
<td>Roadway #</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Next Exit X Miles</td>
<td>Next Exit X Miles</td>
<td>Closed #</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Exit X</td>
<td>Exit X</td>
<td>Do Not Enter #</td>
</tr>
<tr>
<td>0 1</td>
<td>1</td>
<td>Truck Divides</td>
<td>Roadway Closed #</td>
<td>All Traffic For</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Mile Ahead</td>
<td>Mile Ahead</td>
<td>Exit South #</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>All Trucks and Buses</td>
<td>All Traffic</td>
<td>Turnpike North #</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Keep Right</td>
<td>Keep Right</td>
<td>Keep Left #</td>
</tr>
<tr>
<td>0 2</td>
<td>1</td>
<td>Truck Divides</td>
<td>Roadway Closed #</td>
<td>All Traffic For</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Mile Ahead</td>
<td>Mile Ahead</td>
<td>Exit North #</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>All Trucks and Buses</td>
<td>All Traffic</td>
<td>Turnpike South #</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Keep Right</td>
<td>Keep Right</td>
<td>Keep Left #</td>
</tr>
<tr>
<td>B 3</td>
<td>1</td>
<td>N J Turnpike North</td>
<td>Roadway In</td>
<td>All Traffic For</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Closed</td>
<td>Closed</td>
<td>Exit North #</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Cars</td>
<td>Do Not #</td>
<td>North</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Only</td>
<td>Enter</td>
<td>South</td>
</tr>
<tr>
<td>F 4</td>
<td>1</td>
<td>N J Turnpike</td>
<td>All</td>
<td>Exit 10 #</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>North</td>
<td>Traffic</td>
<td>One</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Bars</td>
<td>Traffic</td>
<td>Passenger</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Exit 10</td>
<td>All Exits</td>
<td>Exit 10 #</td>
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</table>

### Signs for Contract W1307

<table>
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<th>Drum No.</th>
<th>Drum Face 1</th>
<th>Drum Face 2</th>
<th>Drum Face 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 30</td>
<td>1</td>
<td>N J Turnpike</td>
<td>N J Turnpike</td>
<td>Roadway #</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>South</td>
<td>South</td>
<td>Closed #</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Exit</td>
<td>DO NOT ENTER #</td>
<td></td>
</tr>
</tbody>
</table>

Figure 25 - New Jersey Turnpike Rotating Drum Signs-Phase 1
Figure 25 (Cont.) - New Jersey Turnpike Rotating Drum Signs-Phase I
<table>
<thead>
<tr>
<th>SIGN STR. NO.</th>
<th>LEFT SIGN</th>
<th>RIGHT SIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ARRANGEMENT</td>
<td>DRUM LENGTH</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>20°</td>
</tr>
<tr>
<td>2</td>
<td>H</td>
<td>21°</td>
</tr>
<tr>
<td>3</td>
<td>G</td>
<td>19°</td>
</tr>
<tr>
<td>4</td>
<td>H</td>
<td>21°</td>
</tr>
<tr>
<td>5</td>
<td>C</td>
<td>15°</td>
</tr>
<tr>
<td>6</td>
<td>D</td>
<td>21°</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>19°</td>
</tr>
<tr>
<td>8</td>
<td>A</td>
<td>16°</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>19°</td>
</tr>
<tr>
<td>11</td>
<td>A</td>
<td>17°</td>
</tr>
<tr>
<td>12</td>
<td>F</td>
<td>16°</td>
</tr>
</tbody>
</table>

Figure 26 - New Jersey Turnpike Rotating Drum Signs - Phase 2
Figure 26 (Cont.) – New Jersey Turnpike Rotating Drum Signs - Phase 2
<table>
<thead>
<tr>
<th>SIGN STR. NO.</th>
<th>LEFT SIGN</th>
<th>RIGHT SIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARRANGE-MENT</td>
<td>DRUM LENGTH</td>
<td>DRUM LENGTH</td>
</tr>
<tr>
<td>1</td>
<td>G</td>
<td>20°</td>
</tr>
<tr>
<td>2</td>
<td>H</td>
<td>210°</td>
</tr>
<tr>
<td>3</td>
<td>G</td>
<td>190°</td>
</tr>
<tr>
<td>4</td>
<td>H</td>
<td>210°</td>
</tr>
<tr>
<td>5</td>
<td>C</td>
<td>190°</td>
</tr>
<tr>
<td>6</td>
<td>D</td>
<td>210°</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>190°</td>
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<tr>
<td>8</td>
<td>A</td>
<td>155°</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>190°</td>
</tr>
<tr>
<td>11</td>
<td>A</td>
<td>17°</td>
</tr>
<tr>
<td>12</td>
<td>F</td>
<td>16°</td>
</tr>
</tbody>
</table>

**DRUM FACE 3**

**FIXED OR FACE**

(EASTERN ROADWAY CLOSED)

<table>
<thead>
<tr>
<th>LEFT SIGN</th>
<th>RIGHT SIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXIT 15E</td>
<td>ALL OTHER</td>
</tr>
<tr>
<td>ONLY</td>
<td>TRAFFIC</td>
</tr>
<tr>
<td>KEEP</td>
<td>KEEP</td>
</tr>
<tr>
<td>LEFT</td>
<td>RIGHT</td>
</tr>
<tr>
<td>ALL OTHER</td>
<td>EXIT 15E</td>
</tr>
<tr>
<td>TRAFFIC</td>
<td>ONLY</td>
</tr>
<tr>
<td>KEEP</td>
<td>KEEP</td>
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<td>KEEP</td>
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<tr>
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<tr>
<td>ROADWAY CLOSED DO NOT ENTER</td>
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</table>

**ALL**

| USE FACE 1 |
| BLANK |

**ROADWAY CLOSED DO NOT ENTER**

**ALL**

| USE FACE 1 |
| BLANK |

**SPORTS COMPLEX**

| USE FACE 1 |
| BLANK |

Figure 26 (Cont.) - New Jersey Turnpike Rotating Drum Signs - Phase 2
Figure 26 (Cont.) - New Jersey Turnpike Rotating Drum Signs - Phase 2
Figure 26 (Cont.) - New Jersey Turnpike Rotating Drum Signs - Phase 2
### Figure 26 (Cont.) - New Jersey Turnpike Rotating Drum Signs - Phase 2

<table>
<thead>
<tr>
<th>SIGN STR. NO.</th>
<th>LEFT SIGN</th>
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<th>ARRANGEMENT</th>
<th>DRUM LENGTH</th>
<th>ARRANGEMENT</th>
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<td>F</td>
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<td>15'-0&quot;</td>
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</table>

**Roadway Closed**

**Do Not Enter**

(Western roadway closed)

**Exit 16W Only**

(all other traffic)

(16W southbound closed)

(all traffic)

(Roadway closed)

(16W southbound closed)
Figure 26 (Cont.) - New Jersey Turnpike Rotating Drum Signs - Phase 2
<table>
<thead>
<tr>
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<th>LEFT SIGN</th>
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</table>

**ARRANGEMENT DRUM LENGTH**

**Figure 26 (Cont.) - New Jersey Turnpike Rotating Drum Signs - Phase 2**
REFERENCES


2. Burns, E. N., Traffic Control Engineer, Bureau of Design Services, Ohio Department of Transportation. Correspondence to Conrad L. Dudek, October 10, 1974.


5. Hauslen, R. A., Assistant Manager, Research Division, the Port Authority of New York and New Jersey. Correspondence to Conrad L. Dudek, September 18, 1974.


