Executive Summary

Rhode Island Congestion Management System Plan

Consisting of:

- **Congestion Management System Plan**
- **Incident Management Plan**
- **ITS Early Deployment Plan**

Rhode Island Department of Transportation
Traffic and Safety Management
September 1997

INTRODUCTION

This document provides an overview of the Rhode Island Congestion Management System (CMS) program consisting of the following:

- Congestion Management System Plan (p. ES-l)
- Incident Management Plan (p. ES-10)
- Intelligent Transportation System (ITS) Early Deployment Plan (p. ES-16)

The Recommendations derived from each of these three elements are also included (p. ES-20).

CONGESTION MANAGEMENT SYSTEM (CMS)

The purpose of the CMS is to implement a systematic statewide process that provides information on transportation system performance to decision makers. This data base of information on congestion can then be used for selecting and implementing cost effective strategies to manage new and existing facilities. The intended product of a CMS is reduced or alleviated congestion and enhanced mobility of persons and goods. A number of traditional and non-traditional strategies may be included in the development of a statewide CMS. Strategies include:

- Transportation demand management (TDM) measures including carpooling, vanpooling, alternative work hours, telecommuting, and parking management.
- Traffic operational improvements such as intersection and roadway widening, channelization, and geometric and signalization improvements.
- Measures to encourage high occupancy vehicles (HOV) usage such as public transit improvements, HOV lane provisions, guaranteed ride home programs, and employer trip reduction ordinances.
- Congestion pricing such as differential peak and off-peak hour toll and parking rates.
- Growth management and activity center strategies wherein land use plans and zoning are focused on encouraging specific types and intensities of land use in these specified area.
- Access management techniques wherein coordination and/or limitation of individual driveways/curb cuts are required to gain access approval to state highways from abutting land uses.
- Incident management strategies including a comprehensive approach to detection/verification of incidents, coordinated response/removal practices, and a program to provide motorists timely and relevant traffic information.

- Application of intelligent vehicle highway system (M-IS), now called intelligent transportation system (ITS) technologies relating to advanced traffic management (ATMS), advanced traveler information (ATIS), commercial vehicle operations (CVO), and advanced vehicle control (AVCS) systems.

- Transit capital and operational improvements.

The CMS network is shown in Figure ES-l and includes approximately 650 miles of roadways classified as: Interstate, Freeway, Principal Arterial (rural and urban), and Rural Minor Arterials.

NETWORK EVALUATION

RIDOT's approach to evaluating the existing CMS network was to build upon data collection activities and resources currently available to the state. The following steps were undertaken in determining existing CMS network performance:

- Evaluating existing data bases to determine the extent of information available to perform analysis;

- Use of existing plans or studies to make preliminary determinations of hot spots or potential problem areas; and,

- Evaluating traffic statistics and the statewide travel demand model data to assist in making reasonable estimates of current congestion.

Performance measures are the central element of any **CMS.** They provide the basis for identifying the extent, severity and specific locations of congestion on a systemwide basis. To identify which measures are appropriate for existing and future use in Rhode Island, the following aspects were considered:

- Availability of data to estimate the performance measure;

- Appropriate level of application (i.e., arterial vs. intersections, freeways vs. arterials);

- Resources required to collect data to provide measure;

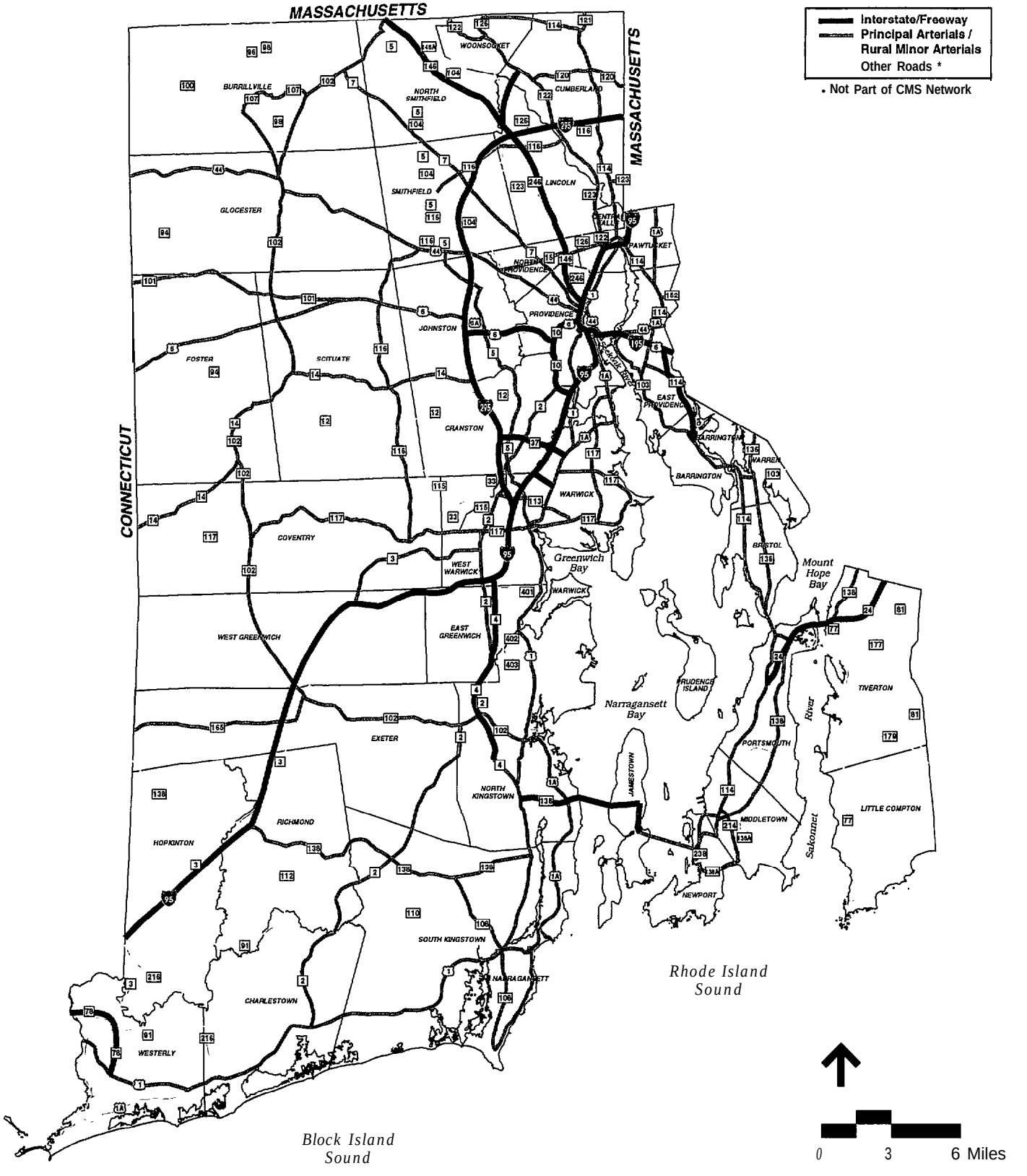
- Relative ease of application; and

- Meaningfulness to both highway and transit systems (i.e., not mode dependent or biased).

Based on these considerations, volume to capacity ratio (v/c), and travel time (speed) were selected as performance measures. The volume to capacity ratio (v/c) approach relates roadway demand to supply. Demand is expressed by roadway volume and supply is expressed as the carrying capacity of a roadway. This measurement provides a simple ratio of demand to supply. Travel time (speed) based performance measures are becoming more widely accepted by the public since they are based on readily identifiable and tangible information. Travel time measures also reflect the assessment of the combined affects of geometric and operational features of the road. Reasons to consider travel time include:

- Public perception is in terms of travel time.

- Volume-based measures break down in oversaturated conditions.



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Proposed CMS Network

Figure ES- 1

- Travel time measures can do a better job at pinpointing locations of congestion and can help in identifying congestion causes.

For this CMS, three periods were selected for evaluating congestion: Peak, Seasonal, and Off-Peak. Standards for each of these periods are summarized by roadway type in Table ES-l.

TABLE **ES-1** ROADWAY SYSTEM PERFORMANCE MEASURE: CONGESTION STANDARDS

FACILITY TYPE	**LIMITED ACCESS**			**NON-LIMITED ACCESS**		
PERIOD	**PEAK**	**SEASONAL**	**OFF-PEAK**	**PEAK**	**SEASONAL**	**OFF-PEAK**
SPEED	**<40**	**<40**	**<50**	**<25**	**<25**	**<30**
V/C	**>.85**	**>.85**	**>.70**	**>.70**	**> .70**	**>.65**

It was determined that the HPMS (Highway Performance Monitoring System) data base provided an acceptable approach to determining congestion. The sample segment information was extrapolated to reflect the "unsampled" portions of the roadway.

The HPMS data also provided a peak period v/c ratio for each sample segment. Calculations were made to obtain peak speed, off-peak v/c and speed, and seasonal v/c and speeds. A growth factor, based on the statewide model and its estimation of vehicle-miles-of-travel by functional class was developed.

State-of-the System

The state-of-the-system included evaluating four different conditions:

1) existing peak period;
2) existing off-peak period;
3) existing seasonal and event related periods on selected roadways, and
4) future (year 2020) peak period.

For each condition, the CMS network was evaluated for limited and non-limited access roadways. Results of applying the congestion criteria to each of the 337 HPMS sections are presented in Figures ES-2, ES-3, ES-4, and ES-5. The following state-of-the-roadway system comments can be made:

- **EXISTING PEAK** (Figure ES-2)

  1. The majority of the freeway system in the Providence Metropolitan area is experiencing congestion during the peak period.

  2. Segments of other freeways, such as I-295, outside of this area are experiencing peak period congestion.

3. Non-limited access highways experiencing peak period congestion are fairly well dispersed. They include major arterials in Warren and on Aquidneck Island (Portsmouth, Middletown, and Newport). Also included are Route 4 and US Route 1 in North Kingstown, South Kingstown, Narragansett and Westerly.

4. Many of the non-limited access roadways labeled as congested are included in the T.I.P. (Transportation Improvement Program) for either study or are in the design phase. This includes signalization programs, as well as construction.

- EXISTING OFF-PEAK (Figure ES-3)

1. The majority of off-peak congestion appears to be occurring within the Providence Metropolitan area;

2. However, there are "pockets" of congestion on Aquidneck Island and in South County.

- EXISTING SEASONAL (Figure ES-4)

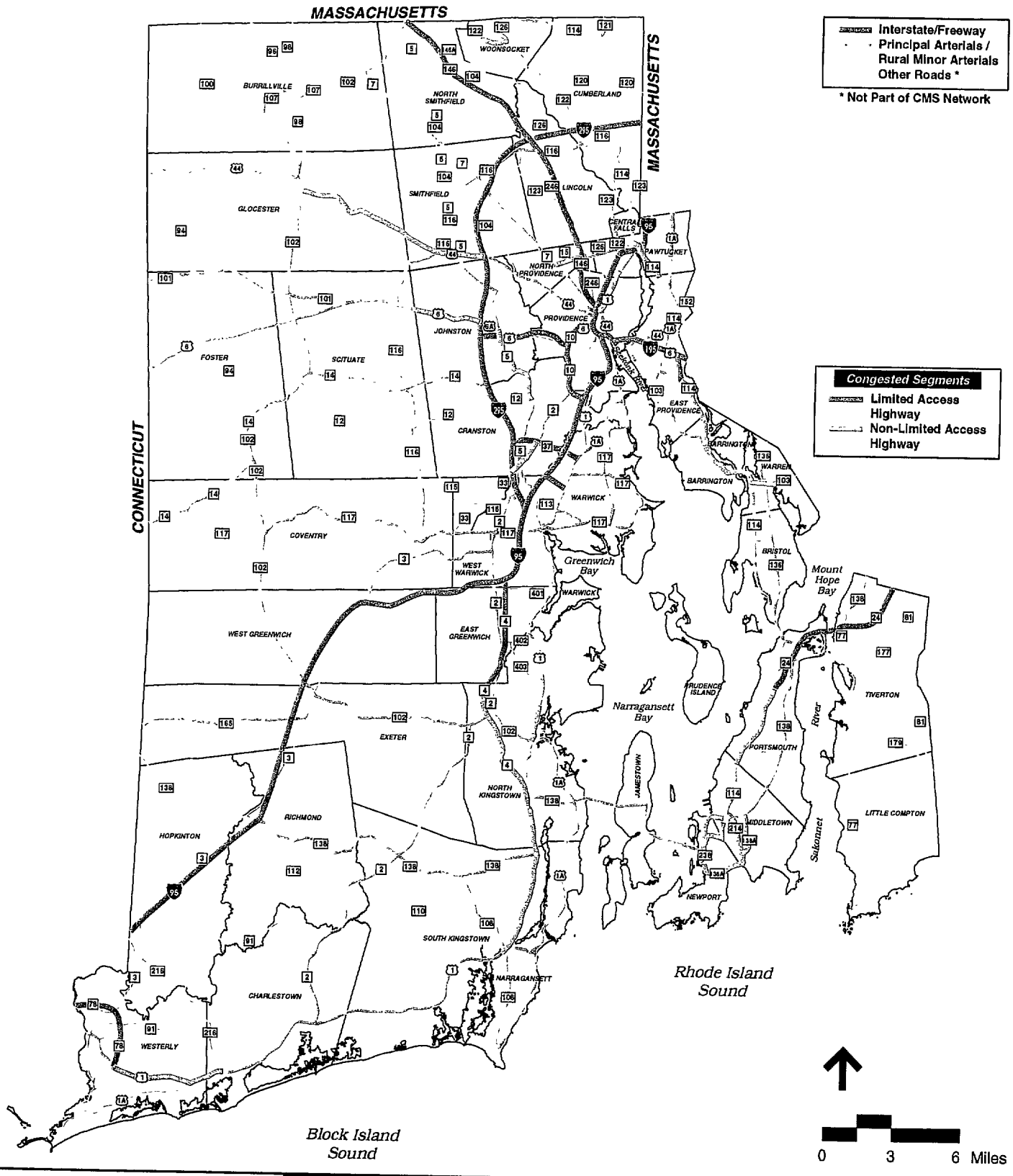
1. There were no freeways experiencing seasonal period congestion.

2. The arterials servicing the recreational traffic in the South County and Newport areas were the only network roadways meeting the seasonal congestion criteria.

- FUTURE PEAK (Figure ES-5)

1. Year 2020 projection of future congestion shows only modest changes from the existing peak period congestion in the number of roadways specified as "congested".

2. The major changes from existing conditions include the length of congestion (i.e., mileage) on I-95, (south of the Providence Metropolitan Area), and the increase in congestion on non-limited access roadways in the South County area.



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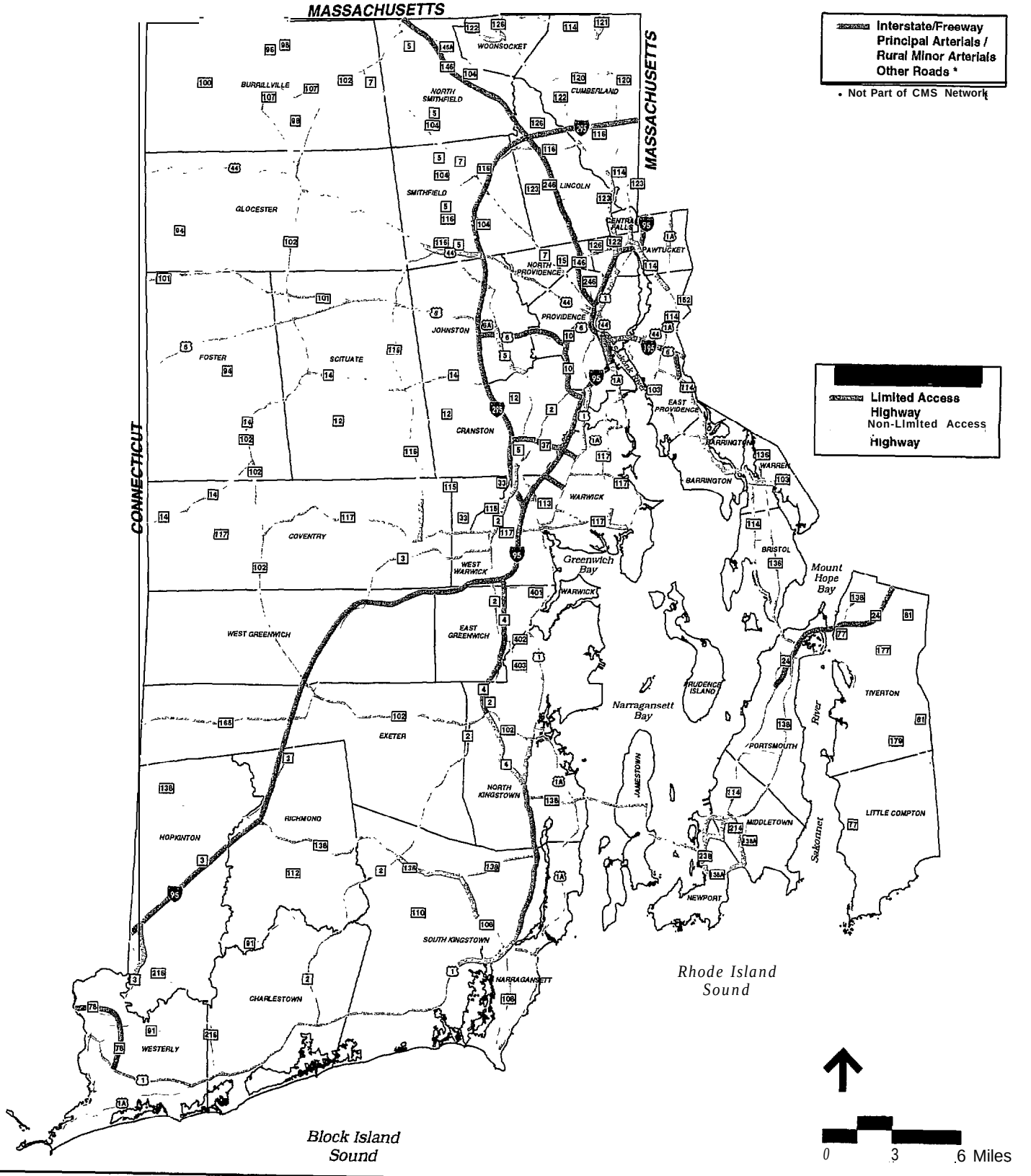
Existing Peak Period Congestion
Based On 1995 HPMS Data Calculated
For Speeds and V/C Ratios

Figure ES-2



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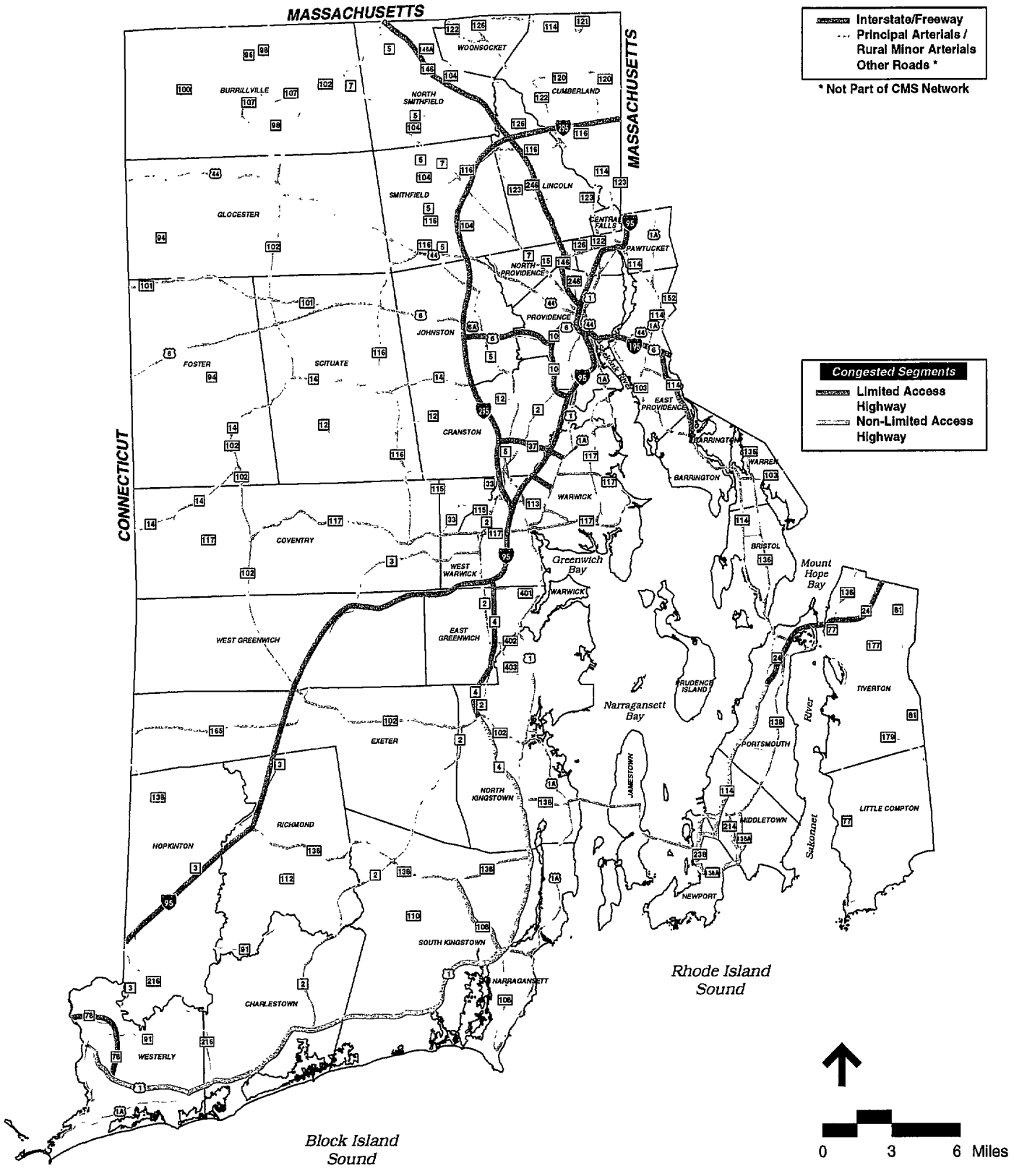
Existing Off-Peak Period Congestion
Based On 1995 HPMS Data Calculated
For Speeds and V/C Ratios

Figure ES-3



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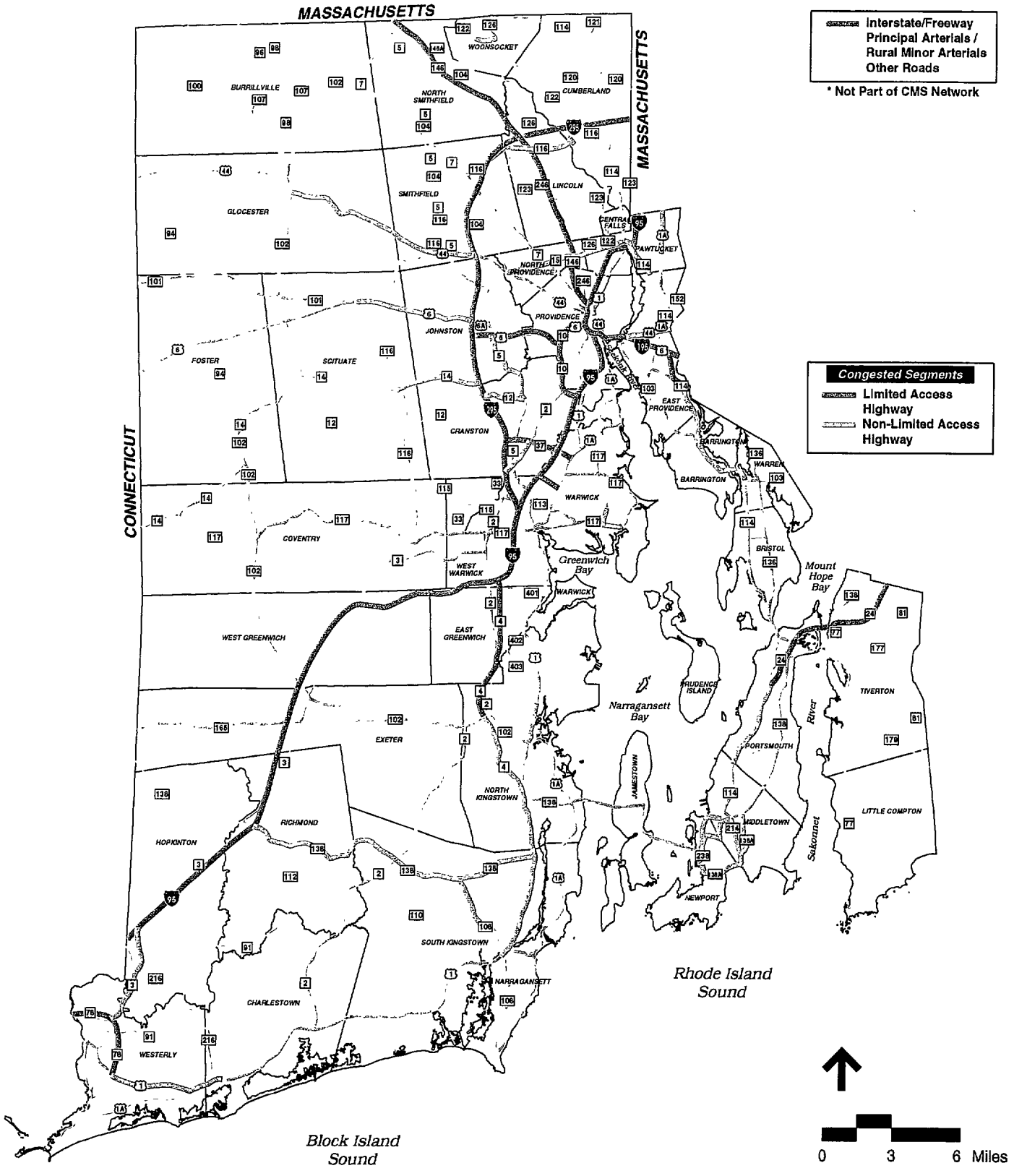
Existing Seasonal Congestion
Based On 1995 HPMS Data Calculated
For Speeds and V/C Ratios

Figure ES-4



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Year 2020 Peak Period Congestion
Based On 1995 HPMS Data Calculated
For Speeds and V/C Ratios

Figure ES-5

System Evaluation and Monitoring

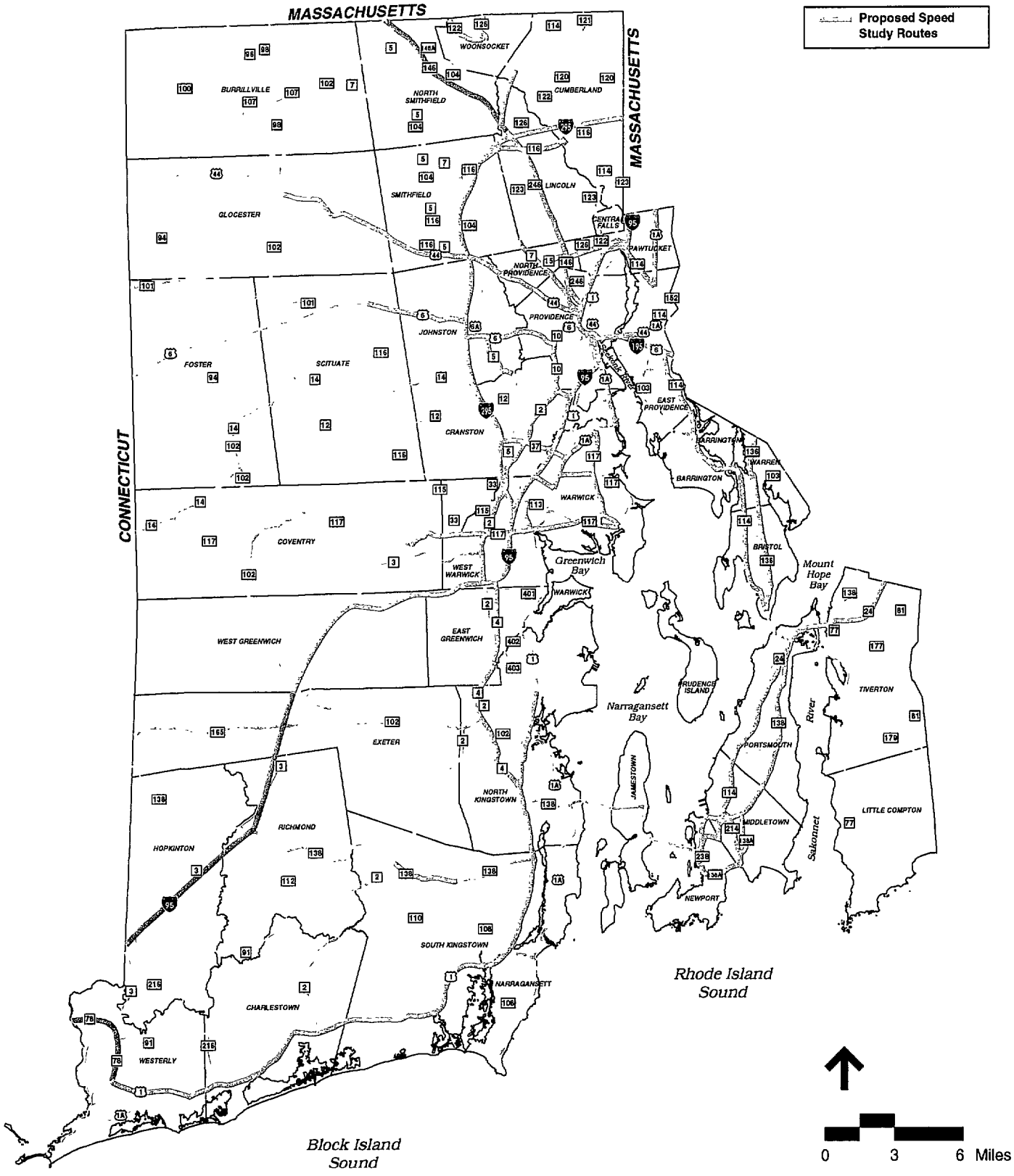
Travel time will be used as a unit of measure to calculate congestion. It is suggested that a new and extensive data collection effort be undertaken to support the use of speed as a performance measure. To accomplish this objective a program has been developed as follows:

- Collect new roadway speed data for the three time periods included in the proposed standards - peak, off-peak, and seasonal;
- Evaluation of speed data;
- Re-evaluate the state-of-the system findings; and
- Revise Action Plan as required.

To initiate this program, a short-term speed data study will be needed on the roadways shown in Figure ES-6. These roadways were determined by assessing results of calculated existing and year 2020 congested areas (Figures ES-2 to ES-S) and a "reality" check on results emanating from usage of the HPMS data. This study will require the installation of new monitoring equipment. Following data collection for the roadways in Figure ES-6, speeds are then calculated for each of the three study periods and, a new calculation of congestion can be made. A comparison can then be made between the congested roadways previously defined and the new data.

Evaluation and Monitoring of the CMS

The CMS Plan is not a one-time effort to produce a report. It is a dynamic process consisting of collecting data, analyzing data, developing plans or programs, or evaluating new or existing procedures to insure that the process is current. This can also include re-evaluation of the performance measures and standards.



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Proposed CMS Routes for Travel Time Survey

Figure ES-6

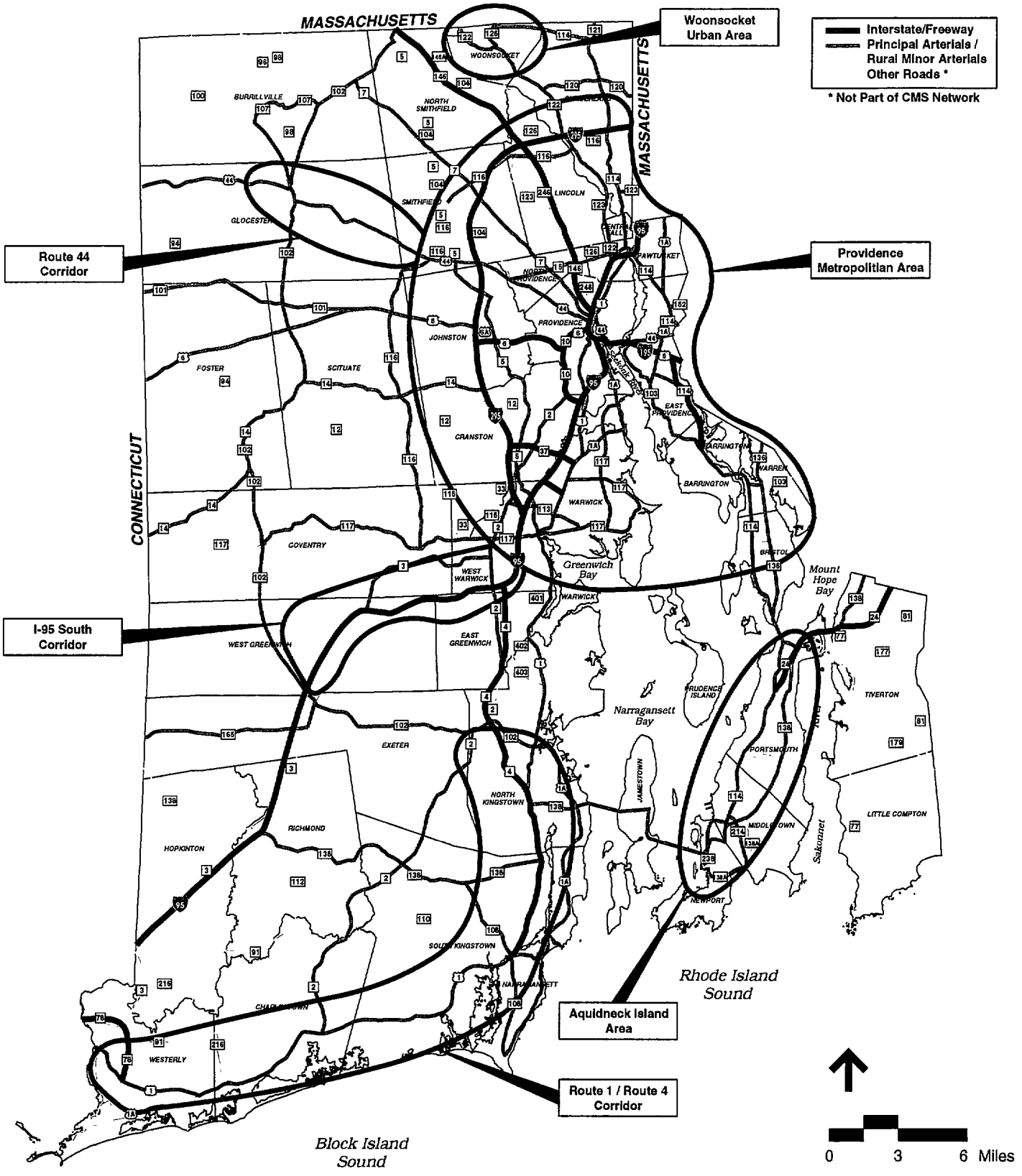
ACTION PLAN

The CMS for Rhode Island is intended to be an integral part of the transportation planning process. The CMS is not intended to be an end unto itself, but a mechanism to provide decision makers with information on traffic operations and a measure of the effectiveness of their planning and programming resources and data collection capabilities. The CMS process should be adjusted as needed. There are a wide range of strategies that when applied individually or in combination can decrease congestion. These strategies include, but are not limited to the following:

- Transportation demand management (TDM) measures
- Traffic operational improvements
- Measures to encourage HOV use
- Public transit capital improvements
- Public transit operation improvements
- Measures to encourage the use of non-motorized modes
- Congestion pricing
- Growth management and activity center strategies
- Access management techniques
- Incident management techniques
- Intelligent vehicle highway systems and advanced public transit information systems
- Transportation system management (TSM) technology
- The addition of general purpose lanes

Figure ES-7 shows the State's potential congested areas/corridors as follows:

- Providence Metropolitan Area
- Aquidneck Island Area
- Woonsocket Urban Area
- Route l/Route 4 Corridor
- Route 44 Corridor
- I-95 South Corridor



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Potential Congested Areas or Corridors Figure ES-7

Tables ES-2 and ES-3 summarize suggested strategies applicable to areas and corridors, and to specific sites. More detailed evaluation will be required to determine individual applicability to a specific area.

SCHEDULE

Implementing the initial CMS Plan is suggested to occur as follows:

- One to Two Years - Assess alternative data collection methodologies for measuring speed and travel time data on the CMS network. A multi-stage approach could be considered including:

  1. For problem identification and monitoring, travel time data should be collected at the "route level" using the "floating car technique".

  2. For areas or sites considered "problems", a more thorough investigation should be undertaken, using larger sample sizes than above.

  3. Measurements of intersection delay, instead of travel times, is more appropriate at "localized" intersections.

  4. Use the data collected from the above studies to better calibrate the speed elements of the statewide traffic model.

- Two to Five Years - Although both v/c and speeds (travel times) were initially used as indicators of congestion, it is recommended that speed and/or travel times be the sole criteria for congestion measurement. Therefore, completion of the data collection updates in the initial years will be used to re-calibrate analysis techniques to insure consistency between the model calculations and field observations/data.

- Ongoing - Strategies for mitigating congestion will need to be re-visited to determine if the list should be expanded or changed based on experience with a particular strategy or new information becoming available.

TABLE ES-2 **APPLICATION OF AREA AND CORRIDOR CONGESTION STRATEGIES**

LOCATION

	Providence Metro Area	Aquidneck Island Area	Woonsocket Area	Route 44 Corridor	I-95 South Corridor	Route l/ Route 4 Corridor
1. Incident Detection and Management System	✓	✓			✓	✓
2. Freeway Traffic Surveillance and Control System	✓				✓	
3. Motorist Information System	✓	✓			✓	✓
4. Ramp Metering/HOV Bypass Ramps	?					
5. Freeway Frontage Roads	?					
6. Integrated Freeway and Arterial Coordination	✓				✓	
7. Traffic Signal Coordination	✓	✓	✓	✓		
8. Computerized Signal System Expansion	✓	✓	✓	?		
9. Arterial Surveillance and Management	✓	✓	?	✓		✓
10. TDM/Transit Improvements	✓	✓	✓	✓	?	?

See Figure ES-7 for locations

Legend:

✓ = Definite application

? = Potential Location application

TABLE ES-3 **APPLICATION OF SITE SPECIFIC CONGESTION STRATEGIES**

LOCATION

	Providence Metro Area	Aquidneck Island Area	Woonsocket Area	Route 44 Corridor	I-95 South Corridor	Route l/ Route 4 Corridor
1. Traffic Signal Installation	✓	✓	✓	✓		?
2. Exclusive Turn Lane Installation	✓	✓	✓	✓		✓
3. Channelization	✓	✓	✓	?		✓
4. Multiple Left-Turn Lanes	✓	✓	✓	?		✓
5. Turn Prohibitions	✓	✓	✓	?		✓
6. Driveway Consolidations Restrictions/Removal	✓	✓	✓	?		✓
7. Intersection Widening (additional through lanes)	✓	✓	✓	✓		✓
8. Intersection Grade Separation	✓					✓
9. Additional Lanes / widening	✓	✓	?	✓	✓	✓

See Figure ES-7 for locations

Legend:

✓ = Definite application

? = Potential Location application

INCIDENT MANAGEMENT PLAN

Incident Management (IM) is one of several strategies included in the CMS. Building upon an earlier Short-Term Incident Management Plan, the Long-Term Incident Management Plan recommends policies, procedures, and systems to improve incident management in Rhode Island. Because much of the congestion that occurs in Rhode Island is non-recurring, it is important to integrate incident management improvements with current congestion management planning. The IM program is organized by the standard pre-, during, and post-incident activities of Detection and Verification, Response and Clearance, and Recovery and Information. Table ES-4 summarizes the existing, short-term, and long-term IM plan elements for Rhode Island.

DETECTION AND VERIFICATION

The goal of incident detection and verification is to identify roadway incidents and dispatch appropriate assistance as quickly as possible. Detection and verification functions need to be strengthened. This could take place through a public-private partnership with private response organizations as well as by involving RIDOT personnel and the traveling public in the process. Remote detection systems including loop detectors and video surveillance being planned as part of the Traffic Operations Center (TOC discussed under ITS Early Deployment) should also be used to enhance detection and verification capabilities.

RESPONSE AND CLEARANCE

Response and clearance are on the on-site activities necessary to manage a roadway incident, including incident command, emergency management, traffic and site control, site clearance, and inter-agency communication. In Rhode Island, there are several areas of response and clearance in need of improvement.

First, expectations for both the transition of incident command, and the control over secondary site impacts, including traffic management, are not clear. Second, inter-agency communication necessary to resolve important issues and access appropriate resources is not as effective as it could be. Third, there is inadequate access to equipment and information. Improved inter-agency procedures and communications tools are needed. Better planning is also needed to identify, create, and ensure ready access to resources.

Table ES-4 INCIDENT MANAGEMENT PLAN ELEMENTS

TIMEFRAME	DETECTION/ VERIFICATION	RESPONSE/ REMOVAL	MOTORIST INFO/ TRAFFIC MGMT.
EXISTING	• Enforcement personnel • Traffic reporters • Private Courtesy/Service Patrols • Motorist Call Boxes • Cellular Telephone (*SP)	• Enforcement agencies • Local Fire/Medical • State Maintenance • Environmental • HAZ-MAT • Tow Truck Agreements • Push Bumpers (State Police/RIDOT vehicles)	• Portable variable message signs VMS (limited use) • Media (commercial radio, print media) • l-800 Telephone # • Pre-planned alternative routes (limited use) • I-95 Corridor Coalition Information Exchange Network (IEN)
SHORT-TERM (O-3 YEARS)	EXISTING PLUS • Limited test use of electronic speed detection (radar) • Several CCVE installations • Traffic operations center (TOC) • Computer link of DOT construction/ maintenance and utility company efforts • Expansion of service patrols	EXISTING PLUS • Additional state and selected local police and RIDOT vehicle push bumpers • Enhanced interagency radio communications • Traffic operations center (TOC) • Strategic locating of materials/equipment • Enhanced personnel training • Clarify response team responsibilities	EXISTING PLUS • Contract with local radio station for specific time slots • Initiate limited use of highway advisory radio (HAR) • Additional permanent and portable VMS • Traffic operations center (TOC) • Motorist education program • Road weather information system (RWIS) • Link arterial closed loop systems to TOC • Define traffic diversion routes for Interstate routes
LONG-TERM (3+ YEARS)	SHORT-TERM PLUS • Widespread installation of speed detection devices • Numerous CCVE installations in metropolitan area	SHORT-TERM PLUS • Accident Investigation (AI) sites on Interstate routes • Specialized equipment purchases/replacements	SHORT-TERM PLUS • Additional permanent and portable VMS • Specific diversion routes for all major routes with centralized traffic control

RECOVERY AND INFORMATION

The recovery and information phase of an incident has two parts. It involves both the restoration of normal traffic flow, and the management and processing of information related to the incident. These are two particularly important and also problematic areas of Rhode Island's IM capabilities.

Currently, pre-planned information systems to manage incident-related traffic, such as alternative route plans, permanent variable message signs, highway advisory radio, or other forms of communication with the motoring public, are not in place. The primary information source is the media. This limits both control and ability to most effectively restore traffic flow. A program to provide traffic information is needed, the foundation of which is being developed throughout the planned TOC.

Management of incident-related information is limited. Existing procedures and computer systems provide for little organization, use, or sharing of data. In addition, no consistent mechanism for performance evaluation is in place. This essential function must be formalized so that productive discussion and action can result.

The Incident Management Task Force's activities and abilities are currently limited by a lack of direction, attention, and momentum. The Task Force requires restructuring and a more formally defined mission in order to effectively guide and support the IM program. In addition, other coordination and planning structures, such as the I-95 Corridor Coalition, need to be better integrated into the Rhode Island IM program as a whole.

Resources must be available to supply those responding to roadway incidents with the right equipment at the proper time and location. At present, appropriate resources are not always available on site when they are needed. In addition, information resources are not readily available to on-site personnel. Careful planning to ensure that resources are available and accessible is necessary. The TOC is the ideal location for information resources.

Incident management requires special skills. The long-term plan identifies three areas where Rhode Island IM personnel need more training. These include: 1) response procedures, 2) traffic management, and 3) the organization and control an emergency situation (incident command systems). A basic level of knowledge in these areas is necessary for all response personnel.

Finally, a number of strategies have been recommended to improve an expand upon ongoing IM activities in Rhode Island. These strategies are categorized in the following areas and summarized in Table ES-5.

- Planning and Program Management.
- Resource Strategies.
- Training and Development.
- Public Involvement.
- Information Exchange.
- Program Assessment.

Table ES-5 INCIDENT MANAGEMENT STRATEGIES

PLANNING AND MANAGEMENT STRATEGIES

Strategy	Task Leaders	Timeframe	Description
Designate a RIDOT TOC Manager/ Coordinator	RIDOT Director's Office/Senior RIDOT IM person	S	Designate a manager/ coordinator to support internal RIDOT activities and help sustain the overall IM program, including planning, coordination, advocacy and management of the TOC.
Reshape the IM Task Force	TOC Manager/Coordinator	S	Reshape the Task Force with a formal mandate, mission and procedures to accomplish information sharing, policy and planning, and debriefing activities
Develop a Unified Response Manual	IM Task Force TOC Manager/Coordinator Chief Admins of Primary Response Agencies	s	Create an inter-agency Manual to ensure agencies follow consistent response procedures, including approaches to different levels of incidents
Revise RIDOT IM SOP	RIDOT Director's Office Human Resources TOC/Manager Coordinator	S	Enhance existing procedures, including clarification and streamlining of decision making authority, empowerment of appropriate personnel, and better integration with roles of other response agencies
Improve Coordination of Planned Activities	RIDOT Director's Office or designee TOC/Manager Coordinator	L	Improve coordination of construction and maintenance activity through enhanced mapping, monitoring, and information sharing to ensure preventable delays do not occur

RESOURCE STRATEGIES

Strategy	Task Leaders	Timeframe	Description
Enhance Ongoing Detection Programs	Traffic detection systems – RIDOT Roadway Patrols – State Police – RIDOT – Private Organizations	L	Strengthen existing detection program in a variety of ways including increasing roadway patrols, purchase of several "RHODE WATCH" RIDOT vans, and utilizing planned TOC electronic systems
Upgrade RIDOT Maintenance Equipment and Information Resource	RIDOT Maintenance	L	Enhance RIDOT Maintenance resources to ensure that they are properly prepared to respond to incidents. Provide information resources to support on-site personnel.
Improve Private Contractor Resources	TOC Manager/Coordinator	S	Put proper mechanisms in place to ensure high quality, immediate private contractor response to incidents when needed. Already the list of tow truck operators is updated every 6 months.

Table ES-5 (Cont'd) **INCIDENT MANAGEMENT STRATEGIES**

RESOURCE STRATEGIES (Cont'd.)

Continue Developing a Communications Equipment Enhancement Plan	TOC Manager/Coordinator	L	Continue to enhance existing communications equipment system to ensure carefully controlled direct communication is possible within and between IM agencies.
Improve Motorists Radio Information	TOC Manager/Coordinator	L	Consider a partnership with a local radio station providing statewide coverage.

TRAINING AND DEVELOPMENT STRATEGIES

Strategy	Task Leaders	Timeframe	Description
Train Personnel on Response Procedures	Human Resources Department IM Task Force	S	Provide IM personnel with an understanding of their own agencies' IM procedures, as well as an overview of IM program
Expand and Develop Traffic Management Training Programs	IM Task Force Human Resources Department	L	Enhance response personnel knowledge of IM Traffic Management issues. Provide more in-depth training for those responsible for traffic management.
Train Primary Respondents in Roadway Incident Command	IM Task Force Human Resources Department	S	Familiarize all response personnel with the basic concepts of Incident Command Systems

PUBLIC INVOLVEMENT STRATEGIES

Strategy	Task Leaders	Timeframe	Description
Develop/Distribute Public Information Materials	TOC Manager/Coordinator RIDOT Community Affairs	S	Develop materials to heighten public awareness. Disseminate information through a variety of channels.

INFORMATION EXCHANGE

Strategy	Task Leaders	Timeframe	Description
Coordination with Connecticut and Massachusetts	TOC Manager/Coordinator	S	Coordinate/share relevant information through I-95 Corridor Coalition and directly with the two states.

Table ES-5 (Cont'd) **INCIDENT MANAGEMENT STRATEGIES**

PROGRAM ASSESSMENT

Strategy	Task Leaders	Timeframe	Description
Develop procedures to test effectiveness and measure traffic benefits	TOC Manager/Coordinator	S	Develop procedures, **maintain** ongoing data collection techniques, and identify evaluation criteria to assess delay and frequency reductions, time/fuel savings, accident costs, and air quality benefits.

Timeframe:

S - short term (0-3 years)
L - long term (3+ years)

ITS EARLY DEPLOYMENT PLAN

As part of the statewide CMS, the transportation links experiencing the greatest delay were identified and the deployment of ITS measures were considered to improve their performance. The four basic functional areas requiring technology for incident management include:

- Surveillance
- Communications
- Motorist Information
- Traffic Management

Figure ES-8 identifies the interrelationship of traffic control (management) and vehicle probes (surveillance) through a Traffic Operations Center (TOC) to the traveler (motorist information). The receiving and transmitting of information is accommodated through a communications network.

TRAFFIC OPERATION CENTER

As noted in Figure ES-9, the traffic operations center (TOC) is at the "heart" of the various hardware and software components designed to better manage transportation on the state's highways. The former Department of Motor Vehicles (DMV) floor space on the first floor of Two Capitol Hill is the recommended TOC site. The floor space meets the space requirements and allows for expansion capability. Table ES-6 summarizes the TOC space requirements and Figure ES-10 illustrates the proposed TOC layout.

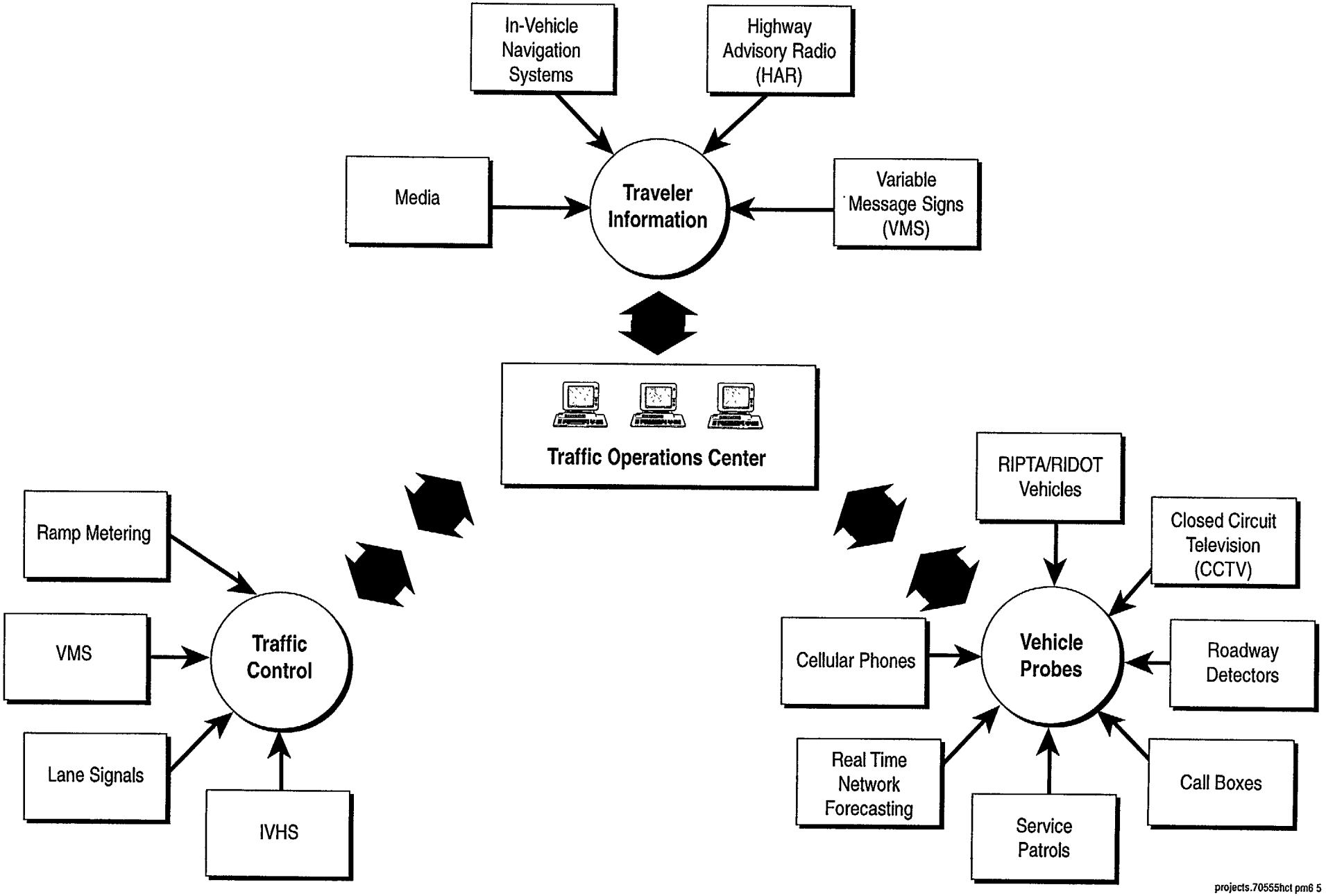
Table ES-6 TOC Space Requirements (Square Feet)

Description	Space
Control Room	1,500
Equipment Room	400
Reception / Clerical / Lobby	500
Conference Room	600
System Manager Office	200
Assistant System Manager Office	175
Engineers Offices (3 @ 150 sf)	450
Supervisors / Technicians (2 @125 sf)	250
Kitchen / Break Room	250
Storage	300
Subtotal	4,625
Add 15% (Hallways, Common Areas, etc.)	700
TOTAL	5,325*

*Assumes other facilities available: Rest rooms/lockers/showers; Cleaning Room; Power Room; I-WAC Room

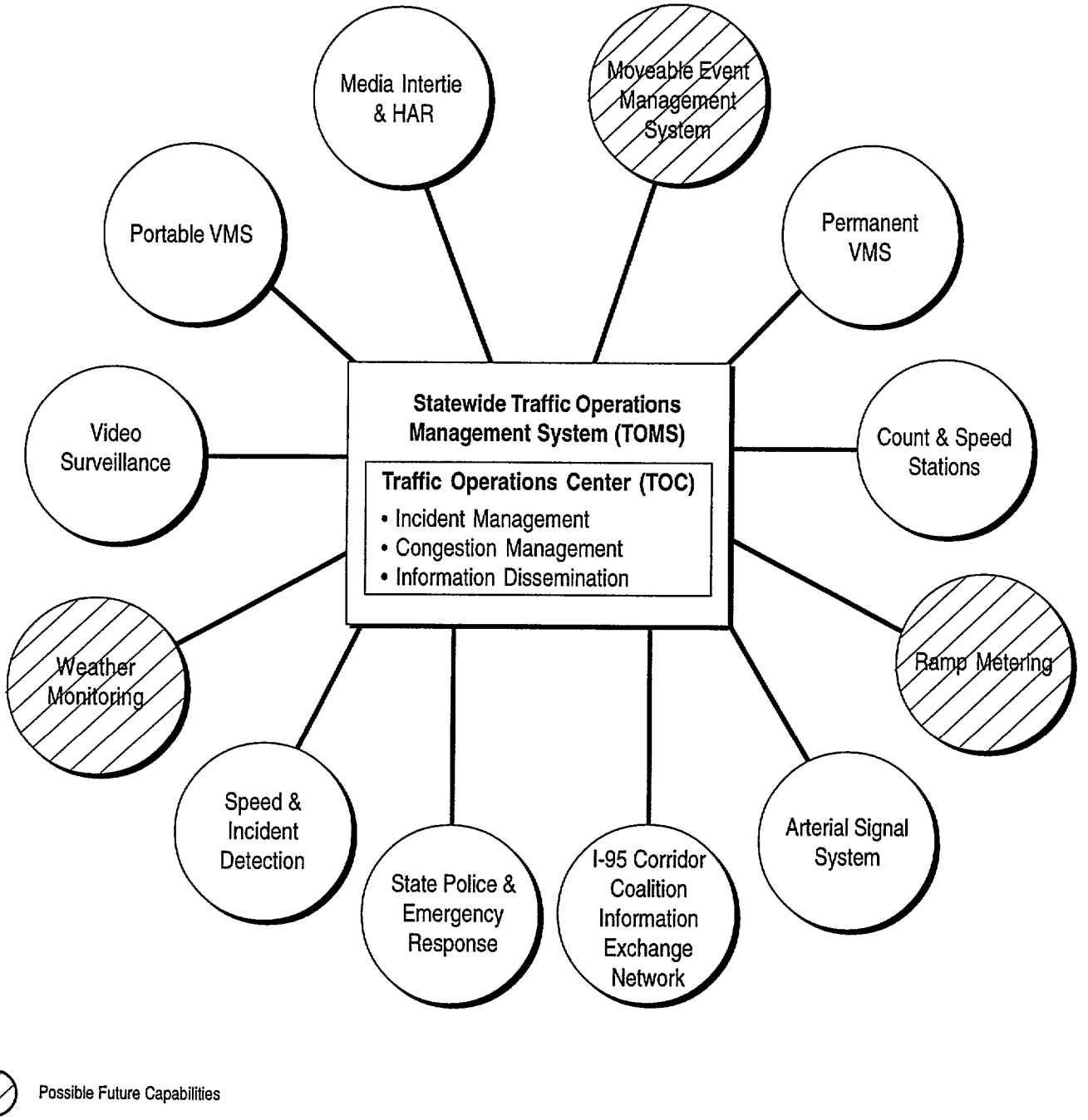
Incident Management - System Framework

Figure ES-8



Statewide Traffic Operations Management System Concept

Figure ES-9



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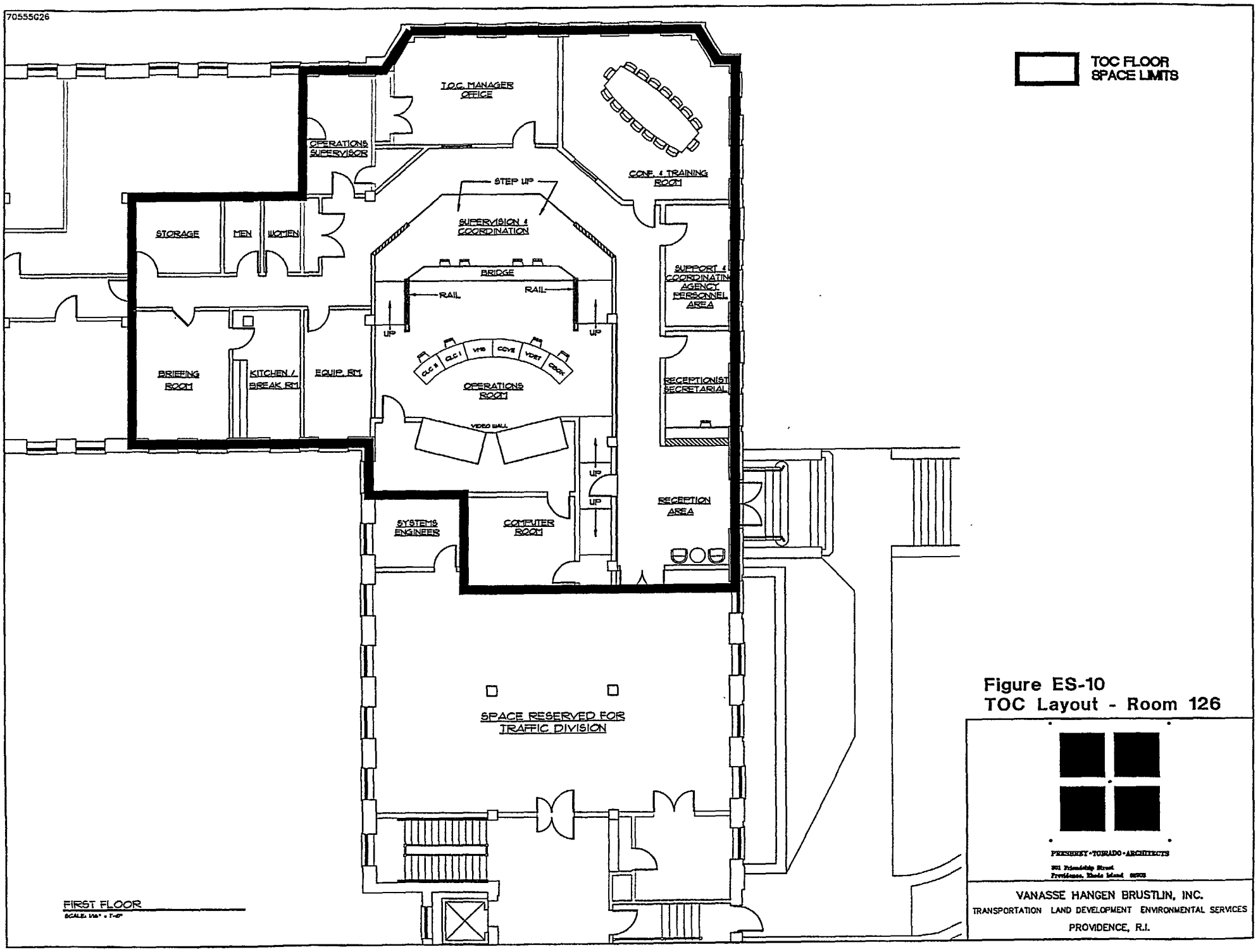

Figure ES-10
TOC Layout - Room 126

PRESSLEY • TOBIADO • ARCHITECTS

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TOC **STAFFING**

The suggested TOC staffing is identified in Figure ES-11. Under normal operations, a TOC Coordinator (TC) administers the TOC facility and staff, and serves as the coordinator for incident management activities at RIDOT. An operations supervisor is directly responsible for the console area and oversees one or more operators. The supervisor is the senior operator with knowledge of the overall operation. The console operator(s) are considered hands on individuals fulfilling the specific directions of the operations supervisor.

The TOC will operate for 24 hours with three (3) shifts. Each shift would have an operations supervisor with one or more operators. There would be a minimum of two people on each shift consisting of the operations supervisor and one operator. The TC would be expected to be on duty during normal RIDOT working hours.

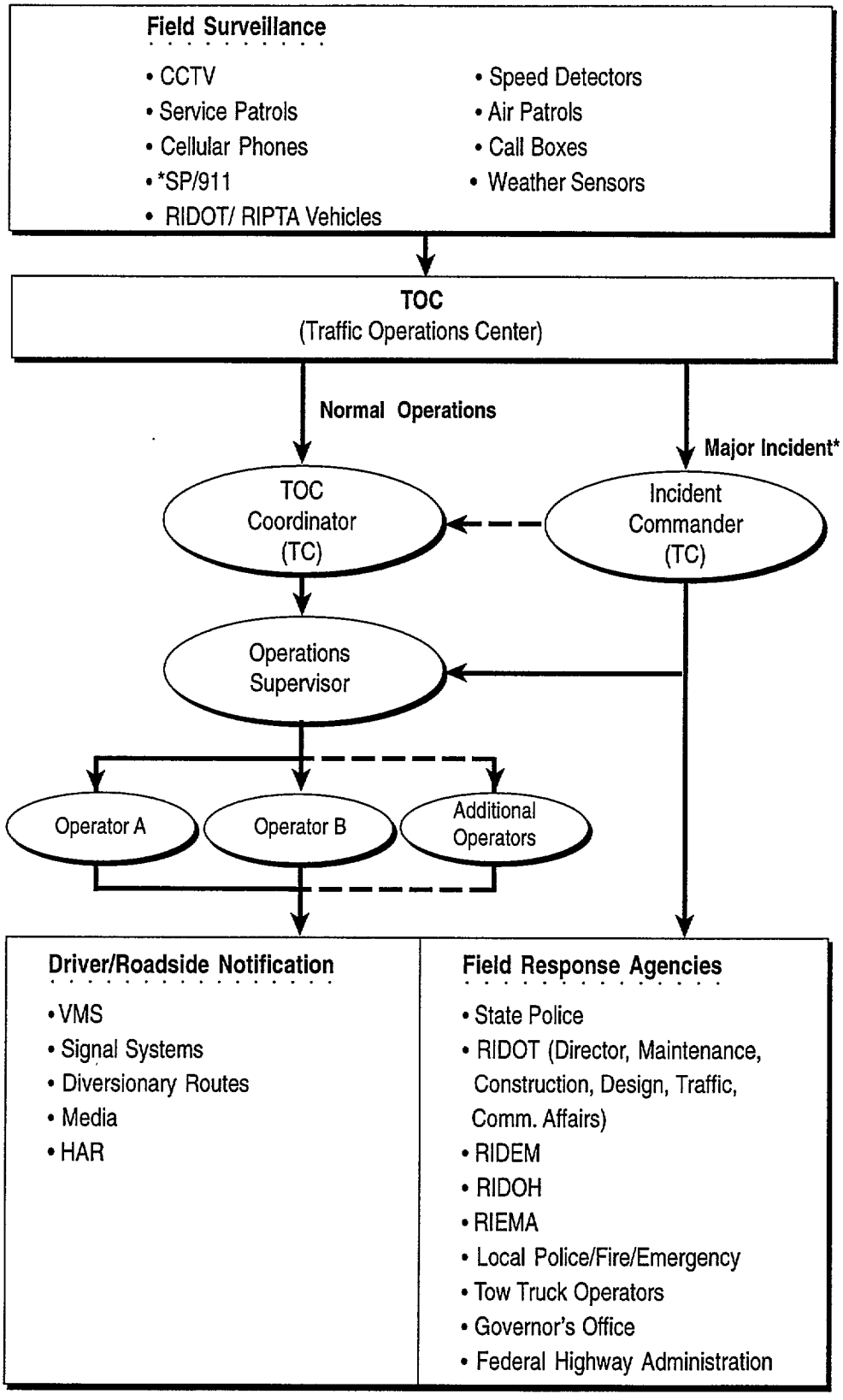
In the case of a major incident, (e.g., an incident which involves closure of one or more lanes of a multi-lane highway for three plus hours or delays greater than one hour or a requirement to use diversionary routes) an Incident Commander (IC) would take control of the TOC and coordinate the "hot spot" field commander in accord with ongoing standard RIDOT procedures. The IC and TC would both be involved in debriefings associated with incidents.

Depending upon the extent of the incident, a number of other individuals from state and local agencies may be present at the TOC. These individuals would be responsible to the IC and be able to communicate directly with various individuals in the field at the incident.

ACTION PLAN

Based upon identifying those transportation links experiencing the greatest delay, the major interstate roadways in the Providence area were selected as the logical first choice for ITS Early Deployment Plan (EDP) in Rhode Island. These roadways include Interstate Route 95 (I-95) and Interstate Route 195 (I-195) generally within the Providence area. Table ES-7 identifies the EDP components of this action plan.

TOC Staffing
Figure ES-11



* Defined as closure of 1 or more lanes on a multi-lane highway for 3+ hours, of traffic delays greater than 1 hour, or requirement to use diversionary routes

Source: Appendix - TM #18

Table ES-7 EDP System Components

SY STEM ELEMENT	LOCATION
Variable Message Signs (VMS)	1. I-95 NB south of Route 117 underpass. 2. I-95 NB south of Route 10 interchange. 3. I-95 NB at Thurber's Avenue overpass. 4. Route 10 NB at Union Avenue overpass. 5. Route 6/10 EB north of Broadway ramp bridge. 5. I-95 SB at I-295 (Massachusetts). 7. I-95 SB at Branch Avenue overpass. 3. I-195 WB at Taunton Avenue ramp overpass. 3. Route 6 EB west of Route 10. 10. I-95 SB at Smithfield Avenue overpass. 11. Route 146 SB north of Branch Avenue underpass. 12. I-195 WB on Washington Bridge No. 700. 13. I-195 WB at Pawtucket Avenue overpass. 14. Route 114 NB south of Mink Street.
Closed Circuit Video Equipment (CCVE)	1. I-95 at I-195 interchange. 2. I-195 WB at Chestnut Street underpass. 3. I-195 EB at Wickenden Street underpass. 4. I-195 at pedestrian overpass. 5. I-95 NJ3 at Thurber's Avenue off-ramp. 6. I-95 NB at Blackstone Street underpass. 7. I-95 SB at Broad Street overpass. 8. I-95 at Broadway overpass. 9. I-95 at Route 6/10 interchange. 10. I-95 SB at Orms Street overpass. 11. I-95 NB at Branch Avenue overpass. 12. Route 6/10 WB at Dean Street overpass. 13. I-95 NB at Broad Street (Route 117) overpass. 14. I-95 SB at Elmwood Avenue underpass. 15. I-95 SB at Route 10. 16. I-195 WB at Taunton Avenue ramp overpass. 17. I-195 EB at Pawtucket Avenue overpass.
Traffic Operations Center	5,000+ sf at Room 126, Two Capitol Hill
Vehicle Detection Stations	Location to be determined
Highway Advisory Radio	2 locations (I-95 at Rte. 2 and I-295 at Rte. 146)
Movable Event Management System	Location to be determined
Weather Monitoring	Location to be determined
Closed Loop Traffic Signal System	10 Systems

EARLY DEPLOYMENT COSTS

Capital costs have been estimated for the various elements of the EDP Action Plan. Table ES-8 summarizes these costs which are based in part on actual bid costs for certain elements and estimates for other elements. These costs include construction and installation, but exclude engineering design, operational staff support, and maintenance/operating costs. It should be noted that individual unit costs for the various EDP elements can vary widely depending upon the location and number of units to be bid in a given contract.

Table ES-8 Estimated Costs - ITS Early Deployment Plan

Element	Number	Estimated Cost(1)
Variable Message Signs	14	$2,100,000(2)
Closed Circuit Video Equipment(3)	17	$1,000,000
Traffic Operations Center	1	$1,200,000
Vehicle Detection Stations	TBD	TBD
Highway Advisory Radio	2	N/C(4)
Weather Monitoring	TBD	$400,000(5)
Movable Event Management System	TBD	$150,000 ””
Closed Loop Traffic Signal System	10	TBD

(1) Costs include equipment installation based on 1997 dollars. Excludes engineering design and operation/maintenance costs.
(2) Based on 8 portable and 14 permanent installations.
(3) Includes compressed video communication linkages.
(4) Provided by I-95 Corridor Coalition.
(5) Based on RIDOT solicited bids proposals.
(6) Cost of one (1) set up.

TBD To be Determined.
N/C No Cost to RIDOT

RECOMMENDATIONS

A number of recommendations have been suggested as part of Rhode Island's CMS Plan. The following paragraphs list these recommendations, as Administrative or Technical. The Technical Memorandum are grouped by function.

ADMINISTRATIVE

- The CMS network consist of approximately 650 miles of roadway (Figure ES-l).

- Additional resources will be required through the RIDOT Intermodal Planning, and Traffic and Safety Management sections to expand, update, monitor, and evaluate existing and new CMS evaluation procedures. It is expected that funding for these efforts can be satisfied by SPR and project construction funding sources.

- Continue to plan, program, design, and deploy ITS strategies throughout the State consistent with available financial and staff resource capabilities.

TECHNICAL

1. CMS Network

   - Performance of the CMS network will initially be based upon speed (travel times) and volume to capacity (V/C) ratio statistics (Table ES-l) and differentiated by time of day (peak/off-peak) and time of year (seasonal/event). The threshold values should be evaluated over time for appropriateness. Ultimately travel time would be the sole evaluation criteria.

   - Continued field testing of travel times/speeds should be undertaken to validate statewide model results (Refer to Figure ES-6). This will require installation of additional field monitoring equipment.

   - Speed data obtained from existing and proposed speed stations should be retained in a format compatible for analytical use on the CMS network. Speed data can be obtained from the closed loop arterial signal systems currently under design.

   - CMS network performance should be updated biannually and serve as input to the State's T.I.P. process.

2. Surveillance

   - Non-invasive detector technology should be the primary installation to be considered on future construction projects.

   - RIDOT should continue to evaluate new detector technologies and field test new applications where possible.

   - CCVE sites should be strategically located to verify incidents, provide for maintenance access, verify VMS message, and be compatible future fiber-optic communication linkages.

   - RWIS sensors should be oriented toward surface and subsurface problems with collected data transmitted to the TOC and RIDOT Maintenance Division. Forward scatter type visibility technology is most appropriate for the State.

3. Communications

- Initial field devices (CCVE and VMS) will use telephone lines for communication. Ultimately fiber-optic linkages should be in place between the TOC and all field devices particularly within the Providence metropolitan area. RIDOT should continue with ongoing efforts to secure statements of interest and advance the selection of suppliers for statewide fiber-optic data, voice, and video communication system utilizing state rights-of-way.

4. Motorist Information

- VMS deployment should consider LED based technology for portable locations and fiber-optic based technology for permanent locations. Permanent overhead installations are preferred for enhanced visibility. RIDOT should continually evaluate VMS technologies to assure the best decisions are made for future field deployments and maintenance capabilities.

- HAR transmissions should consider continuous coverage zones using two or three 10 watt stations (FCC license required) thereby providing I-95 corridor coverage on a single frequency. More isolated locations, like Newport, could be supplemented with an additional station.

5. Traffic Management

- RIDOT should consider use of at least one additional type of traffic controller (besides NEMA) as further closed loop arterial systems are implemented.

- Through the IM Task Force, establish the definition of a major incident. One definition involves a closure of one or more lanes on a multi-lane highway for greater than three hours, or traffic delays greater than one hour, or requires the use of diversionary routes.

- Continue with development of regional and local diversionary routes utilizing the resources of the IM Task Force.

6. Traffic Onerations Center

- Continue with ongoing construction efforts of the TOC in Room 126 at Two Capitol Hill (RIDOT Building).

- Develop appropriate staffing levels and training programs to permit 24-hour TOC operations using a combination of RIDOT staff and outsourcing resources.

- The TOC should serve as the communication focal point during incident response utilizing the resources of other RIDOT Divisions (Maintenance, Construction, Design, Traffic, Community Affairs), other state agencies (RIDEM, RIDOH, RIEMA, and State Police), and other local agencies (police, fire, etc.).

7. Early Deployment Plan

- Deploy as early as possible ITS strategies currently under design (Table ES-7) within the Providence metropolitan area. The most cost effective bids will be secured by considering the recommended strategies (CCVE and VMS) under one contract.