National Cooperative Highway Research Program

NCHRP Synthesis 279

Roadway Incident Diversion Practices

A Synthesis of Highway Practice

Transportation Research Board
National Research Council

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Transportation Research Board
National Research Council

Research Sponsored by the American Association of State Highway and Transportation Officials in Cooperation with the Federal Highway Administration

NATIONAL ACADEMY PRESS
Washington, D.C. 1999

Subject Areas
Highway Operations, Capacity, Traffic Control

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NCHRP SYNTHESIS 279

Project 20-5 FY 1996 (Topic 29-02)
ISSN 0547-5570
ISBN 0-309-06859-2
Library of Congress Catalog Card No. 99-76472

Price $29.00

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Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

and can be ordered through the Internet at:

http://www.nas.edu/trb/index.html

Printed in the United States of America

PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis report will be of interest to officials of municipal, regional, and statewide transportation and law enforcement agencies who are responsible for roadway incident diversion practices. It will also be of interest to others who interact with these agencies to achieve a better understanding of the processes, barriers, and technologies associated with alternate route plan development and deployment. This report presents state-of-the-practice information about the development, deployment, and implementation of roadway incident diversion practices. It documents specific trends in the practice, and in examining individual practices, identifies unique plans, processes, and technologies from which other agencies may find useful applications.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board addresses a broad list of topics and profiles successful incident diversion practices, as reported by surveyed agencies. In particular, it focuses concern on alternate route plans for incidents that happen at random, resulting in the occurrence of nonrecurring congestion.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CONTENTS

ACKNOWLEDGMENTS

Walter M. Dunn, Jr., P.E., Robert A. Reiss, P.E., and Steven P. Latoski, Dunn Engineering Associates, Westhampton Beach, New York, collected the data and prepared the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Michelle Boucher Maffeo, Director, ITS Programs, Massachusetts Highway Department; Richard A. Cunard, Engineer of Traffic and Operations, Transportation Research Board; Pat Irwin, Director of Transportation Operations, Texas Department of Transportation; Kenneth A. Jonak, Expressway Operations Engineer, Bureau of Traffic, Illinois; David McCormack, Regional Traffic Engineer, Washington State Department of Transportation; S. Sean Nozzari, Chief, Traffic Management Operations, CALTRANS District 4; Jon Obenberger, Transportation Specialist, Federal Highway Administration; Chuck Sears, Highway Engineer, Federal Highway Administration; Jonathan Upchurch, Department of Civil and Environmental Engineering, University of Massachusetts, Amherst; and Richard J. Zabinski, ITS Program Coordinator, New York State Department of Transportation.

This study was managed by Donna A. Vlasak, Senior Program Officer, who worked with the consultant, the Topic Panel, and the Project 20-5 Committee in the development and review of the report. Don Tippman was responsible for editing and production.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 Committee and the Synthesis Staff.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

ROADWAY INCIDENT DIVERSION PRACTICES

SUMMARY

This synthesis presents a detailed summary of current roadway incident diversion practices based on a selected survey of transportation agencies that have developed and deployed alternate route plans.

A comprehensive survey questionnaire was prepared for distribution to transportation agencies in all 50 states, the District of Columbia, and Puerto Rico. The synthesis includes survey questionnaire responses from 59 different agencies. A total of 43 respondents of the 59 agencies surveyed indicated having preplanned alternate route plans for responding to the future occurrence of major incidents.

The agencies surveyed provided information addressing the following topics associated with roadway incident diversion:

- Reasons for initiating the development of alternate route plans,
- Alternate route plan development date,
- General characteristics of alternate route plans,
- Frequency of plan deployment,
- Funding,
- Barriers to plan development,
- Time and human resources required in plan development,
- Types of alternate route plans,
- Generation of alternate route plans,
- Alternate route selection criteria,
- Consulted agencies in alternate route plan development,
- Maintenance of alternate route plans,
- Training for agencies participating in alternate route plan deployment,
- Methods for detecting and verifying an incident,
- Criteria for alternate route plan deployment,
- Agencies participating in alternate route plan deployment,
- Field communications,
- Utilization of a traffic management center in alternate route plan deployment,
- Information resources for providing traffic diversion information,
- Nature of diversion information message,
- Promotion of other modes of travel as a diversion alternative,
- Strategies for accommodating diverted traffic along the alternate route,
- Information resources used to guide motorists along the alternate route, and
- Qualitative evaluation of deployment efforts by agencies and motorists.

As part of the review of the literature and survey of transportation agencies maintaining a roadway incident diversion practice, the study presents several interesting findings. The following represents a summary of some important study findings in accordance with the synthesis objectives.

1. The type of diversion scenarios used in metropolitan and rural areas:

- The majority of surveyed agency practices feature alternate route plans linking adjacent freeway interchanges with an arterial extending parallel to the main line; however, a select number of agencies maintain alternate route plans that divert traffic from a freeway to a tollway and/or a high-occupancy vehicle (HOV) facility.
- For partial roadway closures, an optimal diversion percentage often exists after which freeway delays increase because of inadequate capacity on a section of the alternate route.

2. The planning process used to develop an alternate route plan:

   - All but two surveyed agencies with a roadway incident diversion practice for major incidents receives partial or full backing through state funding, and one-third of the respondents indicated the receipt of federal funds.
   - Approximately 85 percent of surveyed state departments of transportation (DOTs) reported being at least partially responsible for developing an alternate route plan, and private consulting firms participated in about 34 percent of surveyed efforts.
   - The surveyed agency practices required an average of 9 months to develop.
   - The state DOT acts as the sole lead agency in the development of alternate route plans in approximately 87 percent of surveyed agency practices, and the lead agency coordinated planning efforts with an average of five other agencies.

3. Criteria used to select an alternate route during the planning process:

   - The 10 most important alternate route selection criteria, as determined by the survey, pertained to motorist impacts.
   - The use of computer traffic simulation models is advantageous for identifying bottleneck locations on proposed alternate routes.

4. Methods used to detect and verify incidents:

   - All surveyed agencies acknowledged the participation of police in some aspect of incident detection and verification.
   - The majority of those agencies surveyed rely on freeway service patrols (72 percent), public use of a free cellular emergency phone call number (69 percent), closed-circuit television (56 percent), and/or information sharing with a traffic advisory service (50 percent).

5. Criteria considered in the decision to deploy an alternate route plan:

   - Over 86 percent of surveyed agencies consider the type of incident, incident duration, and resulting roadway lane blockage in the decision to deploy an alternate route plan.
   - Other common criteria include incident location and time of day.
   - Virtually all occurrences of major incidents require an evaluation of the incident site to assist in the decision to deploy an alternate route plan.

6. Resources used to inform motorists to divert:

   - Over 54 percent of the surveyed agency practices incorporate a traffic management center in the deployment of an alternate route plan.
   - The most commonly used means for providing alternate route information include changeable message signs located upstream of the alternate route access point, highway advisory radio, and media sources.
   - A select number of agencies make real-time alternate route information available to motorists through the use of an in-vehicle traveler information system.

- Approximately 67 percent of surveyed agencies only post mandatory route diversion messages, about 26 percent indicated a mixed use of mandatory and voluntary messages, and 7 percent provided solely voluntary messages to motorists.
- Some surveyed agencies promote the use of other modes of travel as an option to alternate route use, including transit buses and commuter rail.

7. Resources used to guide motorists along the alternate route and back to the original roadway:

   - The most common types of resources used to guide motorists along the alternate route and back to the main line include portable changeable message signs (83 percent of respondents), temporary signing (75 percent of respondents), police assistance (72 percent of respondents), and media sources (67 percent of respondents).
   - In the event of a marked deterioration in traffic flow on the alternate route, 75 percent of surveyed agencies would generate and deploy a secondary alternate route.

8. Methods used to accommodate diverted traffic along the alternate route:

   - Over 83 percent of surveyed agencies accommodate diverted traffic through the use of special police controls and/or the implementation of modified signal-timing strategies.
   - Those surveyed agencies managing freeway-to-HOV facility and freeway-to-tollway alternate route plans allow for the elimination of HOV restrictions and tolls, respectively.
   - A select number of agencies override ramp metering controls to facilitate a better transition to/from the alternate route.

9. Perceived and measured benefits of alternate route plans and any reported barriers to plan development and deployment:

   - The development of alternate route plans requires a committed planning and organizational effort in which several potential barriers to plan development must be addressed, including: (1) possibility of motorists encountering equal or worse levels of service on the alternate route; (2) liability concerns if an accident or safety problems (e.g., mugging) occur due to being directed to an alternate route; (3) public opposition from individuals and community groups; and (4) possible loss of credibility in changeable message sign messages if an undesirable level of congestion arises on the alternate route.
   - Approximately 83 percent of surveyed agencies express a satisfaction with their traffic diversion efforts.
   - Approximately 79 percent of respondents indicate diverted motorists are satisfied after the deployment of an alternate route plan.

CHAPTER ONE

INTRODUCTION

STATEMENT OF THE PROBLEM

Highway congestion represents a serious concern for motorists in all major urban areas, costing travelers in excess of $40 billion annually in the 50 largest cities nationwide (*1*). According to Federal Highway Administration (FHWA) estimates, nonrecurrent congestion, or congestion primarily caused by traffic incidents because of a resulting temporary reduction in roadway capacity, accounts for 60 percent of congestion-induced delay. Moreover, the FHWA predicts this figure will increase to 70 percent by the year 2005 (*2*).

An incident management program represents a planned framework, defining the necessary resources and required procedures to facilitate an efficient, coordinated response to the occurrence of roadway incidents, serving to mitigate the adverse effects of nonrecurrent congestion in a timely manner. The FHWA *Freeway Management Handbook* (*3*) defines incident management as "a coordinated and planned approach for restoring traffic to its normal operations as quickly as possible after an incident has occurred." Incident management consists of the following six components: detection, verification, response, removal, traffic management, and information to motorists.

Studies show that freeway service patrols are cost-effective for mitigating the effects of minor incidents such as vehicle disablements (*4*). Freeway service patrols function to typically satisfy the incident detection, verification, response, and removal components of incident management in the event of a minor incident. However, a greater incident management effort, one necessitating the deployment of a traffic management plan, is required to address the occurrence of major incidents, defined by various transportation agencies surveyed in the study as those that block a minimum of two to all travel lanes for a minimum duration ranging from 1 to 2 hours. The changeable message sign in Figure 1, from the Texas Department of Transportation

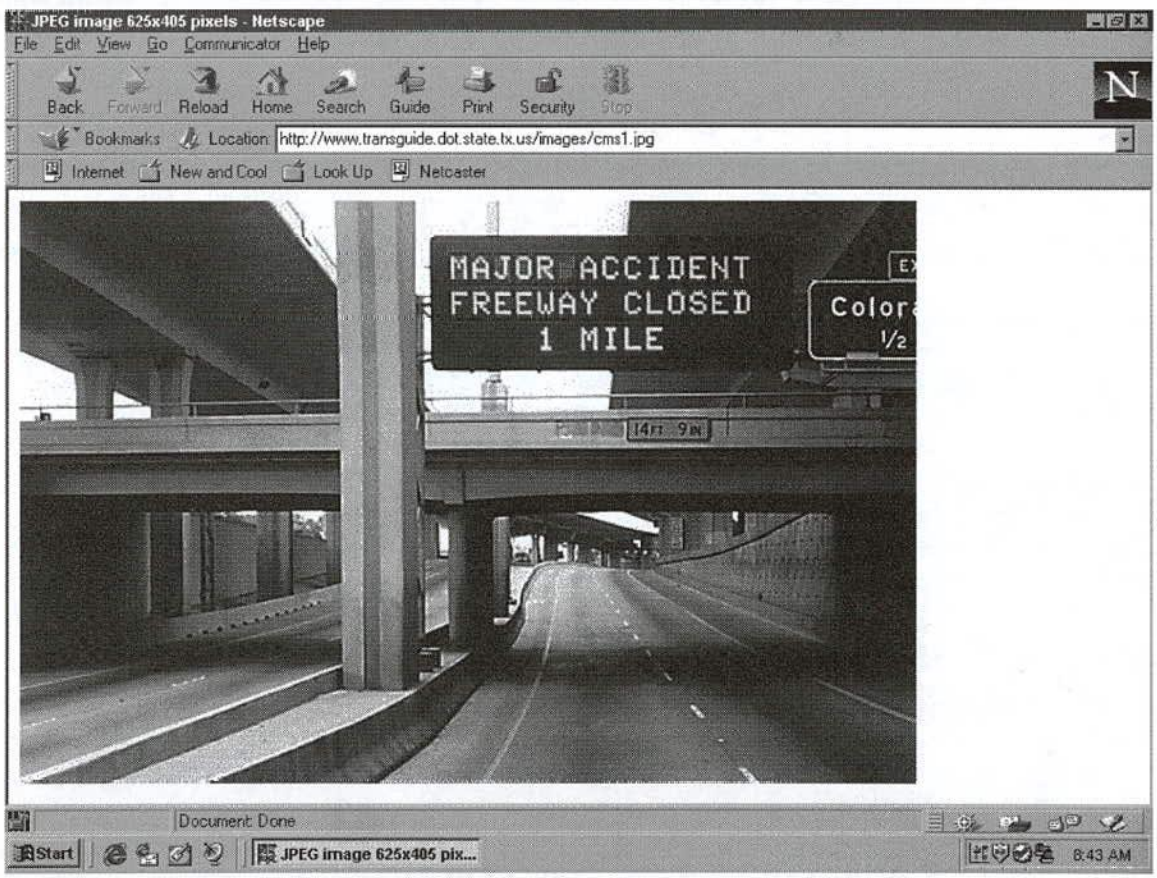

FIGURE 1 Changeable message sign on the Texas DOT–San Antonio District's TransGuide web site. *(Graphics courtesy of the Texas DOT.)*

FIGURE 2 Major incidents were defined as those that block two or more travel lanes for a minimum of 1 to 2 hours and include severe crashes, truck spills, and roadway closures as a result of an act of nature. *(Photo courtesy of the Arizona DOT.)*

(DOT)–San Antonio District's TransGuide World Wide Web site (**http://www.transguide.dot.state.tx.us**), indicates a major reason to maintain traffic management plans. Major incidents include severe crashes, tanker truck spills, and roadway closure as a result of an act of nature (Figure 2).

The deployment of an alternate route plan marks a key traffic management strategy for minimizing the effect of a major incident on traffic flow because it serves to reduce demand at the incident site through the diversion of traffic from the main line. A carefully planned and executed alternate route plan, sensitive to operations on the alternate route, provides several motorist benefits including reduced travel time and delay, improved safety through a lowered probability of secondary crash occurrence, and diminished stress levels. Also, a reduction in vehicle emissions and fuel consumption accompanies nonrecurrent congestion delay savings.

SYNTHESIS OBJECTIVE

This synthesis presents a detailed summary of current roadway incident diversion practices based on a selected survey of transportation agencies that have developed and deployed alternate route plans. In particular, the study focuses on the development and deployment of alternate route plans for random incidents, which result in the occurrence of nonrecurrent congestion. The synthesis addresses the following broad list of topics associated with roadway incident diversion:

- The type of diversion scenarios used in metropolitan and rural areas,
- The planning process used to develop an alternate route plan,
- Criteria used to select an alternate route during the planning process,
- Methods used to detect and verify incidents,
- Criteria considered in the decision to deploy an alternate route plan,
- Resources used to inform motorists to divert,
- Resources used to guide motorists along the alternate route and back to the original roadway,
- Methods used to accommodate diverted traffic along the alternate route,
- Perceived and measured benefits of alternate route plans and any reported barriers to plan development and deployment.

The synthesis profiles current successful incident diversion practices as reported by surveyed agencies, identifies successful processes and alternate route plan components, and provides relevant information for future plan development.

This synthesis is intended to familiarize the reader with the processes, barriers, and technologies associated with alternate route plan development and deployment. It is

anticipated that the study findings will prove useful for any transportation agency seeking to achieve a better understanding of roadway incident diversion practices.

ORGANIZATION OF THE SYNTHESIS

This synthesis consists of five chapters. Chapter 1 (*Introduction)* presents a statement of the problem and the synthesis objective. Chapter 2 (*Literature Review)* provides a report of past studies concerning the development, deployment, and effectiveness of alternate route plans for major incidents. This chapter also includes a review identifying any past or ongoing surveys regarding roadway incident diversion practices. Chapter 3 (*State of Practice)* presents a detailed summary and discussion of survey information addressing the current state of practice of roadway incident diversion. Chapter 4 (*Profiles of Existing Roadway Incident Diversion Practices)* contains profiles of individual successful roadway incident diversion practices. Chapter 5 (*Conclusions)* furnishes a discussion of results, complete with suggestions for future research.

CHAPTER TWO

LITERATURE REVIEW

ROADWAY INCIDENT DIVERSION

A review of the literature and an Internet search yielded limited information relating to roadway incident diversion practices. The Intelligent Transportation Systems (ITS) Cooperative Deployment Network World Wide Web site (**http://www.nawgits.com/icdn.html**), maintained by the National Associations Working Group for ITS, provides links to a vast array of ITS resources, including those pertaining to incident management topics (Figure 3). In general, topics concerning alternate route plan development and deployment were addressed in the literature as part of a comprehensive study on incident management. As stated earlier, traffic management marks a component of incident management and alternate routing represents a traffic management strategy.

A Transportation Research Board (TRB) synthesis (*5*) dedicated a chapter to alternate route planning within a report regarding freeway corridor management. The chapter contained an overview of alternate route plan development objectives and benefits in addition to providing summaries of alternate route planning efforts in Los Angeles and Maryland. The report also included a summary of incident management programs nationwide that provide alternate route information to motorists (these programs are listed in Table 1).

A Texas Transportation Institute (TTI) report (*6*) pertaining to a state-of-the practice review of incident management in the United States contained a discussion of alternate routing in the context of traffic control. Typical ramp diversion and contraflow diversion techniques were

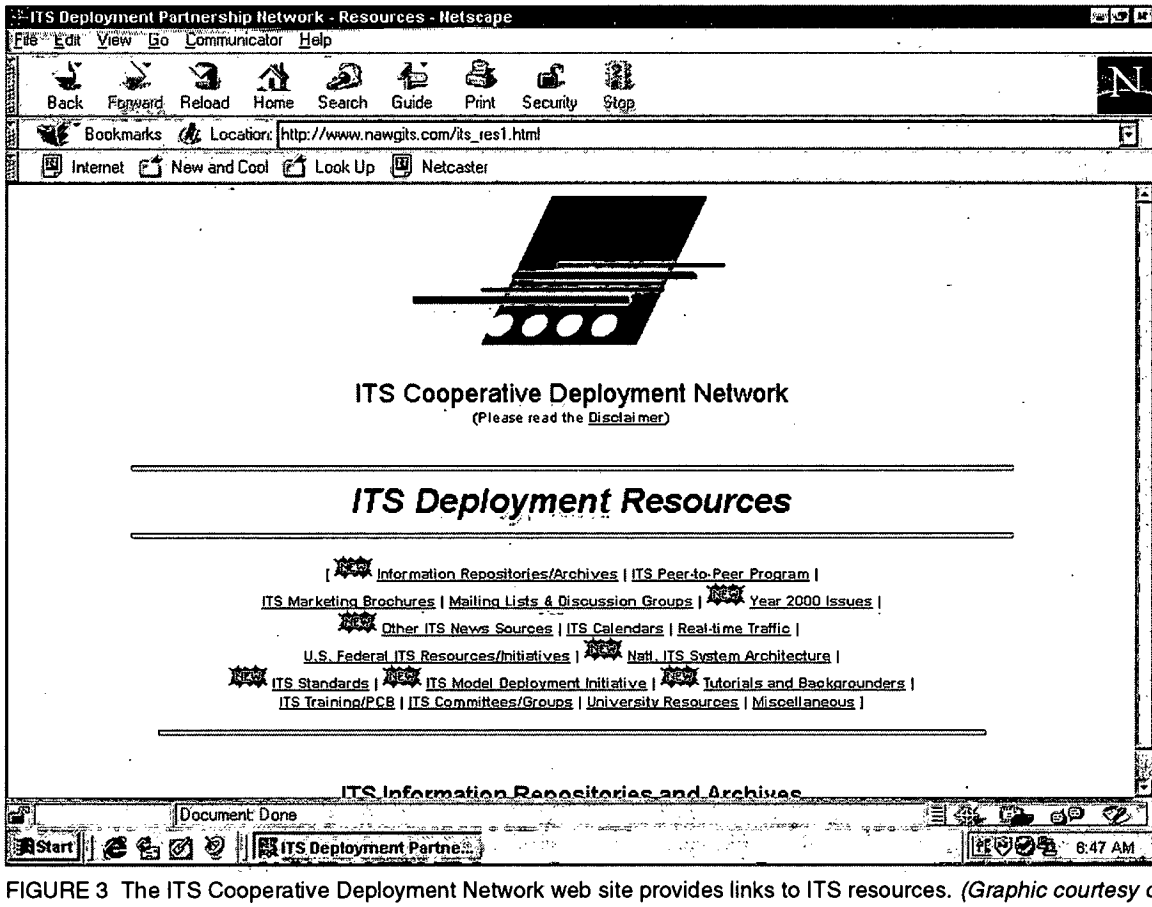

FIGURE 3 The ITS Cooperative Deployment Network web site provides links to ITS resources. *(Graphic courtesy of the National Associations Working Group for ITS).*

TABLE 1
INCIDENT MANAGEMENT SYSTEMS MAINTAINING ALTERNATE ROUTE PLANS (MARCH 1992)

Incident Management System Type	Alternate Route Plans In-Place	Alternate Route Plans Proposed
Areawide	Baltimore, Md. Los Angeles, Calif. Maryland suburbs of District of Columbia Northern Virginia Richmond, Va. TRANSCOM–N.Y./N.J. Montgomery County, Md. Tidewater Area, Virginia Westchester County, N.Y.	Anaheim, Calif. Fairfax County, Va. Fort Worth, Tex. Houston, Tex. Phoenix, Ariz. Seattle, Wash. Massachusetts freeways Miami, Fla. Michigan freeways Milwaukee, Wis. Orlando, Fla. Portland, Oreg.
Corridor	Dayton, Ohio (I-75) El Paso, Tex. (I-10) Los Angeles, Calif. (I-10) Maryland, West (US 40) Maryland (US 50) Michigan (I-75) New Jersey Turnpike New York (Long Island Expressway) Rhode Island (I-95)	New York State Thruway
Spot locations	Baltimore tunnels Colorado (Eisenhower Tunnel–I-70) Tampa, Fla. (Howard Frankland Bridge) New York (Lincoln Tunnel) New York (Holland Tunnel) New York (George Washington Bridge) New York (Tappan Zee Bridge) Florida (Sunshine Skyway)	Boston, Mass. (I-93/I-90)

addressed and illustrated. The TTI report also provided general guidelines for the deployment of alternate route plans. The study provided the following instructions for erecting temporary detour signs along an alternate route:

1. Place a sign at the point of departure from the freeway to establish motorist confidence that the detour is signed.
2. Place signs at all points where a change of travel direction or turn is necessary to remain on the established detour route.
3. Place confirmation signs along lengthy detour segments.
4. Place a sign to confirm the end of the detour at the point where the alternate route reenters the affected roadway.

The FHWA *Freeway Management Handbook* (*3*) provided a concise discussion of traffic diversion techniques within a module dedicated to incident management. The report highlighted alternate route planning strategies, alternate route plan maintenance, and equipment considerations for plan deployment. In addition, the FHWA report listed specific actions for improving conditions and motorist/pedestrian accommodations on alternate routes for roadway construction and special events, of which the following recommended actions warrant consideration in the event of a roadway incident:

- Traffic signal timing adjustments,
- Left-turn restrictions at critical locations,
- Parking restrictions,
- Police control of critical intersections, and
- Use of real-time information systems to encourage diversion.

The FHWA *Freeway Incident Management Handbook* (*7*) summarized 12 steps required for generating an alternate route plan and establishing guidelines for plan deployment. The steps or tasks are as follows:

- Task 1—Assemble and Index Data.
- Task 2—Establish Alternate Route Criteria.
- Task 3—Identify Preliminary Alternate Routes.
- Task 4—Drive and Videotape Preliminary Alternate Routes.
- Task 5—Revise Preliminary Alternate Routes.
- Task 6—Identify Problem Areas.
- Task 7—Identify Commercial Vehicle Restrictions.
- Task 8—Determine Signing.

- Task 9—Assess Highway Advisory Radio.
- Task 10—Develop Operational Procedural Guide for Termination of Alternate Routes.
- Task 11—Develop Notification Procedures.
- Task 12—Estimate Costs.

EVALUATION OF ALTERNATE ROUTE PLANS

A review of the literature revealed limited information concerning the evaluation of alternate route plans.

The previously cited FHWA *Freeway Management Handbook* (*3*) furnishes a comprehensive outline of various economic analyses pertinent to the planning and evaluation of freeway management systems. A significant amount of the information presented applies, in general, to the evaluation of alternate route plans, especially regarding the description of a benefit/cost analysis. A benefit/cost analysis represents a popular means for estimating the effectiveness of incident management techniques such as route diversion, and a benefit/cost ratio equals the equivalent benefit of a practice divided by the equivalent cost of that practice.

The *Freeway Management Handbook* module also provides an overview of specific system costs and benefits for consideration in the estimation process. Therefore, it is recognized that the development of an incident diversion practice includes inherent capital costs, such as the purchase of portable changeable message signs, in addition to continuing costs associated with alternate route plan deployment, all of which must be weighed against any resulting benefits. The benefits of alternate routing reflect that of freeway management systems in general, including reductions in motorist travel time, vehicle operating costs, and accident costs. The FHWA report discusses the limitations associated with the use of traffic simulation models for evaluation and provides instruction for conducting a sensitivity analysis to support findings.

Cragg and Demetsky (*8*) conducted an analysis of various traffic diversion strategies for a section of Interstate 66 in Arlington County, Virginia, to evaluate their effectiveness in reducing nonrecurrent congestion delay. Using the CORSIM microscopic computer traffic simulation model, the researchers examined the overall effects of diversion on a freeway/arterial network, which included the main line and proposed alternate route. The authors used the CORSIM model to identify incident scenarios that favor the deployment of alternate route plans, based on multiple simulation trials where incident severity and duration were varied. In addition, the model was used to establish an optimal signal-timing plan along the proposed alternate routes in the event of plan deployment.

Cragg and Demetsky concluded that, for partial roadway closures, an optimal diversion percentage often exists after which freeway delays increase because of inadequate capacity on a section of the alternate route. The researchers also stressed the importance of including ramps and weaving sections with enough capacity to accommodate diverted traffic in alternate route plans; therefore, the use of computer traffic simulation models is advantageous for identifying bottleneck locations on proposed alternate routes.

Nageli and Aden (*9*) examined traffic operations on preplanned alternate routes for bypassing the I-70/I-225 interchange in Denver, for the purpose of evaluating alternate signal timing plans during incident diversion. Through the use of the CORSIM computer traffic simulation model, the researchers concluded that deployment of alternate signal timing plans to accommodate diverted traffic on an alternate route proves critical for relieving bottlenecks on the alternate route and reducing overall network delay. Nageli and Aden stated that the CORSIM model represented an invaluable tool for evaluating alternate route plans.

HISTORICAL PERSPECTIVE

District 7 of the California DOT (Caltrans) pioneered the development and deployment of alternate route plans for responding to the occurrence of major incidents. In 1971, District 7 initiated the process of developing 2,500 alternate route maps, covering 764 km (475 miles) of freeway. Each map identified several key components vital to the alternate route deployment process including identification of problem location, primary and secondary alternate routes, deployment guidelines, manpower requirements and locations, required signing, necessary closures, responsible parties and associated phone numbers, and special notes unique to the incident area.

Caltrans determined that it was essential to coordinate all involved agencies in the development process and cited a good working relationship, throughout the planning stage, with local agency traffic personnel having jurisdiction over the proposed alternate routes.

The project, with about 65 percent of the alternate route maps completed, has not been expanded since 1979, because of a lack of manpower, a shift in program direction, and the absence of a signed commitment from other involved agencies due to budget uncertainty and priorities (R. Higa, California Department of Transportation–District 7, personal communication, May 1998).

CHAPTER THREE

STATE OF PRACTICE

As part of the study effort, a comprehensive 43 question survey, aimed at those persons represented in state DOT and other transportation agencies who are involved in alternate route plan development and deployment, was prepared for distribution to TRB State Representatives in all 50 states, the District of Columbia, and Puerto Rico. Concurrently, as shown in Figure 4, Internet web sites were examined to obtain similar information.

The questionnaire, contained in Appendix A, consists of three parts. Part 1 seeks to identify and establish an overview of existing roadway diversion practices for randomly occurring incidents. Part 2 is comprised of in-depth, follow-up questions relating to alternate route plan characteristics and development processes concerning those incident diversion practices identified in the previous section. Part 3 includes additional follow-up questions pertaining to alternate route plan deployment processes, in addition to plan operation and effectiveness regarding those incident diversion practices identified in Part 1.

With the development of alternate route plans becoming an increasingly important component of incident management programs nationwide, survey questions were meticulously reviewed so that they would guide respondents in identifying the latest processes, technologies, and planning efforts involved in the development and deployment of alternate route plans. After a summary of survey responses, the remainder of this chapter contains a detailed discussion of survey results and it is organized in accordance with the three stated sections outlined in the questionnaire.

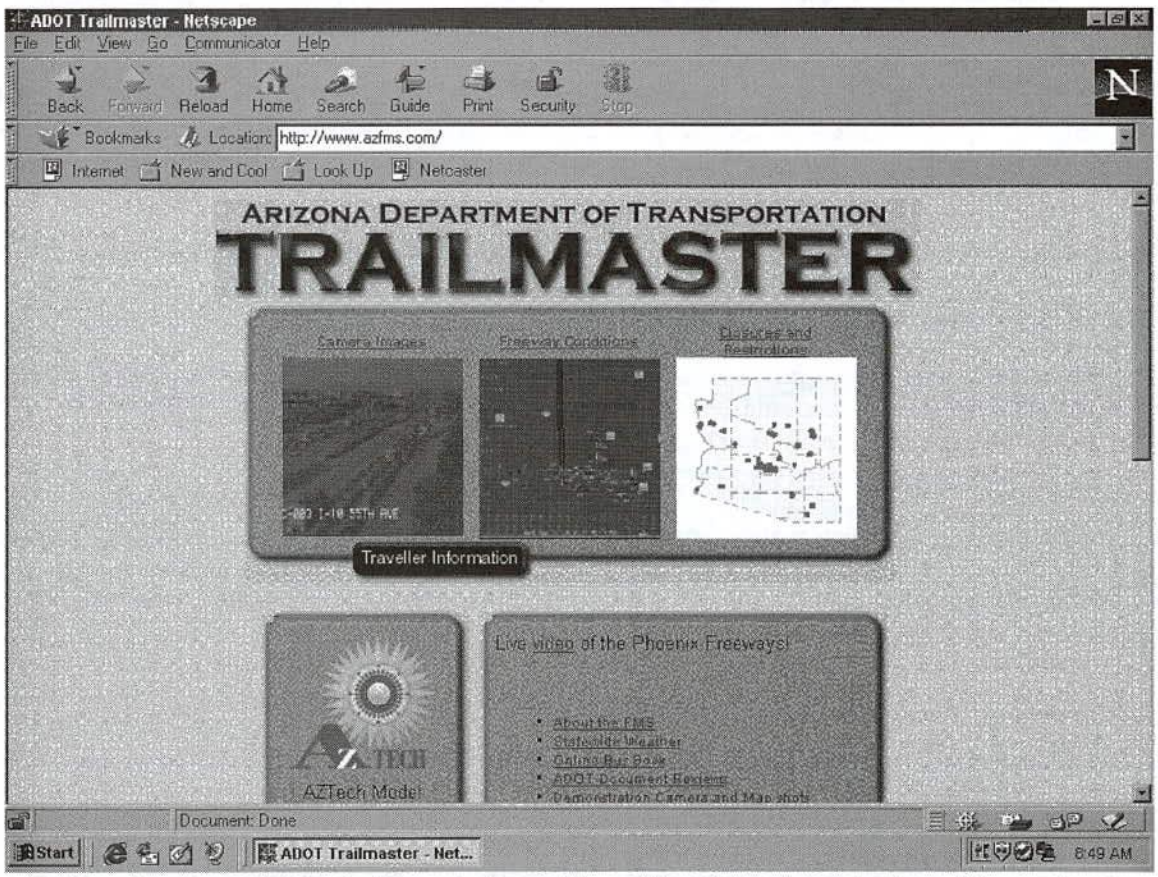

FIGURE 4 The Arizona DOT maintains a web site providing real-time information on traffic conditions and roadway restrictions. *(Graphic courtesy of the Arizona DOT.)*

SURVEY RESPONSE CHARACTERISTICS

The synthesis included a total of 59 of 62 survey questionnaire responses, because three agencies responded twice to the survey. Of the total respondents, 58 are state DOT personnel, with the other 4 individuals serving as: (1) a university research engineer working for a state DOT, (2) a consultant working for a state DOT, (3) a state police officer, and (4) a local police officer. The survey respondents addressed the existence of incident diversion practices on a statewide, district, or local level encompassing one or multiple corridors.

The surveyed agencies represent 38 states in addition to Puerto Rico. Seven of the states submitted responses from multiple districts: six surveys from Virginia, five each from New York and Texas, four from Florida, and two each from Colorado, Kentucky, and Ohio.

IDENTIFICATION OF ROADWAY INCIDENT DIVERSION PRACTICES

Agencies with Alternate Route Plans

Appendix B contains a complete list of agencies that have taken part in the study. A total of 43 surveyed agencies indicated the existence of a preplanned alternate route plan for use in responding to the future occurrence of major incidents. With the exception of a section highlighting the barriers encountered by agencies without a preplanned roadway incident diversion practice, the remainder of the synthesis focuses on the various aspects of preplanned roadway diversion practices for major incidents as reported by those 43 surveyed agencies currently maintaining such traffic management strategies.

Development Reasons

The three most frequently cited reasons for initiating the development of alternate route plans are as follows:

1. As a result of a major catastrophe (e.g., flood, snowstorm, earthquake, bridge collapse) that closed a section of roadway,
2. As a result of good planning goals to be prepared for any future event, and
3. As a result of the high occurrence of incidents such as crashes and major disablements (e.g., fires and spills).

A select number of respondents reported experiences learned from other states as a reason for plan development. For example, the West Virginia DOT acknowledges the long-standing roadway incident diversion practices in the bordering states of Virginia and Maryland as cause for creating alternate route plans for West Virginia's interstate highways.

General Characteristics

Table 2 summarizes some general characteristics of each individual preplanned roadway incident diversion practice for response to major incidents, as reported by the surveyed agencies. The table shows that approximately 65 percent of the practices originated after the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991. ISTEA funding has led to an increased availability and utilization of ITS technology which, in turn, has provided for greater focus on various components of incident management programs including roadway incident diversion practices for traffic management. The following observations were noted:

1. The majority of practices are suited to address the effects of a wide range of incidents including severe crashes, major disablements, and acts of nature. Moreover, an alternate route plan developed by the New York State DOT-Region 4 in Rochester is designed to accommodate evacuations resulting from a nuclear accident.
2. Over 55 percent of the practices contain alternate route plans for, mainly, interstate highways traversing portions of rural areas.
3. As expected, nearly all of the practices include freeway locations in urban areas where various traffic management technologies in addition to the availability of alternate routes are most prevalent.
4. The roadway incident diversion practices vary considerably in coverage area. Some agencies maintain alternate route plans for diverting traffic around certain spot locations; on the other hand, the Florida DOT-District 2 (including Jacksonville) has completed plans that cover 18 counties and more than 555 km (345 miles) of freeway.
5. Approximately 88 percent of the surveyed agencies have deployed a preplanned alternate route plan in the past.
6. The frequency of deploying alternate route plans varies from less than once a year for practices addressing incidents solely related to acts of nature to 250 times per year on Los Angeles freeways where a large scale incident management program exists under the direction of Caltrans-District 7. Caltrans utilizes mobile Traffic Management Teams in areas lacking fixed traffic management equipment to respond to major incidents using portable changeable message signs, highway advisory radio, and temporary detour signs for alternate routing purposes.
7. About 44 percent of the respondents noted that their agency maintains records of incidents where route

TABLE 2

SURVEYED AGENCIES WITH A PRE-PLANNED ROADWAY INCIDENT DIVERSION PRACTICE

Agency	Roadway(s) Name (Coverage Area)	Roadway(s) Type		Location	Area Type		Incident Type(s) Addressed[1]	Development Date	Frequency of Deployment[2]
		Freeway	Arterial		Urban	Rural			
Arizona DOT	I-17, I-10	x		Phoenix	x		A, D, N	July 1993	1/month
Caltrans–District 7	All freeways	x		Los Angeles	x		A, D, N	1971 (initial)	250/year
Colorado DOT–Region 4	I-25 (entire length)	x		Districtwide		x	A, D, N	January 1997	1/week
Colorado DOT–Region 6	I-70, I-225, I-25 (entire length)	x		Districtwide (Including Denver)	x	x	A, D	1996–1997	4–5/year
Connecticut DOT	I-84, I-91, I-95 (section)	x		Statewide (I-95 Greenwich to Branford)	x	x	A	1992	1/month
Delaware DOT	I-95, I-495 (entire length)	x		Statewide	x		A, D, N	1992	1/year
Florida DOT–District 2	I-10, I-75, I-95, I-295 (entire length)	x		Districtwide (Including Jacksonville)	x	x	A, D, N	1986 (initial)	1/week
Florida DOT–District 4	I-95 (entire length)	x		Broward and Palm Beach Counties	x		A, D, N	1994–1995	2/month
Florida DOT–District 5	I-4, I-75, I-95 (section)	x		Daytona Beach (I-4, I-95), Orlando (I-4), Districtwide (I-75)	x	x	A, D, N	1980s (initial)	1/month
Florida DOT–District 6	US-1, I-95 (section)	x	x	Florida City to Key Largo (US-1), Districtwide (I-95)	x	x	A (I-95 only), D, N	1988	1/year
Georgia DOT–District 7	Atlanta freeways (section)	x		Atlanta	x		A, D, N	1997	N/A
Illinois DOT–District 1	JFK, Edens, Eisenhower, and Stevenson Expressways (section)	x		Chicago	x		A, D, N	1993 (initial)	Never implemented

TABLE 2 *(Continued)*

Agency	Roadway(s) Name (Coverage Area)	Roadway(s) Type		Location	Area Type		Incident Type(s) Addressed[1]	Development Date	Frequency of Deployment[2]
		Freeway	Arterial		Urban	Rural			
Iowa DOT	All interstates (entire length)	x		Statewide	x	x	A, D, N	1996	2/year
Kansas DOT	SR-10, US-69, US-73, US-169, I-35, I-70, I-435, I-635, I-670	x		Kansas City	x		A, D, N	Fall 1996	8–10/year
Kentucky Transportation Cabinet	All interstates and parkways (entire length)	x		Statewide	x	x	A, D, N	Summer 1997	1–2/week (I-75 in Lexington)
Maine DOT	I-95 (entire length)	x		Maine/N.H. border to Augusta	x	x	A, D, N	August 1995	Never implemented
Maryland State Highway Administration	I-95, I-270, I-495, I-695 (entire length)	x		Statewide	x	x	A, D, N	Mid-1980s (initial)	2/month
Massachusetts Highway Department	I-93, I-95	x		Boston	x		A, D, N	December 1997	2/year (I-93), 1/year (I-95)
Minnesota DOT	I-94, I-494 (section)	x		Minneapolis (I-494), St. Paul (I-94)	x		A, D, N	1997	3/year (I-94), never implemented (I-494)
Missouri DOT	I-29, I-35, I-44, I-55, I-64, I-70 (entire length)	x		Statewide	x	x	A, D, N	N/A	1/month
Nevada DOT–District 3	I-80 (section)	x		Districtwide		x	A, D	October 1993	Never implemented
New Hampshire DOT	I-95 (entire length)	x		Statewide	x	x	A, D, N	N/A	N/A
New Jersey DOT	SR-3, SR-4, SR-17, US-9W, US-46, I-80, I-287	x		Bergen County	x		A, D, N	May 1996	12/year
	SR-15, SR-23, SR-94, SR-181, SR-183, SR-284, US-206	x	x	Sussex County		x	A, D, N	July 1998	N/A

TABLE 2 *(Continued)*

Agency	Roadway(s) Name (Coverage Area)	Roadway(s) Type		Location	Area Type		Incident Type(s) Addressed[1]	Development Date	Frequency of Deployment[2]
		Freeway	Arterial		Urban	Rural			
New Jersey DOT	SR-10, SR-15, SR-23, SR-24, SR-181, SR-183, US-46, US-206, I-80, I-280, I-287	x	x	Morris County	x	x	A, D, N	July 1998	N/A
New York DOT– Region 4	SR-5, SR-77, US-20		x	Districtwide		x	N, O	June 1997	<1/year
New York DOT– Region 6	SR-17 (entire length)	x		Districtwide	x	x	A, D	1998	Never implemented
North Carolina DOT	All interstates and some U.S. routes	x	x	Statewide	x	x	A, D, N	December 1994 (initial)	N/A
Dayton (Ohio) Police Department	I-75 (entire length)	x		Dayton	x		A, D, N	1989	2/year
Ohio DOT and Kentucky Transportation Cabinet– ARTIMIS	SR-126, SR-562, I-71, I-74, I-75, I-275, I-471 (entire length)	x		Cincinnati, Northern Kentucky	x		A, D	September 1994	2/month
Oregon DOT	I-5 (section)	x		Statewide	x	x	A, D, N	1996	1/month
Pennsylvania DOT	All interstates	x		Statewide	x	x	A, D, N	1988 (initial)	180/year
Texas DOT– Austin District	I-35, US-183 (section)	x		Austin	x		N	N/A	<1/year
Texas DOT– El Paso District	I-10, US-54 (section)	x		El Paso	x		N	1997	Never implemented
Texas DOT– Fort Worth District	I-20, I-30, I-35	x		Fort Worth	x		A	1986	N/A
Texas DOT– Houston District (TranStar)	US-59	x		Houston	x		A, D, N	N/A	2/year
Texas DOT– San Antonio District (TransGuide)	I-10, I-35, I-37, I-410, US-87, US-90, US-281, LOOP-1604 (entire length)	x		San Antonio	x		A, D, N	September 1998	15/year

TABLE 2 *(Continued)*

Agency	Roadway(s) Name (Coverage Area)	Roadway(s) Type		Location	Area Type		Incident Type(s) Addressed[1]	Development Date	Frequency of Deployment[2]
		Freeway	Arterial		Urban	Rural			
Virginia DOT– Fredericksburg District	I-95, US-17 (entire length)	x	x	Districtwide	x	x	A, D, N	1987	4/year
Virginia DOT– Lynchburg District	US-58 and most other primary roads (entire length)	x	x	Districtwide	x	x	A, D, N	1978 (initial)	1/month
Virginia DOT– Northern Virginia District	I-66, I-95, I-395, I-495 (entire length)	x		Districtwide (Including Arlington)	x		A	1991	3/year
Virginia DOT– Richmond District	I-64, I-95, I-295	x		Richmond	x		A	1989	1/month
Virginia DOT– Staunton District	I-64, I-66, I-81 (entire length)	x		Districtwide		x	A, D, N	1991	2/month
Virginia DOT– TMS of Hampton Roads	I-64, I-264, I-564, SR-44	x		Norfolk, Chesapeake, and Virginia Beach	x		A, D, N	N/A	6/year
Washington DOT	I-90 (section)	x		Spokane	x		A, D	N/A	2/year
West Virginia DOT	All interstates (entire length)	x		Statewide	x	x	A, D, N	1995	10–12/year

Note: N/A = not available.

[1]Key: A = accident; D = disablement (e.g., fires and spills); N = act of nature; and O = other (e.g., nuclear accident).
[2]Deployment refers to the utilization of an alternate route plan, resulting in the diversion of traffic from the main line, during the occurrence of a random incident.

diversion was used. The availability of such incident data is essential for future studies seeking to optimize or determine the cost-effectiveness of a particular set of alternate route plans.

Funding

The sources of funding used to support the development and deployment of preplanned alternate route plans include state, federal, and local agencies. All but two surveyed agencies with a roadway diversion practice for major incidents receives partial or full backing from state funding. These funds generally consist of tax dollars from department of motor vehicle fees, fuel taxes, and state or local sales taxes. One-third of respondents indicated the receipt of federal funds for roadway incident diversion, including the Kentucky Transportation Cabinet, which manages an incident diversion practice for all Kentucky interstate highways and parkways that relies solely on federal highway funds for safety. It should be recognized that the cost of supporting an incident management program, including the cost incurred as a result of the development and deployment of alternate route plans, could be defrayed by federal funding. A number of federal funding sources are available, including those specified in the Transportation Equity Act for the 21st Century (TEA-21) legislation.

The Dayton (Ohio) Police Department is the only surveyed agency to obtain exclusive local funding for the development and deployment of alternate route plans. The agency maintains 74 preplanned alternate route plans, developed by Dayton's Traffic Engineering Department, for Interstate 75 within the Dayton city limits. The Florida DOT-District 5 (including Daytona Beach and Orlando) also receives partial funding from local county and city agencies.

TEA-21 Legislation

The June 9, 1998, passage of TEA-21, a reauthorization of ISTEA, secured federal funding for surface transportation through fiscal year 2003. The TEA-21 legislation serves "to encourage and promote the safe and efficient management and operation of integrated, intermodal surface transportation systems to serve the mobility needs of people and freight and foster economic growth and development." TEA-21 continues to maintain the eligibility of Federal-aid Highway Program funds for operating costs associated with traffic monitoring, management, and control. The legislation allocates $1.282 billion in contract authority to fund the ITS program over the fiscal year period 1998–2003, raising an increased awareness concerning the importance of planning and deploying ITS technology in addition to furnishing agencies with the opportunity to improve the operational effectiveness of their incident management efforts including traffic management. As evidence of the increased flexibility in the use of federal funding, TEA-21 stipulates that both National Highway System (NHS) and Surface Transportation Program (STP) funds may be applied to infrastructure-based ITS capital improvements, and Congestion Mitigation/Air Quality Improvement Program (CMAQ) funds may be used in the deployment of traffic management strategies aimed at improving air quality through achieving improvements in traffic operations.

Other Funding Sources

Several additional options exist for obtaining funds to cover costs associated with the deployment of an alternate route plan. Deployment refers to the utilization of an alternate route plan resulting in the diversion of traffic from the main line during the occurrence of an incident. For example, the Federal Emergency Management Agency (FEMA) may reimburse the operational cost of deploying an alternate route plan in response to a natural disaster. With regard to the occurrence of traffic accidents, some states, including California, Illinois, Texas, and Washington, seek compensation from the at-fault motorist's insurance company for operational costs in performing various incident management activities at the accident site.

Barriers to Overcome

The development of alternate route plans requires a committed planning and organizational effort in which several potential barriers to plan development must be addressed. Of the surveyed agencies without a preplanned roadway incident diversion practice, six agencies indicated the following barriers encountered in considering plan development:

- Lack of an adequate alternate route (e.g., geometrics),
- Unknown conditions on the alternate route,
- Lack of traffic monitoring equipment on the alternate route,
- Possibility of motorists encountering an equal or worse level of service on the alternate route,
- Liability concerns if an accident or safety problems (e.g., mugging) occur due to being directed to an alternate route,
- Public opposition from individuals and community groups,
- Opposition from other agencies,
- Lack of agency human resources to develop alternate routes,
- Possible loss of credibility in changeable message sign messages if an undesirable level of congestion arises on the alternate route,

- Agency perception that there is not a problem which requires diversion, and
- Prohibitive cost.

A comparison of survey responses from agencies presiding over urban and rural environments revealed that different sets of obstacles impede the development of alternate route plans. The Wyoming Highway Patrol, in conjunction with the Wyoming DOT, cited the lack of agency human resources to develop diversion routes as an obstacle to alternate route plan development in a rural setting. On the other hand, those agencies with jurisdiction in an urban area experienced a set of problems, hindering alternate route plan development, unique to their environment. The Michigan DOT-Metro District (Detroit) reported the following barriers as most critical to the establishment of alternate route plans in an urban environment: possible loss of credibility in changeable message sign messages if an undesirable level of congestion arises on the diversion route and the lack of traffic monitoring equipment on alternate routes. The contrast in obstacles between the discussed locations concerns the amount of agency coverage area in a typical rural environment versus the level of traffic throughout an entire freeway/arterial network in a typical urban area. Chapter 4 profiles the successful traffic diversion efforts of the New York State DOT on Long Island despite not having developed a preplanned alternate route plan.

ALTERNATE ROUTE PLAN CHARACTERISTICS

Plan Development

The process of developing preplanned alternate route plans and procedures for plan deployment requires a group endeavor involving all agencies affected by and participating in the deployment of an alternate route in the event of a major incident. In general, the overall effort involves the identification of problem locations on the main line, the evaluation of proposed alternate routes, the determination of appropriate criteria for plan deployment, the agreement of participating agency roles and responsibilities, the identification of resources required to deploy and complete the alternate route operation, and the establishment of guidelines for plan evaluation and updating. The extent of the manpower, time, and organization needed to create a roadway incident diversion practice is significant as indicated by the surveyed agencies.

Approximately 85 percent of surveyed state DOTs reported being at least partially responsible for developing an alternate route plan. The staff size required for plan development varied from 1 staff person to a minimum of 10 agency personnel, with an average of 4 individuals assigned to develop each surveyed agency practice. Private consulting firms participated in about 34 percent of the surveyed efforts, utilizing a range of from two to five personnel to complete the plan development stage. Overall, the surveyed agency practices required an average of 9 months to develop, ranging from 1 month to 2 years. It should be noted that the reported workload estimates for alternate route plan development refer to the efforts required in completing an entire statewide or jurisdictional plan containing multiple preplanned alternate routes, and the wide range of work force and time requirements reflect the varying complexity and size of surveyed agency practices.

Alternate Routes

There are four common types of alternate routes: (1) freeway-to-freeway, (2) freeway-to-arterial, (3) arterial-to-arterial, and (4) arterial-to-freeway. The majority of surveyed agency practices feature alternate route plans linking adjacent freeway interchanges with an arterial extending parallel to the main line. However, some areas can accommodate other types of roadway incident diversion. The Texas DOT-Houston District, the Maryland DOT, the Arizona DOT, and the Virginia DOT-Hampton Roads TMS (traffic management system) have alternate route plans, which include rerouting all traffic from a freeway to a high occupancy vehicle (HOV) facility. Also, the Florida DOT-Districts 4 (Broward and Palm Beach Counties) and 5 (including Daytona Beach and Orlando) maintain alternate route plans, which include diverting traffic from a freeway to a tollway. The collection of tolls within the section of tollway serving as an alternate route is suspended for all traffic traversing the alternate route, including through traffic on the tollway. In Florida, the Florida Highway Patrol has the authority to waive tolls in those cases involving the use of a tollway section as an alternate route. The Texas DOT-Houston District recommends the use of tollways, free of charge, only during hurricane evacuations. In the event of a roadway incident, Texas DOT officials will post pertinent information concerning the incident by means of a changeable message sign located upstream of a tollway entrance ramp; however, the agency will not designate the tollway as an alternate route. Therefore, motorists face the option of paying a toll in exchange for saving travel time.

With the occurrence of a major incident, satisfying certain jurisdictional specific criteria, approximately 88 percent of surveyed agencies access preplanned alternate routes categorized by incident location on the main line. About 37 percent of surveyed agency practices allow for the generation of an alternate route in real time under the constraints of a preplanned framework containing various response scenarios, and two-thirds of the agencies producing alternate routes in real-time seek to obtain and consider conditions on potential alternate routes during the route selection process. The knowledge of real-time conditions on

FIGURE 5 Real-time information, obtained by means including closed-circuit television cameras, represents an important component of the operation success of any alternate route plan. *(Photo courtesy of the Arizona DOT.)*

potential alternate routes can be obtained by means ranging from the use of closed-circuit television cameras to manual observation and reporting by other team members such as police patrol officers. The availability of such real-time information represents an important component to the operational success of any alternate route plan (Figure 5).

Alternate Route Selection Criteria

The selection of an alternate route necessitates a rigorous review of a plethora of criteria with potential impacts on diverted motorists and, most importantly, the community surrounding the proposed alternate routes. Each surveyed agency indicated a unique set of criteria considered in alternate route selection during the planning process. Table 3 lists the identified criteria, as ranked by respondents, in the frequency of importance.

It is interesting to note that the 10 most important alternate route selection criteria, as determined from the survey, pertained to motorist impacts. The greatest community concern involved the type and intensity of residential development existing on the alternate route. Local community officials and city law enforcement agencies play a key role in providing the knowledge needed for the evaluation of criteria relating to the impacts of diverted traffic on commercial and residential areas adjacent to or near the proposed alternate route and, therefore, should be involved early in the planning process (*5*).

Agency Involvement

The state DOT acts as the sole lead agency in the development of alternate route plans in approximately 87 percent of surveyed agency practices. In New Jersey and North Carolina, the state DOT and state police serve as co-lead agencies in the planning process. The State Emergency Management Agency in Missouri and the Dayton Police Department in Ohio represent the only non-DOT agencies to function as the exclusive lead agency in the development of a surveyed agency practice. Results indicated that the lead agency coordinated planning efforts with an average of five other agencies, including the following:

- State DOT
- State police
- County police
- Local police
- Freeway service patrol operators
- Private tow truck operators
- County department of public works
- Local department of public works
- Local fire officials
- Emergency medical service officials
- Major incident response team
- Hazardous materials response team
- Transit provider.

In addition, some surveyed agencies reported having consulted with a private sector traffic reporting firm, the

TABLE 3
SUMMARY OF SURVEYED CRITERIA USED TO SELECT AN ALTERNATE ROUTE DURING THE PLANNING PROCESS

Rank	Alternate Route Selection Criteria	Entity Impacted
1	Proximity of alternate route to closed roadway	Motorist
2	Ease of access to/from alternate route	Motorist
3	Safety of motorists on alternate route	Motorist
4	Height, weight, width, and turning restrictions on alternate route (e.g., commercial vehicles)	Motorist
5	Number of travel lanes on or capacity of alternate route	Motorist
6	Congestion induced on alternate route	Motorist
7	Traffic conditions on alternate route	Motorist
8	Number of signalized intersections, stop signs, and unprotected left turns on alternate route	Motorist
9	Travel time on alternate route	Motorist
10	Pavement conditions on alternate route	Motorist
11	Type and intensity of residential development on alternate route	Community
12	Existence of schools and hospitals on alternate route	Community
13	Percentage of heavy vehicles (e.g., trucks, buses, recreational vehicles) on route from which traffic is to be diverted	Motorist
14	Grades on alternate route	Motorist
15	Type and intensity of commercial development on alternate route	Community
16	Availability of fuel, rest stops, and food facilities along alternate route	Motorist
17	Noise pollution	Community
18	Transit bus accommodation	Motorist
19	Air quality	Community

FHWA, and a Metropolitan Planning Organization. The Florida DOT-Districts 2 and 4 each organized alternate route planning teams comprised of 11 of the previously stated agencies, and the Iowa DOT and Kansas DOT each organized teams consisting of 10 agencies each.

Distribution of Alternate Route Plan

In general, the agencies participating in the alternate route planning process represent those agencies that also keep a copy of the alternate route plan. Also, trucking companies in Oregon have a copy of the Oregon DOT alternate route plans, and the New Jersey DOT provides a copy of their alternate route plans to dispatch centers for medical, fire, and police agencies. A total of six different agencies possess a copy of the alternate route plan for an average surveyed practice. The Florida DOT-District 2 represents one of 12 agencies with a copy of the alternate route plan for the District. All of the surveyed agencies maintain alternate route plans on hard-copy documents; furthermore, approximately 34 percent of surveyed agencies have a copy of the alternate route plan on a computer diskette or CD-ROM to facilitate faster retrieval of plan specifics. The Maine DOT, New Jersey DOT, New York State DOT-Region 4, and the Texas DOT-San Antonio District also have the capability of accessing preplanned alternate routes from a geographic information system (GIS). The application of GIS technology to this incident management practice contributes to shorter response times relative to the other stated means of alternate route plan maintenance because Global Positioning System data for querying appropriate alternate routes in a GIS can be obtained instantly at the incident site location as opposed to mile marker information needed for searching most other hard-copy documents.

The Texas DOT-San Antonio District has the means to inform persons at home or work of current incidents and alternate routing on San Antonio freeways in real time via their TransGuide World Wide Web site (**http://www.transguide.dot.state.tx.us/map/inmap**) (Figure 6). The Georgia DOT and Oregon DOT intend to post alternate route plans on the World Wide Web in the future. Currently, the Bergen County Office of Emergency Management operates a World Wide Web site promoting the existence of alternate route plans for Bergen County (New Jersey).

Training

Approximately 93 percent of surveyed agencies indicate that some form of training is provided for those agency officials participating in alternate route plan deployment. Of the surveyed agency practices with trained personnel, about 89 percent of the training effort involve the distribution of a manual, about 26 percent involve classroom instruction, and about 16 percent involve a simulation in the field. Specifically, the Connecticut DOT, Nevada DOT, New York State DOT-Region 4, Texas DOT-San Antonio District, Virginia DOT-Fredericksburg District, and Virginia DOT-Hampton Roads TMS coordinate simulations for all agencies involved in the alternate route plan deployment process. Similarly, the Florida DOT-District 2 and the Dayton (Ohio) Police Department distribute instructional videos as part of their training efforts.

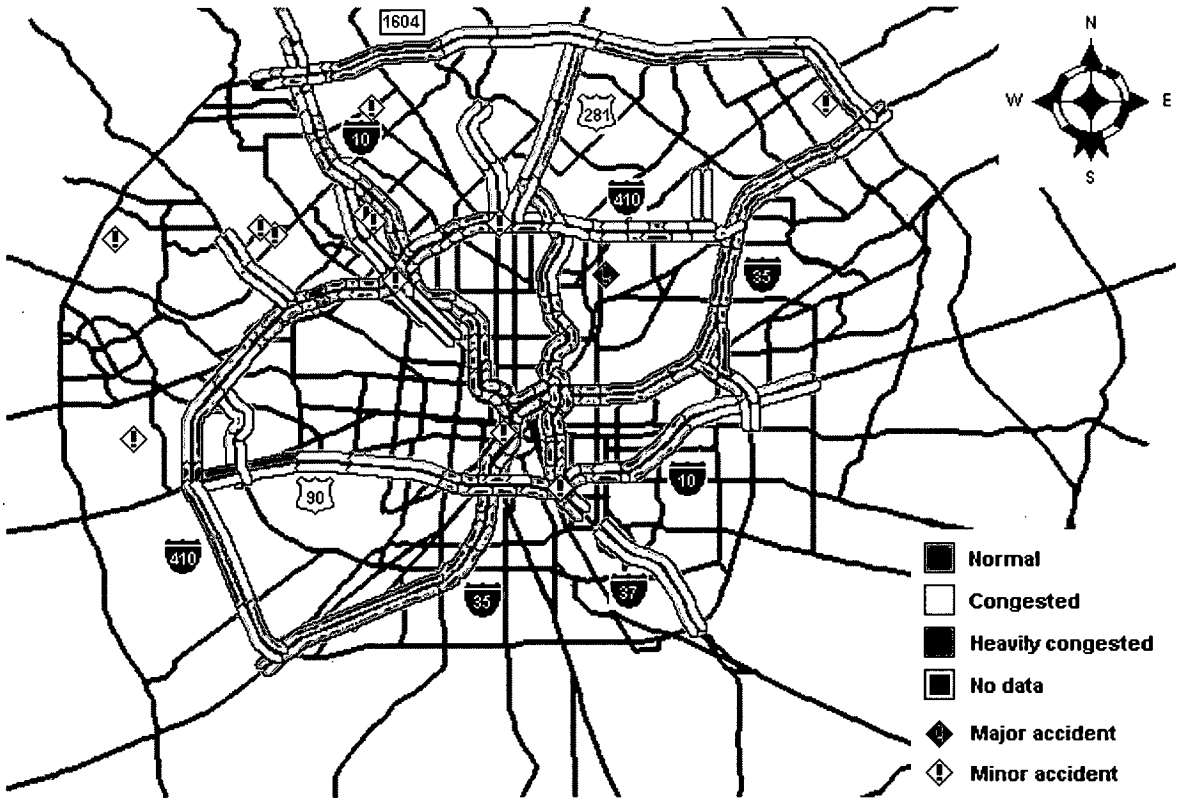

FIGURE 6 The Texas DOT-San Antonio District TransGuide web site provides information of current incidents and alternate routing on San Antonio freeways in real time. *(Graphic courtesy of the Texas DOT.)*

ALTERNATE ROUTE PLAN DEPLOYMENT

The deployment of an alternate route plan represents a response to the traffic management requirements of an incident management program. The survey responses provide insight into the applicability of traffic diversion as part of incident management in relation to: (1) incident detection and verification methods, (2) guidelines for deployment of alternate routing plan, (3) motorist information, (4) traffic management on alternate routes, (5) evaluation of plan, and (6) cost. These six aspects are described in the following paragraphs.

Incident Detection and Verification Methods

The surveyed agencies use one or more of the following methods for detecting and verifying a typical incident:

- Police
- Freeway service patrol
- Free cellular emergency phone call number
- Closed-circuit television
- Information sharing with a traffic advisory service
- Surveillance sensors/detectors coupled with an incident detection algorithm
- Roadside call box.

All surveyed agencies acknowledged the participation of police in some aspect of incident detection and verification, and the majority of those surveyed also rely on freeway service patrols (72 percent), public use of a free cellular emergency phone call number (69 percent), closed-circuit television (56 percent), and/or information sharing with a traffic advisory service (50 percent).

Guidelines for Deployment of Alternate Routing Plan

Traffic diversion represents the decision and deployment of a traffic management plan as an operational strategy in response to a major incident, and the determination of plan deployment is governed, in general, by a set of criteria relating to the characteristics of the incident. Over 86 percent of surveyed agencies considers the type of incident, incident duration, and resulting roadway lane blockage in the decision to deploy an alternate route plan. Other common criteria include incident location and the time of day. Table 4 contains a list of surveyed agencies that have set prespecified guidelines for alternate route plan deployment on at least one corridor. Virtually all occurrences of major incidents require an evaluation of the incident site to assist in the decision to deploy an alternate route

TABLE 4
SUMMARY OF SURVEYED CRITERIA FOR ALTERNATE ROUTE PLAN DEPLOYMENT

Agency	Prespecified Criteria	
	Lanes Blocked	Incident Duration
Florida DOT–District 4	Two or more lanes	More than 2 hours
Kansas DOT	N/A	2 or more hours
New Jersey DOT	All lanes	1.5 or more hours
Virginia DOT–Hampton Roads TMS	All lanes	2 or more hours
Virginia DOT–Northern Virginia District	N/A	2 or more hours
Virginia DOT–Staunton District	All lanes	2 or more hours
Washington DOT	Two or more lanes	1 or more hours

Note: N/A = not available.

plan. Moreover, upon making a decision to deploy an alternate route plan, the latest traffic conditions on the designated alternate route should be obtained and reviewed prior to diverting traffic from the main line to ensure the operational success of the alternate route plan.

As stated earlier, the state DOTs served as the lead agency in the development of most surveyed agency practices; however, only 58 percent of those incident diversion practices designate the state DOT to solely lead the alternate route plan deployment efforts. The state police represent the sole lead agency for plan deployment in approximately 26 percent of surveyed agency practices, and other agencies assuming the lead role in a particular practice include the local fire officials, by statute, in Connecticut; the State Emergency Management Agency in Missouri; and the Dayton Police Department in Ohio. The lead agency in the alternate route plan deployment process makes the final decision to deploy an alternate route, organizes communications, and coordinates the efforts of all participating agencies. A total of six different agencies are involved in plan deployment efforts for an average surveyed agency practice. The Florida DOT-District 2 works with as many as 10 other agencies during the deployment process, and the Iowa DOT coordinates response teams represented by as many as 9 other agencies.

The operational success of any alternate route plan is reflective of all agencies working together through incident management to effectively manage the incident scene. This can be ensured through the establishment of operational agreements between all agencies participating in incident management efforts. Examples of agency coordination during the alternate route plan deployment process are outlined in the profiles of existing random incident diversion practices contained in chapter 4.

The maintenance of constant, uninterrupted communications among agencies participating in alternate route plan deployment efforts represents a key focal point for ensuring a successful incident response operation. Over 94 percent of the surveyed agencies indicated the use of cellular communications. In addition, approximately 89 percent of those surveyed use radio communications with a dedicated frequency and one-third have available radio communications without a dedicated frequency. The New York State DOT-Region 4 also uses portable computers for communicating with other response team members. As part of TransGuide operations, the Texas DOT-San Antonio District uses closed-circuit television video to supplement dedicated radio communications with emergency supervisors at remote locations.

The inclusion of a traffic management center (TMC) for monitoring alternate route plan deployment operations is beneficial because the center can serve as the point of coordination and communication for managing response team personnel and traffic diversion efforts in reaction to a particular incident (Figure 7). Over 54 percent of the surveyed agency practices incorporate a TMC in the deployment of an alternate route plan. A TMC may range from a police or highway agency dispatch center in a rural area to a traffic operations center in a major metropolitan area. Other possible responsibilities of a TMC include incident detection and verification and the provision of motorist information regarding traffic diversion.

Motorist Information

Proper pretrip and en route communication with motorists is paramount to maintaining a successful traffic management operation. The provision of dynamic methods of communicating a continuous flow of information to motorists makes for a more effective freeway management system (Figure 8) (*3*). Such an information system is no more important than during the deployment of an alternate route plan requiring motorists to depart from the main line, negotiate an alternate route, and return to the main line.

The survey results reveal that a wide range of resources, ranging from manual efforts to state-of-the-art technology, is used to inform motorists of alternate routes. The following is a list of motorist information resources identified by the surveyed agencies:

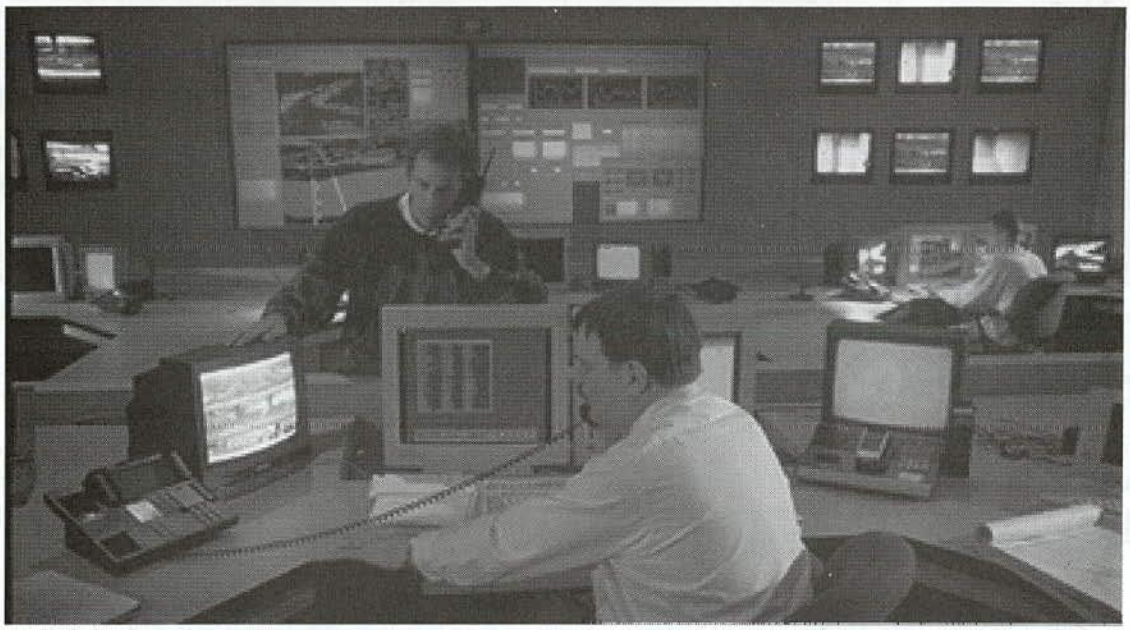

FIGURE 7 ARTIMIS Traffic Management Control Center, Cincinnati. *(Photo courtesy of the Ohio DOT.)*

FIGURE 8 Dynamic methods of communicating a continuous flow of information to motorists makes for a more effective freeway management system. *(Photo courtesy of the Wisconsin DOT.)*

- Police
- Portable changeable message signs
- Pull-through signs (e.g., signs guiding diverted traffic along an alternate route)
- Color-coded detour logo sign
- Media sources
- Traffic advisory services
- Changeable message signs
- Highway advisory radio
- Route marker assemblies
- Temporary signing
- In-vehicle traveler information system
- Internet.

The most commonly used means for providing alternate route information include changeable message signs located upstream of the alternate route access point, highway advisory radio, and media sources, all of which comprise the infrastructure of most traffic management systems in major metropolitan areas today (Figure 9). The Texas DOT-Houston District and the Texas DOT-San Antonio District represent the only surveyed agencies to

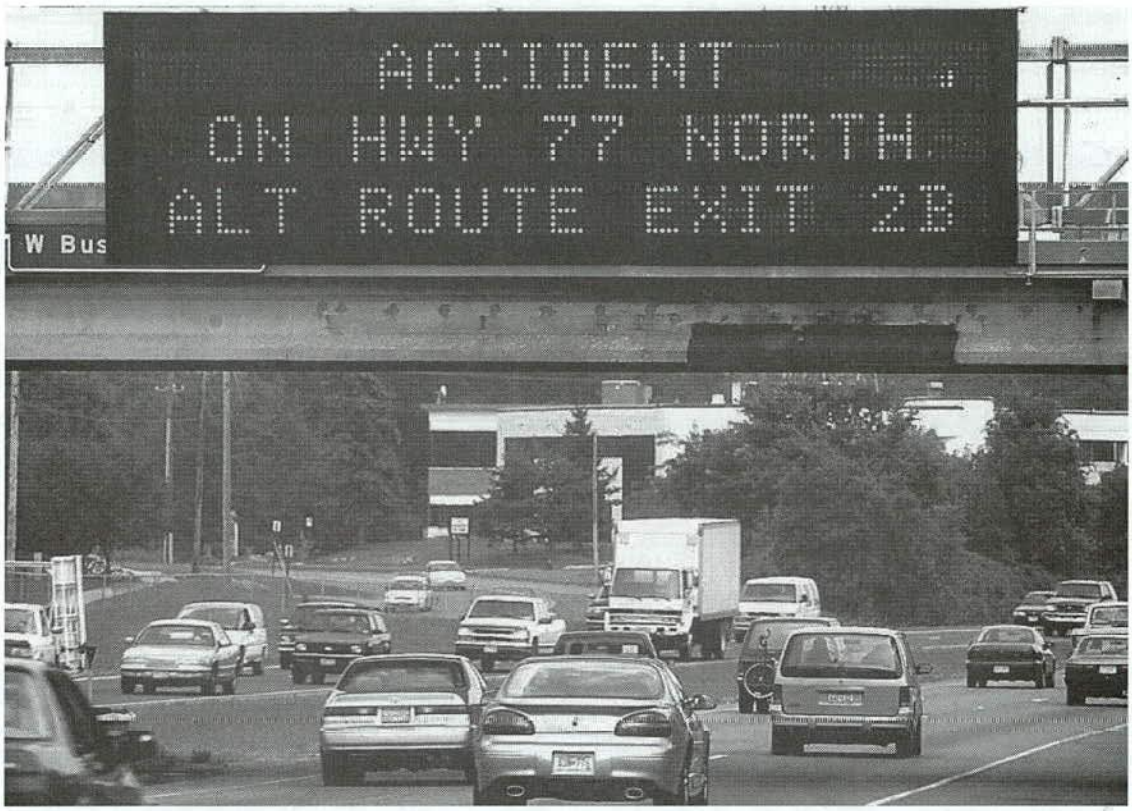

FIGURE 9 Among the most commonly used means for providing alternate route information are changeable message signs located upstream of the alternate route access point. *(Photo courtesy of the Minnesota DOT.)*

make real-time alternate route information available to motorists through the use of an in-vehicle traveler information system.

Alternate route information passed to motorists may consist of either a mandatory or voluntary message. An example of a mandatory message is "Major delays ahead, divert to alternate route," and a sample voluntary message is "Major delays ahead, minor delays on alternate route." Approximately 67 percent of surveyed agencies only post mandatory messages via information resources, such as changeable message signs. About 26 percent of survey respondents indicated a mixed use of mandatory and voluntary messages, whereas 7 percent provided solely voluntary messages to motorists.

As part of an Arizona DOT study (*10*) to evaluate aspects of Phase I of the I-10/I-17 freeway management system in Phoenix, which maintains approximately 7,000 prewritten messages for the 25 variable message signs in the system network, an analysis of motorist response to voluntary alternate route diversion messages posted on changeable message signs was conducted. Driver responses to alternate route messages of voluntary compliance were examined through an analysis of two specific case studies concerning daytime, weekday accidents blocking one or more main line traffic lanes for 30 minutes or more. The analysis compared main line and alternate route traffic volumes during the message display and for 30-minute periods before and after the message posting. A statistical analysis of data revealed a significant level of diversion, from 12 to 14.5 percent of traffic from the main line for the two case studies investigated, occurs when motorists are advised of an alternate route via a changeable message sign located upstream of the accident location.

In the event of an incident resulting in several hours of complete road closure, some surveyed agencies promote the use of other modes of travel as an option to alternate route use. These alternate modes include transit buses and commuter rail. The Colorado DOT-Region 6, Delaware DOT, New York State DOT-Region 4, and Virginia DOT-Richmond District encourage motorists to use transit buses, and both the Illinois DOT-District 1 and the Massachusetts Highway Department recommend commuter rail use. The Connecticut DOT, Pennsylvania DOT, and Virginia DOT-Northern Virginia District promote both transit bus and commuter rail usage.

Traffic Management on Alternate Route

The intent of introducing any traffic diversion strategy is to reduce the quantity of demand on the affected main

FIGURE 10 The Minnesota DOT has installed permanent route guidance signs on some preplanned alternate routes in the Twin Cities. *(Photo courtesy of the Minnesota DOT.)*

line, where capacity has been significantly reduced. However, without careful planning, motorist satisfaction may not necessarily increase. The effectiveness of a roadway incident diversion practice revolves around the accommodation of diverted traffic along the alternate route. It is essential that the diverted traffic encounter a noticeably higher level of service on the alternate route compared with that on the main line. Therefore, the application of special corridor management efforts to the alternate route is required to ensure satisfactory traffic flow operations and to minimize adverse impacts to the surrounding area.

More than 83 percent of surveyed agencies accommodate diverted traffic through the use of special police controls and/or the implementation of modified signal timing strategies. The enforcement of parking restrictions, during the diversion process, on the alternate route represents another method indicated by survey respondents. Those surveyed agencies managing freeway-to-HOV facility and freeway-to-tollway alternate route plans allow for the elimination of HOV restrictions and tolls, respectively. Caltrans-District 7 and the Texas DOT-Houston District also override ramp metering controls to facilitate a better transition to/from the alternate route.

The most common types of resources used to guide motorists along an alternate route and back to the main line include portable changeable message signs (83 percent of respondents), temporary signing (75 percent of respondents), police assistance (72 percent of respondents), and media sources (67 percent of respondents). A select number of surveyed agencies also indicated the use, on the alternate route, of at least one of the discussed information resources used to inform motorists on the main line to divert. For example, the Minnesota DOT has installed permanent route guidance signs on some preplanned alternate routes in the Twin Cities, which may be activated from a traffic operations center during deployment of an alternate route plan (Figure 10). Under the direction of the Dayton Police Department, the city of Dayton (Ohio) erected permanent detour signs, which hinge open from a closed position as needed for accommodating diverted traffic, along six preplanned alternate routes for three sections of Interstate 75 within the city limits (Figure 11) (*11*). In the event of a marked deterioration in traffic flow on the alternate route, 75 percent of surveyed agencies would generate and deploy a secondary alternate route.

Incident Profile: Phoenix, Arizona

This incident profile of Phoenix, Arizona, serves to outline the function and interrelation of the previously cited technologies and procedures for incident response and traffic management, given the occurrence of an incident warranting diversion of traffic to an alternate route. The Arizona DOT (ADOT) maintains an easily accessible World Wide Web site (**http://www.azfms.com**), which

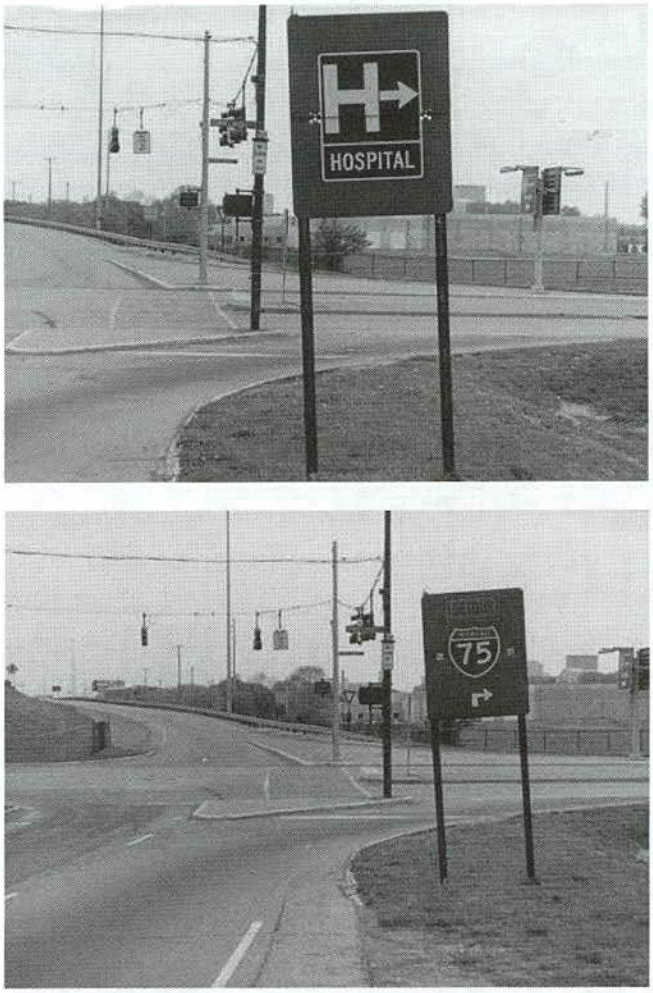

FIGURE 11 Dayton, Ohio, has erected permanent detour signs along six preplanned alternate routes for three sections of I-75 within the city limits. *(Photos courtesy of the Dayton Police Department.)*

provides real-time information on traffic conditions and roadway restrictions to assist travelers in selecting an appropriate route before initiating a trip via Interstate 10 and Interstate 17 in the Phoenix metropolitan area (Figure 4). The web site includes the following discussion of ADOT's freeway management system response procedures to the occurrence of a hypothetical incident on Interstate 17 that requires deployment of an alternate route plan:

> In the Traffic Operations Center, located near the Durango curve on I-17, computers that monitor loop detectors buried throughout the freeway system have detected a traffic slowdown on I-17 near Northern Avenue. In the control room an audible alarm is sounded and on the video display wall a graphic image of the Phoenix area freeway system shows a flashing red indication of the location of the potential traffic incident. The computers automatically display images from the closed-circuit television cameras nearest to the traffic slowdown on another portion of the video display wall.
>
> One of the FMS operators observes a line of traffic backing up on the freeway and enters a command at her console to take over management of this incident. The alarm is silenced. A screen is displayed showing a computer selected portion of the freeway map with graphic representations of the FMS equipment. She immediately operates the pan/tilt/zoom controls of the nearest video camera to better observe the incident. She sees two vehicles that have apparently collided in the high speed lane, damaging a length of median glare screen.
>
> The operator enters onto the freeway map her best estimate of the location of the incident. She types in information about the traffic incident (number 1 lane closed, two vehicles involved in a collision, median glare screen damaged, etc.), then enters a command that confirms these details are to be posted. The freeway status bulletin regularly transmitted to local media and public agencies by computer and FAX, and available through voice and computer dial-up to the FMS Public Information Computer, is immediately updated with this information.
>
> The ramp metering signals upstream of the incident automatically have their timing intervals lengthened and downstream intervals shortened or eliminated.
>
> Another on-duty operator enters commands at his console to dispatch emergency services. A series of menus and prompts guides him in identifying all information needed by the public safety and emergency services agencies being summoned. He transmits notifications to the Department of Public Safety (DPS) and ADOT personnel. If this incident involves certain preselected criteria (fatality, multiple injuries, hazardous material, significant facilities damage, etc.), additional notifications will be transmitted by computer generated voice or other methods to Federal Highway Administration and ADOT management.
>
> The first operator selects a menu item for motorist notification. She sees that the FMS computers have identified two variable message signs (VMS) upstream of the incident and are recommending messages to be displayed, "ACCIDENT 2 MILES, LEFT LANE CLOSED" and "ACCIDENT AHEAD, LEFT LANE CLOSED." The computers have also identified two highway advisory radio (HAR) transmitter locations, one adjacent to the accident and one several miles upstream, and are recommending a similar message: "ACCIDENT SOUTHBOUND I-17 NEAR NORTHERN AVENUE, LEFT LANE CLOSED." She adds a comment "FOR ACCESS TO I-10 SOUTHBOUND, USE THUNDERBIRD ROAD EAST AND THEN SOUTH ON SR51, THE SQUAW PEAK FREEWAY" to the upstream transmitter location. She enters a command that confirms these VMS and HAR messages and initiates their broadcast.
>
> Finally, ramp metering signal intervals that have been automatically adjusted by the computers are reviewed. There is still heavy congestion upstream of the incident, so intervals upstream of the incident are lengthened. Several ramp meter signals downstream of the incident are turned off to allow free flow of traffic onto southbound I-17.
>
> The FMS operator continues to monitor the traffic incident. She observes the DPS and a tow truck as they arrive on the scene and take charge. ADOT maintenance crews arrive and remove the damaged median glare screen. As soon as the roadway is cleared, she enters a command on her console to indicate that the incident has cleared. The FMS computers automatically halt display of the VMS messages and transmission of the HAR radio broadcasts. The freeway status bulletin is updated to indicate the accident has been cleared. After lingering congestion has cleared, the FMS computers notify the operator to enter the command that resets the ramp meter signals to the intervals preprogrammed into the system.

TABLE 5

SUMMARY OF ROADWAY INCIDENT DIVERSION PRACTICE COST INFORMATION

Agency	Location	Estimated Development Cost ($)	Number of Preplanned Alternate Routes	Estimated Equipment Cost ($)	Equipment Maintained	Estimated Deployment Cost ($)	Frequency of Deployment
Colorado DOT–Region 4	Districtwide	20,000	19	50,000	5 portable changeable message signs 3 sets of temporary detour signs	20,000	1/week
Illinois DOT–District 1	Chicago	36,000	JFK Expressway = 6 Edens Expressway = 6 Eisenhower Expressway = 8 Stevenson Expressway = 10	N/A	N/A	N/A	Never implemented
Kentucky Transportation Cabinet	Statewide	75,000	Approximately 200 (1 in each direction per set of adjacent interstate/parkway interchanges)	N/A	N/A	N/A	1–2/week (I-75 in Lexington)
New Jersey DOT	Bergen County	150,000	275	50,000	2 vans each containing radios and a set of roll-up signs with velcro arrows	N/A	12/year
	Morris County	100,000	507	50,000	1 van containing a set of roll-up signs with velcro arrows (shared with Sussex County)	N/A	N/A
	Sussex County	80,000	281	50,000	1 van containing a set of roll-up signs with velcro arrows (shared with Morris County)	N/A	N/A
Dayton (Ohio) Police Department	Dayton	5,000	74	5,000	33 permanent detour signs Portable detour signs	N/A	2/year
Virginia DOT–Richmond District	Richmond	10,000	Approximately 50 (1 in each direction per set of adjacent interstate highway interchanges)	N/A	N/A	N/A	1/month

Note: N/A = not available.

Evaluation of Plan

Evaluation represents a key element in achieving and maintaining the successful operation of any incident management component. The qualitative and quantitative evaluation of a roadway incident diversion practice serves to identify successes and failures concerning agency decision making, response team coordination, communications, and alternate route operations. The results of such efforts assist agency officials in the reevaluation and/or future planning of various alternate route plan development and deployment strategies.

Approximately 83 percent of surveyed agencies express a satisfaction with their traffic diversion efforts. Similarly, about 79 percent of respondents indicate that diverted motorists are satisfied after the deployment of an alternate route plan. General comments regarding those surveyed agencies voicing concerns include the need for more planning and fine-tuning, better coordination between participating agencies, more infrastructure, and added alternate route plan coverage area. Motorist remarks solely pertained to the presence of congested conditions on the alternate route.

With regard to quantitative evaluations, the TTI is preparing to release a study addressing the cost-effectiveness of the Texas DOT-Houston District TranStar incident management program components that include traffic diversion. The Florida DOT-District 6 also has future plans for a cost-effectiveness study of traffic diversion within the context of their ITS operations. Overall, approximately 72 percent of surveyed agencies believe further research needs to be conducted regarding roadway incident diversion practices.

Cost

A select number of surveyed agencies provided estimated cost data relating to alternate route plan development, deployment, and/or equipment needs. Table 5 contains a summary of the stated cost information in addition to information concerning the number of preplanned alternate routes developed, the equipment maintained to facilitate traffic diversion efforts only, and the frequency of diversion plan deployment. It should be noted that the range of reported roadway incident diversion practice cost estimates reflect the varying complexity and size of surveyed agency practices.

CHAPTER FOUR

PROFILES OF EXISTING ROADWAY INCIDENT DIVERSION PRACTICES

This chapter provides a detailed profile of four roadway incident diversion practices across the country. Each profile is based on information from state DOT survey responses, telephone interviews, and supplemental documents pertaining to agency traffic diversion efforts. The first three profiles furnish an in-depth look at alternate route plan development and the framework, guidelines, processes, and technologies used in alternate route plan deployment. The final profile details the successful traffic diversion efforts of one agency not having developed a preplanned alternate route plan. The following sections summarize incident diversion practices in New Jersey, Ohio, Oregon, and New York. This chapter concludes with a summary of alternate route plan documentation by several surveyed agencies.

BERGEN COUNTY, NEW JERSEY

Background

The New Jersey DOT maintains a roadway incident diversion practice of over 275 alternate route plans for Bergen County, New Jersey. Bergen County is primarily urbanized and is located in the northeast corner of New Jersey, within the New York metropolitan area. The 1990 U.S. Census population of Bergen County was 825,380.

Alternate Route Plan Development

Using a staff of five, the state DOT developed alternate route plans for three state highways, two U.S. highways, and two interstate freeways in Bergen County over the course of 2 years. The plans were completed in May 1996. The DOT consulted with seven other agencies during the alternate plan development process, including state police, county police, local police, county department of public works, local department of public works, local fire officials, and emergency medical service officials.

The DOT distributed copies of the alternate route plans and response procedures to the stated agencies in addition to major incident response teams, hazardous materials

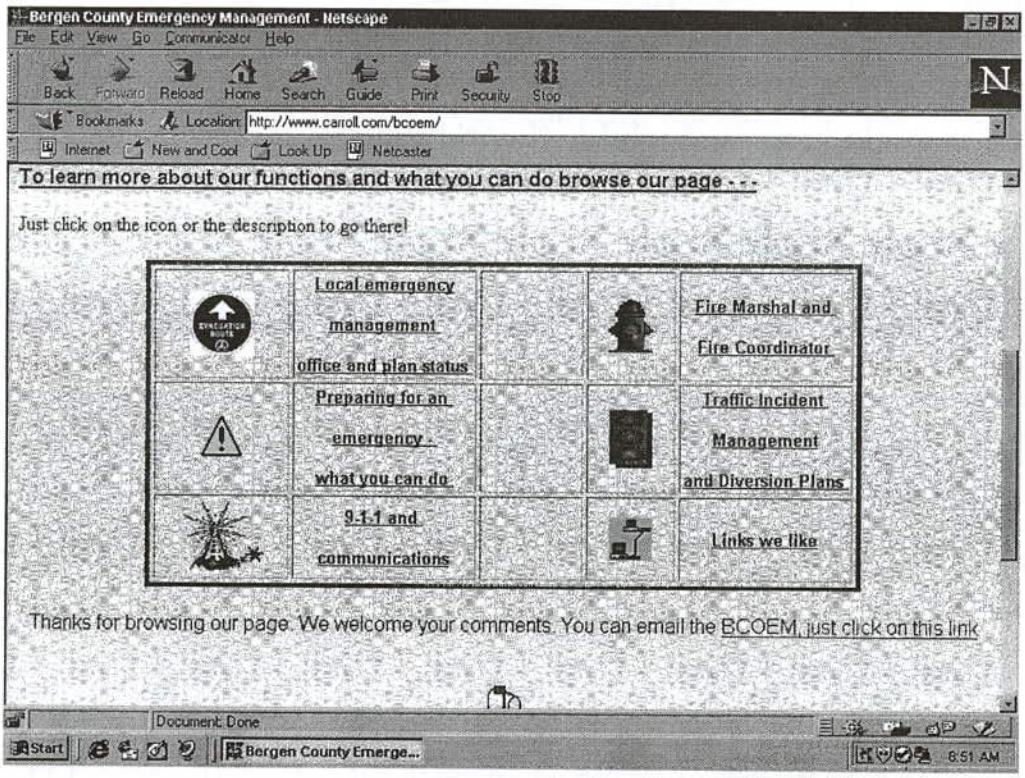

FIGURE 12 The Bergen County, New Jersey, Office of Emergency Management (BCOEM) operates a web site that includes information on alternate route plans. *(Graphic courtesy of the Bergen County Office of Emergency Management.)*

response teams, emergency dispatch centers, traffic services, and toll agencies. The alternate route plans are maintained on hard-copy documents, computer software, and a GIS. Those agencies participating in the deployment of alternate route plans receive training through the distribution of a manual and classroom instruction.

The Bergen County Office of Emergency Management (BCOEM), a consulting agency to the DOT during alternate route plan development, operates a World Wide Web site that includes information on alternate route plans for the local area (Figure 12). This web site (**http://www.carroll.com/bcoem/traffic.htm**) provides a brief overview of the incident diversion practice for Bergen County and a graphic showing a sample alternate route plan, thus raising public awareness of the practice (Figure 13).

Alternate Route Plan Deployment

The *Bergen County Traffic Incident Management Diversion Route Plan* (*12*), prepared by the state DOT in conjunction with the Bergen County Police Chiefs Association and the Bergen County Police Traffic Officers Association, outlines the procedures, responsibilities, and criteria for the alternate route plan deployment. In the event of an incident, the investigating police agency serves as the Incident Commander on site, responsible for delegating the resources and personnel needed for appropriate incident response. After assessing the nature of the incident, anticipated duration, and resulting impact on traffic flow, the police agency assigns a "Level of Implementation" to the incident site.

The traffic incident management plan identifies two Levels of Implementation based on the spatial and temporal characteristics of the incident and the corresponding time of day. Different deployment criteria exist for the daytime hours of 5:00 A.M. to 11:00 P.M. and the overnight hours of 11:00 P.M. to 5:00 A.M. A summary of criteria necessary for deployment of the traffic incident management plan, under one of the Levels of Implementation, is as follows:

- Level I requires an incident blocking two or more lanes for less than 90 minutes or an incident blocking at least one lane for an estimated 90 or more minutes during daytime hours. This level involves notification of the Bergen County Traffic Incident Management Response Team (BCTIMRT) by the investigating police agency. The BCTIMRT, consisting of representatives from the investigating police agency, New Jersey DOT, and Bergen County police, will then respond to the incident site and determine whether additional actions to minimize the effects of nonrecurrent congestion are necessary. During overnight hours, Level I requires an incident blocking one lane of a two-lane highway or two lanes of a three-lane highway for 90 minutes or more.
- Level II requires complete road closure that is expected to last 90 minutes or more. This level mandates the deployment of an alternate route plan by the BCTIMRT. The criteria for Level II deployment remains the same for daytime and overnight hours.

The New Jersey DOT signs and maintains the alternate route, and the agency also activates pertinent changeable message signs and highway advisory radios. In addition, the New Jersey DOT assists in conducting lane and roadway closures, moving spilled cargo from travel lanes, and relocating minor gasoline and oil spills.

The BCTIMRT also initiates and supervises a traffic information network throughout the entire duration of the incident. Finally, the BCTIMRT coordinates postincident meetings with other involved agencies to discuss and critique alternate route plan deployment efforts. When asked to rank the degree of satisfaction by indicating "not satisfied," "somewhat satisfied," "satisfied," or "very satisfied," after deployment of an alternate route plan, the New Jersey DOT expressed that it was very satisfied with past cases involving traffic diversion.

Key Findings

Key findings associated with the roadway incident diversion practice in Bergen County can be summarized as follows:

- The New Jersey DOT maintains over 275 alternate route plans for Bergen County, marking this one of the most comprehensive roadway incident diversion practices surveyed.
- The DOT stores alternate route plans on computer software and a GIS to permit fast retrieval of plan specifics.
- The DOT operates a World Wide Web home page promoting the existence of alternate route plans for Bergen County, thus raising public awareness of the practice.
- The alternate route plan specifies deployment criteria based on the spatial and temporal characteristics of the incident in addition to the time of day.
- All agencies involved in alternate route plan deployment meet regularly to conduct a review of the practice.

Sample Alternate Route Plan

Appendix C contains an alternate route plan, obtained from the New Jersey DOT Traffic Operations-North, for

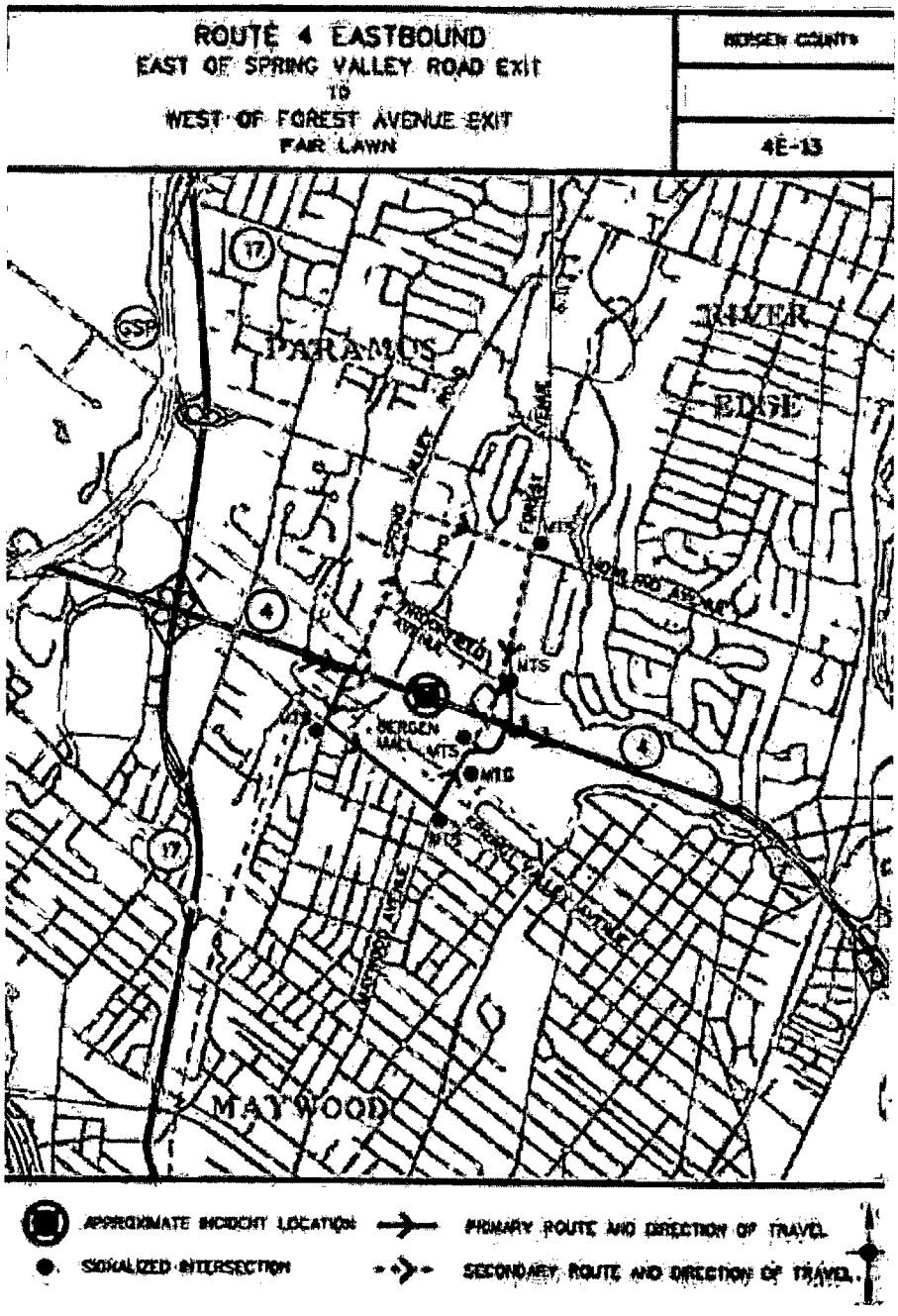

FIGURE 13 The BCOEM web site provides a brief overview of the incident diversion practice for Bergen County and a graphic showing a sample alternate route plan. *(Graphic courtesy of the Bergen County Office of Emergency Management.)*

response to an incident occurring between a select pair of interchanges on Northbound State Route 17 in the vicinity of the city of Paramus. The plan provides a description and schematic of primary and secondary alternate routes, a list of ramp and local street closures during diversion, the location of variable message signs to be used in addition to posted messages, and a list of key contact phone numbers. The plan diagram also includes the location and jurisdiction of traffic signals on the proposed alternate routes, where "CTS" represents a county traffic signal and "MTS" marks a municipal traffic signal.

GREATER CINCINNATI METROPOLITAN AREA

Background

The Advanced Regional Traffic Interactive Management and Information System (ARTIMIS) is a comprehensive traffic management system incorporating state-of-the-art ITS technologies designed to monitor 142 km (88 miles) of freeways, bounded by Interstate 275, in the Cincinnati metropolitan area, including a portion of northern Kentucky. The ARTIMIS coverage area encompasses the city

of Cincinnati (1990 U.S. Census population of 364,040) and the neighboring city of Covington, Kentucky (1990 U.S. Census population of 43,264), in addition to adjacent suburbs. ARTIMIS represents a partnership of the Kentucky Transportation Cabinet, Ohio DOT, FHWA, Ohio–Kentucky Regional Council of Governments, and the city of Cincinnati.

Alternate Route Plan Development

A consultant developed the freeway-to-freeway alternate route plans over a 5-month period with a staff of three. The plans were completed in September 1994. The following agencies, led by the Kentucky Transportation Cabinet, were consulted in the development process: state DOT, state police, county police, local police, local fire officials, and emergency medical service officials.

The ARTIMIS traffic management system maintains preplanned alternate route plans for 29 of the 52 corridors, defined as a section of roadway in one direction between two major interchanges, in its coverage area. The alternate routes are stored on hard-copy documents and computer software, and the material is maintained at the ARTIMIS Operations Control Center (*12*).

Alternate Route Plan Deployment

The decision to initiate the alternate route deployment process is the responsibility of the investigating police agency at the incident site, in conjunction with other agency personnel. A different set of criteria, dependent on incident severity, for deploying an alternate route exists for the morning and afternoon peak hours, the midday hours, and the overnight hours. During the morning and afternoon peak, advisory alternate routing is deployed in the event of a two-lane closure for more than 2 hours or a greater than two-lane closure for less than one-half hour. Mandatory alternate routing is deployed in peak hour cases involving incidents blocking more than two lanes for 30 minutes or more. A complete summary of response actions for all combinations of spatial and temporal incident characteristics is presented in Appendix D (*13*).

The ARTIMIS traffic management system uses several information resources to inform motorists of alternate routes including permanent and portable changeable message signs, highway advisory radio, and media sources (Figure 14).

Because all of the preplanned alternate routes are on freeways monitored by the ARTIMIS, the system operations plan recommends a real-time analysis of operations on the proposed alternate route through the review of inductive loop detector readings and closed-circuit television images before traffic is diverted from the affected main line (*13*).

Given the aforementioned satisfaction rankings, the ARTIMIS program manager interviewed as part of the study indicated that the agency is satisfied with past alternate routing efforts.

Key Findings

Key findings associated with the roadway incident diversion practice in Cincinnati can be summarized as follows:

- ARTIMIS and the associated roadway incident diversion practice incorporates agencies from two states, Ohio and Kentucky.
- The practice represents a component of the ITS framework in-place for the Cincinnati metropolitan area, thus utilizing state-of-the-art technology for traffic management.
- The practice uses a traffic management center to coordinate alternate route plan deployment efforts and to serve as a communications hub for response team members.
- Response team members at the traffic management center can access real-time information, via inductive loop detector readings and closed-circuit television images, on alternate routes.

JACKSON, JOSEPHINE, AND DOUGLAS COUNTIES IN OREGON

Background

The Oregon DOT-Region 3 coordinated the development of alternate route plans for six continuous sections of Interstate 5 in Jackson, Josephine, and Douglas Counties. These counties are located in southwest Oregon and encompass a primarily rural area. Douglas County is adjacent to and north of Jackson and Josephine Counties, both of which border California. The 1990 U.S. Census populations of Jackson, Josephine, and Douglas Counties were 146,389, 62,649, and 94,649, respectively.

Alternate Route Plan Development

The development of the alternate route plans was completed in 1996, and the plans are maintained in an *Emergency Detour Contingency Manual* (EDCM) for Region 3 (*14*). Various DOTs, police, and public works agencies from Oregon and California, in addition to private trucking

FIGURE 14 The ARTIMIS traffic management system uses several information resources including permanent changeable message signs to inform motorists of alternate routes. *(Photo courtesy of TRW, Inc.)*

companies and the United Parcel Service, received copies of the EDCM during its initial distribution.

The EDCM contains a total of 46 preplanned alternate routes for each direction of travel along Interstate 5 in the stated area. Each alternate route plan illustrates the proposed alternate route and provides information pertaining to the exact placement of detour signs. In addition, oversize vehicle restrictions and the existence of narrow roads, bridges, and tunnels along the alternate route are identified. The manual also provides, for each section, a contact list of response team participants in the alternate route plan deployment process.

Alternate Route Plan Deployment

In the event of a major incident closing all of northbound or southbound Interstate 5, motorists are informed to divert from the main line and are guided to the alternate route through the use of portable changeable message signs, route marker assemblies, temporary signing, and various traffic control devices such as cones and drums. Temporary detour signs are also erected at prespecified locations along the alternate route to guide motorists along the route and back to Interstate 5.

The Oregon DOT notes it is satisfied with statewide traffic diversion efforts along Interstate 5, citing a particular example involving the occurrence of a sinkhole in Region 3, where the use of a preplanned alternate route worked very well.

Key Findings

Key findings associated with the roadway incident diversion practice in southwest Oregon can be summarized as follows:

- The Oregon DOT maintains 46 alternate route plans for the tri-county area, making for one of the most comprehensive roadway incident diversion practices surveyed for rural areas.
- The alternate route plans identify oversize vehicle restrictions given inadequate geometric conditions on the alternate route.
- The DOT distributed copies of the alternate route plans to private trucking companies.

Sample Alternate Route Plan

Appendix E contains an alternate route plan, from the cited *Emergency Detour Contingency Manual* (*14*), for response to an incident occurring between adjacent interchanges on Interstate 5 in Jackson County. The plan furnishes a schematic of the proposed alternate route, the location of detour sign placement on the alternate route in addition to the specific sign type (left or right arrow) required, the

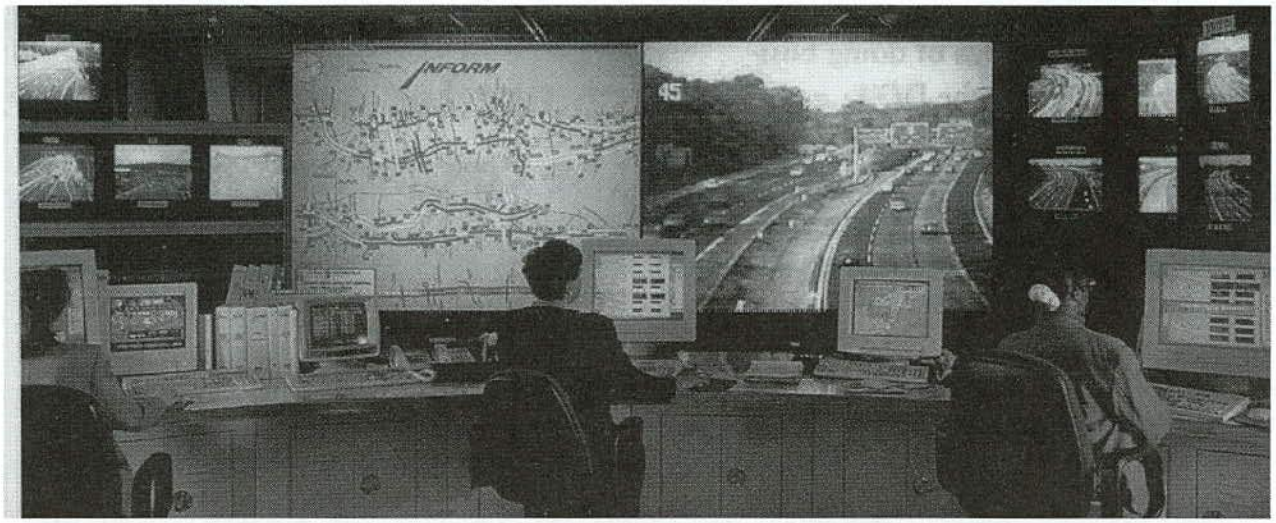

FIGURE 15 The New York State DOT operates the INFORM system for select freeways and parkways within eastern Queens County, Nassau County, and western Suffolk County on Long Island. *(Photo courtesy of the New York DOT.)*

length of the alternate route, and a determination of oversize vehicle restrictions on the alternate route.

LONG ISLAND, NEW YORK

Background

The New York State DOT operates one of the nation's most extensive advanced traffic management systems, the INformation FOR Motorists (INFORM) system for select freeways, parkways, and arterials within eastern Queens County, Nassau County, and western Suffolk County on Long Island (Figure 15). The 1990 U.S. Census populations of Nassau County and Suffolk County were 1,287,348 and 1,321,864, respectively. INFORM operators assess traffic operations through the use of real-time information from surveillance sensors located in the pavement at approximately 800-m (0.5-mile) intervals and from closed-circuit television cameras. Motorists are, in turn, advised of downstream traffic conditions, in addition to conditions on other roadways within the INFORM coverage area via permanent changeable message signs stationed throughout the INFORM network.

INFORM Network

The configuration of Long Island's east/west parallel freeways (Long Island Expressway and Northern State Parkway/Grand Central Parkway) and arterials (Long Island Expressway Service Roads and New York State Route 25), in addition to north/south connecting roadways (various freeways, parkways, and arterials), is ideal for route diversion as a result of recurrent or nonrecurrent congestion. The INFORM system includes coverage of a 56-km (35-mile) corridor comprised of the Long Island Expressway (Interstate 495) and the Northern State Parkway. For example, in the event of an incident occurring on the Long Island Expressway, motorists may choose to divert to a service road located adjacent and parallel to the main line. The Long Island Expressway Service Roads provide two or three lanes of travel in each direction, and the roadways can be accessed at each I-495 interchange. In addition, motorists in passenger cars may also choose to divert from I-495 to the parallel Northern State Parkway and vice versa. The INFORM system includes variable message signs located on north/south roadways to advise motorists of traffic conditions before they enter either the Long Island Expressway or Northern State Parkway, thus allowing motorists to select the best east/west route based on present traffic conditions.

Traffic Diversion Approach

The New York State DOT has not developed a preplanned alternate route plan for incorporation into the INFORM system, citing such barriers to plan development as the possibility of motorists encountering an equal or worse level of service on the alternate route. Given the high volume of traffic throughout the INFORM network, even a small percentage of vehicles diverted to an alternate route during a partial main line closure can result in a considerable enhancement in traffic flow on the affected roadway, as well as within the corridor. Therefore, the DOT decided not to advise motorists to divert, but rather to provide motorists with real-time information on traffic conditions, and motorists themselves must make the decision to divert to an alternate route of their choosing. The key to the successful operation of the INFORM system rests on providing accurate, up-to-date, real-time information regarding traffic

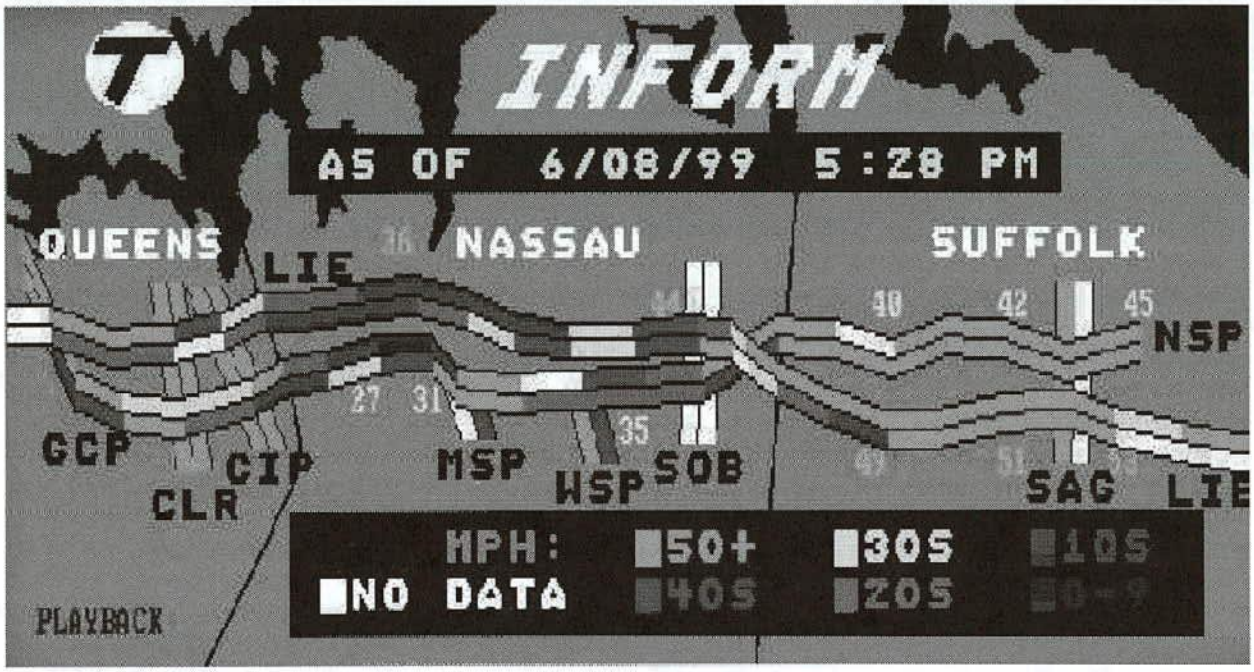

FIGURE 16 The INFORM traffic operations center disseminates real-time information on current traffic conditions to the local Long Island cable television station and a kiosk at a major Long Island shopping mall. *(Graphic courtesy of the New York State DOT.)*

conditions on the main line and potential alternate routes, thus influencing a driver's decision to divert from the main line. By providing such frequent, accurate traffic information updates, INFORM operators can better optimize traffic conditions from a network perspective.

The INFORM traffic operations center disseminates real-time information on current traffic conditions to the local Long Island cable television station in addition to a kiosk at a major Long Island shopping mall to facilitate pretrip planning (Figure 16). Thus, travelers can use this information to select the best route in arranging their trip before entering onto the highway system. This pretrip planning helps to effectuate diversion in the event of nonrecurrent or recurrent congestion occurring at a location within the INFORM coverage area.

Key Findings

Key findings associated with the advanced traffic information system on Long Island can be summarized as follows:

- Given the high volume of traffic throughout the INFORM network, even a small percentage of vehicles diverted to an alternate route during a partial main line closure can result in a considerable enhancement in traffic flow on the affected roadway, as well as within the corridor.
- The key to the successful operation of the INFORM system rests on providing accurate, up-to-date, real-time information regarding traffic conditions on the main line and potential alternate routes, thus influencing a driver's decision to divert from the main line to an alternate route of his/her choosing.
- The INFORM traffic operations center disseminates real-time information on current traffic conditions to the local Long Island cable television station in addition to a kiosk at a major Long Island shopping mall to facilitate pretrip planning, which helps to effectuate diversion before travelers enter onto the highway system.

OTHER SURVEYED ROADWAY INCIDENT DIVERSION PRACTICES

As previously stated, all surveyed agencies maintain alternate route plans on hard-copy documents. Several survey respondents returned incident response documents containing preplanned alternate route maps and other pertinent information concerning alternate route plan deployment. The alternate route plans obtained as part of the survey effort specified the following items of information regarding alternate route plan deployment:

- Primary and secondary alternate route maps,
- Routing instructions for traversing an alternate route,
- Main line closure locations warranting use of specified alternate route,
- Specification of lead agency during alternate route plan deployment process,
- Specification of guidelines for alternate route plan deployment,
- List of emergency response contacts,
- Speed limit and number of available lanes on alternate route,
- Radius of ramps and length of weaves on alternate route,
- Ramp and side street closure locations,
- Signing locations,
- Number of signs required at each signing location,
- Nature of message provided at each signing location,
- Nature of message furnished to the media and/or a traffic advisory service,
- Police officer/incident responder stationing locations,
- Number of police officers/incident responders required at each stationing location,
- Number of police/incident response vehicles required at each stationing location, and
- List of police officer/incident responder duties at each stationing location.

Appendixes F–M contain excerpts of alternate route plans for the following surveyed agencies:

- I-95 Corridor Coalition-New England Region: Appendix F contains a sample alternate route plan for an incident occurring on Interstate 95 in Fairfield County, Connecticut (*15*).
- Florida DOT-District 4: Appendix G contains a sample alternate route plan for an incident occurring on Interstate 95 in Fort Lauderdale (*16*).
- Florida DOT-District 6: Appendix H contains a sample alternate route plan for an incident occurring on Interstate 95 in Miami (*17*).
- Illinois DOT-District 1: Appendix I contains a sample alternate route plan for an incident occurring on Interstate 55 in Chicago (*18*).
- Kentucky Transportation Cabinet: Appendix J contains a sample alternate route plan for an incident occurring on Interstate 24 in McCracken County (*19*).
- Dayton, Ohio Police Department: Appendix K contains a sample alternate route plan for an incident occurring on Interstate 75 in Dayton (*11*).
- Oregon DOT: Appendix L contains a sample alternate route plan for an incident occurring on State Highway 97 in Klamath County (*20*).
- Oregon DOT: Appendix M contains a sample alternate route plan for an incident occurring on Interstate 5 in Marion County (*21*).
- Washington State DOT: Appendix N contains a sample alternate route plan for an incident occurring on Interstate 90 in Spokane (*22*).

CHAPTER FIVE

CONCLUSIONS

RECOMMENDATIONS FOR NEW AND EXISTING PRACTICES

This study yields important information concerning the development, deployment, and evaluation of roadway incident diversion practices. The aggregation of survey responses served to identify specific trends in the practice, and the examination of individual practices resulted in the identification of unique plans, processes, and technologies that other agencies may find as useful applications. The following list contains recommendations for agencies seeking to develop or update a roadway incident diversion practice:

- Model the incident diversion practice after existing practices.
- Research and consider the successes and failures of other practices.
- Provide training for the key team members involved with developing alternate route plans.
- Seek funding from federal, county, municipal, and private sources to supplement state dollars (e.g., TEA-21, NHS, STP, CMAQ, FEMA, insurance companies) for initial alternate route plan development costs and regular operating costs.
- Involve local community officials and agencies early in the planning process to assist in evaluating impacts on the environment and the community surrounding proposed alternate routes.
- Establish memorandum of understanding with local agencies.
- Identify temporary signing requirements to guide

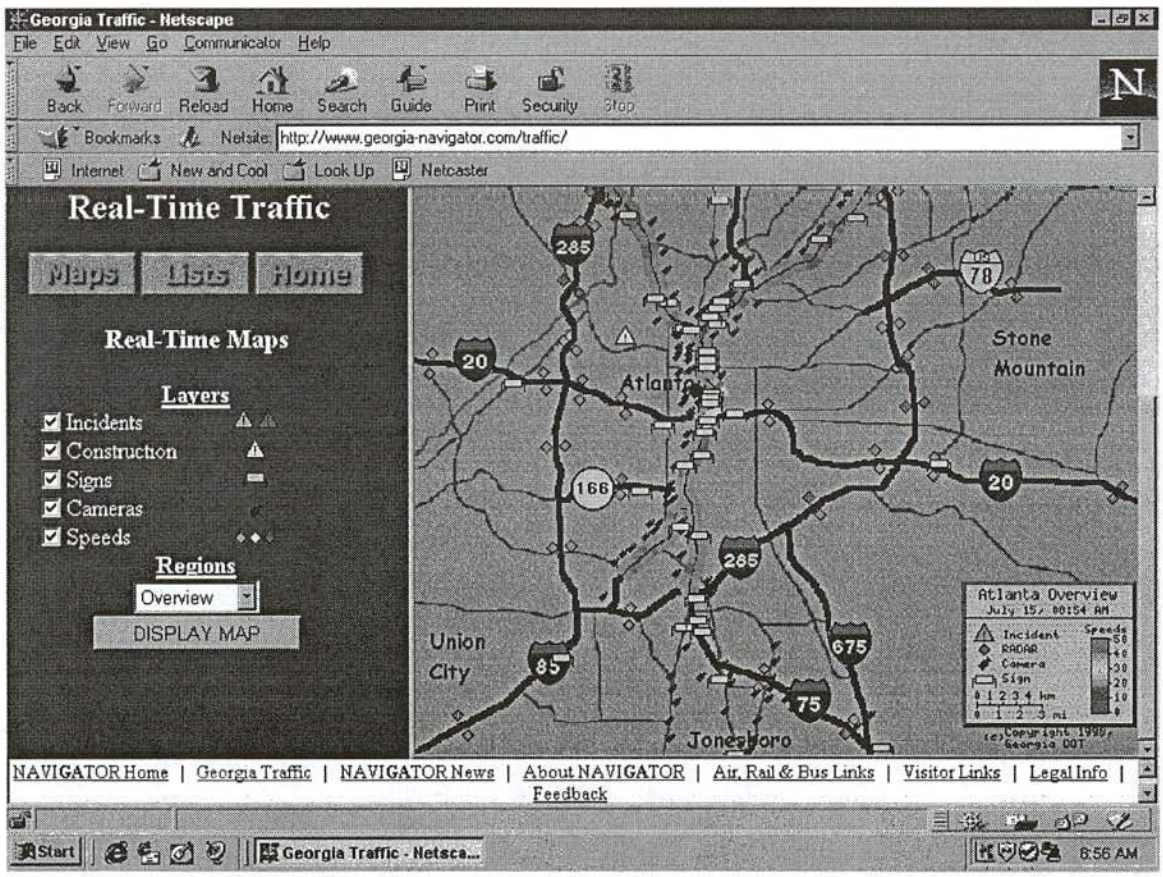

FIGURE 17 The Internet is an effective means of furnishing detailed, real-time traffic information. The above example is from the Georgia DOT's web site. *(Graphic courtesy of the Georgia DOT.)*

motorists along the alternate route and attach to the preplanned alternate route plan.

- Establish criteria for alternate route plan deployment based on the spatial and temporal characteristics of the incident in addition to the time of day.
- Utilize a computer traffic simulation model in the alternate route plan development stage to simulate the operation of proposed alternate routes so that potential capacity constraints, necessary criteria for plan deployment, and appropriate operational strategies (e.g., signal timing plans on the alternate route) can be identified.
- Maintain alternate route plans on computer software or a GIS and provide real-time electronic access to plans to facilitate fast retrieval.
- Provide a copy of alternate route plans to private trucking companies.
- Promote public awareness of the practice.
- Conduct practice drills in the field with all agencies participating in the deployment process.
- Promote common communications in the field, including investigating the use of cellular communications.
- Strive to obtain real-time information on alternate routes.
- Investigate the use of various technologies for the dissemination of pretrip and en route travel information. For example, the Internet represents an effective means of furnishing detailed, real-time traffic information, as evidenced by the Georgia DOT's Navigator World Wide Web site (**http://www.georgia-navigator.com**) (Figure 17).
- Provide alternate route information to local news media and traffic advisory services.
- Investigate and promote the use of other modes of travel, such as transit buses and commuter rail, as an option to alternate route use in the event of an incident resulting in several hours of complete road closure.
- Maintain records of incidents inducing traffic diversion for use in future evaluation studies.
- Maintain records of costs expended in efforts to develop and deploy an alternate route plan.
- Conduct regular qualitative reviews of the practice to identify needed improvements.
- Utilize focus groups to evaluate the practice.
- Require commitment from lead agency to maintain ongoing support toward the continued improvement of alternate route plans and deployment actions.
- Conduct an extensive cost-effectiveness study of the practice.

FUTURE RESEARCH

Alternate Route Plan Development Manual

Agencies would find useful a publication containing a detailed set of guidelines and procedures for developing alternate route plans. Such a manual, based on the successes and failures of agencies nationwide, could detail various motorist and public issues effected by alternate route planning in addition to key legal considerations, thus facilitating a more efficient alternate route plan development process. The publication would serve as an essential reference and training tool for various lead agency personnel and associated team members involved in the development of alternate route plans.

Operational Strategies for Discontinuing Alternate Route Plan Deployment

This study documents various operational strategies regarding the deployment of an alternate route plan upon occurrence of an incident and the management of traffic throughout the duration of an incident. However, subsequent to the clearance of an incident, there remains a period of time required for queues on the main line to dissipate. The study included limited examples of specific criteria and operational strategies for ceasing deployment of an alternate route plan, such as the timing and process for discontinuing the diversion of traffic to an alternate route coupled with the removal of required signing and the elimination of special traffic controls. Additional research aimed at establishing guidelines for discontinuing alternate route plan deployment would prove useful for optimizing traffic flow throughout the entire time an incident effects main line road operations. The use of a computer traffic simulation model, similar to that used in evaluating proposed alternate route plans and deployment actions, represents one approach for developing effective operational strategies for returning traffic to normal operations.

Alternate Route Plan Cost-Effectiveness Study

Limited information exists in the literature concerning the cost-effectiveness of roadway incident diversion practices. Such studies would assist agency officials in the reevaluation and/or future planning of various alternate route plans and deployment strategies in addition to traffic diversion practices as a whole.

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APPENDIX A

Study Questionnaire

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
Project 20-5, Topic 29-02
ROADWAY INCIDENT DIVERSION PRACTICES

QUESTIONNAIRE

Name of primary respondent: _____
Title: _____
State DOT or Other Affiliation: _____
Address: _____
Phone No.: _____
Fax No.: _____
E-mail: _____

Attached is a questionnaire seeking information on current roadway incident diversion practices for both scheduled activities (e.g., roadway construction, roadway maintenance, special events) and random incidents (e.g., major accidents, major disablements, acts of nature). Specifically, the questionnaire requests detailed information concerning random incident diversion plan characteristics and random incident diversion plan implementation. The survey results will serve as a basis for the development of a synthesis providing a detailed nationwide summary of current practices concerning roadway incident diversion plans and operational methodologies.

The questionnaire contains the following three parts: Part 1 - Identification of Roadway Incident Diversion Practices, Part 2 - Random Incident Diversion Plan Characteristics, and Part 3 - Random Incident Diversion Plan Implementation.

Please return the completed questionnaire and any supporting documents to:

Steven P. Latoski
Dunn Engineering Associates
66 Main Street
Westhampton Beach, New York 11978

If you wish, you may fax your response to him at (516) 288-2544. If you have any questions, please call Mr. Latoski at (516) 288-2480.

We would appreciate your response by April 22, 1998.

Please forward copies of this questionnaire to those persons represented in state Department of Transportation districts or other local agencies who may be involved in random incident diversion plan development and implementation.

THANK YOU FOR YOUR TIME AND EFFORT!!

PART 1 IDENTIFICATION OF ROADWAY INCIDENT DIVERSION PRACTICES

Objective: Part 1 seeks to identify and establish an overview of existing roadway diversion practices for random incidents and scheduled activities within the jurisdiction of those surveyed.

1. Does your agency have an incident diversion plan that shows maps and/or descriptions of detour routes between exits/intersections on limited access highways/arterials? Yes ___ No ___

   1a. What is the approximate date that the plan was prepared? _____

   1b. Why did your agency develop an incident diversion plan (check all that apply)? If checked, please circle the corresponding degree of importance (H = high, M = medium, L = low).

As a result of a major catastrophe that closed a section of roadway:
- Flood _____ H M L
- Snowstorm _____ H M L
- Earthquake _____ H M L
- Bridge collapse _____ H M L
- Other acts of nature _____ H M L
- Other _____ H M L

As a result of experiences learned from other states _____ H M L
- List states _____

As a result of the high occurrence of random incidents such as crashes and major disablements (e.g., fires and spills) _____ H M L

As a result of numerous planned construction and maintenance activities _____ H M L

As a result of good planning goals to be prepared for any future event _____ H M L

Other _____ H M L

2. Does your agency have a pre-planned diversion plan for the following types of *scheduled activities*?

Incident Type	Yes	No	If yes, check/answer all that apply							
					Time of occurrence		Type of roadway for which diversion plan exists		Diversion plan coverage area	
			Urban Area	Rural Area	Daytime	Night (9PM to 5AM)	Freeway	Arterial	Entire Length	Section
Roadway Construction	—	—	—	—	—	—	—	—	—	—
Roadway Maintenance	—	—	—	—	—	—	—	—	—	—
Roadway Closure	—	—	—	—	—	—	—	—	—	—
Special Event	—	—	—	—	—	—	—	—	—	—
Other _____	—	—	—	—	—	—	—	—	—	—

2a. Has a diversion plan been implemented? Yes ___ No ___

2b. Does your agency maintain records of incidents where route diversion was used? Yes ___ No ___

2c. Which of the following served as a source of funding for the development and implementation of the diversion plan(s)?

State Department of Transportation _____
Federal Highway Administration _____
Other _____

2d. If the answer to Question 2 is "no" for all types of scheduled activities, then which of the following barriers did your agency encounter in considering plan development? If checked, please circle the corresponding degree of importance (H = high, M = medium, L = low).

Lack of an adequate diversion route (e.g., geometrics, etc.) _____ H M L
Unknown conditions on diversion route _____ H M L
Possibility of motorists encountering equal or worse level of service on alternate _____ H M L
Liability concerns if accident or safety problems (e.g., mugging) occur due to being directed to alternate _____ H M L
Public opposition _____ H M L
Opposition from other agencies _____ H M L
Lack of agency human resources to develop diversion routes _____ H M L
Possible loss of credibility in changeable message sign messages if an undesirable level of congestion arises on the diversion route _____ H M L
Agency perception that there is not a problem which requires diversion _____ H M L
Cost prohibitive _____ H M L
Other _____ H M L

3. Does your agency have a diversion plan for the following types of *random* incidents?

Incident Type	Yes	No	If yes, check/answer all that apply					
			Urban Area	Rural Area	Type of roadway for which diversion plan exists: Freeway	Type of roadway for which diversion plan exists: Arterial	Diversion plan coverage area: Entire Length	Diversion plan coverage area: Section
Major Accidents	—	—	—	—	—	—	—	—
Major Disablements (e.g., spills, fires)	—	—	—	—	—	—	—	—
Acts of Nature (e.g., roadway washout)	—	—	—	—	—	—	—	—
Other _____	—	—	—	—	—	—	—	—

3a. Has a diversion plan been implemented? Yes ___ No ___

3b. Does your agency maintain records of incidents where route diversion was used?
Yes ___ No ___

3c. Which of the following served as a source of funding for the development and implementation of the diversion plan(s)?

State Department of Transportation _____
Federal Highway Administration _____
Other _____

3d. If the answer to Question 3 is "no" for all types of random incidents, then which of the following barriers did your agency encounter in considering plan development? If checked, please circle the corresponding degree of importance (H = high, M = medium, L = low).

Lack of an adequate diversion route (e.g., geometrics, etc.) _____ H M L
Unknown conditions on diversion route _____ H M L
Possibility of motorists encountering equal or worse level of service on alternate _____ H M L
Liability concerns if accident or safety problems (e.g., mugging) occur due to being directed to alternate _____ H M L
Public opposition _____ H M L
Opposition from other agencies _____ H M L
Lack of agency human resources to develop diversion routes _____ H M L
Possible loss of credibility in changeable message sign messages if an undesirable level of congestion arises on the diversion route _____ H M L
Agency perception that there is not a problem which requires diversion _____ H M L
Cost prohibitive _____ H M L
Other _____ H M L

If a diversion plan exists for a *random* incident, then please continue on to Part 2 of the survey.

If a diversion plan does not exist for a *random* incident, then please go to Question 26 on Page 8.

PART 2 RANDOM INCIDENT DIVERSION PLAN CHARACTERISTICS

Objective: Part 2 consists of in-depth, follow-up questions, relating to diversion plan characteristics and development processes, concerning those random incident diversion practices identified in Part 1.

4. Indicate nature of incident diversion plan generation.

Pre-planned ___ Real-time (develop as incident occurs) ___

4a. If real-time, is knowledge of real-time conditions on alternate routes known? Yes ___ No ___

4b. Are the alternative route conditions considered in the diversion route selection? Yes ___ No ___

5. Indicate the type of diversion plan used.

Freeway-to-freeway _____ Freeway-to-tollway _____
Freeway-to-HOV facility _____ Freeway-to-arterial _____
Arterial-to-freeway _____ Arterial-to-arterial _____
Other _____

6. How much time was required to develop the diversion plan? ____ month(s)

7. Who was responsible for developing the diversion plan?

Agency _____ Please identify _____
Staff size required _____
Consulting engineers _____ Please identify _____
Staff size required _____

8. Which of the following criteria was considered in selecting the diversion route? If checked, please circle the corresponding degree of importance (H = high, M = medium, L = low).

Proximity of diversion route to closed roadway _____ H M L
Travel time on diversion route _____ H M L
Number of traveled lanes on or capacity of diversion route _____ H M L
Pavement conditions on diversion route _____ H M L
Safety of motorists on diversion route _____ H M L
Type and intensity of residential development on diversion route _____ H M L
Transit bus accommodation _____ H M L
Noise pollution _____ H M L
Existence of schools and hospitals along diversion route _____ H M L
Traffic conditions on diversion route _____ H M L
Congestion induced on diversion route _____ H M L
Ease of access to/from diversion route _____ H M L
Number of signalized intersections, stop signs, and unprotected left turns on diversion route _____ H M L
Grades on diversion route _____ H M L
Type and intensity of commercial development on diversion route _____ H M L
Height, weight, width, and turning restrictions on diversion route (commercial vehicles) _____ H M L
Air quality _____ H M L
Availability of fuel, rest stops, and food facilities along diversion route _____ H M L
Percentage of heavy vehicles (trucks, buses, RV's) on route from which traffic is to be diverted from _____ H M L
Other _____ H M L

9. Which of the following agencies or groups were consulted in developing the diversion plan (check all that apply)?

State DOT _____
State police _____
County police _____
Local police _____
Freeway service patrol operators _____
FSP name _____
Private tow-truck operators _____
County Department of Public Works _____
Local Department of Public Works _____
Local fire officials _____
Emergency medical service officials _____
Major incident response team _____
Name _____
Hazardous materials response team _____
Other _____

9a. What is the lead agency? Name _____

10. Indicate the agencies or groups that have a copy of the diversion plan (check all that apply).

State DOT _____
County Department of Public Works _____
Local Department of Public Works _____
State police _____
County police _____
Local police _____
Local fire officials _____
Emergency medical service officials _____
Freeway service patrol operators _____
Major incident response team _____
Private tow-truck operators _____
Hazardous materials response team
Other _____

10a. How are the diversion plans maintained?

On hardcopy documents (e.g., maps) _____
On a computer diskette/CD-ROM _____
Within a geographic information system _____
On a World Wide Web site _____
Other _____

11. Is the following training provided to those participating in diversion plan implementation?

	Yes	No		Yes	No
Distribution of manual	___	___	Distribution of video	___	___
Classroom instruction	___	___	Practice drill in field	___	___

Other_____

12. Have there been any modifications or updates to the original diversion plan? Yes ___ No ___

Please continue on to Part 3 of the survey

PART 3 RANDOM INCIDENT DIVERSION PLAN IMPLEMENTATION

Objective: Part 3 is comprised of additional follow-up questions, pertaining to plan implementation processes in addition to plan operation and effectiveness, regarding those random incident diversion practices identified in Part 1.

13. Indicate the method used for detecting and verifying a typical incident (check all that apply).

___ Police
___ Closed-circuit TV
___ Surveillance sensors/detectors coupled number with an incident detection algorithm
___ Information sharing with traffic advisory service
___ Freeway service patrol
___ Free cellular emergency phone call number
___ Roadside call box
___ Other_____

14. What criteria must be met to implement the diversion plan (check all that apply)?

___ Type of incident
___ Incident location
___ Time of day
___ Other_____
___ Incident duration
___ Roadway lane blockage

15. Which of the following agencies or groups were involved in implementing the diversion plan (check all that apply)?

___ State DOT
___ State police
___ County police
___ Local police
___ Freeway service patrol operators
FSP name_____
___ Private tow-truck operators
___ Other_____
___ County Department of Public Works
___ Local Department of Public Works
___ Local fire officials
___ Emergency medical service officials
___ Major incident response team
___ Name_____
___ Hazardous materials response team

15a. What is the lead agency? Name _____

16. Which of the following communication technologies are used between administrators and on-site incident management personnel during implementation of the diversion plan (check all that apply)?

___ Radio with dedicated frequency
___ Radio without dedicated frequency
___ Other_____
___ Cellular
___ Low powered TV station at incident site

17. Is a traffic management center involved in the implementation of the incident diversion plan?
Yes ___ No ___

18. Indicate the resources used to inform motorists to divert (check all that apply).

___ Police
___ Portable changeable message signs
___ Pull-through signs
___ Color-coded detour logo sign
___ Media sources
___ Traffic Advisory Services
___ Other_____
___ Changeable message signs
___ Highway advisory radio
___ Route marker assemblies
___ Temporary signing
___ In-vehicle traveler information system

18a. Indicate the nature of the information resource (e.g., changeable message sign) message.

Command, Example: "Major delays ahead, divert to alternate route" ___
Voluntary, Example: "Major delays ahead, minor delays on alternate route" ___

18b. Does the information resource message promote other modes of travel (e.g., rail) as a diversion alternative? Always ___ Sometimes ___ Never ___

19. Indicate the methods used to accommodate diverted traffic along the diversion route (check all that apply).

___ Signal timing strategies
___ Elimination of HOV restrictions
___ Police controls
___ Elimination of tolls
___ Parking restrictions
___ Other_____

20. Indicate the resources used to guide motorists along a diversion route and back to the original roadway (check all that apply).

___ Police
___ Portable changeable message signs
___ Pull-through signs
___ Color-coded detour logo sign
___ In-vehicle traveler information system
___ Other_____
___ Temporary signing
___ Highway advisory radio
___ Route marker assemblies
___ Media sources
___ Traffic advisory services
___ None

20a. If the diversion route deteriorates, will other alternative routes be generated and used?
Yes ___ No ___

21. Indicate the degree of your agency's satisfaction after implementation of the diversion plan.

___ Very satisfied ___ Satisfied
___ Somewhat satisfied ___ Not satisfied

22. Indicate the degree of motorist satisfaction after implementation of the diversion plan.

___ Very satisfied ___ Satisfied
___ Somewhat satisfied ___ Not satisfied
___ Unknown

23. What is the estimated cost of the incident diversion practice?

Total $_____
Development $_____
Implementation $_____
Equipment $_____

24. Has a cost-effectiveness study of incident diversion been conducted? Yes ___ No ___

Results_____

25. Does your agency believe that further research needs to be conducted regarding incident diversion priorities?
Yes ___ No ___

26. Please list a contact person for obtaining additional information.

Contact person: Name_____
Title_____
Agency name_____
Address_____
_____
Phone_____
Fax_____
E-mail_____

Please send any publications and/or in-house documents, maps and plans concerning the planned and/or random incident diversion practice along with the completed questionnaire to:

Steven P. Latoski
Dunn Engineering Associates
66 Main Street
Westhampton Beach, New York 11978

End of survey. Thank you.

APPENDIX B

List of Surveyed Agencies

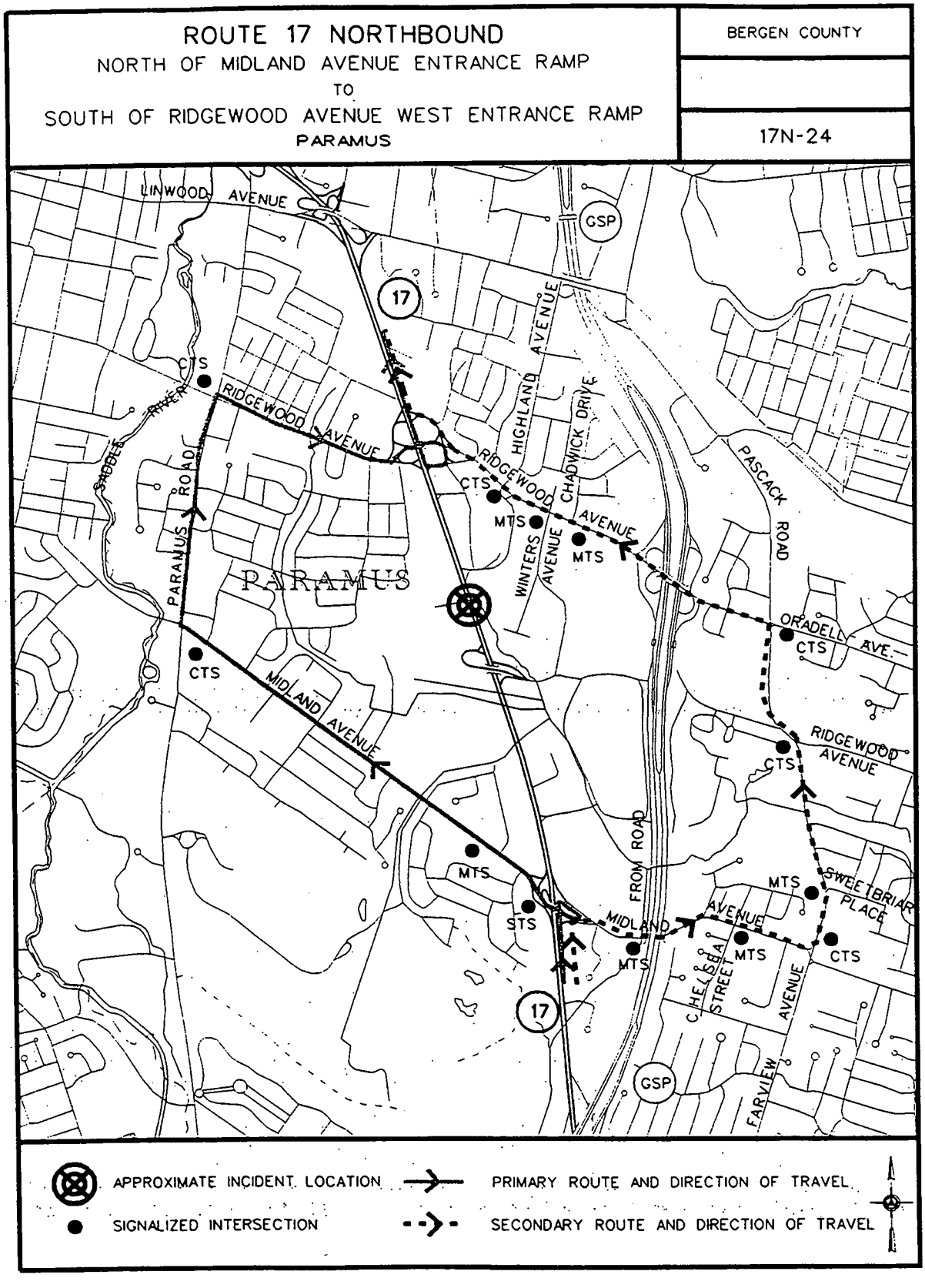
Agency	Location	Pre-Planned Roadway Diversion Practice For Major Random Incidents	
		Yes	No
Arizona DOT	Phoenix, AZ	x	
Arkansas State Highway and Transportation Department	Little Rock, AR		x
Caltrans–District 7	Los Angeles, CA	x	
Colorado DOT–Region 4	Greeley, CO	x	
Colorado DOT–Region 6	Denver, CO	x	
Connecticut DOT	Newington, CT	x	
Delaware DOT	Bear, DE	x	
Florida DOT–District 2	Jacksonville, FL	x	
Florida DOT–District 4	Ft. Lauderdale, FL	x	
Florida DOT–District 5	Deland, FL	x	
Florida DOT–District 6	Miami, FL	x	
Georgia DOT	Atlanta, GA	x	
Hawaii DOT	Honolulu, HI		x
Illinois DOT–District 1	Schaumburg, IL	x	
Iowa DOT	Ames, IA	x	
Kansas DOT	Kansas City, KS	x	
Kentucky Transportation Cabinet	Frankfort, KY	x	
Louisiana Transportation Research Center	Baton Rouge, LA		x
Maine DOT	Augusta, ME	x	
Maryland Highway Administration	Hanover, MD	x	
Massachusetts Highway Department	Boston, MA	x	
Michigan DOT–Metro District	Detroit, MI		x
Minnesota DOT	Minneapolis, MN	x	
Missouri DOT	Jefferson City, MO	x	
Montana DOT	Helena, MT		x
Nebraska Department of Roads	Lincoln, NE		x
Nevada DOT–District 3	Elko, NV	x	
New Hampshire DOT	Concord, NH	x	
New Jersey DOT	Trenton, NJ	x	
New York State DOT–Region 2	Utica, NY		x

Agency	Location	Pre-Planned Roadway Diversion Practice For Major Random Incidents	
		Yes	No
New York State DOT–Region 3	Syracuse, NY		x
New York State DOT–Region 4	Rochester, NY	x	
New York State DOT–Region 6	Hornell, NY	x	
New York State DOT–Region 8	Poughkeepsie, NY		x
New York State DOT–Region 10	Hauppauge, NY		x
North Carolina DOT	Raleigh, NC	x	
Dayton Police Department	Dayton, OH	x	
Ohio DOT and Kentucky Transportation Cabinet–ARTIMIS[1]	Cincinnati, OH	x	
Oklahoma DOT	Oklahoma City, OK		x
Oregon DOT	Salem, OR	x	
Pennsylvania DOT	Harrisburg, PA	x	
Puerto Rico Highway and Transportation Authority	San Juan, PR		x
South Carolina DOT	Columbia, SC		x
Tennessee DOT	Nashville, TN		x
Texas DOT–Austin District	Austin, TX	x	
Texas DOT–Dallas District	Dallas, TX		x
Texas DOT–El Paso District	El Paso, TX	x	
Texas DOT–Fort Worth District	Fort Worth, TX	x	
Texas DOT–Houston District (TranStar)	Houston, TX	x	
Texas DOT–San Antonio District (TransGuide)	San Antonio, TX	x	
Virginia DOT–Fredericksburg District	Fredericksburg, VA	x	
Virginia DOT–Lynchburg District	Lynchburg, VA	x	
Virginia DOT–Northern Virginia District	Fairfax, VA	x	
Virginia DOT–Richmond District	Colonial Heights, VA	x	
Virginia DOT–Staunton District	Staunton, VA	x	
Virginia DOT–TMS[2] of Hampton Roads	Virginia Beach, VA	x	
Washington DOT	Seattle, WA	x	
West Virginia DOT	Charleston, WV	x	
Wyoming Highway Patrol	Cheyenne, WY		x

[1]ARTIMIS = Advanced Regional Traffic Interactive Management and Information System
[2]TMS = Traffic Management System

APPENDIX C

Sample Alternate Route Plan, Bergen County, New Jersey



ROUTE 17 NORTHBOUND

North of Midland Avenue Entrance Ramp to South of Ridgewood Avenue West Entrance Ramp

PARAMUS

PRIMARY ROUTE
Exit traffic at Midland Avenue west,
bear right onto Midland Avenue and cross over Route 17 [→DS],
cross light at ramp from Route 17 South (STS) [↑DS],
" light at Church of the Annunciation (MTS) [↑DS],
turn right onto Paramus Road (CTS) [→DS],
* " right onto Ridgewood Avenue (CTS) [→DS],
bear left for Ridgewood Avenue and cross over Route 17 [←DS],
turn right onto ramp to Route 17 North [→DS].

* **NOTE:** If incident is under the Ridgewood Avenue Overpass continue diverting traffic as follows: cross Ridgewood Avenue (CTS) [↑DS], cross Linwood Avenue (CTS) [↑DS], cross over Route 17, turn right onto ramp to Route 17 North [→DS].

SECONDARY ROUTE
Exit traffic at Midland Avenue east,
cross From Road (MTS) [↑DS],
" Chelsea Street (MTS) [↑DS],
turn left onto Farview Avenue (CTS) [←DS],
cross Sweetbriar Place (MTS) [↑DS],
" Ridgewood Avenue (CTS) [↑DS],
Farview Avenue becomes Pascack Road,
turn left onto Oradell Avenue (CTS) [←DS],
cross over Garden State Parkway,
Oradell Avenue becomes Ridgewood Avenue,
cross Chadwick Drive (MTS) [↑DS],
" Winters Avenue (MTS) [↑DS],
" Highland Avenue (CTS) [↑DS],
turn right onto ramp to Route 17 North [→DS].

RAMPS / SIDE STREETS TO BE CLOSED
1. Ramp from Midland Avenue
2. Sears Drive
3. A&S Drive
4. Park Place
5. Driveways from Fashion Center
6. Ramp from Ridgewood Avenue east

VARIABLE MESSAGE SIGN LOCATIONS - NJDOT
1. Route 4 East - MAGIC - #S4E2.2 (East of Route 208/West of Route 17)
2. Route 4 West - Milepost 4.5 (East of Forest Avenue)
   MESSAGE: 17 NORTH, CLOSED // NORTH OF, MIDLAND,AVE // EXPECT,DELAYS
3. Route 17 North - MAGIC - #S17N6.7 (South of Route 46)
4. Route 17 North - Milepost 10.0 (South of Essex Street)
   MESSAGE: ROUTE 17, CLOSED, 4 MI AHD // EXPECT, DELAYS
5. Route 80 West - MAGIC - #S80W66.3 (East of Route 17)
6. Route 80 East - MAGIC - #S80E61.1 (West of Garden State Parkway)

KEY CONTACT PHONE NUMBERS

Paramus Police	(201) 262-3400
Ridgewood Police	(201) 652-3900
Bergen County Police	(201) 646-2700
NJDOT: Dispatcher / Traffic Operations - North	(201) 648-2550
TRANSCOM	1-800-872-3342

APPENDIX D

Summary of Incident Response Actions

Advanced Regional Traffic Interactive Management and Information System (ARTIMIS) Cincinnati Metropolitan Area

Time of Day	Estimated Duration	Lanes Impacted/Action Level			
		0 Lanes	1 Lane	2 Lanes	>2 Lanes
0000–0600	< 2 hours	0	0	1*	3*
	2–4 hours	0	0	2*	3*
	> 4 hours	0	0	2*	3*
0600–1000	<.5 hours	1	1	2	3
	.5–2 hours	1	1	2	4
	> 2 hours	1	2	3	4
1000–1500	< 2 hours	1	1	2	3
	2–4 hours	1	1	2	3
	> 4 hours	1	2	3	3
1500–1900	<.5 hours	1	1	2	3
	.5–2 hours	1	1	2	4
	> 2 hours	1	2	3	4
1900–2400	< 2 hours	0	0	1*	3*
	2–4 hours	0	0	2*	3*
	> 4 hours	0	0	2*	3*

Level 0	• No special action required.
Level 1	• Implement Response Plan to notify appropriate operations personnel. • Turn on Level 1 Chargeable Message Sign (CMS) and Highway Advisory Radio (HAR).
Level 2	• Implement Response Plan to notify appropriate operations personnel. • Turn on Level 2 CMS and HAR. • Turn HAR flashing lights on at Level 2.
Level 3	• Implement Response Plan to notify appropriate operations personnel. • Turn on Level 3 CMS and HAR. • Turn HAR flashing lights on at Level 3. • Provide Advisory Alternate Routing.
Level 4	• Implement Response Plan to notify appropriate operations personnel. • Turn on Level 4 (and above) CMS and HAR. • Turn HAR flashing lights on at Level 4. • Provide Mandatory Alternate Routing.

Level n CMS n = number of decision points prior to the incident corridor.

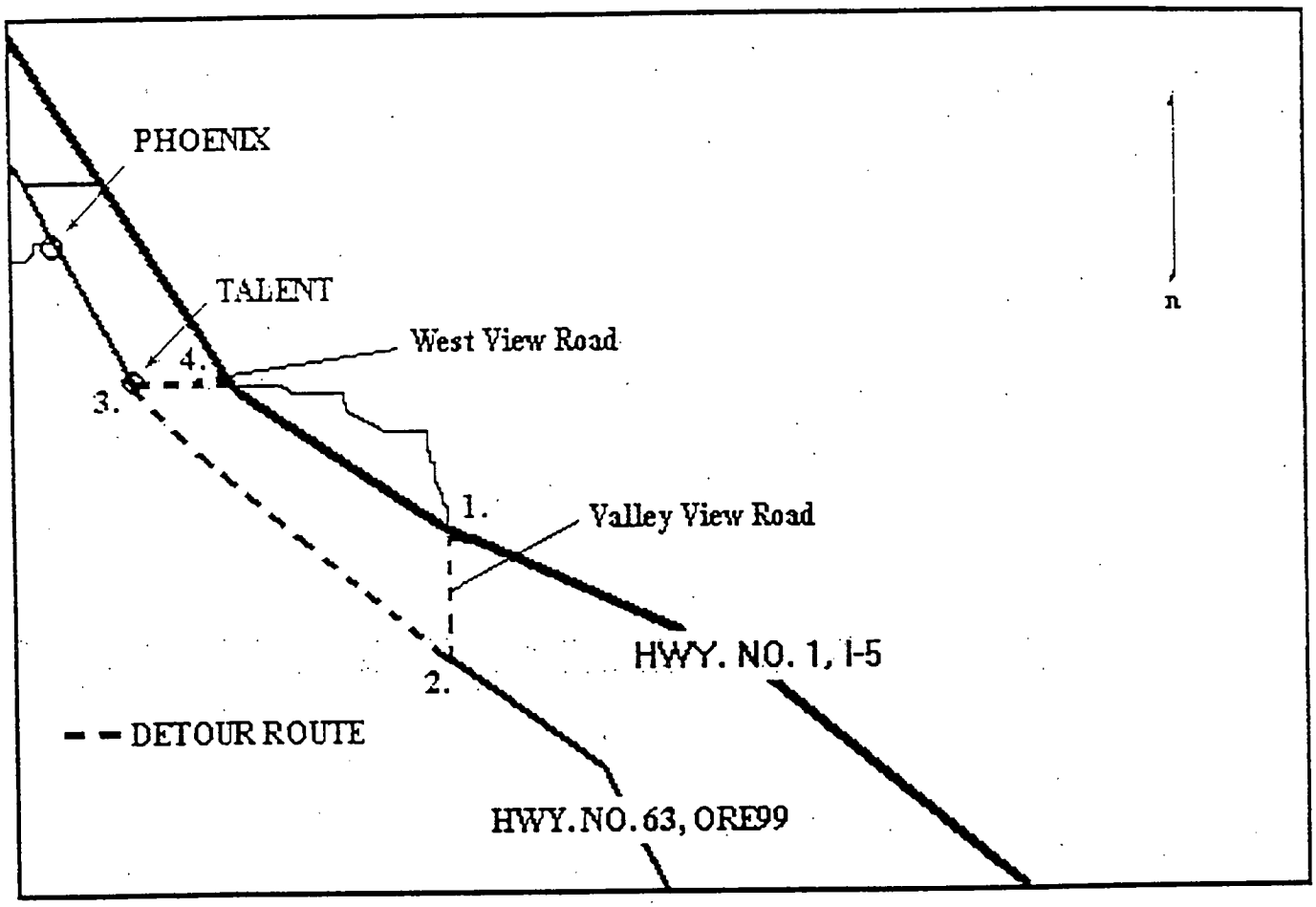
Level n HAR n = number of times the related advisory is repeated in a HAR cycle (e.g. within a 3 minute cycle).

Level n* * = notification of operations personnel may be required to implement outside normal duty hours.

APPENDIX E

Sample Alternate Route Plan, Jackson County, Oregon

NORTHHBOUND DETOUR
VALLEY VIEW RD.
EXIT 19, M.P. 18.94 TO
WEST VIEW RD./TALENT
EXIT 21, M.P. 20.89



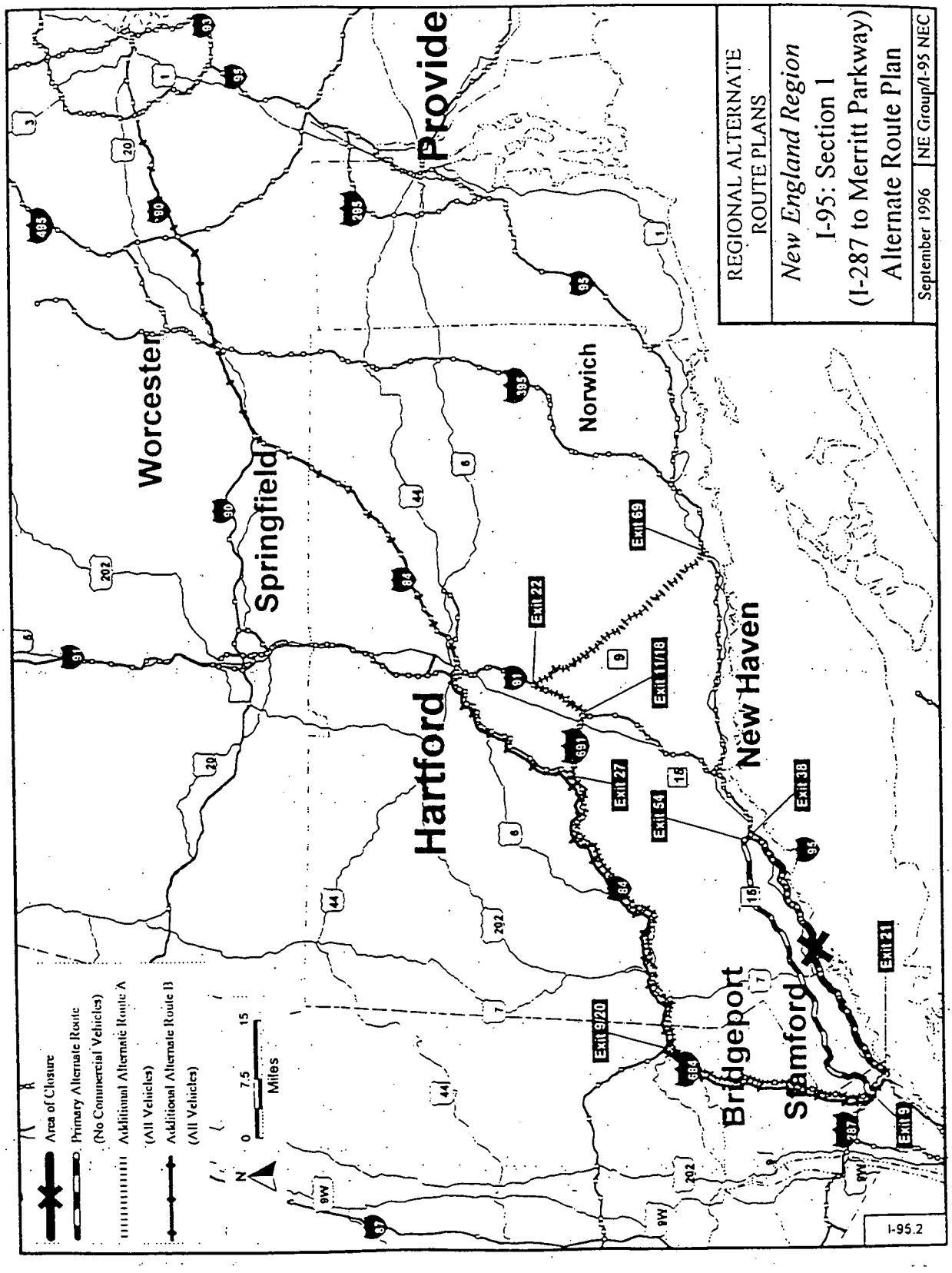
DETOUR INFORMATION AND SIGNING LOCATIONS

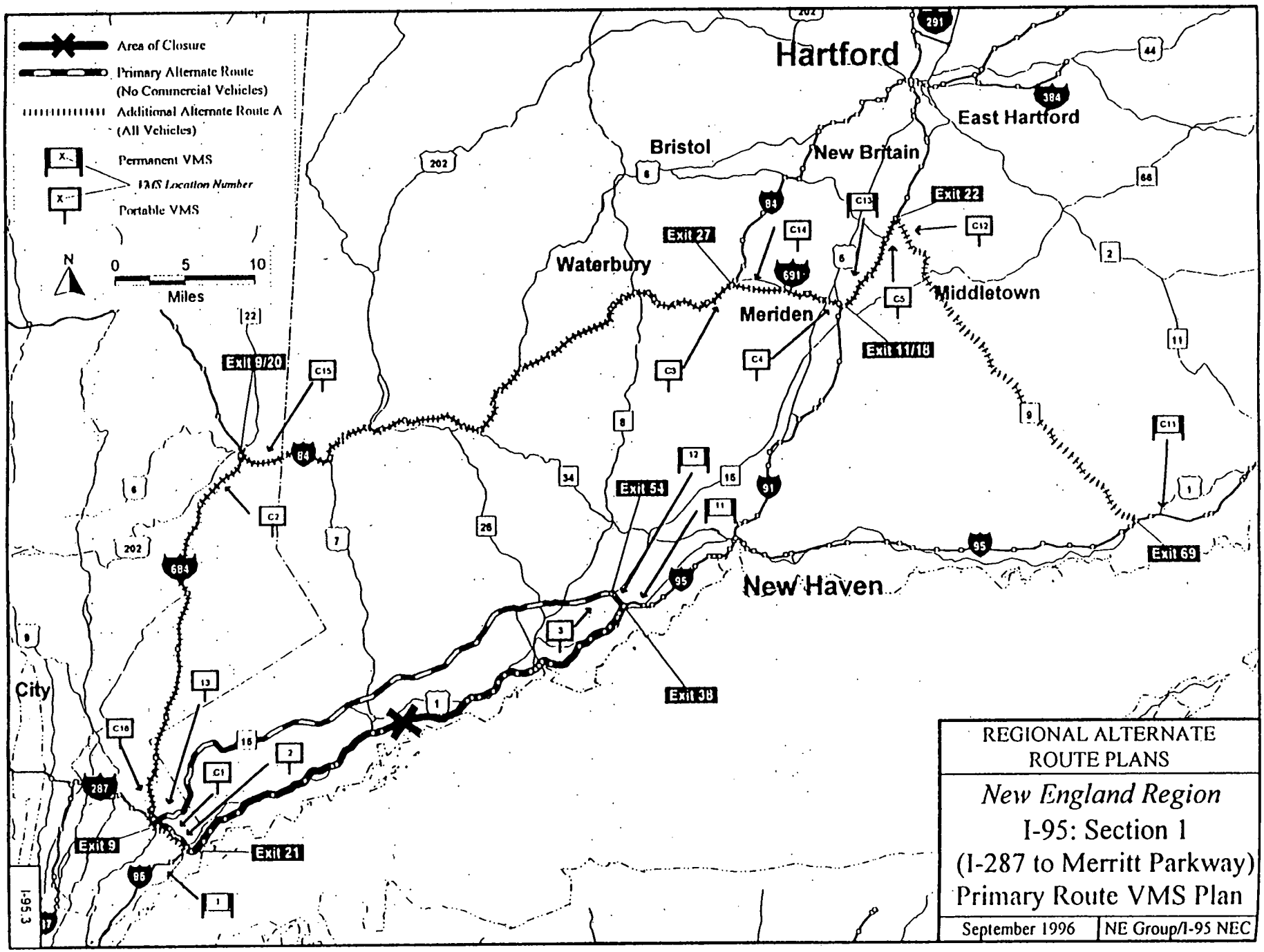
1. Left detour sign on Valley View Rd. at stop sign.
2. Right detour sign at Rogue Valley Hwy. No. 63, ORE99 @ Valley View Road.
3. Right detour at West View Rd. @ Rogue Valley Hwy. No. 63, ORE99.
4. Left detour on West View Rd. at I-5 northbound onramp.

Length of detour: 3.46 miles
Oversize restrictions: No oversize loads due to narrow bridge.

APPENDIX F

Sample Alternate Route Plan, Fairfield County, Connecticut





REGIONAL ALTERNATE ROUTE PLANS

New England Region

I-95: Section 1

(I-287 to Merritt Parkway)

Primary Route VMS Plan

September 1996 | NE Group/I-95 NEC

NEW ENGLAND REGIONAL ALTERNATE ROUTE PLANS

Permanent/Portable VMS Messages for Primary Alternate Routes

Roadway: I-95
Section: 1
From: I-287
To: Merritt Parkway

Location	Permanent/Portable VMS Legend	Comments
1	I-95 CLOSED USE I-287 TO ALT ROUTE	All traffic
2	CARS TO I-95 N → USE MERRITT PARKWAY	Non-Commercial traffic
3	TRAFFIC TO I-95 N → USE EXIT 54	Non-Commercial traffic
11	I-95 CLOSED CARS USE MERRITT PKWY	Non-Commercial traffic
12	TRAFFIC TO I-95 S - USE MERRITT PKWY	Non-Commercial traffic
13	TRAFFIC TO I-95 S → USE I-287 S TO I-95	Non-Commercial traffic
C1	TRUCKS TO I-95 N → USE I-684 N TO I-84	Commercial traffic; sign to follow sign #2
C2	TRAFFIC TO I-95 N → USE I-84 E TO I-691	Commercial traffic

Location	Permanent/Portable VMS Legend	Comments
C3	TRAFFIC TO I-95 N → USE I-691 E TO I-91	Commercial traffic
C4	TRAFFIC TO I-95 N → USE I-91 N TO CT 9	Commercial traffic
C5	TRAFFIC TO I-95 N → USE CT 9 S TO I-95	Commercial traffic
C11	I-95 CLOSED XX MILES AHEAD → TRUCKS USE CT 9 N TO I-91	Commercial traffic
C12	TRAFFIC TO I-95 S → USE I-91 S TO I-691	Commercial traffic
C13	TRAFFIC TO I-95 SOUTH USE I-691 W	Commercial traffic
C14	TRAFFIC TO I-95 S → USE I-84 W TO I-684	Commercial traffic
C15	TRAFFIC TO I-95 S → USE I-684 S TO I-287	Commercial traffic
C16	TRAFFIC TO I-95 S → USE I-287 S TO I-95	Commercial traffic

APPENDIX G

Sample Alternate Route Plan, Fort Lauderdale, Florida

DETOUR # 7 ROUTING INSTRUCTIONS

I - 95 NORTHBOUND

Incident Location:	Between On - Ramp Griffin Rd. and On - Ramp I-595
Ramp Closure:	On - Ramp at Griffin Rd.
Detour Route:	Exit to Griffin Rd. - Eastbound; turn left at U.S. 1 - Northbound; turn left at I-595 - Westbound Return to I-95
VM Sign:	I - 95 BLOCKED/RIGHT LANE FOLLOW DETOUR
Number of Detour Signs:	5

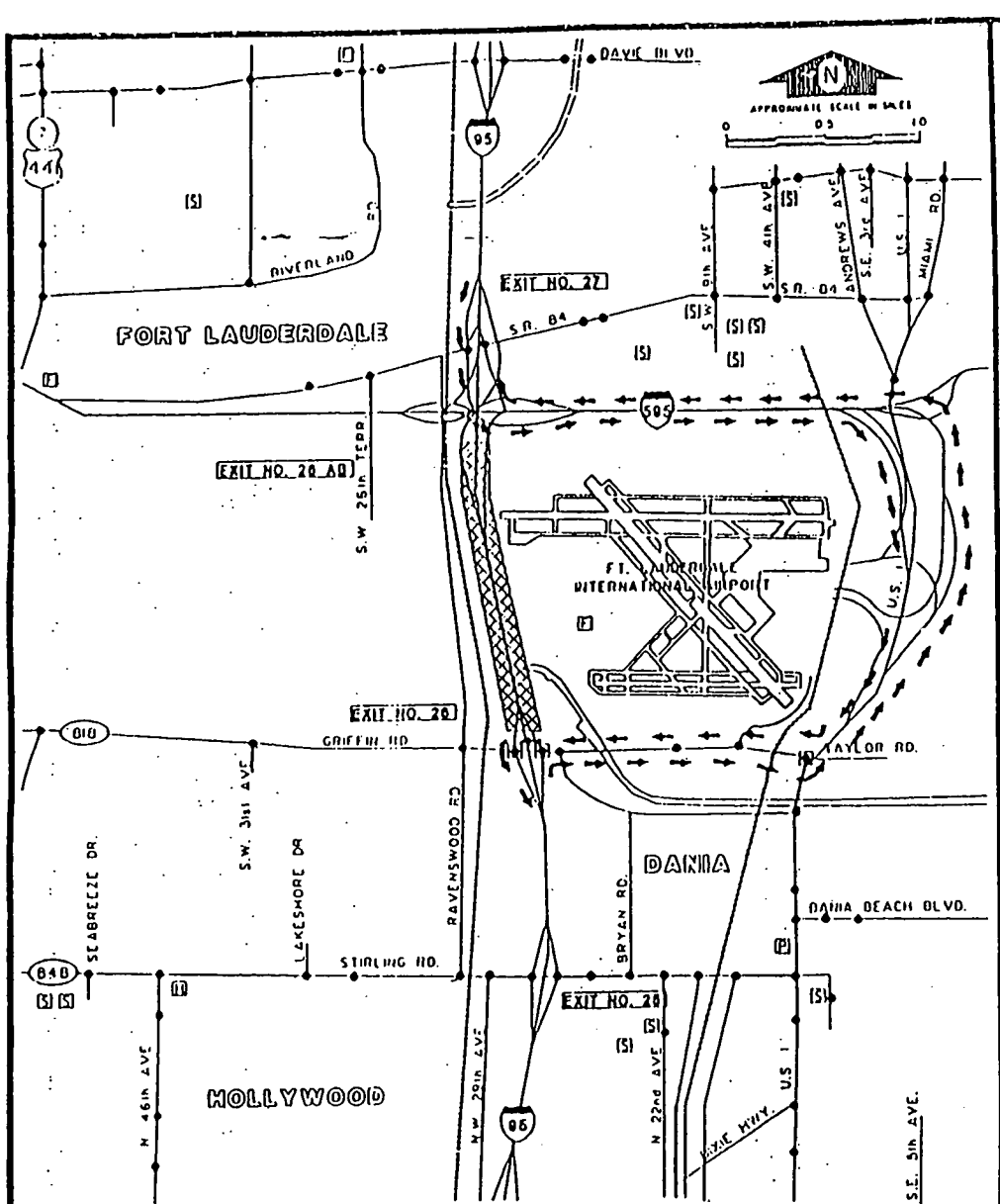
I - 95 SOUTHBOUND

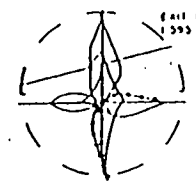
Incident Location:	Between On - Ramp I-595 and On - Ramp Griffin Rd.
Ramp Closure:	On - Ramp at I-595
Detour Route:	Exit to I-595 - Eastbound; turn right at U.S. 1 - Southbound; turn right at Griffin Rd. - Westbound Return to I - 95
VM Sign:	I - 95 BLOCKED/RIGHT LANE FOLLOW DETOUR
Number of Detour Signs:	5

SPECIAL INSTRUCTIONS

Median shoulders OK for traffic? _____YES _____NO

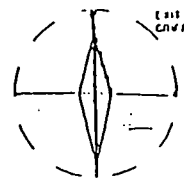
Outside shoulders OK for traffic? _____YES _____NO





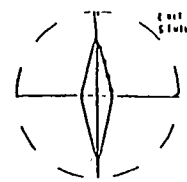
SOUTHBOUND CLOSURE

SB ON-RAMPS AT I-595
S.B. MAINLINE AT I-595 OFF-RAMP



NORTHBOUND CLOSURE

NB ON-RAMP AT GRIFFIN RD
NB. MAINLINE AT GRIFFIN RD. OFF-RAMP



NORTHBOUND CLOSURE

N.B. ON-RAMP AT STIRLING RD

LEGEND

- AREA OF CLOSURE
- PRIMARY ROUTE
- SIGNAL
- POLICE CONTROLLED SIGNAL
- RAMP/ROAD CLOSURE
- SCHOOL [S]
- POLICE STATION [P]
- HOSPITAL [H]
- FIRE RESCUE [F]

NOTES

DIVERSION OF THROUGH VEHICLES:

SOUTHBOUND THROUGH VEHICLES SHOULD BE DIRECTED TO THE TURNPIKE AT I-595

NORTHBOUND THROUGH VEHICLES SHOULD BE DIRECTED TO THE TURNPIKE AT GOLDEN GLADES

FOR MAINLINE CLOSURES BETWEEN I-595 OFF-RAMPS AND I-595 ON-RAMPS, DETOUR TRAFFIC TO I-595 AND U-TURN TRAFFIC BACK ONTO I-595 TOWARD I-595 AT ELLER DRIVE AND/OR U.S. 441

CHECK EXACT LOCATION OF INCIDENT TO DETERMINE IF I-95 RAMP CLOSURE IS REQUIRED

DIVERSION ROUTES

NORTH BOUND	GRIFFIN RD. (E.B.) U.S. 1 (N.B.) I-595 (W.B.)
SOUTH BOUND	I-595 (E.B.) U.S. 1 (S.B.) GRIFFIN RD. (W.B.)

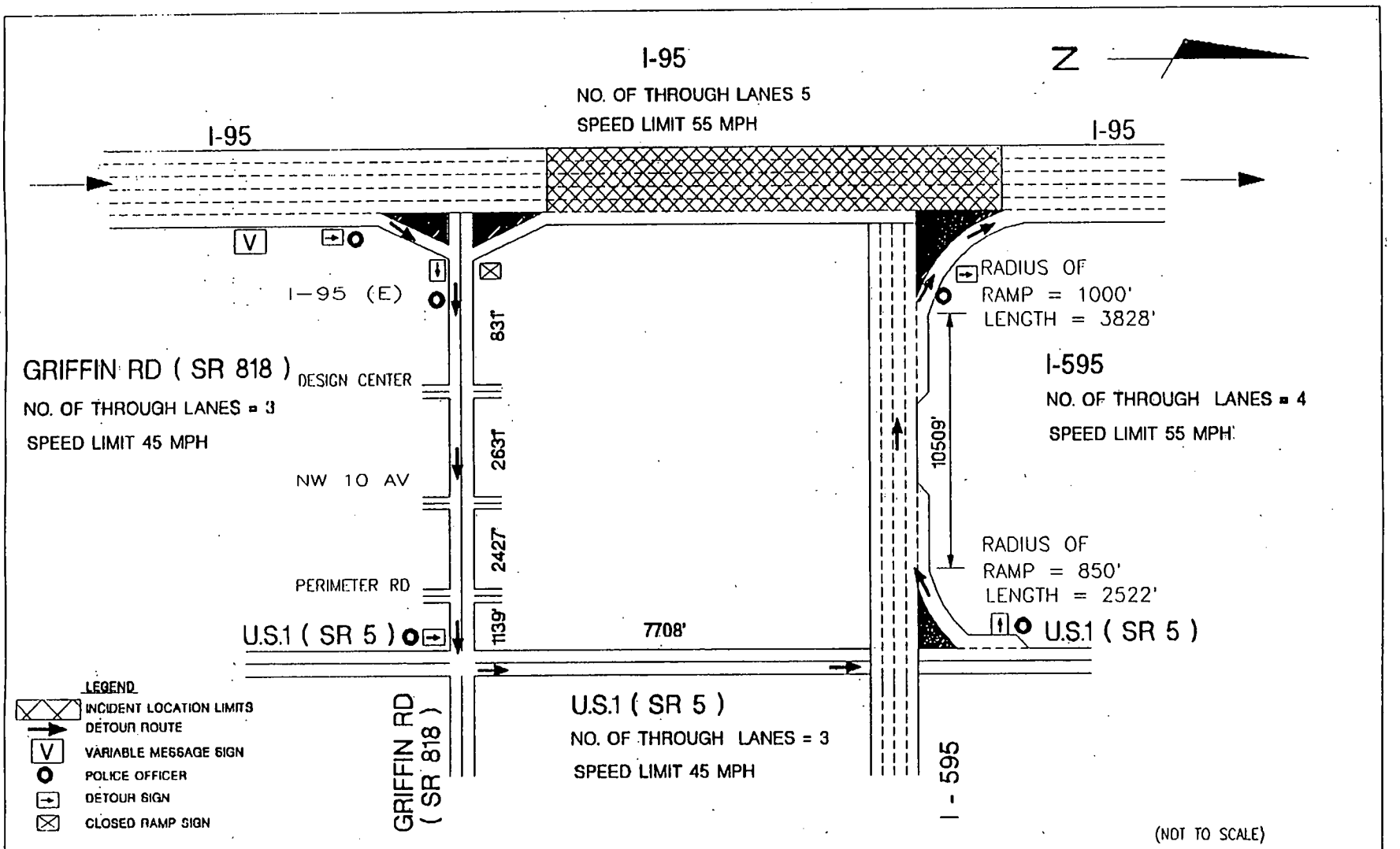
LIMITS OF CLOSURE

GRIFFIN RD. (M.P. 23.63)

TO

I-595 (M.P. 24.95)

SHEET 7



I-95 INCIDENT DETOUR ROUTE # 7 NORTHBOUND - CITY OF FORT LAUDERDALE

APPENDIX H

Sample Alternate Route Plan, Miami, Florida

I-95 FREEWAY INCIDENT MANAGEMENT TEAM

DIVERSION ROUTE MANUAL

IMPLEMENTATION OF DIVERSION ROUTES

A decision to implement a diversion route should be made by the responsible Police Agency in consultation with the Florida Highway Patrol and the Florida Department of Transportation.

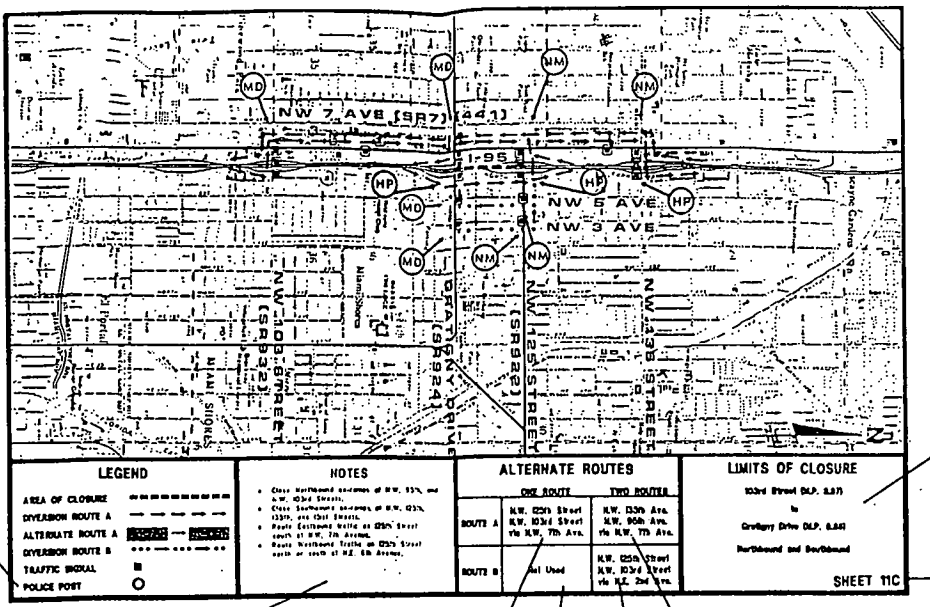
This decision should be based on the following factors:

- The number of lanes remaining open
- The time it will take to remove the incident from the travel lanes
- The traffic volumes normally experienced during the hours that the incident will remain on the roadway

Always check the operational condition of the diversion route before activating the diversion!

EMERGENCY CONTACT NAMES AND TELEPHONE NUMBERS

City of Miami Police Department	579-3449	
Dade County Police and Emergency Services	595-6263	
Dist. 1 - West of I-95, North of 103rd St		557-7090
Dist. 6 - East of I-95, North of 103rd St.		947-4421
Dist. 2 - North of City of Miami to 103rd St.		638-6721
Dade County Department of Public Works		
Days	592-8925	
Alternate	592-3580	
Evenings/Weekends	595-6263	
Dade County Manager's Staff Duty Officer - Obtain current number from	595-6263	
Florida Highway Patrol	470-2500	
Florida Department of Transportation		
Days	470-5335	
Alternate		
Evenings/Weekends		



POLICE POST JURISDICTION

- (M) City of Miami
- (MD) Metro Dade
- (MB) North Miami Beach
- (MS) Miami Shores
- (NM) North Miami
- (HW) Hollywood
- (HP) Florida Highway Patrol

LIMITS OF CLOSURE

Interstate 95 is closed to vechicular traffic between these street locations and mile posts (M.P.) as shown on map by ▬▬▬▬▬

CLOSURE DIRECTION

N = Northbound Closure
S = Southbound Closure
C = Combined Northbound and Southbound Closure

NOTES

Supplementary actions required when implementing these diversion routes.

ROUTE A is used when only one diversion route is required.
Example, if only one route is required the diversion route to be implemented is between N.W. 125th St. and N.W. 103rd St. via N.W. 7th Ave.

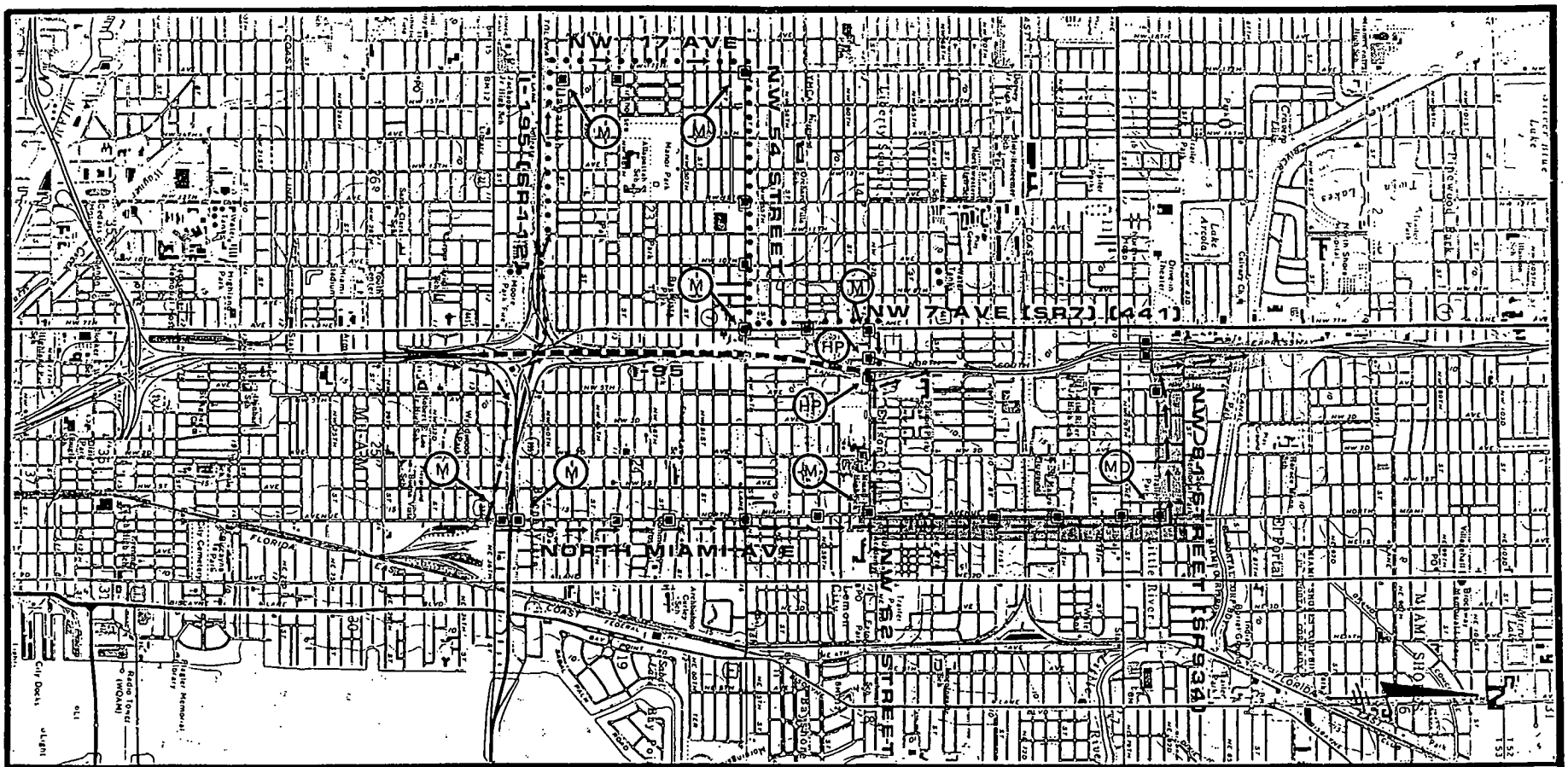
ALTERNATE ROUTE A is used when two diversion routes are required.
Example, If two routes are required Alternate Route A will be between N.W. 135th St. and N.W. 95th St. via N.W. 7th Ave.

ROUTE B is not used when only one diversion route is implemented.

ROUTE B is used when two diversion routes are required.
Example, If two routes are required Route B will be between N.W. 125th St. and N.W. 103rd St. via N.E. 2nd Ave.

FREEWAY INCIDENT MANAGEMENT PLAN

GUIDELINES FOR USE OF I-95 DIVERSION ROUTE MANUAL



LEGEND

- AREA OF CLOSURE
- DIVERSION ROUTE A
- ALTERNATE ROUTE A
- DIVERSION ROUTE B
- TRAFFIC SIGNAL
- POLICE POST

NOTES

- Close ramps to Northbound I-95 from SR 112 (I-195).

ALTERNATE ROUTES

	ONE ROUTE	TWO ROUTES
ROUTE A	SR 112 N.W. 62nd Street via N. Miami Ave.	SR 112 N.W. 81st Street via N. Miami Ave.
ROUTE B	Not Used	SR 112 N.W. 62nd Street via N.W. 17th Ave.

LIMITS OF CLOSURE

SR 112 (M.P. 4.94)

to

N.W. 62nd Street (M.P. 6.31)

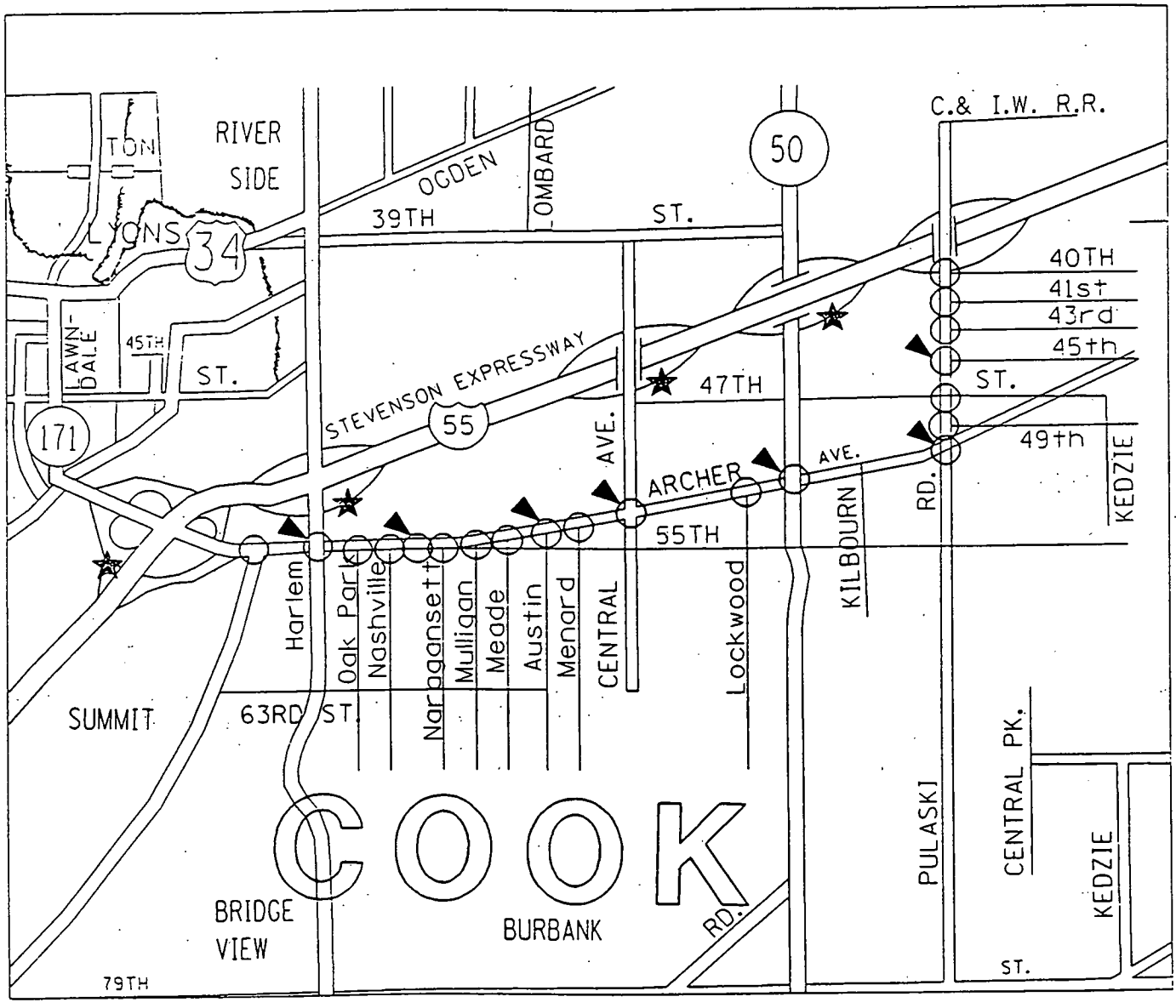
Northbound

SHEET 6N

APPENDIX I

Sample Alternate Route Plan, Chicago, Illinois

PRE–SIGNED DETOUR 2
NORTHEASTBOUND
(Illinois 171 To Pulaski Rd.)



LEGEND

- ○ OFFICER CONTROLLED INTERSECTION
- ◀ PERMANENT SIGNING
- ★ RAMP CLOSURE

Pre-Signed Detour 2 Northeastbound

Locations and Duties	Officers	Vehicles	Permanent Re-Route Signs
I-55 @ Exit Ramp to NEB IL 171 Route all NEB I-55 traffic to exit at IL 171 exit ramp. Direct traffic east on IL 171. (Archer Ave.)	2	2	0
Archer Ave. @ Harlem Ave. Control the intersection. Direct re-routed traffic to continue eastbound on Archer Ave. (55th St.).	1	0	1
Archer Ave. @ Oak Park Ave. Control the intersection. Direct re-routed traffic to continue eastbound on Archer Ave. (55th St.).	1	0	0
Archer Ave. @ Nashville Ave. Control the intersection. Direct re-routed traffic to continue eastbound on Archer Ave. (55th St.).	1	0	0
Archer Ave. @ 55th St. Control the intersection. Direct re-routed traffic to bear left (northeastbound) onto Archer Ave.	1	0	1
Archer Ave. @ Naragansett Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	0
Archer Ave. @ Mulligan Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	0
Archer Ave. @ Meade Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	0
Archer Ave. @ Austin Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	1
Archer Ave. @ Menard Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	0
Archer Ave. @ Central Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	1
Archer Ave. @ Lockwood Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	0

Pre-Signed Detour 2 Northeastbound

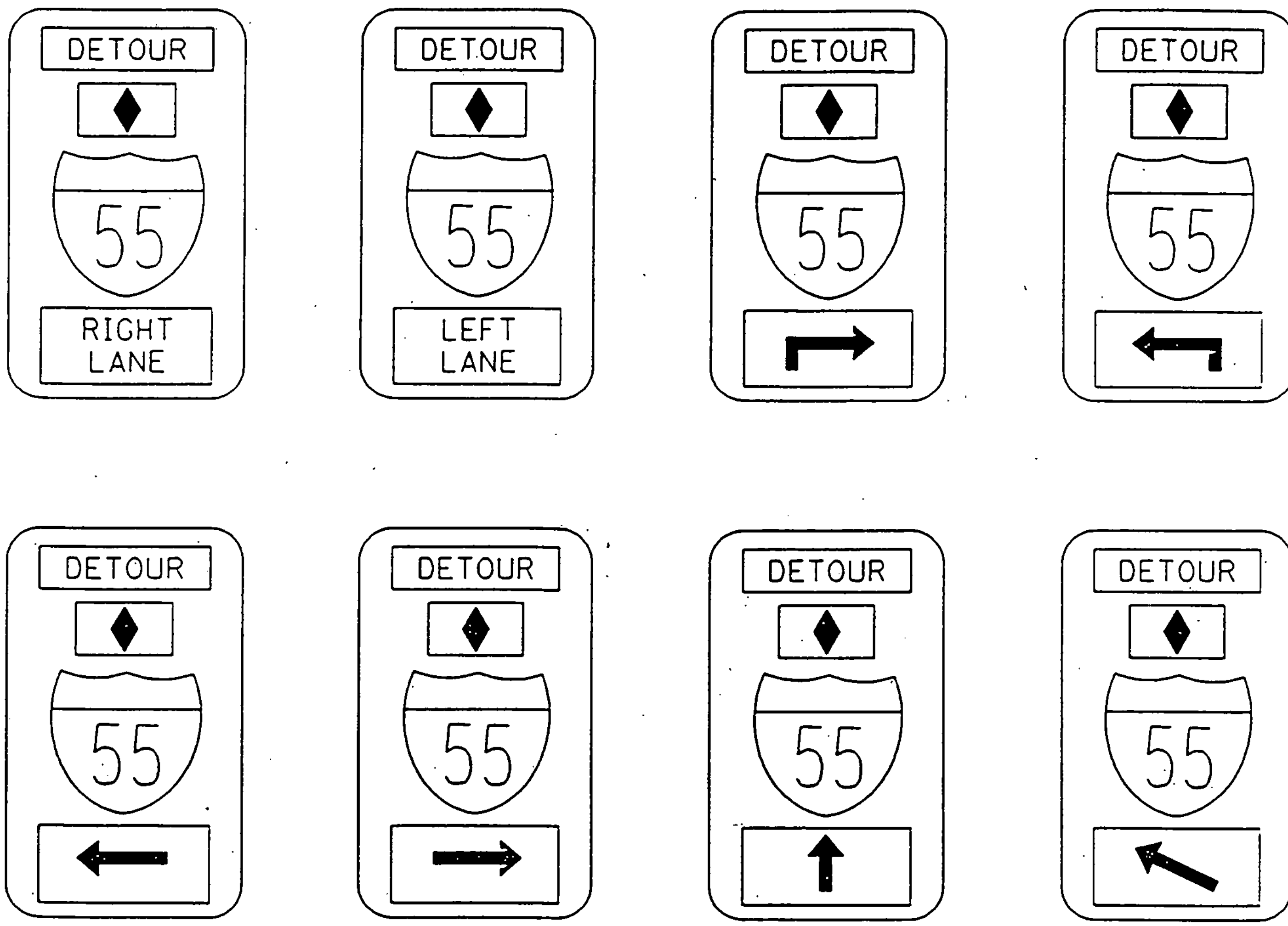
Locations and Duties	Officers	Vehicles	Permanent Re-Route Signs
Archer Ave. @ Cicero Ave. Control the intersection. Direct re-routed traffic to continue northeastbound on Archer Ave.	1	0	1
Archer Ave. @ Pulaski Rd. Control the intersection. Direct re-routed traffic to turn left (northbound) onto Pulaski Rd.	1	0	2
Pulaski Rd. @ 49th St. Control the intersection. Direct re-routed traffic to continue northbound on Pulaski Rd.	1	0	0
Pulaski Rd. @ 47th St. Control the intersection. Direct re-routed traffic to continue northbound on Pulaski Rd.	1	0	0
Pulaski Rd. @ 45th St. Control the intersection. Direct re-routed traffic to continue northbound on Pulaski Rd.	1	0	1
Pulaski Rd. @ 43rd St. Control the intersection. Direct re-routed traffic to continue northbound on Pulaski Rd.	1	0	0
Pulaski Rd. @ 41st St. Control the intersection. Direct re-routed traffic to continue northbound on Pulaski Rd.	1	0	0
Pulaski Rd. @ 40th St. Control the intersection. Direct re-routed traffic to continue northbound on Pulaski Rd.	1	0	0
Pulaski Rd @ NEB I-55 Stevenson Ent. Ramp Direct re-routed traffic to turn right onto northeastbound I-55 (Stevenson)	1	0	0

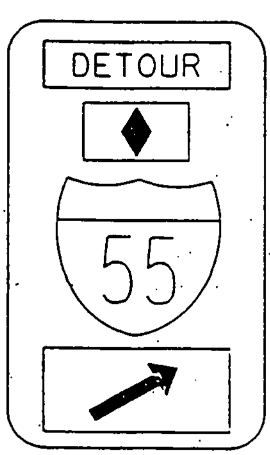
**Northeastbound Ramp Closures*

Locations and Duties	Officers	Vehicles	Permanent Re-Route Signs
Harlem Ave. Entrance to NEB I-55	1	1	0
Central Ave. Entrance to NEB I-55	1	1	0
Cicero Ave. Entrance to NEB I-55	1	1	0
IL 171 Entrance to NEB I-55	1	1	0

**Close all of the above entrance ramps before the full closure site.*

DETOUR SIGNS





◆ ='NORTH' OR 'SOUTH' DEPENDING ON DIRECTION OF DETOUR

I-24
DETOUR ROUTES
Between
Exit 4 - Exit 7

McCRACKEN COUNTY

DETOUR ROUTE

EMERGENCY RESPONSE CONTACTS

POLICE
KSP: 1-800-222-5555
1-502-856-3721

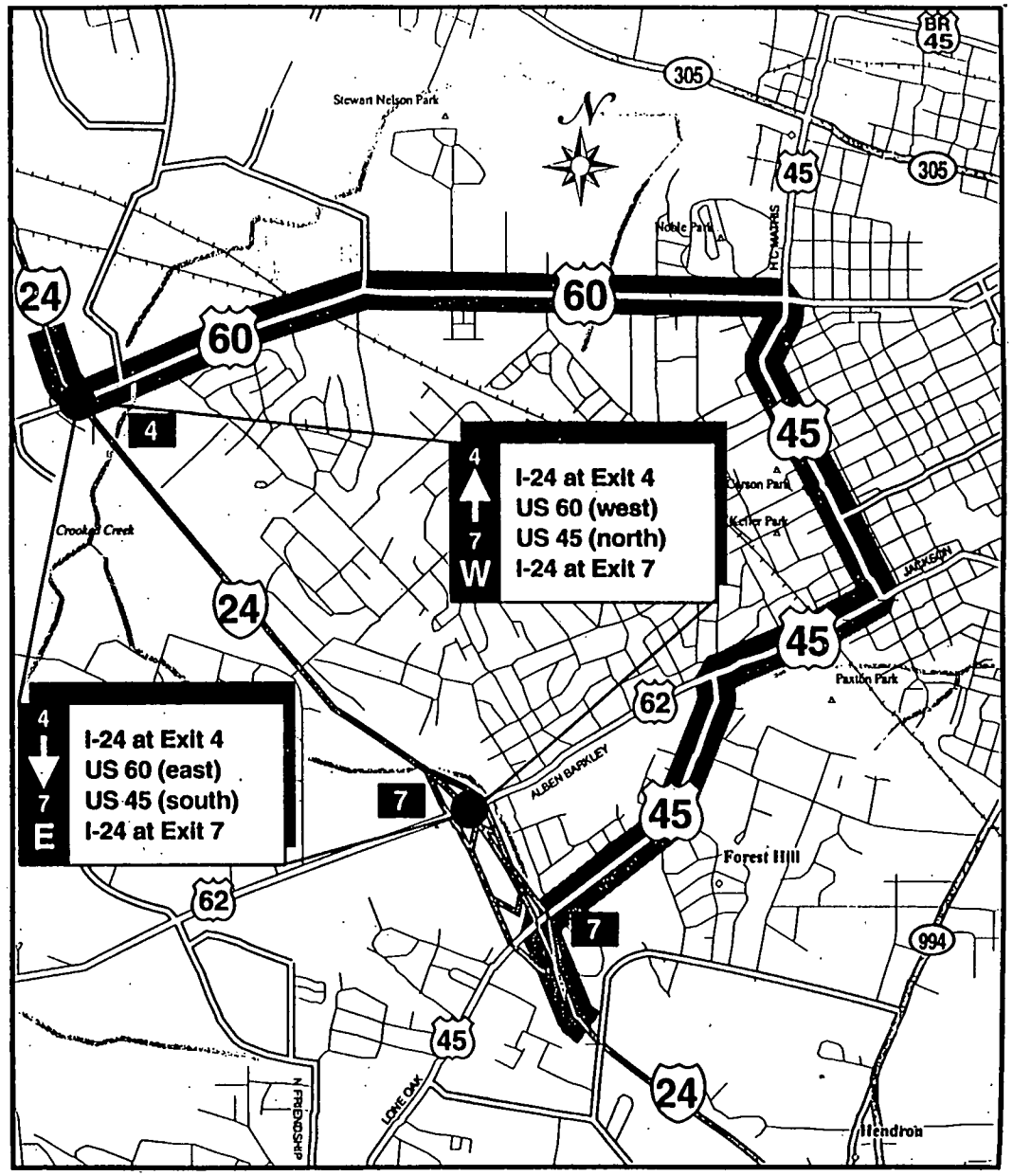
LOCAL FIRE/EMS/POLICE (LOCAL 24 HOUR WARNING POINT)
1-502-444-8550

DES-KY EMERGENCY RESPONSE HOTLINE
1-800-255-2587
1-502-564-7815

NATURAL RESOURCES SPILL HOTLINE
1-800-928-2380

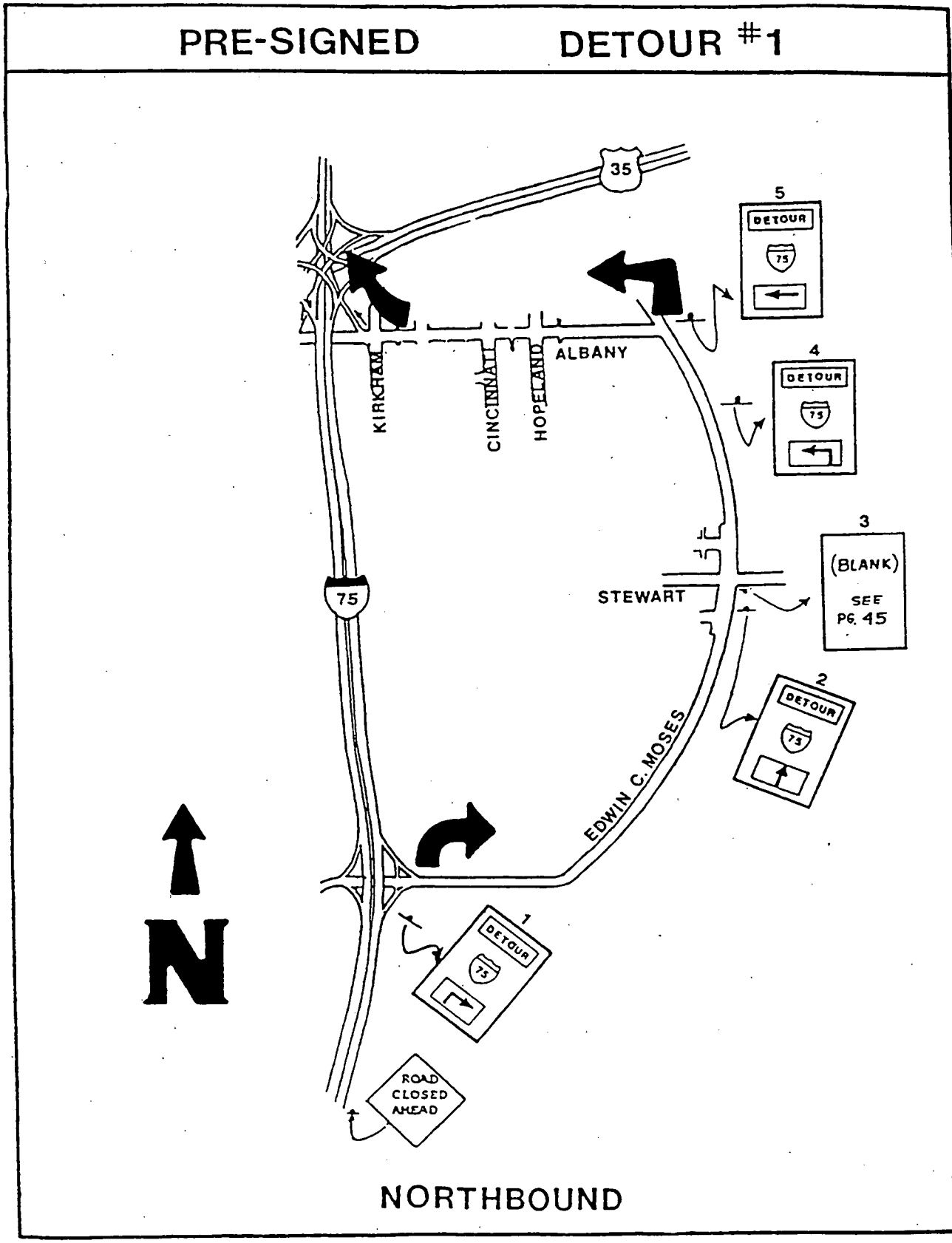
HIGHWAY DEPARTMENT
District 1 Office 1-502-898-2431
McCracken Co. Maintenance 1-502-442-6924

MOTOR VEHICLE ENFORCEMENT
1-800-928-2402
1-502-564-3276



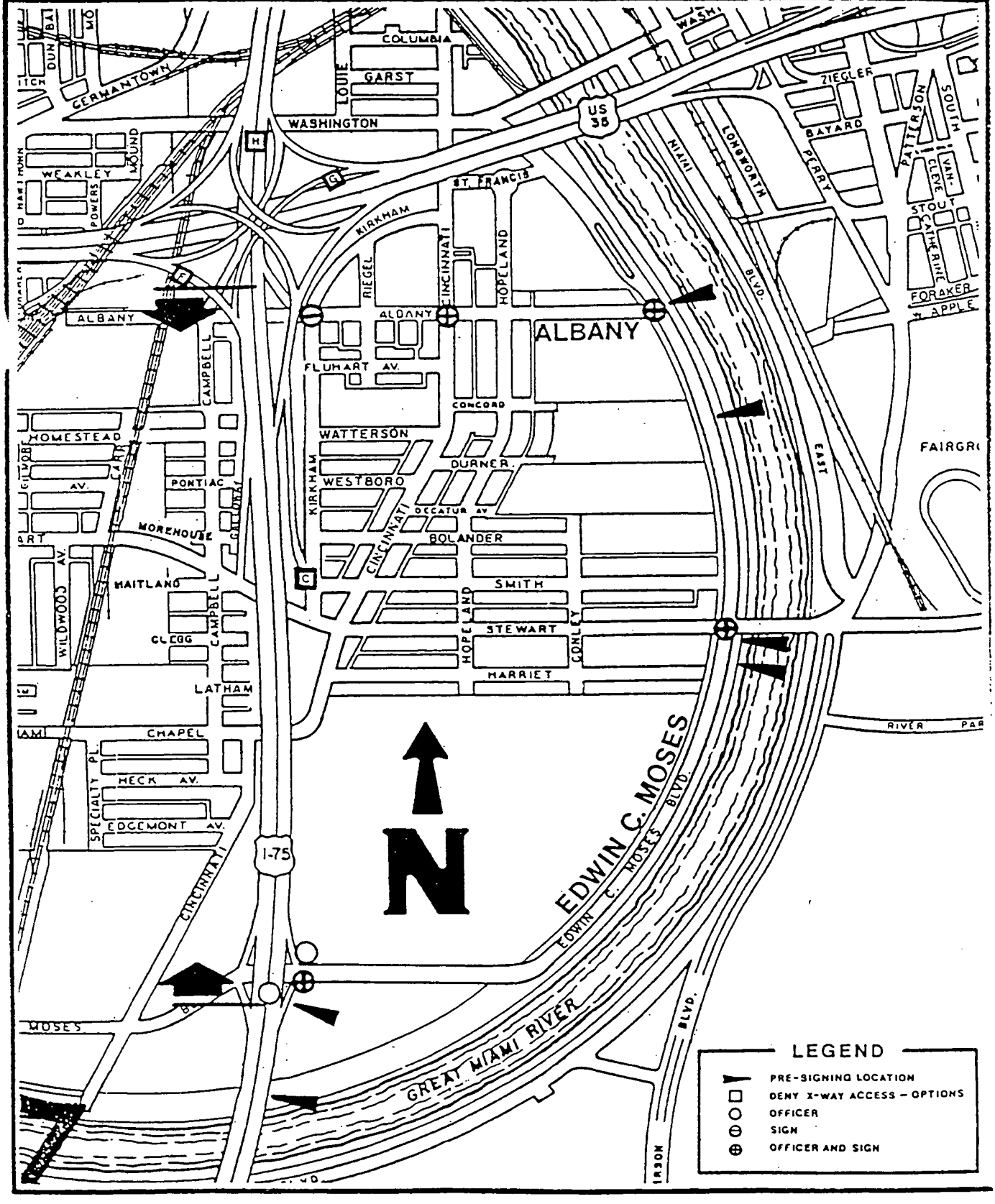
APPENDIX K

Sample Alternate Route Plan, Dayton, Ohio



PRE-SIGNED DETOUR #1

NORTHBOUND SUPPLEMENT



PRE-SIGNED DETOUR 1

Northbound Only

RESOURCES:	Officers	Re-Route Signs
	9	5

TRAFFIC CONTROL POINTS

Officers	Re-Route Signs	Location and Duties
2	0	I-75 and Northbound Exit Ramp 51-H to Edwin C. Moses Blvd. Route all northbound I-75 traffic off at ramp 51-H to Edwin C. Moses Blvd.
1	1	Edwin C. Moses Blvd. and Northbound Exit Ramp 51-H Turn re-routed traffic eastbound (right) onto Edwin C. Moses Blvd. and control intersection.
1	0	Edwin C. Moses Blvd. and Northbound I-75 entrance ramp 51J Deny entry to northbound I-75
2	1	Edwin C. Moses Blvd. and W. Stewart Street Expedite northbound re-routed traffic straight ahead on Edwin C. Moses Blvd. across W. Stewart Street and control intersection.
1	1	Edwin C. Moses Blvd. and Albany Street Turn re-routed traffic westbound (left) onto Albany Street and control intersection.
1	1	Albany Street and Cincinnati Street Expedite westbound re-routed traffic straight ahead on Albany Street across Cincinnati Street and control intersection.
1	1	Albany Street and Northbound Entrance Ramp 52 A-J Turn re-routed traffic north (right) onto entrance ramp 52 A-J and control intersection.

NOTE: At Edwin C. Moses Blvd. and W. Stewart streets, two signs indicate left turn to reach I-75. These signs must be covered during re-routing. (1) Located on Northwest corner (2) Located on East side of Edwin C. Moses Blvd. about 100 ft. South of intersection.

OPTIONAL CLOSURE POINTS

Designation	
C	Kirkham Street entrance ramp 34 to U.S. 35.
F	U.S. 35 eastbound junction of ramp 52 B-P to Southbound I-75.
G	U.S. 35 westbound junction of ramp 52 B-R to Southbound I-75.
H	On I-75 southbound at junction to eastbound and westbound U.S. 35.

Media Release
DESCRIPTION

PRE-SIGNED DETOUR #1
(Northbound)

BLOCKAGE: The area between Northbound I-75 exit ramp 51H to Edwin C. Moses Blvd. and Northbound I-75 Albany Street entrance ramp 52 A-J.

The blockage area is approximately between mile markers 51.61 and 52.68

DETOUR ROUTE: Northbound I-75 traffic is detoured onto eastbound Edwin C. Moses Blvd., continuing to Albany Street, then west on Albany Street to re-enter Northbound I-75 via ramp 52 A-J from Albany Street.

PICKUP/DELIVERY LIST

Pre-Signed Detour #1

PICK-UP AND DELIVER

Portable Detour Signs - 5
Barricades ---------- 9
Cones ---------- 25

DELIVERY LOCATIONS

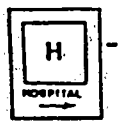
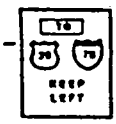
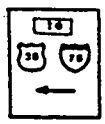
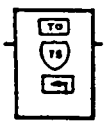
Cones	Barricades	Portable Detour Signs	Location
15	5	0	I-75 and northbound exit ramp 51H to Edwin C. Moses Blvd.
10	0	1	Edwin C. Moses Blvd. and northbound exit ramp 51H (cones form merger lane).
0	4	0	Edwin C. Moses Blvd. and Northbound I-75 entrance ramp 51J.
0	0	1	Edwin C. Moses Blvd. and West Stewart Street.
0	0	1	Edwin C. Moses Blvd. and Albany Street.
0	0	1	Albany and Cincinnati Streets.
0	0	1	Albany Street and Northbound I-75 entrance ramp 52 A-J.

Check with route supervisor for barricades required at any additional I-75 closure points not listed above.

Permanent Sign Locations

For use by person assigned to open or close permanently mounted emergency detour signs

☑ PRE-SIGNED DETOUR # 1 (Northbound)

Sign Number	Sign Message Before Opening	Location
1		located on right side of ramp 51-H from northbound I-75 to Edwin C. Moses Blvd. (about 75 ft. south of intersection with Edwin C. Moses Blvd)
2		located on east side of Edwin C. Moses Blvd., across from Harriet St.
3		located at southeast corner of Edwin C. Moses Blvd. and Stewart St. (This sign is blank when opened - covering the conflicting left turn message)
4		located on east side of Edwin C. Moses Blvd., about 500 ft. south of Albany St. (between Value City and Warehouse Club)
5		located on east side of Edwin C. Moses Blvd., at Albany Street intersection

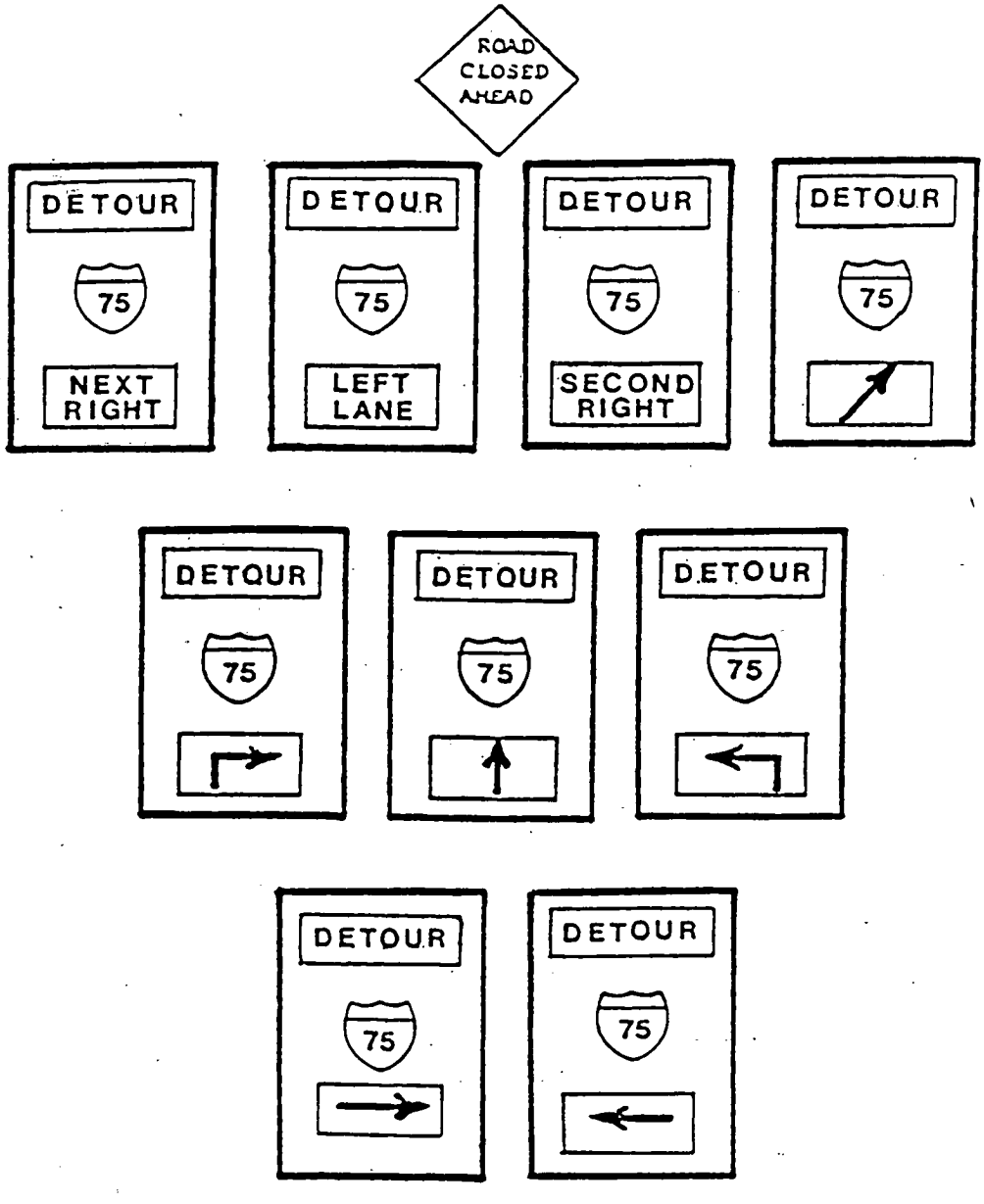
SUPERVISORS NOTE:

(1) Signs will be closed by Traffic Sign Shop upon request

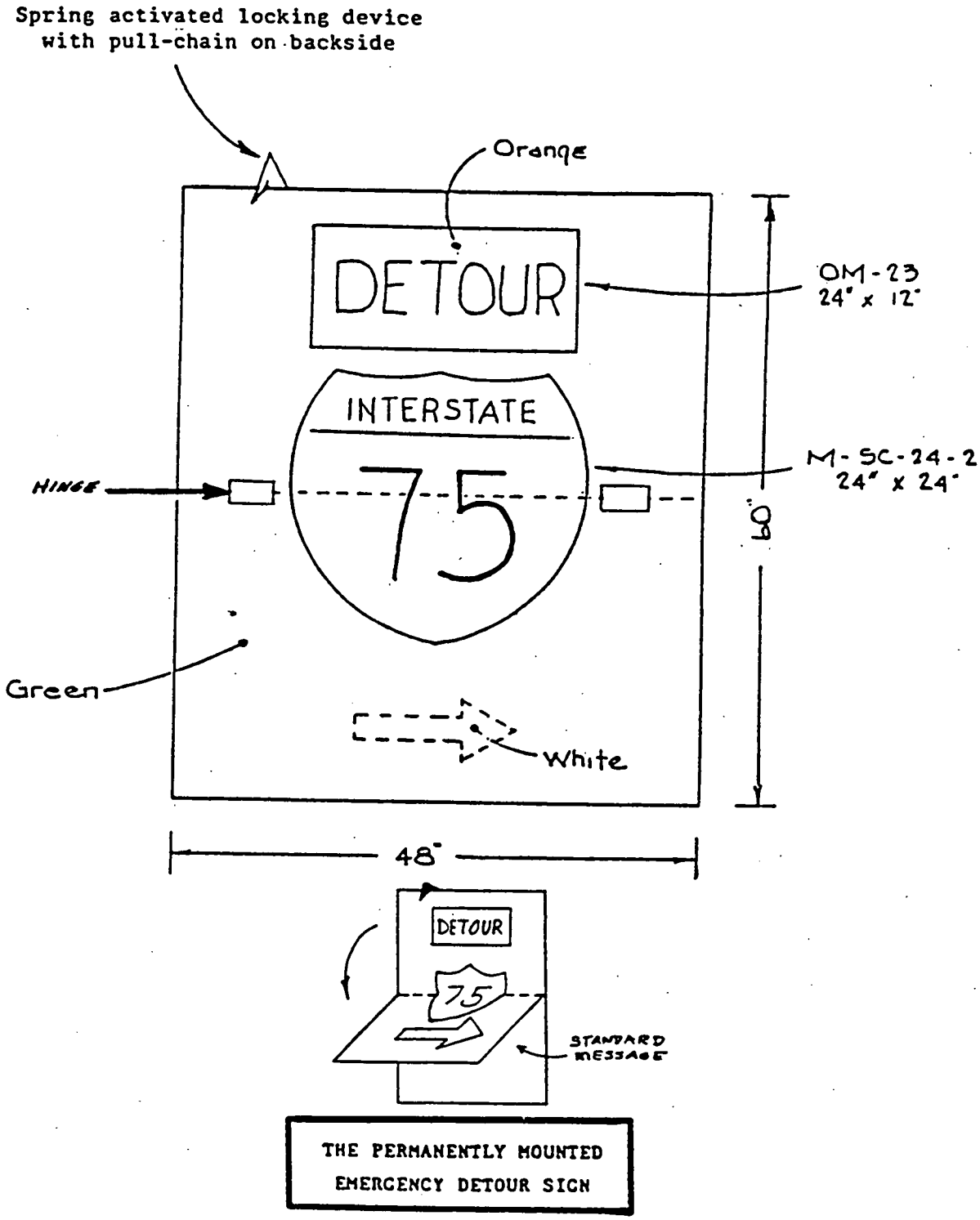
(2) Notify Traffic Sign Shop immediately of damaged or inoperative signs

(3) "Road Closed Ahead" signs are installed 1000 ft. in advance of closure area. Optionally available, they are intended for supplemental use during extended term detouring (located on right side of highway).

Pre-Signed Detours



Designed to readily fold open from a closed position, these signs are permanently installed and ready for emergency use.



THE PERMANENTLY MOUNTED
EMERGENCY DETOUR SIGN

APPENDIX L

Sample Alternate Route Plan, Klamath County, Oregon

DETOUR TRAFFIC CONTROL SIGNS, etc.

HIGHWAY 97

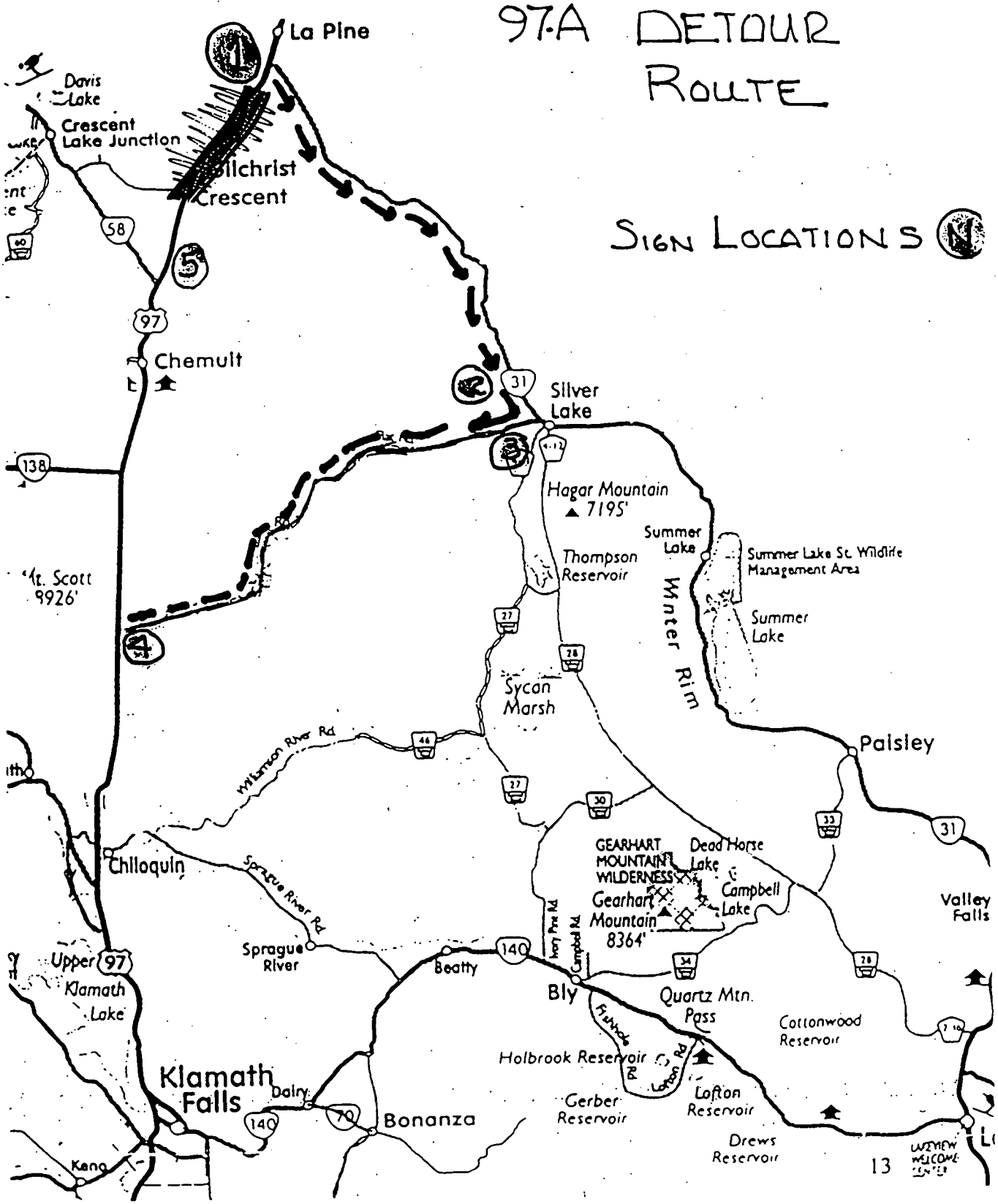
97-A

Southbound:	97/31 "Detour Ahead" "Detour/Arrow" Lt. "Road Closed" Barricade	Sign location 1
	31/Silver Lake Rd. "Detour/Arrow" Rt.	Sign location 2
Northbound:	97/Silver Lake Rd. "Detour Ahead" "Road Closed to Bend" "Detour/Arrow" Rt. Barricade	Sign location 4
	Silver Lake/31 "Detour/Arrow" Lt.	Sign location 3
	97/Crescent cutoff "Detour Ahead" "Road Closed" "Detour Arrow" Lt. Barricade	Sign location 5

Detour Descriptions

Highway 97

97-A. SB - Detour left State Hwy route 31 to Silver Lake Road. Right on Silver Lake Road back to Hwy 97.
NB - Detour right at Silver Lake Road to State Hwy route 31. Left on Hwy 31 back to Hwy 97. North bound traffic may continue north to Hwy 58 for westbound traffic.


97-A DETOUR ROUTE
SIGN LOCATIONS
La Pine
Davis Lake
Crescent Lake Junction
Crescent
58
97
Chemult
31
Silver Lake
138
Mt. Scott 9926'
Hagar Mountain ▲ 7195'
Summer Lake
Thompson Reservoir
Summer Lake St. Wildlife Management Area
Summer Lake
Winter Rim
Sycan Marsh
Paisley
Williamson River Rd.
Chiloquin
Sprague River Rd.
GEARHART MOUNTAIN WILDERNESS
Gearhart Mountain 8364'
Dead Horse Lake
Campbell Lake
Valley Falls
Upper Klamath Lake
Sprague River
Beatty
140
Bly
Quartz Mtn. Pass
Cottonwood Reservoir
Holbrook Reservoir
Gerber Reservoir
Lofton Reservoir
Klamath Falls
Dairy
70
Bonanza
Drews Reservoir
Keno
13

Potential Incident Contacts

For events occurring on the following highways.

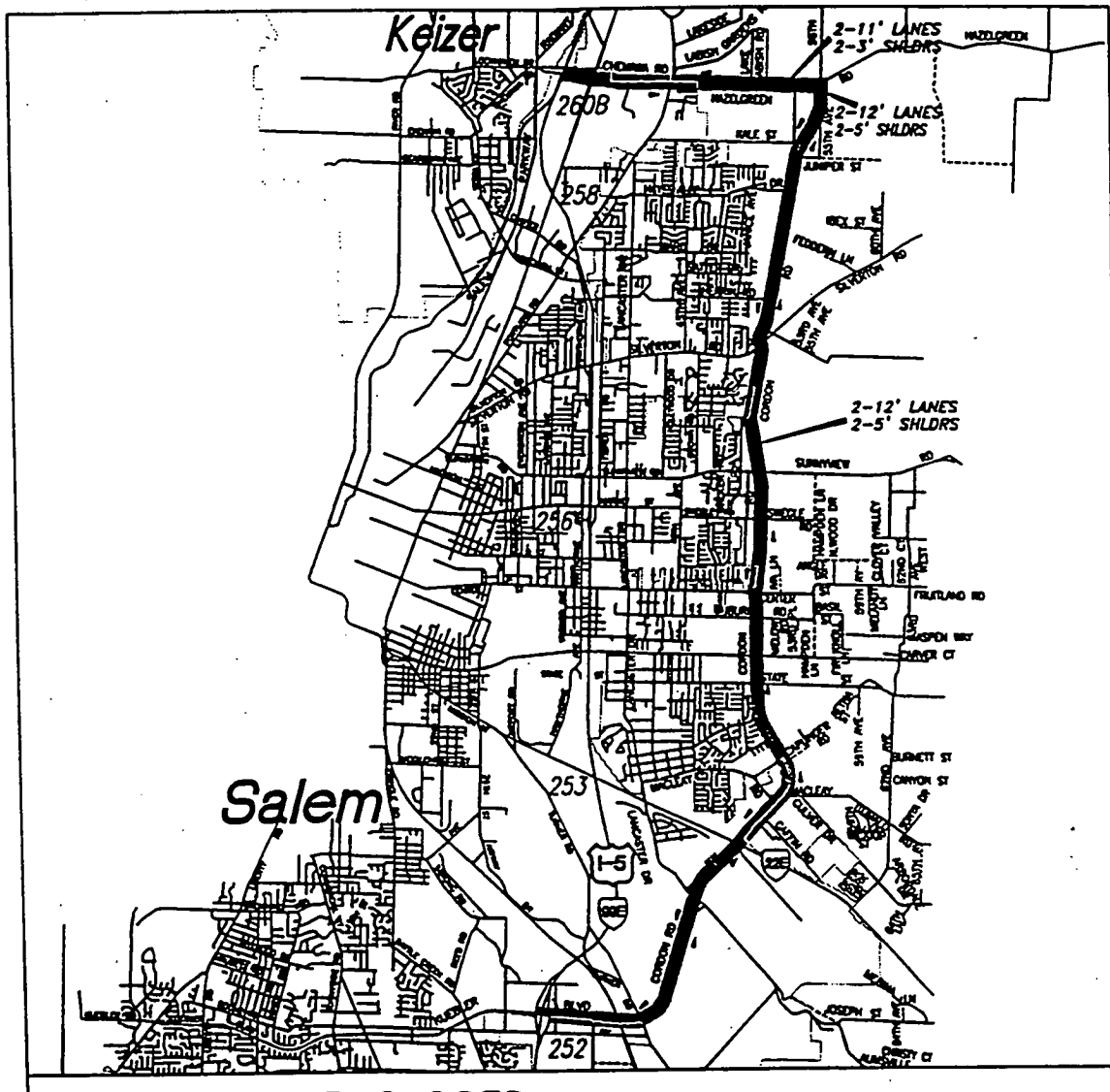
Highway 97

97-A
MP 169.68 to MP 185.39
Fremont Hwy Jct to the Crescent Lake Cut-off Road (Co.).

Contacts:	Oregon Department of Transportation.....	883-5532 or 883-5662
	Klamath County Public Works.....	883-4696
	Lake County Road Department.....	947-6048
	Klamath County Sheriff Office.....	883-5130
	Oregon State Police.....	883-5711
	Klamath County Emergency Services.....	883-5130
	911.....	9-1-1

APPENDIX M

Sample Alternate Route Plan, Marion County, Oregon



INTERSTATE 5 CLOSED
FOR INCIDENTS BETWEEN EXITS 253 AND 256

ALTERNATE ROUTE–NORTHBOUND

Use Exit 252 (Kuebler Blvd.), East and North on Kuebler Blvd./ Cordon Rd. to Hazelgreen Rd., West on Hazelgreen Rd./ Chemawa Rd. to I–5 (260B).

ALTERNATE ROUTE–SOUTHBOUND

Use Exit 260b (Chemawa Rd.), East on Chemawa/Hazelgreen Rd. to Cordon Rd., South on Cordon Rd./Kuebler Blvd. to I–5 (252).

Map 8

I-5 DETOUR USING KUEBLER BLVD. & CORDON ROAD

I-5 NORTHBOUND

TOTAL SIGNS AND FLAGPERSONS NEEDED

Signs			Flaggers
7	⇑	Detour Route Markers	8
1	⇐	Detour Route Marker	

KUEBLER BLVD. - NORTHBOUND - AT TURNER ROAD

1	⇑	Detour Route Marker (SE Corner) Possible Signal Light Change to Flash	1

KUEBER BLVD. - NORTHBOUND - AT LANCASTER DR./AUMSVILLE HWY

1	⇑	Detour Route Marker (SE Corner) Possible Signal Light Change to Flash	1

CORDON ROAD - NORTHBOUND - AT MACLEAY

1	⇑	Detour Route Marker (SE Corner)	1

CORDON ROAD - NORTHBOUND - AT STATE STREET

	⇑	Detour Route Marker (SE Corner) Signal Light Change to Flash	1

CORDON ROAD - NORTHBOUND - AT CENTER STREET

1	⇑	Detour Route Marker (SE Corner) Signal Light change to Flash	1

CORDON ROAD - NORTHBOUND - AT SUNNYVIEW RD

1	⇑	Detour Route Marker (SE Corner)	1

CORDON ROAD - NORTHBOUND - AT SILVERTON ROAD

1	⇑	Detour Route Marker (SE Corner) Signal Light Change to Flash	1

CORDON ROAD - NORTHBOUND - AT HAZELGREEN ROAD

	⇐	Detour Route Marker (SE Corner) Signal Light Change to Flash	1

I-5 SOUTHBOUND

TOTAL SIGNS AND FLAGPERSONS NEEDED

Signs			Flaggers
7	⇑	Detour Route Markers	8
1	⇒	Detour Route Marker	

CORDON ROAD - SOUTHBOUND - AT HAZELGREEN ROAD

1 ⇒ Detour Route Marker (NW Corner) 1

CORDON ROAD - SOUTHBOUND - AT SILVERTON ROAD

1 ⇑ Detour Route Marker (NW Corner)
Signal Light Change to Flash 1

CORDON ROAD - SOUTHBOUND - AT SUNNYVIEW ROAD

1 ⇑ Detour Route Marker (NW Corner)

1 ⇑ Detour Route Marker (NW Corner) 1

CORDON ROAD - SOUTHBOUND - AT CENTER STREET

1 ⇑ Detour Route Marker (NW Corner) 1
Signal Light Change to Flash

CORDON ROAD - SOUTHBOUND - AT STATE STREET

1 ⇑ Detour Route Marker (NW Corner) 1
Signal Light Change to Flash

CORDON ROAD - SOUTHBOUND - AT MACLEAY ROAD

1 ⇑ Detour Route Marker (NW Corner) 1

CORDON ROAD - SOUTHBOUND - AT LANCASTER DRIVE/AUMSVILLE HWY

1 ⇑ Detour Route Marker (NW Corner) 1
Possible Signal Light Change to Flash

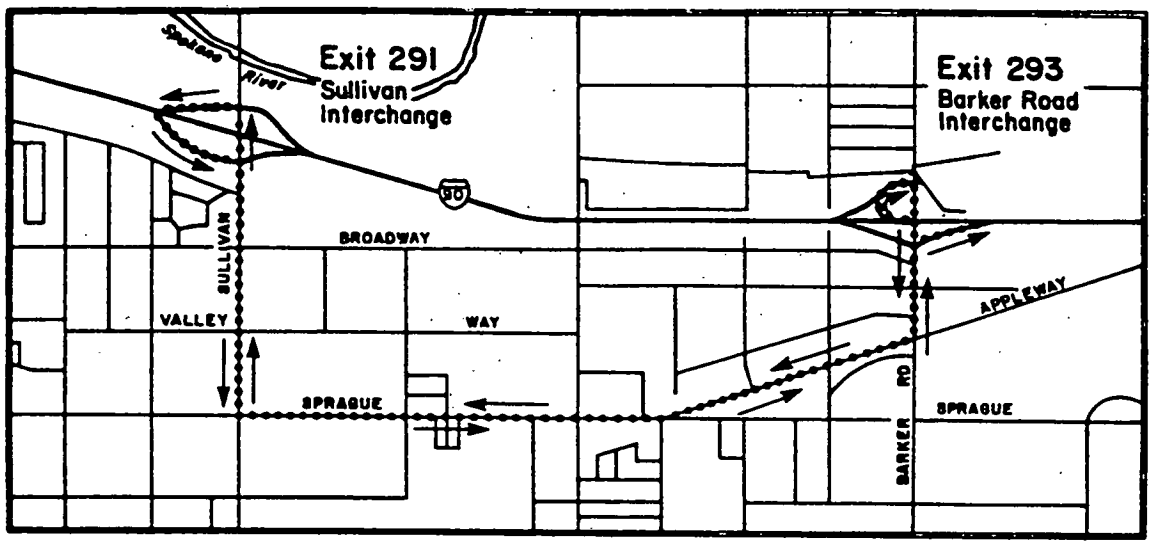
KUEBLER BLVD. - SOUTHBOUND - AT TURNER ROAD

1 ⇑ Detour Route Marker (NW Corner) 1
Possible Signal Light Change to Flash

NOTE: The Signal lights should be changed to flash mode and back again to signal only by someone trained to do so! Ex: Supervisors, Foremen, Sign Shop, Radio Shop

APPENDIX N

Sample Alternate Route Plan, Spokane, Washington



Eastbound	Westbound
at Exit 291 EB ramp terminal, turn right onto Sullivan Rd	at Exit 293 WB ramp terminal, turn right onto Baker Rd
at Appleway signal, turn left	at Appleway signal, turn right
at Baker Rd signal, turn left	at Sullivan Rd signal, turn right
at SR 90 EB on-ramp, turn right	at SR 90 WB on-ramp signal, turn left

Figure A11. Exit 291 Sullivan Interchange to Exit 293 Baker Rd. Interchange

THE TRANSPORTATION RESEARCH BOARD is a unit of the National Research Council, a private, nonprofit institution that provides independent advice on scientific and technical issues under a congressional charter. The Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering.

The mission of the Transportation Research Board is to promote innovation and progress in transportation by stimulating and conducting research, facilitating the dissemination of information, and encouraging the implementation of research findings. The Board's varied activities annually draw on approximately 4,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

The National Academy of Sciences is a nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encouraging education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences, by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

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Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
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ADDRESS CORRECTION REQUESTED

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