Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/VA–R6		

4. Title and Subtitle	5. Report Date
Incident Management in Virginia: A State of the Practice Report	November 1991
	6. Performing Organization Code
7. Author(s)	8. Preforming Organization Report No.
Frank D. Shepard	VTRC 92-R6
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Virginia Transportation Research Council Box 3817, University Station Charlottesville, Virginia 22903-0817	11. Contract or Grant No.
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Virginia Department of Transportation 1401 E. Broad Street Richmond, Virginia 23219	14. Sponsoring Agency Code 2551

15. Supplementary Notes

16. Abstract

Because of the number of incidents and the magnitude of their consequences, the Virginia Department of Transportation made a concerted effort to ensure that incident management became a top priority and spearheaded an effort to start a statewide incident management program. This report documents that program. This program was concerned with the coordination of programs involved in preventing incidents and those concerned with detecting, responding to, and clearing incidents after they occur. Formal incident management programs in three large urban areas in addition to other efforts by the Virginia Department of Transportation, the Virginia State Police, and Fairfax County are summarized. The documentation contained herein can be used to aid other states in developing incident management programs.

17. Key Words	18. Distribution Statement
congestion incident management	

19. Security Clasif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	45	

FINAL REPORT

INCIDENT MANAGEMENT IN VIRGINIA: A STATE OF THE PRACTICE REPORT

Frank D. Shepard
Research Scientist

Virginia Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Transportation and the University of Virginia)

In Cooperation with the U.S. Department of Transportation
Federal Highway Administration

Charlottesville, Virginia

November 1991
VTRC 92-R6

TRAFFIC & PLANNING RESEARCH ADVISORY COMMITTEE

L. C. TAYLOR, Chairman, Salem District Traffic Engineer, VDOT

E. D. ARNOLD, JR., Executive Secretary, Senior Research Scientist, VTRC

M. G. ALDERMAN, Regional Sign Shop Co-ordinator, VDOT

W. S. BLACK, Fredericksburg District Traffic Engineer, VDOT

B. R. CLARKE, Asst. Transportation Planning Engineer, VDOT

G. R. CONNER, Asst. Rail & Public Transportation Administrator, VDOT

J. C. DUFRESNE, Culpeper District Traffic Engineer, VDOT

D. L. FARMER, Chief Transportation Planner, Hampton Roads Planning District Commission

C. F. GEE, State Construction Engineer, VDOT

C. D. HALL, Asst. State Traffic Engineer, VDOT

T. A. JENNINGS, Safety/Technology Transfer Co-ordinator, Federal Highway Administration

Y. LLORT, Northern Va. District Planning & Operations Engineer, VDOT

T. W. NEAL, JR., Chemistry Lab Supervisor, VDOT

R. L. SAUVAGER, Asst. Urban Division Administrator, VDOT

TABLE OF CONTENTS

FINAL REPORT

INCIDENT MANAGEMENT IN VIRGINIA

Frank D. Shepard
Research Scientist

INTRODUCTION

Highway incidents include traffic accidents, disabled vehicles, spilled loads, and other extraordinary events that reduce the capacity of the roadway. Significant congestion and delay occur when major incidents cause the blockage of a lane or the entire road for long periods of time. Also, the large number of minor incidents account for a large portion of the total delay.

The magnitude of the problem is obvious from a recent FHWA study,[1] which shows that incidents account for 60 percent of all freeway congestion in the larger urban areas, and with the increase in future travel coupled with the increased periods of time freeways operate at or near capacity, this could be as high as 70 percent by the year 2005 unless improvements are made. Also, it is estimated that the $5 billion spent nationwide on delay and fuel in 1984 could reach $35 billion in 2005 unless there are concentrated efforts to combat incident-related congestion. The projected rate of increase in congestion is predicted by the FHWA to be greater in the medium size cities.

The amount of time required for the notification that an incident has occurred and the amount of time required to clear obstacles from the road are crucial to the management of incidents. The significance of time can be seen from the often quoted statement from California[2] that every minute saved in clearing an incident saves other motorists 4 to 5 minutes during off-peak periods and 40 to 50 minutes during peak periods.

Incident management primarily involves

- reducing the time required to detect an incident
- reducing the time required to respond to an incident
- reducing the time to clear an incident
- efficiently managing personnel and traffic.

Most of the incidents we hear about involve major accidents that tie up several lanes or entire freeways for hours. However, minor accidents and disablements, particularly if they occur during peak periods, account for a significant portion of the total delay attributable to incident-related congestion. The cumulative effect of the large number of minor incidents results in a large part of the total delay.

The Virginia Department of Transportation (VDOT) has made a concerted effort to ensure that incident management becomes a top priority and has spearheaded an effort to start a statewide incident management program. This incident management program includes four main features:

1. Initiating incident management programs in the major urban areas of the state.
2. Supporting other state agencies that deal with incident management.
3. Providing information through statewide seminars and workshops.
4. Continuing to expand and refine incident management statewide.

The purpose of this report was to document and describe the state of the practice of some incident management efforts in Virginia. As such, the report can be useful for other states that desire to establish similar programs.

MAJOR INCIDENT MANAGEMENT PROGRAMS

Three areas of Virginia were targeted for formal incident management programs: Northern Virginia, the Richmond metropolitan area, and the Hampton Roads Tunnel.

The Richmond Metropolitan Area Incident Management task force was created in 1987 as a joint effort between the Virginia Department of Transportation and the Virginia Department of State Police (VSP). This task force was established to set up an operational system and procedures for minimizing the disruption and threat to safety posed by major incidents on the interstate system in the Richmond area.

In 1988, an effort was initiated by the VDOT to improve operations on Northern Virginia freeways including I-66, I-95, I-495, and the Dulles Toll Road. A consultant was hired to develop the *Northern Virginia Freeway Management Team Operating Manual*, which presents a regional plan for traffic management on the freeways.

A Hampton Roads Bridge-Tunnel Advisory Committee was established in 1988 for the purpose of improving the management of traffic through the tunnels in Tidewater. Representatives from the cities of Hampton, Norfolk, and Portsmouth, along with officials of the VSP and VDOT, comprise the committee.

The basic programs for incident management in Richmond and Northern Virginia are similar, and the common elements are summarized below. Because of the uniqueness of the procedures for managing incidents in and around the Hampton Roads Bridge-Tunnel, it is discussed separately.

Richmond's and Northern Virginia's Incident Management Programs

Setting up an incident management program involved the formation of a task force consisting of those who represent the agencies associated with the transportation facility, i.e., state and local transportation agencies, state and local police, and fire and emergency service agencies. Members were chosen who were interested in the control of nonrecurring congestion, had a knowledge of the variables surrounding incident management, and had authority to make decisions.

The basic objective was to have a coordinated effort to achieve the common goal of minimizing the disruption posed by incidents on the freeways. This was accomplished by the development of a manual that:

- defines the roles and responsibilities of state and local agencies involved in incident management
- outlines general procedures for interagency coordination during incidents
- defines certain traffic management procedures for use by agency personnel at the scene
- defines an operational plan with specific procedures and detour plans for the diversion of traffic.

The operations manual may be obtained by contacting VDOT at 3975 Fair Ridge Dr., Fairfax, VA 22033 for the Northern Virginia manual and P.O. Box 259, Colonial Heights, VA 23834 for Richmond's.

Interagency Responsibilities

Virginia State Police

The VSP has the responsibility for responding to traffic incidents on the freeway system. The ranking VSP officer is in charge of the incident scene, unless a fire or hazardous material spill is involved, in which case the ranking fire official is in charge. The following operational guidelines are used by the VSP:

- contact support agency personnel
- isolate the incident
- control traffic and pedestrians
- identify and implement alternate routing
- establish a command post for the purpose of managing personnel, equipment, medical, etc.
- perform accident investigation.

Virginia Department of Transportation

VDOT provides traffic management support for major incidents in the form of signs and traffic control along with necessary equipment, materials, and personnel for clean-up.

Fire and Rescue Agencies

Unless fire or rescue agencies are already at the incident scene, the determination of the need for fire and/or rescue services is normally made by the ranking police officer at the scene. For incidents involving fire or hazardous materials, the fire agency is in charge of activities at the scene.

City and County Police

City and county police departments may respond to incidents on the interstate system, depending on the proximity of their offices to the incident, availability of VSP personnel, and the nature of the incident. For incidents on other roads, these agencies would respond with personnel, equipment, and/or materials if needed.

City and County Public Works

These agencies are not normally involved in incidents on state roadways, but they may provide traffic management support for incidents on city or county roads or where traffic congestion from incidents on state roads spills over. Also, these agencies may be involved in signal operations to accommodate a detour from the interstate system.

Media Representatives

There is no formal coordinating mechanism between the media and local/state agencies, however, the media, especially commercial radio stations, play an important role in disseminating traffic information to the public, which is typically received from state/local agencies or airborne traffic reporters. Incidents detected by radio traffic reporters are normally relayed to the appropriate state or local agencies.

Alternate Route Plan

Major incidents often result in prolonged delays or road closures requiring the diversion of traffic to alternate routes. It is important that detour routes be chosen prior to the occurrence of an incident and that they be able to accommodate the traffic that can be expected. This is done by assuming that an incident will occur on a particular section of highway between potential alternate routes and working out the details of the detour.

When to Establish Alternate Route

The decision to close that portion of the freeway on which the incident has occurred is made if the incident will result in a significant delay. Generally, when

two or more lanes of a freeway are expected to be shut down for two or more hours, institution of the alternate route plan should be considered. This decision is normally made by the ranking police officer in conjunction with other agency personnel, particularly those from VDOT. However, if a fire or hazardous spill is involved, the ranking fire officer should make the decision.

Setting Up an Alternate Route

Before implementation, the entire route should be driven to ensure that the route is free of construction and/or maintenance activities as well as other bottlenecks. Normally, VDOT would be requested to bring the signs to the site and set up the detour. In the event that VDOT cannot bring the signs and personnel as quickly as needed, police personnel may obtain the signs and set up the detour.

Alternate Route Maps

Alternate route maps for most of the potential incident locations are provided in the operation manual. The maps serve as a guide for setting up the detours. Examples of alternate route maps for the Richmond area, which were plotted using the CADD system, are shown in Figure 1. The actual CADD drawings are in color, which show better than the black and white. They give the incident location and alternate routes and Figure 2 shows the traffic flow and traffic control for specific intersections along the alternate route. Figures 3 and 4 show the alternate routing instructions and map, respectively, for Northern Virginia. The following suggestions are followed when activating an alternate route:

- Place a sign at the point of departure from the freeway to create confidence in motorists that the detour is signed.
- Place signs at all points along the route where motorists must change directions.
- Use confirmation signing along lengthy straight sections or where the detour route continues straight through a major signalized intersection.
- A detour sign at the re-entry point is helpful.
- Signs are normally erected on the right side of the roadway; however, where left turns are required, the signs should be placed on the left side if possible.
- In heavily congested areas, flags should be placed on the detour signs to attract attention.
- Detour signs should be erected in reverse order starting from the end of the detour unless circumstances dictate otherwise.
- Every attempt should be made to place the signs so that they are as visible as possible.

In addition to the signs placed along the detour route, the mainline of the freeway is signed to alert motorists of the upcoming closure. A typical traffic con-

LOCATION 1

PETERSBURG/COLONIAL HEIGHTS AREA INCIDENT DETOUR PLAN

INCIDENT BETWEEN RTE.144 (TEMPLE AVE.) AND EXIT 3

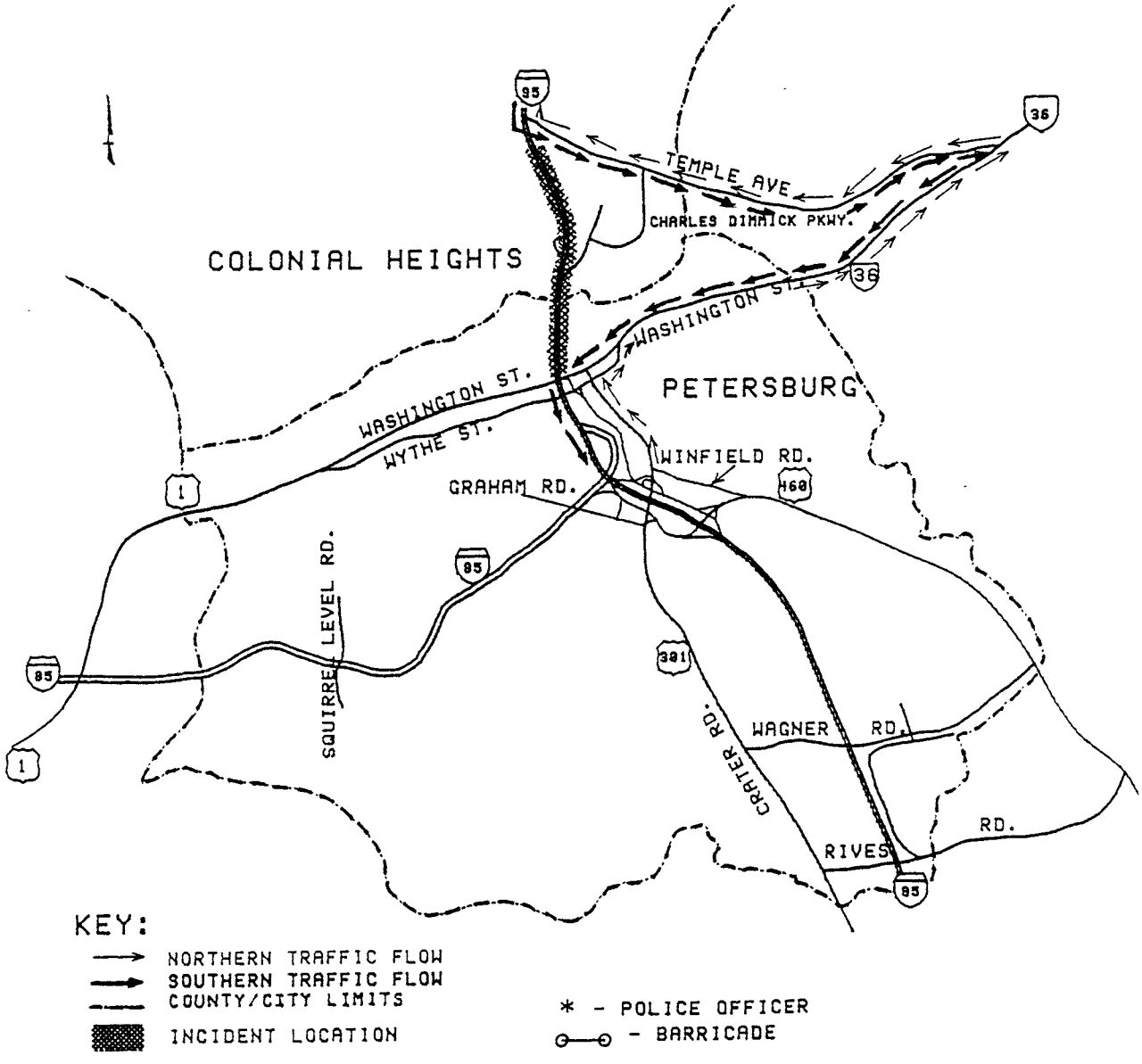
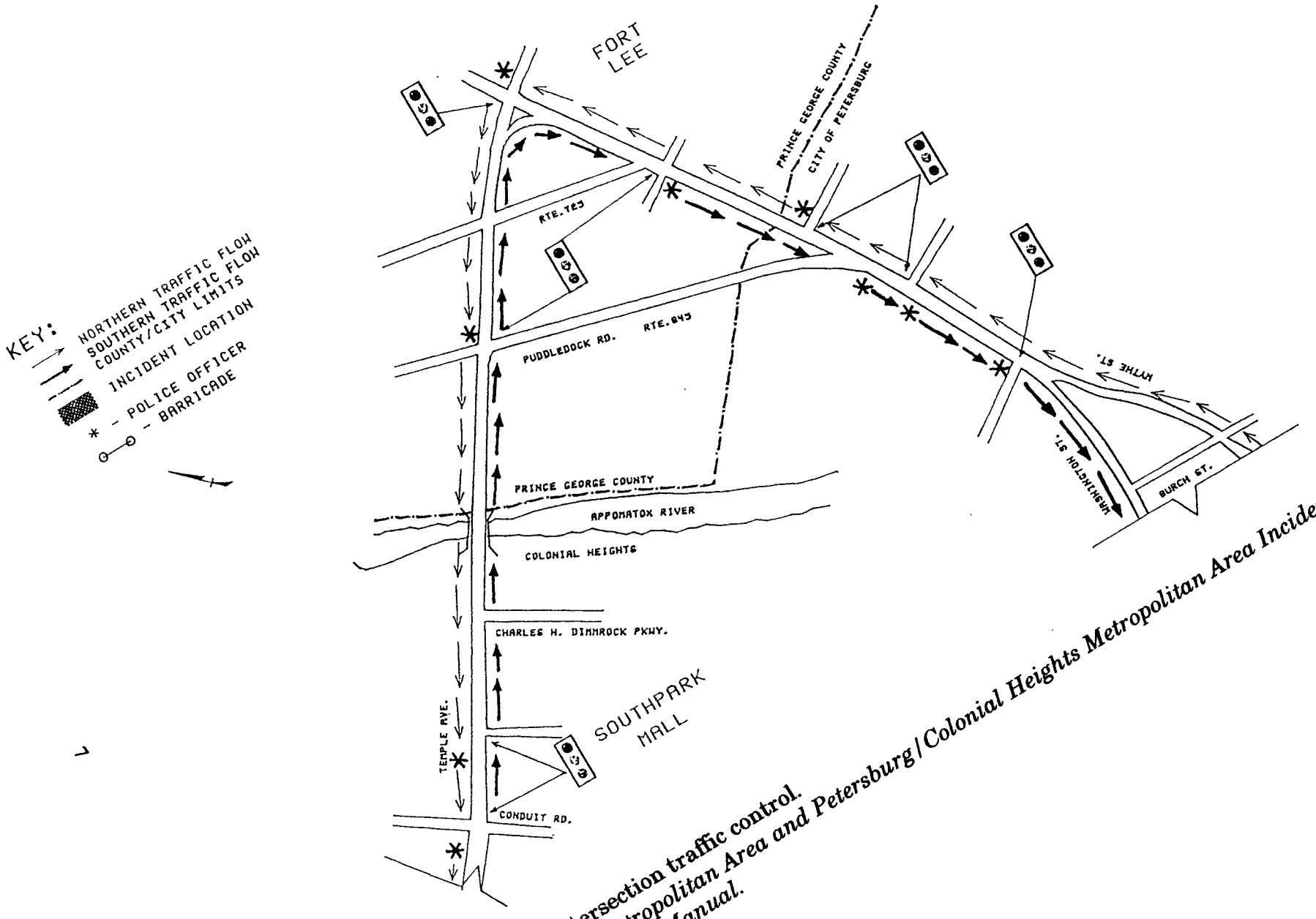


Figure 1. Alternate route map.
Source: *Richmond Metropolitan Area and Petersburg/Colonial Heights Metropolitan Area Incident Management Operations Manual.*



2. **Alternate route intersection traffic control.**
Source: *Richmond Metropolitan Area and Petersburg/Colonial Heights Metropolitan Area Incident*
agement Operations Manual.

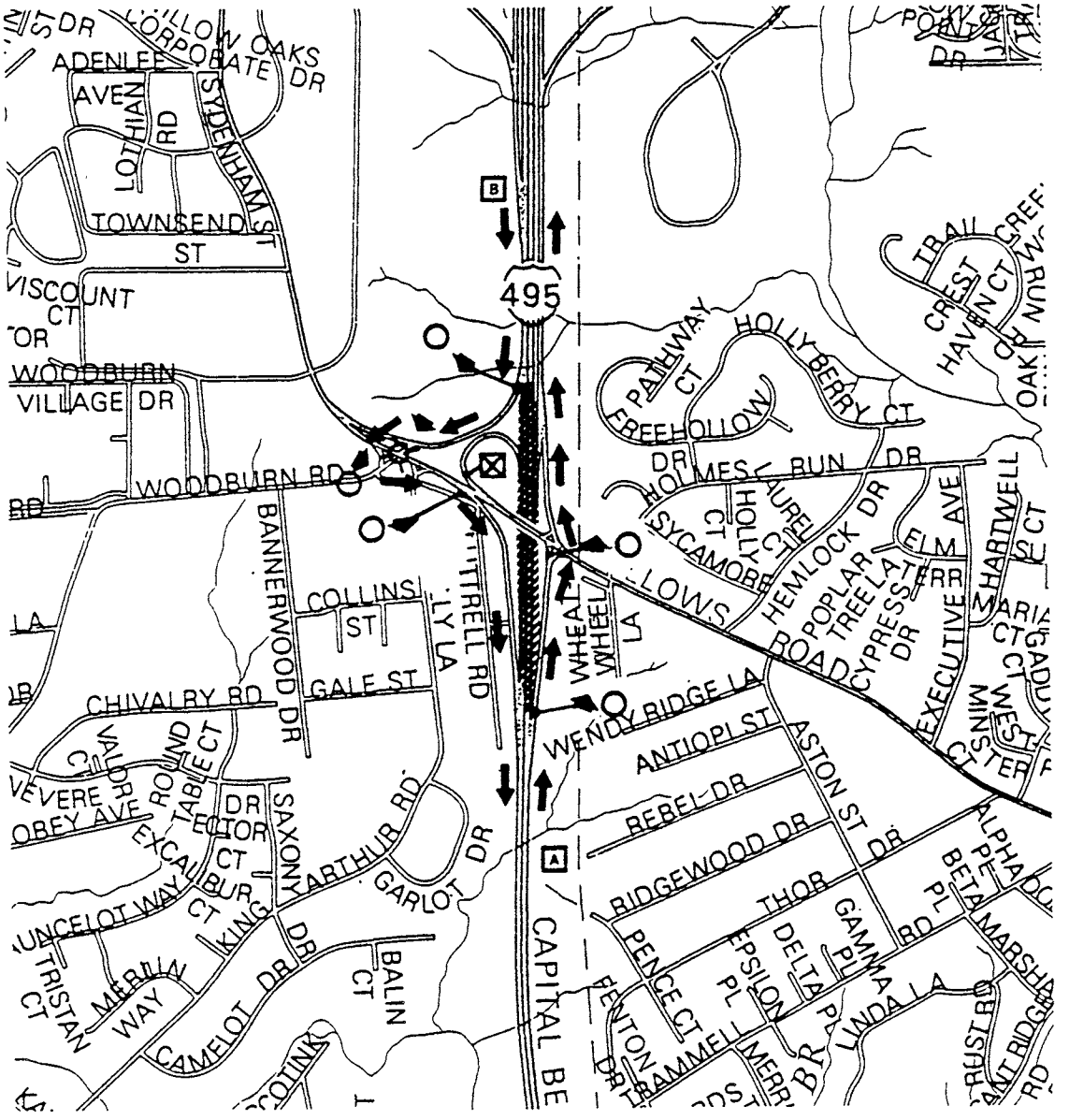


Figure 3. Alternate route instructions.
Source: *Northern Virginia Freeway Management Team Operating Manual.*

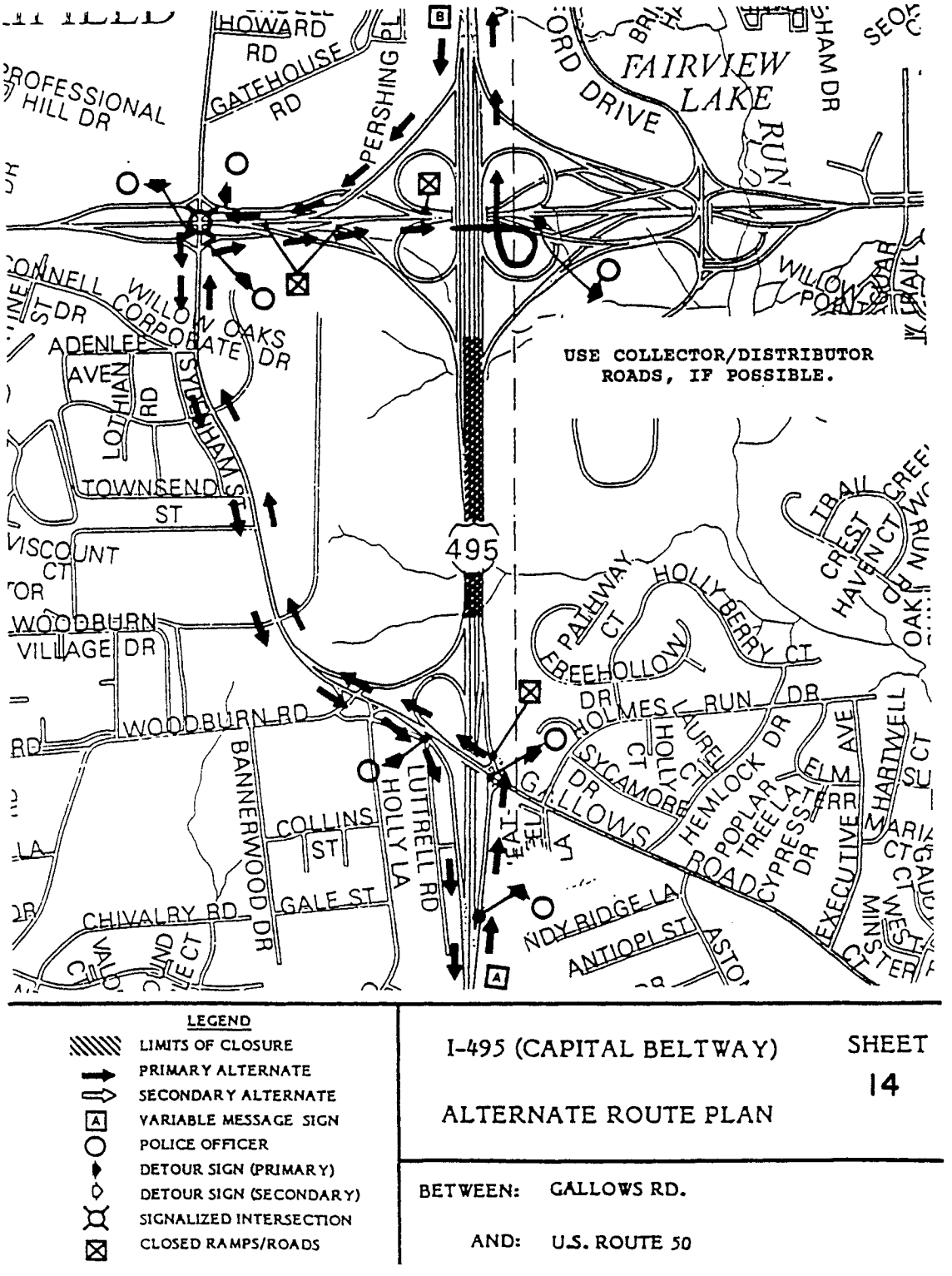


Figure 4. Alternate route map.
Source: *Northern Virginia Freeway Management Team Operating Manual.*

trol layout for total closure is shown in Figure 5. Every attempt is made to use variable message signs at the road closure and at the major decision points or interchanges.

Traffic Signals Along The Alternate Route

Because of the large increase in traffic, the signal system on the alternate route will not function efficiently and should be manually controlled to facilitate flow. The alternate route should be given as much time as possible.

Guidelines For Contacting Agencies

The operation manual contains a list of phone numbers for key personnel and equipment available within each agency. The lines of communication are well established for police, fire, and emergency agencies, and individuals and agencies to be contacted are available at the various communication centers. It is important that jurisdictions affected by traffic congestion keep in routine contact with each other because the lines of communication between jurisdictions are not as well established with regard to problems of congestion.

Hazardous Materials

When responding to an incident, the first responder should consider the possibility of a hazardous material being involved. Hazardous materials can sometimes be identified by placards on a vehicle; however, not all hazardous materials are identified, and caution should be used when in doubt. The appropriate fire department should be informed when hazardous materials are present.

Appendix A contains guidelines for the first responder to a potential hazardous-material incident. Some of the steps listed are appropriate only for personnel trained in handling hazardous materials and should not be attempted by others.

Debriefings

Debriefings are an important aspect of the incident management program since they allow all those involved in the incident to meet and critique the decisions and procedures used in responding to and managing it. This communication within the agencies along with the refinement of the incident management program results in more effective procedures. Typically, debriefings occur only after major incidents; however, lessons may be learned from other incidents.

Major Incidents

Command Posts

At major incidents, a command post may be established as a center of communications. The command post could be a location as simple as the hood of a pa-

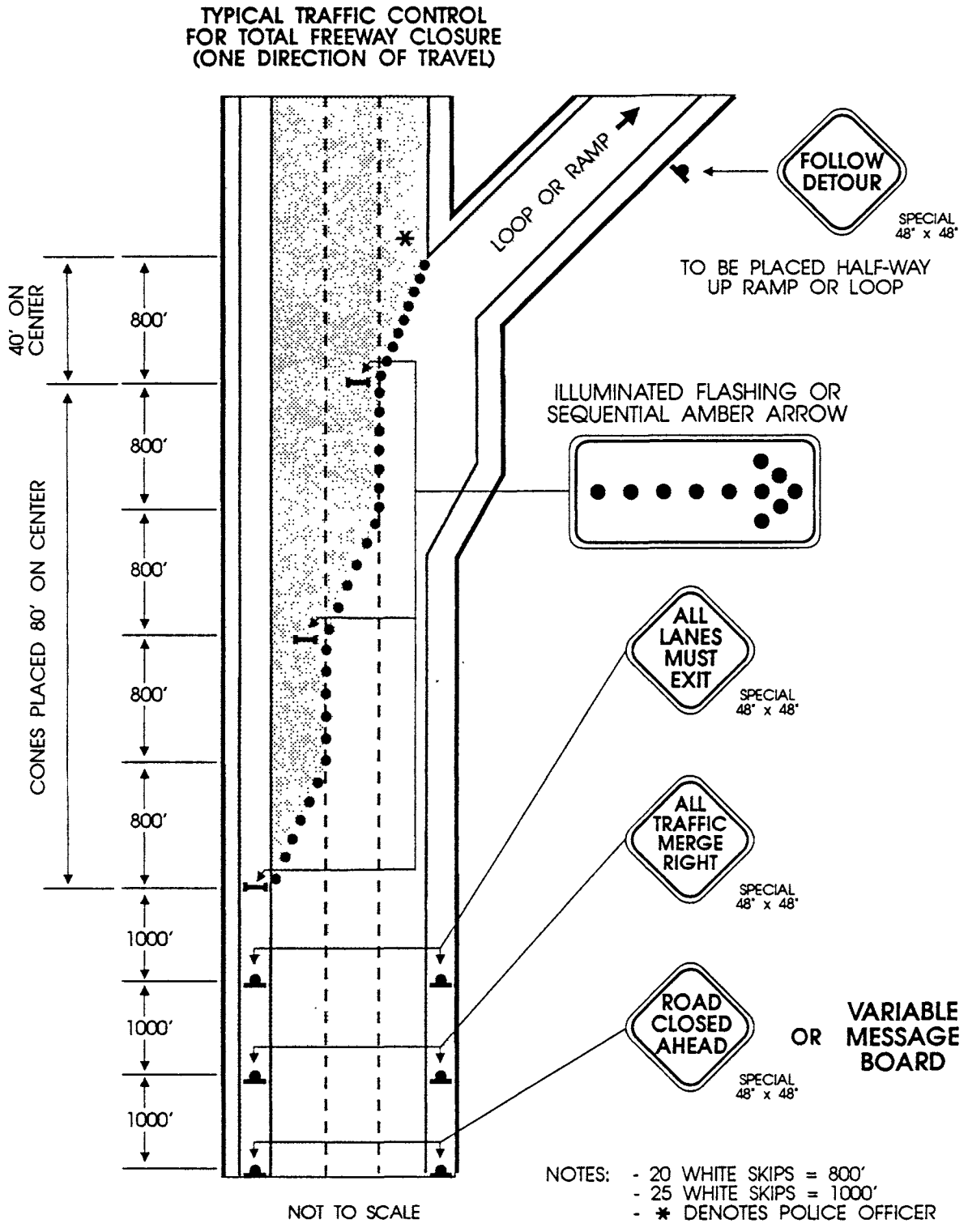


Figure 5. Typical traffic control for total freeway closure.
Source: *Richmond Metropolitan Area and Petersburg/Colonial Heights Metropolitan Area Incident Management Operations Manual.*

trol car or it could include the use of a mobile communications unit, depending on the magnitude of the incident. In either case, the location of the command post should be easily identifiable by agency personnel approaching the scene. The existence and location of the command post should be communicated so that support personnel such as VDOT employees know exactly where to report. At a major incident with many pieces of VDOT equipment, a staging area for VDOT vehicles and personnel will be needed.

Staging Areas

At major incidents, substantial amounts of equipment will be involved. However, the equipment is not usually needed at the scene of the incident at one time, but different pieces are used at different times. To keep the equipment and associated personnel from creating additional confusion at the scene, a staging area should be established. VDOT will often be one of the primary users of the staging area when supplying cleanup equipment to other agencies. The selection of the staging area should be a joint decision of the incident commander and the agencies using the staging area. Normally, the staging area will be a right or left shoulder of the freeway within one-half of a mile of the incident site. Good communication between the incident command post and the staging area is vital. It is also important that the personnel bringing incoming equipment to the staging area be told exactly where the staging area is located. The staging area should be situated so that agency vehicles do not have to weave across major traffic flows.

Interaction with the Media

Media contact at a major incident should be handled through a designated public relations person at the scene. This will enable information to get out to the public quickly while keeping pressure off the individuals most directly involved in responding to the incident. Providing the media with accurate, timely updates on traffic conditions and expected actions is an important part of reducing the impact of a major incident on areawide traffic congestion. If the media are present at the scene, information can be released there. Otherwise, key radio stations should be notified directly by police personnel.

Accident Investigation

When it is necessary to investigate an accident, it should be done as quickly and safely as possible. Conducting an accident investigation on the shoulder can have a significant impact on traffic backups, especially during rush-hour. If possible, the investigation should be conducted completely off the freeway. If it is necessary to conduct the investigation on the freeway, it should be done quickly and cause as little disruption as possible. Also, the rapid response of wreckers for towing vehicles is important in minimizing congestion.

Northern Virginia Incident Management Team

An incident management team has been organized in Northern Virginia with the following command guidelines. If an incident occurs necessitating responses from several agencies to a central location, then the following should take place:

- Command level representatives from these agencies will meet at the incident command post for the purpose of coordinating agency resources and responses.
- Agency representatives will bring together the Incident Management Team
  - — to arrive at decisions for the resolution of problems relating to interagency coordination and utilization of resources
  - — to coordinate each agency's role with other agency representatives to ensure expedient resolution of the incident and avoid duplication of effort
  - — to ensure safety of agency participants and the general public through coordination of incident related activities
  - — to coordinate media information releases to ensure accuracy and timeliness.

Hampton Roads Bridge-Tunnel

The Hampton Roads Bridge-Tunnel (HRBT), which is the only interstate link across the Hampton Roads Harbor, is a location in which serious congestion occurs. Given the rapid growth of the area, the congestion during peak periods, and the significant increases in tourist traffic during the summer when the beaches are open, any restriction in traffic flow leads to congestion and long delays. Last year 4,551 incidents occurred on the HRBT. (See Appendix B for a summary of incidents.) They ranged from disabled vehicles to major accidents. An estimate of the impact of these incidents is given in Table 1. The incident time includes the time between first identifying the problem and clearing it. Incident management at the tunnel includes two primary goals: (1) the reduction of factors contributing to incidents and (2) the effective management of the response to these incidents once they have occurred.

In addition to the ongoing efforts to reduce congestion, a HRBT Advisory Committee was established in June 1988 for the purpose of improving the management of traffic through the tunnels in Tidewater. Representatives from the cities of Hampton, Norfolk, Portsmouth, and officials from the Virginia State Police and Virginia Department of Transportation comprise the advisory committee.

Reduction of Incident-Causing Factors

Since the parallel tunnel at the HRBT was opened in 1976, traffic on the 3.5-mile facility has increased an average of about 10 percent per year, with 1987 daily traffic volumes reaching 92,500 vehicles. Many efforts have been initiated in an attempt to reduce congestion and incidents. A stoppage on the facility results in a major disruption, often causing six-mile backups on each approach along with traffic problems in the surrounding Willoughby section of Norfolk.

Table 1

HAMPTON ROADS BRIDGE TUNNEL TRAFFIC FLOW ANALYSIS

INCIDENT IMPACT AT CAPACITY

Incident	Incident Time (Minutes)	Shock Wave Length[1] (Miles)
Nonaccident (flat tire, overheating, etc.)	5 – 7	1.25 – 1.75
Accident without injury	10	2.50
Accident with injury	25	6.25

[1]Field observations indicate that the average shock wave travels 15 mph under capacity conditions.

Traffic congestion at the bridge-tunnel results from five main causes:

- slow moving vehicles
- oversize vehicles
- vehicle stoppages
- capacity restrictions
- accidents.

The reduced width of the tunnel coupled with the phobias and tensions of first-time drivers, the 4 percent upgrade, and trucks and recreational vehicles cause traffic to slow, which often results in backups.

Vehicle stoppages are primarily caused by stalled vehicles that have gas and/or mechanical problems. These stoppages often cause the air temperature in the tunnel to increase especially during the summer months, thereby causing more vehicles to overheat, which causes additional stoppages. Another significant problem is the number of stoppages created because of the need to inspect and remove vehicles that are overheight or are transporting hazardous materials. Turning these vehicles around or entering them in the traffic flow after being inspected causes slow-downs and stoppages and can lead to backups. With traffic volumes often exceeding tunnel capacity, backups frequently occur because of rush hour traffic, traffic slowdowns, and vehicle stoppages. Serious tunnel and area-wide congestion often result from accidents. Major efforts have been initiated to lessen the impact of these congestion-causing factors.

Public Relations

The DOT has made a special effort to improve public relations and the dissemination of information through news releases and news conferences designed to advise local motorists of the congestion in the tunnel area and to point out alternate

routes that may be considered during congested periods. Local traffic reporters were invited to meet with VDOT personnel and to inspect the tunnel facility in an effort to improve their understanding of each others functions and thus improve communication.

Highway Advisory Radio

Six highway advisory radio stations operated by the Department are located at strategic route diversion points. The taped messages advise motorists in advance of congestion in the tunnel area. Also, recent radio messages include reminders to motorists of the importance of servicing their vehicles and driving safely.

Increased Visibility in the Tunnel

Visibility in the tunnel was enhanced by increasing the illumination and by a more rigorous cleaning process. This speeds up traffic flow while providing a safer driving environment.

Reduction of Stoppages

As noted earlier, stoppages are a prime contributor to tunnel delay, and a significant percentage of them are caused by restrictions imposed by the HRBT on overwidth and overheight vehicles. Once stopped and inspected, the slow moving truck must re-enter the traffic stream, which must be slowed or in some cases stopped. As a result of the HRBT Advisory Committee recommendation that reduced the overheight/overwidth restrictions, the number of truck stoppages at the inspection stations have sharply decreased, thereby reducing the congestion normally associated with stopping mainline traffic to allow re-entry of trucks into the traffic stream.

Traffic Information

Because of the large number of calls to the control room for traffic information, an automated four-line digital telephone announcer was installed in 1988 along with a new telephone system that permits direct inward-dialing. In 1989, a cellular toll-free telephone system was installed to allow potential users to receive real-time traffic information updated every 15 minutes during peak periods, and there has been significant use of the system (see Table 2).

In August 1989, only 327 calls were from outside the area, indicating that this service is being highly utilized by commuters, local citizens, or tourists already in the area.

Emergency Pull-Outs

Providing emergency pull-outs on the approach bridges to the tunnel has a significant effect on traffic flow since the majority of disabled vehicles can safely stop out of the travel lanes. More pull-outs or a continuous emergency lane would be of benefit on the westbound approach.

Table 2

USE OF THE CELLULAR TELEPHONE SYSTEM

Month/Yr	Total Messages
Jan 89	14
Feb 89	1,084
Mar 89	3,049
Aug 89	26,161
Oct 89	7,968

Expediting Weekend/Holiday Traffic Flow

To expedite traffic flow through the Hampton Roads Bridge-Tunnel on weekends (Friday through Sunday), the Operations Department assigns extra available patrollers to wave traffic on and to help disabled or lost motorists. Also, extra emergency crewmen are assigned to key locations. Safety service patrols are assigned on schedules of 8:00 A.M. to 4 P.M. and from 4:00 P.M. to 12:00 midnight. If traffic warrants, all or part of these extra patrollers, emergency crewmen, and safety service patrol operators are held over their scheduled time until traffic holdups are cleared and traffic resumes its normal flow.

Reduce Driver Distraction

Scenic views or roadside activities, which greatly distract drivers from monitoring the roadway ahead of them, lead to reduced traffic flows and rear-end accidents. Where possible, roadside activities are reduced to a minimum. For example, roadside repairs are performed during off-peak periods; disabled vehicles or those involved in accidents are removed from the roadside as quickly as possible; and drivers' views of distracting activities are shielded.

Alternate Routes

Based on the recommendations of the HRBT Advisory Committee, a program was implemented to mark alternative routes for motorists to avoid delays at the tunnel during the hours of peak traffic volume or periods of congestion. Drivers traveling from North Carolina or Virginia Beach to Hampton or Williamsburg can follow blue and gold or red and gold signs leading them along an alternative route. Brown and gold signs lead motorists to the Outer Banks, and green and gold signs direct travelers onto Route 460 to Petersburg or Richmond.

About 250,000 brochures explaining the program have been distributed to tourist information centers and hotels from Nags Head (N. C.) to Williamsburg. The brochure (see Figure 6) has a map of the Hampton Roads area and explains

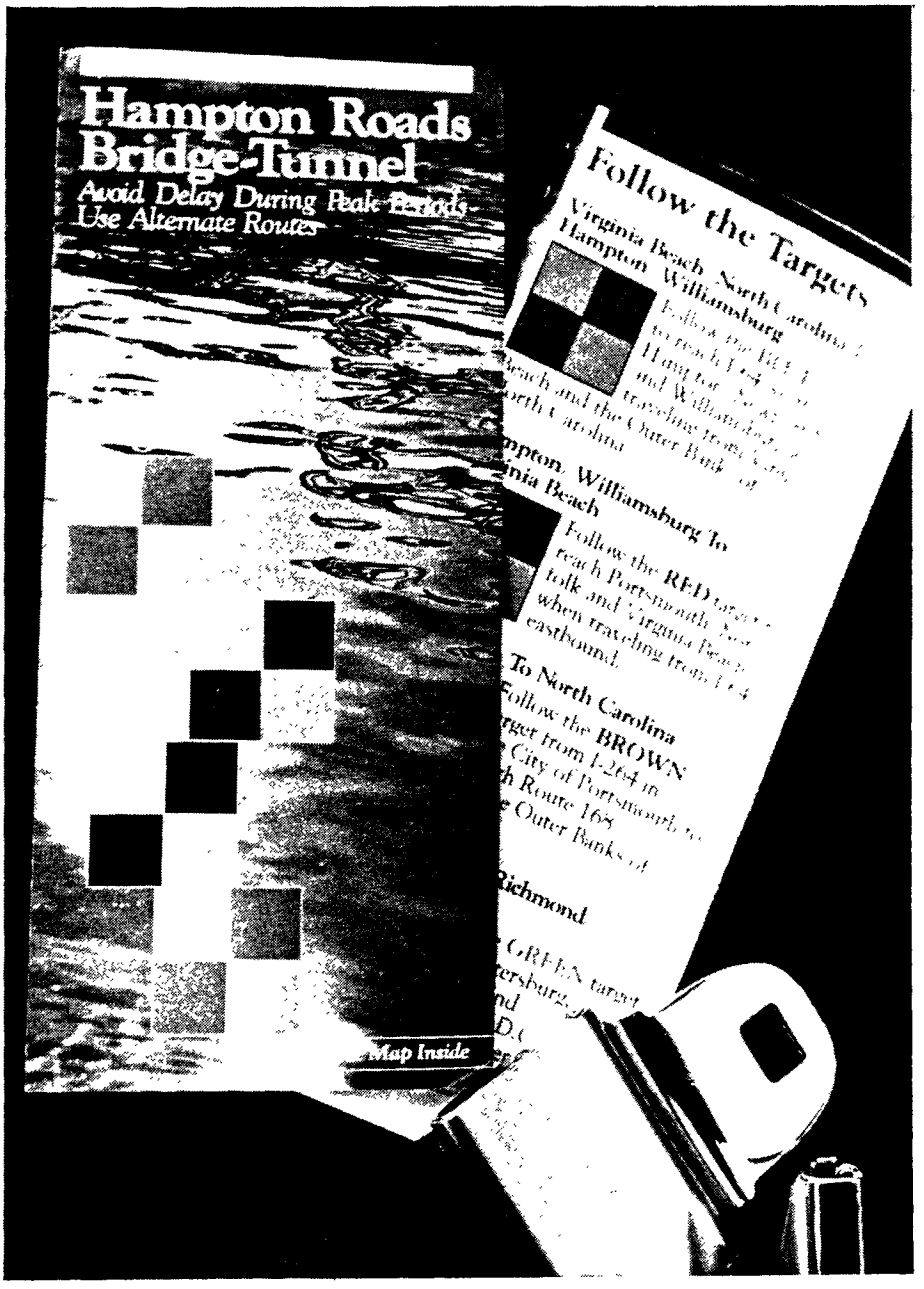


Figure 6. Alternate routes brochure.

how to follow the targets shown on the map. Use of the alternate route can add up to 30 minutes to a trip; motorists, however, won't be sitting in stop-and-go traffic.

Incident Management Procedures

There are several ongoing procedures that are used for incident management for the HRBT.

Traffic Management System

Incident detection is very important, and the traffic management system (TMS) for the HRBT provides T.V. monitoring of traffic lanes and tunnel entrances. Also, graphic displays show all traffic conditions throughout the tunnel and roadways. A control console provides override and manual control of the fully computerized system. Operators can reprogram the system, change speed limits, reroute traffic, and switch T.V. cameras as traffic conditions require.

Since 1984, additional closed circuit T.V. cameras have been installed on the Hampton and Norfolk shores to aid in the detection of traffic stoppages and accidents. Additional vehicle loop detectors and variable message signs were also installed on the tunnel's approaches, along with an upgrade of traffic programs to be more responsive to the increased traffic.

Response and Removal of Incidents

Fast response to incidents is critical to good traffic flow through the HRBT, and there are several procedures to expedite it.

Quick response by the police is important as it allows vehicles to be removed as soon as possible. In addition to police cruisers, four State Police motorcycles are stationed at the tunnel to provide quicker access to the incident site during periods of heavy congestion.

After detection, the quick removal of vehicles is important in minimizing the backup associated with incidents. The HRBT has three wheel-lift wreckers, two intermediate size wreckers, and two short-wheelbase wreckers (40,000 pound capacity) for towing large trucks. During peak traffic periods, the normal two wreckers are increased to five wreckers to improve their response time. To expedite the removal of vehicles from the roadway, the Department has an agreement with the Department of State Police that allows the wreckers to remove vehicles when there are no personal injuries.

For the normal removal of a vehicle that blocks one lane in the tunnel or on the bridge, an emergency crewman is dispatched with an appropriate size wrecker with the normal flow of traffic. Traffic signals are set on red to close the lane in which the disabled vehicle has stopped. The traffic signals on the other lane are set on amber. When the emergency crewman arrives on the scene, he positions the wrecker in front of the vehicle, prepares the vehicle for towing, and then tows the vehicle out of the tunnel or off of the bridge. For vehicles with flat tires, the emer-

gency crewman determines whether the vehicle can be towed normally or whether a dolly is needed to remove it.

For removal of vehicles that block both lanes in one of the tunnels, traffic signals in both lanes are set on red. The tunnel is cleared of all vehicles ahead of the accident, and wreckers are dispatched into the tunnel traveling against the normal flow of traffic. When the wreckers arrive on the scene, they will turn around and prepare the vehicles for towing. If any other emergency services are needed, the emergency crewman will notify the Control Room. The vehicles are then removed from the tunnel.

For removal of vehicles that block both lanes of a bridge, the wrecker will be dispatched with the flow of traffic using the emergency lane if an emergency lane is provided. Both lane traffic signals will be set on red. When the wrecker arrives on the scene, the emergency crewman will request other emergency services if needed. The emergency crewman will prepare the vehicles for towing and then tow them to one of the tunnel islands.

For removal of vehicles that block both lanes of the bridge (when an emergency lane is not provided), the traffic signals in both lanes will be set on red. When all traffic ahead of the accident vehicles has cleared the bridge, the wreckers will be dispatched against the normal flow of traffic. Emergency Services will be at the scene and prepare the vehicles for towing. The vehicles will then be towed to one of the tunnel islands.

OTHER INCIDENT MANAGEMENT INITIATIVES

In addition to the formal incident management programs for the major metropolitan areas, other initiatives within the state have been implemented by VDOT, the VSP, and city agencies.

Virginia Department of Transportation

The VDOT, in addition to being involved in the formal incident management program mentioned above, has been active in other areas.

District Incident Management Program

The nine districts within the VDOT were requested to submit incident management plans that included closure layouts, trail blazer signs for detours, and telephone numbers of key contact personnel. The Bristol and Fredericksburg programs are outlined below.

Bristol

The incident management program in the Bristol District includes an incident management team consisting of VDOT personnel, Bristol fire, police, traffic engineering, and rescue, and the VSP. Also, a response team has been established. A manual has been printed that includes the following:

- names and phone numbers of the management team
- names and phone numbers of the response team
- suggested traffic diversion plans for potential incident locations
- traffic control layouts for right, left, and complete lane closures
- listing of all major newspapers, radio stations, and television stations
- location and capacity of hydrants available to I-81.

The response team is called if police officers determine that the incident will last for more than one hour. The team meets every month to discuss past incidents and revise procedures. Each residency has a mini-team that can handle short-term incidents, and each residency is equipped with sign trailers and two variable message boards.

There have been two major incidents on Interstate 81 involving fire and explosion, and the District's handling of the incidents was commended.

Fredericksburg

The Fredericksburg District developed an incident management plan for I-95, which provides a concise, easy-to-follow traffic control plan for incidents that require the closure of I-95. A manual is available that provides:

- names and telephone numbers of contact persons
- lane closure and trail blazer information
- sign layouts for each I-95 interchange in the district.

Following a major freeway incident in March 1989, when the Interstate was closed for 17 hours because of a hazardous material spill, VDOT traffic and maintenance personnel, State Police, emergency, medical, fire, rescue, and state and local hazardous materials coordinators met to critique their response. Some of the insights that issued from this debriefing were as follows:

- There was an inadequate number of variable message signs. Thus, 11 new signs have been purchased and are available at each headquarters along I-95. Trucks have been modified for towing the signs.
- There was a problem with radio communication between the VDOT and State Police. Communication is extremely important, so a command center would be a big asset in handling such major incidents.

- It is important that the proper signs at specified locations be checked.
- Keys for traffic signals should be made available to appropriate individuals, especially the State Police.
- Some layouts and traffic control needed to be revised.

This critique was very beneficial in improving the incident management plan. The importance of meeting after major incidents or periodically cannot be overstated. There is always something to learn because of the variability of incidents.

Traffic Management System

In Northern Virginia, about 200,000 vehicles use the I-395 and I-66 corridors daily. The VDOT has developed a comprehensive traffic management system to reduce congestion on these two major interstates. The TMS system plays a significant role in reducing the time it takes to detect and remove an incident and vehicles from the interstate system.

The TMS gathers traffic data in the form of vehicle volume and speed by using 550 traffic loops embedded in the traffic lanes and entrance ramps. Thirty-eight closed circuit television cameras (CCTV) placed at key locations along the two interstates allow traffic managers to monitor traffic inside the control center for traffic congestion, accidents, and disabled vehicles. If an accident occurs within the range of the cameras, the control center has the capability to zoom in with the camera to get a close-up view of the situation. There are 72 changeable message signs that can be changed by remote control to display a variety of messages to motorists. A State Police area headquarters is also located in the building for quick response to accidents, traffic delays, and other incidents.

A daily log is kept in the TMS control room to record each incident that occurs on I-395 (6 lanes, 11 miles long, ADT 140,000 vehicles). The information recorded includes the following:

- Date
- Location/route
- Type/description of problem
- Time
  - — detected
  - — reported
  - — arrived/who arrived
  - — cleared
- Notification

- Signs available
- TMS operator

In 1987, a total of 765 lane-blocking incidents occurred:

- 333 minor accidents that required no emergency vehicles or towing service
- 91 major accidents with personal injuries that required towing service
- 98 incidents in which the driver solved the problem and drove off
- 203 incidents that involved disabled vehicles.

Table 3 shows the number and type of incidents recorded and the number of lanes blocked. Nineteen percent of the incidents involved trucks even though trucks make up only 5 percent of traffic on I-395.

Table 3

LANE BLOCKING INCIDENTS IN 1987

No. Lanes Blocked	Type of Vehicle	
	Car	Truck
1	514	156
2	67	18
3	—	—
Road closed	5	5
Total	586	179

In Northern Virginia the detection time, which is the time from the occurrence of an incident to the time of police notification, is about 7 to 8 minutes, however, with the TMS facilities the detection time is decreased to 2 to 3 minutes.

A study[3] by the State Police found that the average response time, which is the time from police notification to arrival on the scene, is 14 minutes. The response time exceeded 20 minutes 25 percent of the time and often exceeded an hour.

Records[3] indicate that the average clearance time for a one-lane blockage is 29 minutes, whereas two lanes are blocked, the clearance time is approximately 47 minutes.

Service Patrols

Recent research[4] suggests that the single largest category of incidents is daytime, non-lane-closing disablements and other incidents, which account for almost half of all incident duration. Although minor, these types of incidents have a significant effect on traffic congestion. Because of their large number, any reduction in

the average duration of disablements would significantly reduce total incident duration.

In Northern Virginia, service patrols have taken on the task of responding to incidents. The number of incidents responded to and the expansion in Northern Virginia attests to this need and their effectiveness. Since 1984, when the patrol had two pickup trucks and worked the Capital Beltway Monday through Friday 4:00 A.M. to 8:00 P.M., it has been expanded to seven vehicles working 4:00 A.M. to 8:00 P.M. and three vehicles working 8:00 P.M. to 4:00 A.M. Monday through Friday. The routes have been expanded to include:

- I-66 from the District of Columbia Line to the Springfield Bypass intersection
- I-66 from the Springfield Bypass intersection to the Fauquier County line
- I-395 from the Springfield Split to the District of Columbia Line
- I-95 from the Springfield Split to the Occoquan River Bridge
- I-95 from the Occoquan River Bridge to the Stafford County Line
- I-495 from the American Legion Bridge to Route 236
- I-495/I-95 from Route 236 to the Woodrow Wilson Bridge.

The vehicles are 1/2-ton pickups and are equipped with gas and diesel fuel, oil, water, air, bumper jacks, standard and metric lugwrenches, fire extinguishers, flares, brooms, "Stay-Dry" (for gasoline and oil spills,) and arrowboards. The trucks are equipped with two radios, one for communicating with VDOT and the other for direct contact with the Virginia State Police (trooper and/or dispatcher). If they are the first on the scene at an accident site, the patrol unit will set up temporary traffic control and contact the appropriate agencies. The magnitude of assistance can be seen from Table 4, which gives the number of incidents attended and the type of service rendered for June 1988 when there were only three vehicles working from 4:00 A.M. to 8:00 P.M.

Table 4

SAFETY SERVICE PATROL ASSISTANCE IN JUNE 1988

Type Incident	Vehicle Type					Total/%	Wrecker called
	Car	Bus	Truck	Tractor Trailer	Other		
Abandon	323	3	32	9	63	430/35	2
Mechanical	170	2	34	12	34	252/21	84
Tire	94	4	17	9	27	161/13	10
Gas	78	—	5	—	21	104/9	4
Water	65	26	2	3	5	101/8	2
Accident	42	1	7	1	1	52/4	4
Other	64	24	6	3	18	115/10	5
TOTAL	836	60	103	37	179	1215	111

Traffic Control During Construction

The "Task Force on Traffic Management During Construction or Reconstruction" was established by VDOT to address traffic management problems associated with major projects. It was to focus on incident management and motorist information systems. Considerations included alternate routes, police patrols, wrecker service, staging areas, service patrols, highway advisory radio, pull-offs, public relations, etc.

Statewide Seminars and Workshops

Upon initiation of the statewide incident management program, a special effort was made by VDOT to provide one- and two-day seminars and workshops around the state. It was felt important to get the different disciplines who are involved in incident management together and to make them aware of the consequences of incidents and how to manage them. It is anticipated that the seminars and workshops will continue; however, they will focus on the smaller urban areas.

Future Research

The state recently made a video concerning incident management in Virginia, which includes much of what is being presented here. This is being produced for the Federal Highway Administration for an upcoming workshop, which will be offered around the nation. This video will also serve as a valuable informational and public relations tool. A copy of the video entitled "Relieving Traffic Congestion Through Incidnet Management in Virginia" may be obtained by contacting the Safety and Systems Application Division of the Federal Highway Adminstration in McLean, Virginia.

Another ongoing research project entitled "Urban Congestion Alleviation Demonstration Projects for the Capital Beltway" investigates new technologies for real-time incident detection, reporting, and response. The VDOT along with the Research Council is involved in the development of a freeway surveillance system based on the use of video detection technology. This study involves the demonstration and evaluation of the system's capabilities for detecting incidents, and it will be installed on I-95 in the vicinity of the Woodrow Wilson Bridge.

The Research Council is in the process of initiating a study that will focus on incident management for smaller cities and urban areas and will analyze the problem through case studies drawing on the experience gained from existing incident management endeavors in Virginia. It is hoped that two to three seminars can be held in Virginia to provide information to localities.

Virginia State Police

The VSP have been working closely with the VDOT in initiating the formal incident management program and this cooperation and communication has re-

sulted in more effective incident management statewide. The VSP have always been involved in incident management since they are the primary force dealing with incidents on the state highways. In addition to handling incidents, the VSP have initiated various procedures in dealing with incidents and some of these will be discussed here.

Motorist Assistance Program

The VSP recently initiated a motorist assistance program in the Richmond area to respond to disabled vehicles during peak periods of traffic flow. The motorist assistance vehicle is an old police cruiser that has been equipped in such a manner that it can be of assistance to disabled vehicles. This program uses civilian employees at about one-half the cost of law enforcement officers. The program's objectives are:

- to reduce traffic congestion and vehicle hours of motorist delay caused by traffic hazards through earlier detection and rapid removal of vehicles from the roadways
- to reduce the number of secondary or subsequent traffic crashes directly or indirectly caused by these hazards
- to reduce the amount of time expended by troopers handling such hazards or incidents
- to compare response times of this program with the Department's current response times using only troopers on regular patrol
- to reduce the cost of performing duties that do not require the powers of a sworn law enforcement officer by using part-time or lower-salaried civilian employees
- to reduce the cost of responding to such incidents through the use of equipment that is less expensive than that required by troopers.

Pilot testing of this program in the Richmond area will take place on the following routes:

- I-64/Quioccasin to I-95 at Exit 15A, 9.1 miles one way; carries an average of 30,000 vehicles per day
- I-95/I-64 Interchange to RMA Expressway, 3 miles one way; carries 47,000 to 61,000 vehicles per day
- Richmond Downtown Expressway, 3.5 miles one way; carries approximately 35,000 vehicles per day
- I-95 at Parham Road to I-95 at Maury Street Exit, 10 miles one way; carries 53,000 to 99,000 vehicles per day

- I-95/I-64 Interchange to I-64/Nine Mile Road, 5 miles one way; carries approximately 35,000 vehicles per day.

The last full year of statistics showed 19,298 assists to motorists, averaging 13 minutes each. Time expended in responding to such incidents was not included. Also, these figures do not include the incidents to which local police responded. The VSP motorist assitance program has been expanded to Northern Virginia.

Motorcycle Patrol

The Virginia State Police has started a program of motorcycle patrols on heavily traveled interstates in Northern Virginia, Hampton Roads, and Richmond. Nine troopers make up the Northern Virginia squad, seven troopers are part of the Hampton Roads patrol, and Richmond has eight troopers. Motorcycles have become quite useful in helping police get to problem areas such as traffic tie-ups and accidents more quickly than in patrol cars. During rush-hour gridlock or when accidents stall traffic, the motorcycles can ride the shoulder and median strips or get through toll plazas, which allows them to respond faster. Also, motorcycles have lower visibility than the cruiser and attract less attention, resulting in fewer "rubberneckers."

Push Bumpers

Push bumpers are used on marked State Police vehicles and have been very helpful in clearing disabled vehicles from the traveled portion of a roadway. The disabled vehicles' operator/owner must consent to being pushed by the police vehicle. Vehicles are pushed from the point of stoppage in the traveled lane to the closest safe shoulder.

Wrecker Service

The timely removal of vehicles from the highway is important in minimizing delay. Wreckers are often used in towing disabled or wrecked vehicles. The following general guidelines have been established by the VSP to allow vehicles to be moved in a more efficient manner.

- An owner or operator at the accident scene will be asked what wrecker he or she desires and an attempt will be made to secure it. If the wrecked vehicle is a definite traffic hazard and the requested wrecker is a considerable distance and another wrecker can be obtained much closer, then the closer wrecker will be called. If the owner is absent or incapable of normal conversation, a wrecker from the nearest place of business will be called.

- In small towns where there are several places providing wrecker service, each approximately the same distance from the scene of the accident, calls for wreckers will be split on an equitable basis.

- A permanent written record is kept of the date, time, and firm name, and who requested the service. If the owner's request was not complied with, it is determined why it wasn't. If the call was from the investigator and it was not to the nearest wrecker service, it is determined why it wasn't.

In urban areas where expeditious wrecker service is critical to restoring traffic flow to normal, the above guidelines may be adjusted.

Fairfax County Police Department

Fairfax County has over 700,000 people and, with its proximity to Washington, D.C., has its share of traffic incidents. In 1986, the Public Safety Communications Center (PSCC) was opened to provide computerized dispatch for all police, fire, and rescue service. The PSCC enables the Police Department to dispatch officers and rescue personnel more efficiently; it also enables the Police Department to better track accident and traffic control activity.

Incidents that are pending for dispatch are sorted by priority and time and presented to the dispatcher for selection and subsequent dispatch. When an incident is selected for dispatch, the system takes into account a variety of considerations such as status of units, priority, etc. and automatically recommends the unit for dispatch.

Information is received in the unit on the mobile data terminal shown in Figure 7. The initial dispatch message provides the officer with such information as: event type, priority, urgency, location, complainant's name, address, phone number, remarks, and other units responding. The officer is alerted to the dispatch by a buzzer, the event appears on the screen and his status is set or "dispatched." By pressing a status key, the officer indicates they are "enroute," "on scene," or "in service." Other function keys permit the officer to indicate their availability, whether they are out of their vehicle or unable to handle a dispatch.

To better handle traffic problems, a Traffic Information Center (TIC) was established in 1988. The TIC is staffed Monday through Friday from 6:30 to 8:30 A.M. and 3:30 to 6:30 P.M. and coordinates the department's fleet of patrol cars, motorcycles, and helicopters with the PSCC and advises them of methods to utilize resources most effectively. By carefully monitoring activity on the dispatch console video monitor (see Figure 8), TIC members can follow the course of traffic incidents accurately and can send instructions to the units and receive messages via monitor. Particular concern is paid to how quickly a traffic problem can be rectified.

The TIC monitors the VSP activities and traffic in adjacent jurisdictions, such as Alexandria and Arlington. Also, they help coordinate efforts with VDOT, which helps minimize the time required to clear accidents and respond to a number of problems that delay traffic. Direct telephone lines with VDOT help ensure rapid response to needs for light repair, salt/sand, or sign repair. Events are logged and reviewed every two weeks to ascertain locations that habitually exhibit congestion

Figure 7. Mobile data terminal.

Figure 8. Dispatch console video monitor.

or have high accident rates. A VDOT liaison officer is assigned to monitor these areas to determine whether roadway improvements or enforcement is necessary to expedite traffic flow.

The centralized motorcycle response capability, which consists of 21 cycles (6 to 8 on the road at a time), has enabled officers to respond rapidly to accidents, since they can maneuver through dense traffic jams easier than patrol cars. This rapid response helps decrease traffic congestion and facilitates the removal of wrecked automobiles.

Also, the Helicopter Division plays a critical role since they can observe jammed areas from the air and recommend that wreckers and rescue units be dispatched immediately. They can also give the TIC team an idea of the extent of congestion and the number of officers needed. The helicopter stays in constant communication with the TIC on a dedicated radio channel.

CONCLUSIONS

Why and how did incident management programs in Virginia get started? One only had to drive the highways in the urban areas or listen to the frequent radio "traffic reports" to know there was a serious problem with traffic congestion caused by incidents. With the realization that steps had to be taken to combat the problem, top officials from the VSP and VDOT established formal programs in Northern Virginia, Richmond, and at the Hampton Roads Bridge-Tunnel.

Formal Incident Management Programs

In Northern Virginia, a consultant was hired to work in conjunction with VDOT to develop an incident management program, whereas, in Richmond and Hampton Roads, VDOT spearheaded the effort. Once the decision was made to establish an incident management program, an important first step was the establishment of a task force or committee comprised of all agencies and disciplines that are involved with traffic congestion and that have the common goal of getting traffic back to normal as quickly and safely as possible.

This group is made up of individuals with a knowledge of the variables surrounding incident management, and they have the authority to make decisions. The meetings between these groups allows an awareness of each other's problems and provides a forum for discussing ways of working together more effectively. Knowing someone on a first name basis after being aware of and discussing their problems certainly sets the stage for meaningful and effective dialogues, initiatives, procedures, etc. for combating their common problems.

A primary objective of these groups is to establish procedures to be followed when an incident occurs. These procedures are typically found in a manual that

conveniently presents information on interagency responsibilities along with procedures for establishing alternate routes. This manual is the "bible" for handling incidents, and it is important that it have relevant information for incident management. It should include

- lines of authority to establish who is in charge
- responsibilities of agencies involved (in terms of personnel and equipment)
- when and how to establish alternate routes
- guidelines for contacting agencies (with telephone numbers of key personnel)
- procedures for handling hazardous materials
- guidelines for interacting with the media
- guidelines for debriefings.

This incident management process provides the framework for working together in a coordinated and cooperative manner to handle any type of incident.

The Hampton Roads Bridge-Tunnel advisory committee is a good example of a program set up to address incident management for a special facility. The membership from local and state agencies is supplemented with representatives from surrounding cities, the U.S. Navy, and local residents, all of whom have a common concern for the impact of traffic congestion and the improvement of the tunnel facilities.

This committee has been very active in discussing, recommending, and implementing many features that have been effective in reducing congestion. These efforts fall into two categories: (1) the reduction of incident-causing factors and (2) the institution of incident management procedures to expedite the response to incidents. Some of the changes implemented to reduce incident-causing factors are as follows:

- A toll-free telephone number was installed to allow free calls from anywhere in Virginia. Callers receive up-to-date, real-time traffic information updated every 15 minutes during peak periods. Also, signs were erected to encourage motorists with cellular telephones in their vehicles to call ahead for traffic information.
- Overheight and overwidth vehicle restrictions were reduced to allow free flow of trucks. This resulted in significantly fewer truck stoppages at inspection stations.
- Public relations were improved through news releases and news conferences that advised local motorists of tunnel congestion and alternate

routes. Also, traffic reporters were invited to meet with VDOT personnel and to inspect the tunnel facility to improve understanding and communications.

- Additional signs were erected, such as "Check Gas" and "Maintain 55 MPH," to remind motorists to check their fuel prior to arriving at the tunnel and to remind motorists to maintain the posted speed.
- Six highway advisory radio stations were located at strategic route diversion points to advise of congestion in the tunnel area.
- Emergency pull-outs were erected on bridge approaches to provide a refuge for disabled vehicles.
- Safety service patrols were provided from 8:00 A.M. to 12:00 midnight.
- A program was implemented to provide motorists with alternate routes to avoid delays during periods of congestion. Alternate route markers were installed at key points to guide motorists, and 250,000 brochures were distributed to show the alternate routes and give instructions for using them.

There are also ongoing procedures that are used for incident management:

- Incident detection and monitoring is achieved by the Traffic Management System, which utilizes T.V. monitoring and graphic displays. Also, operators can reprogram the system, change the speed limit, and reroute traffic.
- Police cruisers and motorcycles are stationed at the tunnel to provide quicker access to incidents.
- Special procedures and vehicles are used for expediting the response to incidents in the facility.

Other Incident Management Initiatives

In addition to these formal incident management programs, other initiatives within the state include the following:

- The nine districts within VDOT have incident management plans for the major highways. These include closure layouts, trail blazer signs, and telephone numbers of key contact personnel.
- A Traffic Management System in Northern Virginia uses 550 loop detectors and 38 closed circuit television cameras to allow traffic monitoring for incident detection, response, and removal. Also, there are 72 changeable message signs, which can be remotely controlled to display a variety of messages.

- VDOT service patrols in Northern Virginia have been effective in lessening the impact of the largest category of incidents, i.e., non-lane-closing disablements. The pickups used in these patrols are equipped with gas, diesel fuel, oil, water, air, jacks, and radios for communicating with VDOT and VSP.
- VSP initiated a popular and successful motorist assistance program using old police cruisers and civilian employees to assist typical disablements.
- Motorcycles have been used by the VSP as a means of faster response to incidents since they have the ability to maneuver and travel areas inaccessible to patrol cars.
- VSP push bumpers have been very helpful in clearing disabled vehicles from the traveled portion of a roadway, thereby reducing the clearance time.
- Guidelines have been established for wrecker services to allow vehicles involved in incidents to be moved in a more organized and efficient manner.
- A primary example of a county getting involved in incident management is Fairfax County, which, along with its involvement in the Northern Virginia Freeway Management Team effort, has initiated successful procedures for dealing with incidents. A Traffic Information Center was established that coordinates the county's fleet of patrol cars, motorcycles, and helicopters in the event of an incident. Video monitors at the center and in the patrol cars allow dispatch information to be efficiently transmitted and received. This coordination along with the communications with VDOT and adjacent cities help minimize the time required to respond to incidents and to clear disabled vehicles and other obstructions.
- From the onset of this concentrated effort to manage incidents statewide, there have been seminars, workshops, and conferences around the state that described to different disciplines the consequences of incidents and provided a forum to meet and discuss problems and to understand incident management and how to implement it.
- Research is continuing and will concentrate on improving current incident management procedures.
- Incident management task forces or teams meet frequently to update and refine their program while critiquing past efforts.
- The different disciplines continue to discuss the problems and ways of working together to lessen incident-caused delay. A good example was a recent statewide conference in which a full day was devoted to formal panel discussions of incident management. VDOT, VSP, and city and county agencies had a chance to ask questions, share experiences, and get to know each other better.

Incident management in Virginia has included the procedures involved in the prevention of incidents and the procedures involved in saving time detecting and responding to incidents and clearing the consequences of incidents after they occur. A VDOT employee recently commented that "the key is to have a plan, and be able to communicate with other agencies involved in incident management, and have the necessary equipment to handle the incident in terms of clearing it and handling traffic."

REFERENCES

1. Lindley, Jeffrey D. January 1989. "The Urban Congestion Problem," Transportation Research Circular No. 344. Washington, D.C.: Transportation Research Board.

2. Ropet, D. H. December 1987. "Incident Management," Transportation Research Circular No. 326. Washington, D.C.: Transportation Research Board.

3. Lawrence, C. 1988 "Shirely Highway Incident Study," Richmond: Virginia Department of Transportation.

4. Giuliaho, G. June 1988. "Incident Characteristics, Frequency, and Deviation on a High Volume Urban Freeway," Irvine: Institute of Transportation Studies, University of California

APPENDIX A

The HAZMAT Resource Inc.
PLANNING, TRAINING, COMMUNICATING SPECIALISTS
2100 Raybrook, S.E , Suite 109, Grand Rapids, MI 4950

A Hazardous Materials Incident
1st Responder Study/Reference Guide

When responding to any accident, spill or fire scene, the first responder should always ask himself...

Might this be a HAZARDOUS MATERIALS INCIDENT... containing Flammable, Toxic, Reactive or Corrosive materials??

If the possibility exists, the First Responder...
SHOULD

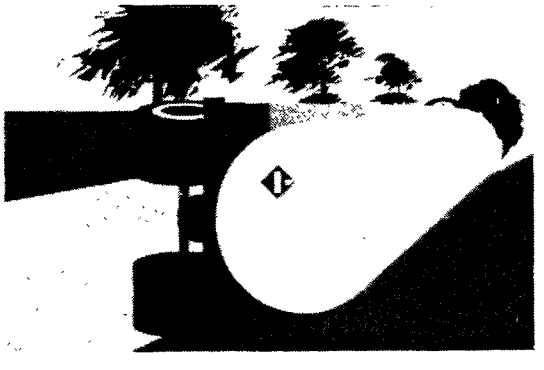
A. APPROACH and Remain... UPWIND.
B. Secure the Scene... check for ignition sources
C. IDENTIFY... from a distance, using binoculars if possible.
D. COMMUNICATE... to your dispatcher what you are able to identify from a distance.

1 IDENTIFICATION PROCEDURE

1. Locate any SHIPPING PAPERS if available from carrier personnel.
2. If not available, the First Responder should REMAIN UPWIND and using binoculars...
   Locate a:
   - Placard or ID Number
   - Product Name
   - Carrier name
   - Vehicle Name
   - License Number
   - NFPA Identificaton Diamond* (for stationary storage tanks)
   - What is the Container Shape?

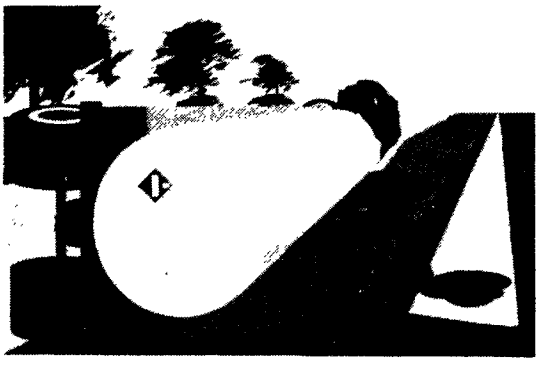
Communicate any of this information available to your dispatcher. He will contact other professionals, who **will** help.

2 IF YOU CANNOT IDENTIFY THE MATERIALS from a distance... which of these conditions exist?



A. With **no** LEAKS, SPILLS, FIRES or BADLY DAMAGED CONTAINERS:

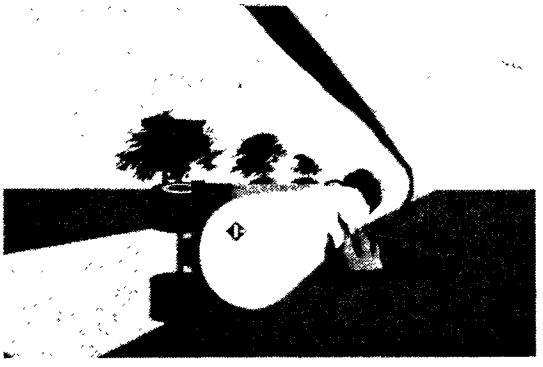
1. Approach Cautiously ... using self contained breathing apparatus & full fire turnout gear.
2. Obtain Needed Identification... from the site.
3. Withdraw All People... and communicate identification to your dispatcher.



B. With a LEAK, SPILL, but **NO FIRE**:
Approach ONLY with specially trained, properly trained personnel... to gain identification.

If those personnel are not available...

- consider down wind evacuation
- contact state agencies _____
  _____
  _____
- contact CHEMTREC 1-800-424-9300 for assistance.



C. When there's a CONTAINER WITH **FIRE** IMPINGING ON IT!

1. **Withdraw** from the area
2. Notify fire and police dispatchers
3. Consider area evacuation
4. Ask for assistance from...
   - state agencies _____
     _____
   - contact CHEMTREC 1-800-424-9300... for assistance

THIS CAN BE A MOST HAZARDOUS SITUATION RESULTING IN B.L.E.V.E. CONDITIONS, ETC...

3 COMMUNICATION PROCEDURE

Key Things to Communicate:

A. Scene Location... **specifically**
B. **Any** Shipping Paper Information (see "Identification Procedures For Hazardous Materials" Training Guide)
C. Any Placards?
D. The Hazard Class(es)
E. 4 Digit ID Number(s)
F. Shipper or Carrier Names
G. Container Shape
H. Any Injuries or Exposures?
I. What about the Weather?
- wind speed
- direction
- forecast?

J. Any Streams, Rivers or Lakes nearby?
K. Any Leaks, Spills or Fires?
L. What's the eminent danger?

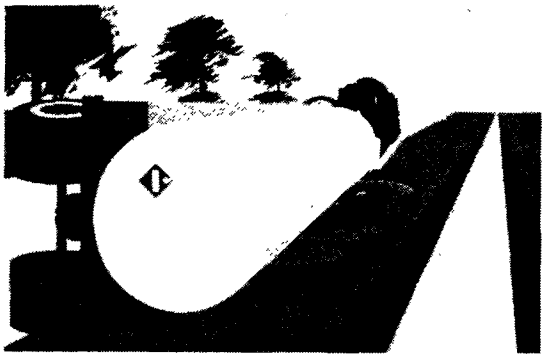
4 EVEN AT AN INCIDENT WITH...

A. Known Hazards
B. Identified materials
C. and Specially trained/equipped personnel available...

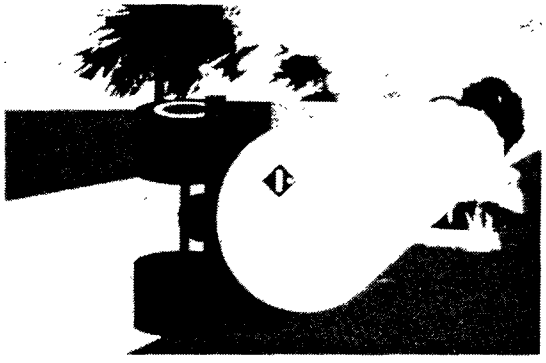
...the First Responder **still** must:
SECURE THE SCENE.

- Block all necessary roads
- Evacuate persons from immediate site
- Restrict onlookers **including the media**.

5 WHEN HANDLING OR CONTAINING HAZARDOUS MATERIALS:



1. Contain Materials... **do NOT FLUSH** it away



2. Block Sewers or Accesses to streams or bodies of natural water.

6 RESCUE TIPS

ATTEMPT TO RESCUE **ONLY** IF POSSIBLE WITHOUT ENDANGERING **ADDITIONAL** LIVES.

Consider...

- Explosion
- Fire
- Contamination or Exposure

...potentials

WHEN CONTEMPLATING RESCUE:
Consider...

- the **whole picture**
- with the Latest Information

...before allowing rescue personnel into the site.

REMEMBER: ***A HAZARDOUS MATERIALS INCIDENT CAN PROVIDE UNUSUAL AND OFTEN DIFFICULT TO RECOGNIZE PERILS TO THE EMERGENCY RESPONSE PROFESSIONAL.***

APPENDIX B

CC: Mr. C. A. Nash, Jr.
Mr. C. E. Morris
Mr. W. W. White
Mr. J. E. Harrison
Mr. D. L. Hatch
Mr. G. B. Kinker
Mr. S. D. Hanshaw
Operations (4)

HAMPTON ROADS BRIDGE TUNNEL
VEHICLE STOPPAGE REPORT

Month of Dec 31 19 90 — Jan 1 - annual totals

	11-7						7-3						3-11						TOTAL
	Eastbound			Westbound			Eastbound			Westbound			Eastbound			Westbound			
	North Bridge	Tunnel	South Bridge	North Bridge	Tunnel	South Bridge	North Bridge	Tunnel	South Bridge	North Bridge	Tunnel	South Bridge	North Bridge	Tunnel	South Bridge	North Bridge	Tunnel	South Bridge	
Stalled Car	31	55	33	20	51	58	81	99	32	75	105	133	91	126	45	78	139	140	1392
Stalled Truck	6	9	3	7	9	12	35	25	15	25	45	37	31	38	12	20	36	35	400
Stalled Motorcycle	1	1					1	2	2	1		3		1		2	3	4	21
Stalled Bus	1							2						1			1		5
Flat Tire Car	6	12	4	8	20	17	17	28	13	18	17	24	13	27	15	24	25	25	313
Flat Tire Truck		4		2	6	2	6	8	1	7	6	6	2	5	4	4	3	7	73
Out of Gas Car	11	10	1	5	10	10	6	9	6	4	17	22	13	19	11	9	17	19	199
Out of Gas Truck	1	3	1	2			2	4	2	4	5	5	3	9	2	2	8	5	58
Out of Gas Motorcycle							2				1	2	2					1	8
Escorts (Loads over 10'6")		1						536		1	469			123			77		1207
*Miscellaneous	28	56	26	35	41	33	23	57	17	19	70	48	19	48	14	9	54	21	618
Accidents	5	14	3	5	7	11	16	29	2	3	24	40	8	37	3	3	22	15	247
Fire					2		1	1			1		1	1	1	1	1		10
TOTALS	90	165	71	84	146	143	190	800	90	157	760	320	183	435	107	152	386	272	4551

Fire Extinguishers Used 4

*(Debris pickup, Investigate calls, Ped. on Bridge, Maritime incidents, etc.)

VEHICLE INSPECTION
Will. 50,957 Veh.
S.I. 1,681 Veh.
Hmpt. 43,746 Veh.
N.I. 1,138 Veh.
TOTAL 97,522

Overheight stopped on islands-measured and turned around
Westbound 407 Eastbound 7 Total 414

Unescorted Wide Loads 10'6" or under
Westbound 9 Eastbound 6 Total 15

Jan 1 - Dec 31 19 89 4,731

BT Superintendent A