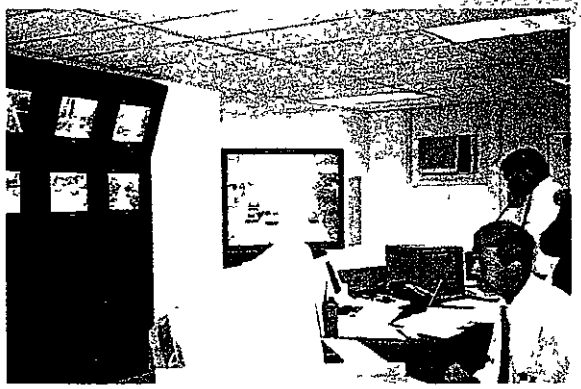
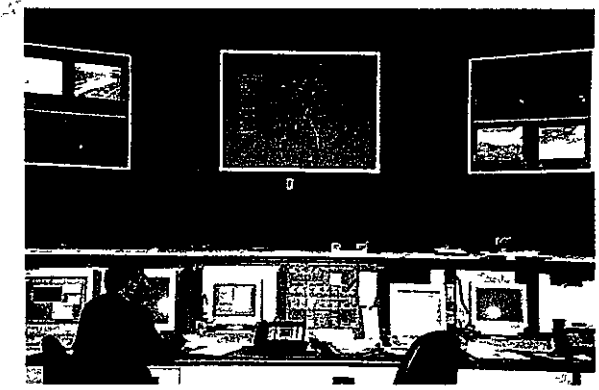
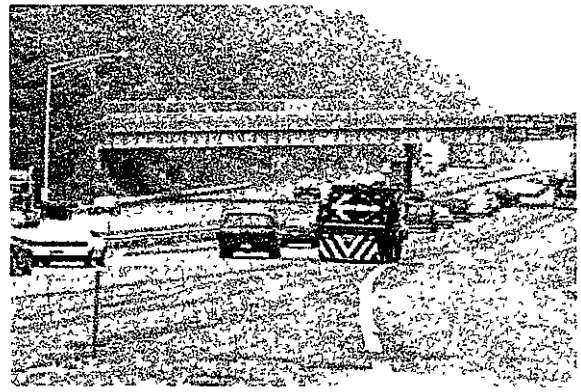
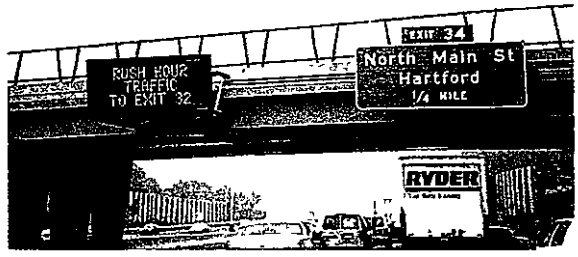
Intelligent Transportation Systems "ITS": A Strategic Plan for the Capitol Region









EXECUTIVE SUMMARY

NOVEMBER 1997

- Connecticut Department of Transportation
Capitol Region Council of Governments
DKS Associates

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INTRODUCTION

The ITS Strategic Plan outlines a strategy for improving the efficiency of the Capitol Region's *existing* highway and transit systems. The Region' s overall goal is to improve the efficiency and effectiveness of existing systems so as to reduce the need to build new facilities or add new services. The specific objective of the ITS Plan is to identify ways of improving system efficiency through the application of various communications and information technologies.

The 1994 Capitol Region Transportation Plan stressed the need to improve the efficiency of existing transportation systems through better system management. Financial and environmental constraints make it increasingly difficult to solve mobility, congestion, and safety problems by building new highways or adding new transit services. We need to find additional ways to make existing systems work better. One such way is to use advanced technologies to improve system efficiency.

WHAT IS ITS?

Intelligent Transportation Systems (ITS) involve the application of advanced technology to assist in the solution of transportation problems and the management of transportation systems Of key importance are telecommunications and information technologies that allow information on the transportation systems to be collected, processed, and disseminated. The information is valuable to transportation agencies that are responsible for operating and managing the systems, but it is also valuable to the traveling public who must make decisions about what transportation mode to use, which route to take. or what time of day to travel Collectively these applications of telecommunications and information technologies to improve transportation management and information are known as Intelligent Transportation Systems. These systems can help reduce congestion, improve safety. and improve mobility

The implementation of ITS technology is not new ITS elements such as computerized signal systems have been used for well over a decade in the Capitol Region to manage traffic flow on arterial roads However. ITS systems are increasingly being used for other transportation management purposes such as highway management, transit operations management, incident management, and travel information management.

The ITS Plan identifies strategies for addressing these individual management needs. It also provides a framework for integrating the individual ITS components into a more effective system.

ORGANIZATION

The ITS Plan is organized into four primary chapters that address the following types of system management needs

- Travel Information,
- Transit and Rideshare Management,
- Highway Management, and
- Incident Management

ITS Systems for commercial vehicle operations (CVO) are not included in this plan. A separate plan. entitled **"Connecticut ITS/CVO Institutional Issues Study,"** was prepared for the entire State of Connecticut by the ATA Foundation, 1995 More detailed (and agency specific) recommendations are now being prepared as part of an ITS/CVO Business Plan.

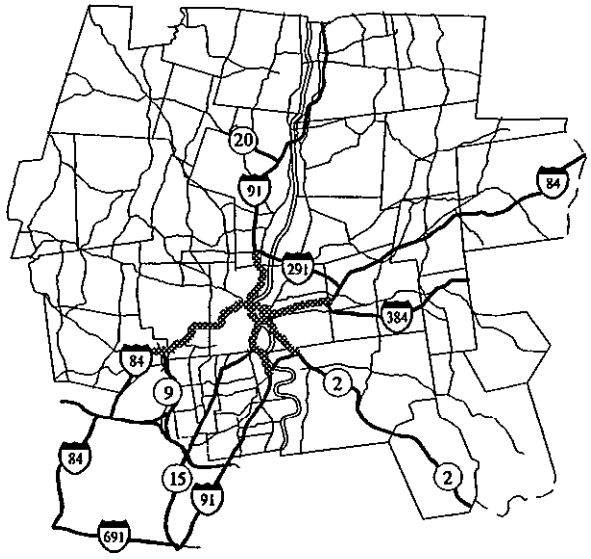
PROGRAM PHASING

The transportation management needs that can be supported by ITS technologies are substantial, and the geographic area to be covered is extensive. Therefore, the establishment of priorities and a strategy for phasing system implementation is important. In recognition of this, a three-phase implementation strategy is proposed:

Phase 1: Years l-5: Phase 1 encompasses the first five years of the ITS program. It contains the highest priority elements of the plan, and the freeway elements are restricted to the "core area" of the Region.

Core Area. The core area includes the central part of the Region where I-91, I-84, and Route 2 converge. The outer bounds of the area are generally set at the point where the radial freeways connect with a circumferential freeway. These junctions provide an opportunity for traffic to divert in order to avoid traffic problems in the core area.

Core Area



Phase 2: Years 6-10: Phase 2 includes years six through ten (6-10) of the program. These elements are considered important to the overall transportation management strategy, but are of lower priority or are outside the core area

Phase 3. Years 11-20: Phase 3 is the long term or speculative phase. Elements are included in this phase for any of three reasons: (1) they are not needed in the short or moderate term, (2) they are not cost effective at this point in time, but might become so as technology costs decrease in the future; or (3) the technology is still not proven. *There is no commitment to fund Phase 3 projects at this time, therefore the projects are not included in this document.*

Early Build. The proposed phasing is intended to serve as a "guide" for implementation. The phasing plan does not preclude any given element from being constructed earlier than indicated. Early construction is actually encouraged if the opportunity to do so becomes available, and the entire schedule can be advanced. Likewise, if a reconstruction project is initiated on a Phase 2 section of freeway, the ITS elements for that section should be included in the freeway reconstruction project plans. Inclusion of ITS elements in larger road reconstruction projects is a cost effective method of implementing ITS systems This "piggyback" approach achieves lower unit costs and minimizes traffic disruptions due to construction activity.

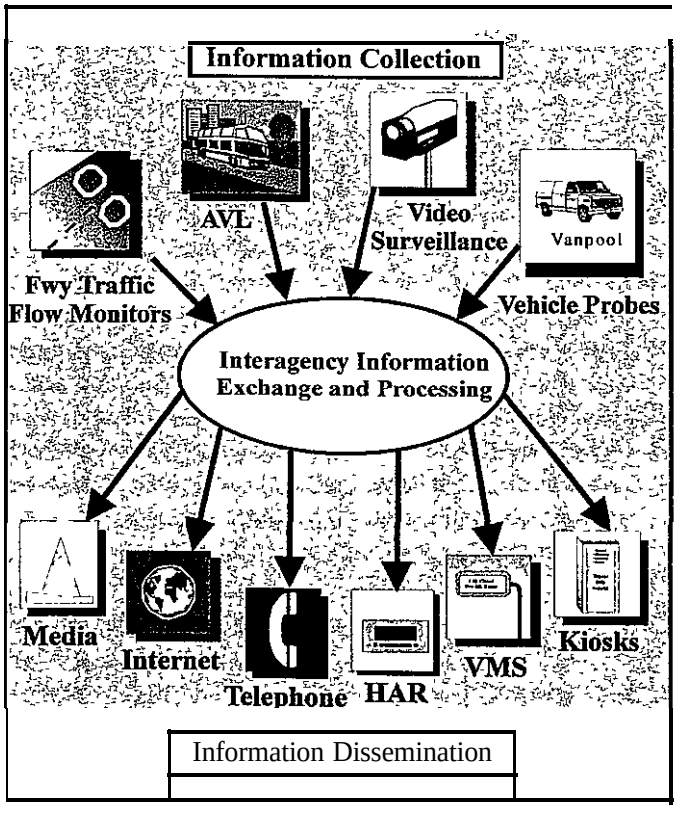
TRAVEL INFORMATION SYSTEM RECOMMENDATIONS

A key clement of the plan is the creation of a regional travel information system to serve both operators and users of the Region's highway and transit systems. The regional travel information system requires the performance of three basic functions: data collection, information processing, and data dissemmation. The information system needs to Integrate all modes of travel.

Data Collection. Transportation system operators and users presently have limited real-time information on dynamic conditions such as current traffic flow. Data collection efforts need to be expanded to provide more real-time information on system conditions. Recommended data collection improvements for the highway system include a network of *video surveillance cameras* and *traffic flow monitors* Comparable information on the status of transit operations will be provided through the installation of an *automatic vehicle location system* on the CT Transit bus system and the Transit District's demand responsive system. This will provide information on the location of all transit vehicles and an indication of how well they are adhering to their schedules.

Information Processing. Each agency will be responsible for processing the raw data that it collects. However, it is the ultimate goal of the travel information system to have all the information available through a single source. Operators and users should be able to check a single Internet site or call a single phone number to get information on the status of any highway or transit system. All the data need not be stored at a single location, but it must be accessible through a single site. This will require some coordination of databases and some central processing. A general system architecture for achieving this coordination has been recommended. However, additional analysis is required to specify the detailed data exchange requirements.

Travel Information System



Data Dissemination. Information will be disseminated to system operators and users through a variety of means. Information for the general public will be available via the Internet (map of current travel speeds, bus schedule information, interactive ride-matching service, etc.), special travel information *phone lines, variable message signs* (VMS), *highway advisory radio* (HAR), and *electionic kiosks* at major transit stations and other key locations Radio and television stations will also have direct access to this information so that they will be able to improve their traffic reporting services, Operating agencies that interact frequently (such as ConnDOT and the State Police) will have *direct communication links* for exchanging information.

TRANSIT & RIDESHARE MANAGEMENT SYSTEM RECOMMENDATIONS

Priority ITS recommendations for the transit and rideshare systems include improving information services and enhancing dispatching and scheduling functions. Information services can be improved by making information more readily available via the travel information system discussed above. Dispatching, scheduling, and routing can be improved through the use of automatic vehicle location (AVL) systems, onboard data terminals, and onboard navigation. With the exception of the travel information needs, the recommendations are specific to each transit operator.

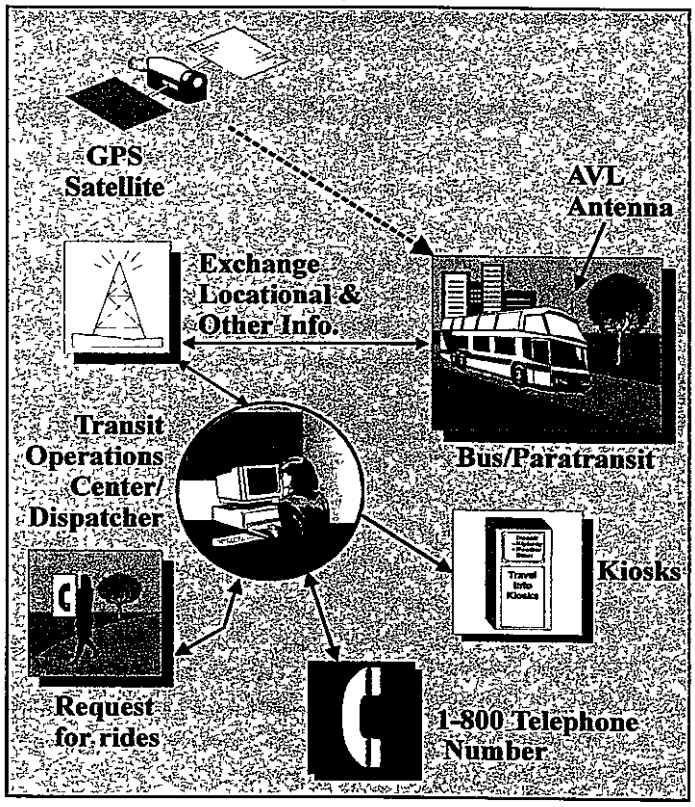
CT Transit. The primary recommendation is to install interior *video cameras on 80* buses to improve passenger security. Another important element is the implementation of an *AVL system on* all 240 buses. It is also recommended that related "*Smart Bus"* systems be installed to enhance the effectiveness of AVL. The Smart Bus components like the AVL devices to other bus system elements such as the electronic destination signs, stop announcement system, automatic passenger counters, and mechanical system monitors. Location information from the AVL system allows full automation of systems such as stop announcement and passenger counters. In the latter case, AVL allows identification of the locations where passengers boarded or alighted.

Transit District. *An onboard data terminal system with AVL capability* is recommended for the Greater Hartford Transit District's demand responsive ADA service. The District's need for AVL is actually greater than the fixed route bus service since driver schedules and itineraries are constantly changing. The proposed system will give the District the ability to immediately and automatically update a driver's itinerary even when the driver is on the road.

Rideshare. The ITS recommendations for the Rideshare Company include listing the Rideshare services in the *regional travel information system* and developing a more *dynamic ride-matching* capability. The latter will be accomplished through the use of an on-line and interactive matching program via the Internet.

Transit Information System. A regional transit information system will be developed as an interim step until a full multimodal travel information system can be developed. This will involve the creation of an Internet site for transit information as well as a statewide "1-800" *information phone line.* Persons calling the phone line will be able to access information on any transit or rideshare service in the state.

Transit Management System



HIGHWAY MANAGEMENT SYSTEM RECOMMENDATIONS

Recommendations in this section involve making more effective use of the regional arterial and freeway system. Maps depicting the location of highway management elements described below are included at the end of this section.

Traffic Monitoring and Surveillance. Video coverage of the Capitol Region freeway system is an important tool for monitoring traffic flow conditions as well as detecting and verifying traffic incidents. Expansion of the limited ConnDOT *video surveillance cameras* to include all freeways in the central area of the Region is a high priority over the next ten years (see Figure 1). Video coverage also needs to be extended to critical arterial locations. *Traffic flow monitors* (detectors) will be installed along the freeway system to provide travel speed data to the travel information system, and to collect traffic volume data needed for normal planning and administrative purposes (see Figure 2).

Information Dissemination Support: VMS & HAR. Information collected from monitoring and surveillance devices must be forwarded to motorists. The existing *VMS system* will be expanded to fill gaps in the system, especially those near critical freeway-to-freeway junctions (see Figure 3). The two existing *HAR stations* in the Capitol Region will be modified to provide travelers with current information on traffic conditions and incidents (see Figure 4). Two new HAR stations will be added to provide full coverage in the central part of the Region. An additional HAR site will be installed near Bradley International Airport to provide information to motorists arriving and departing the airport.

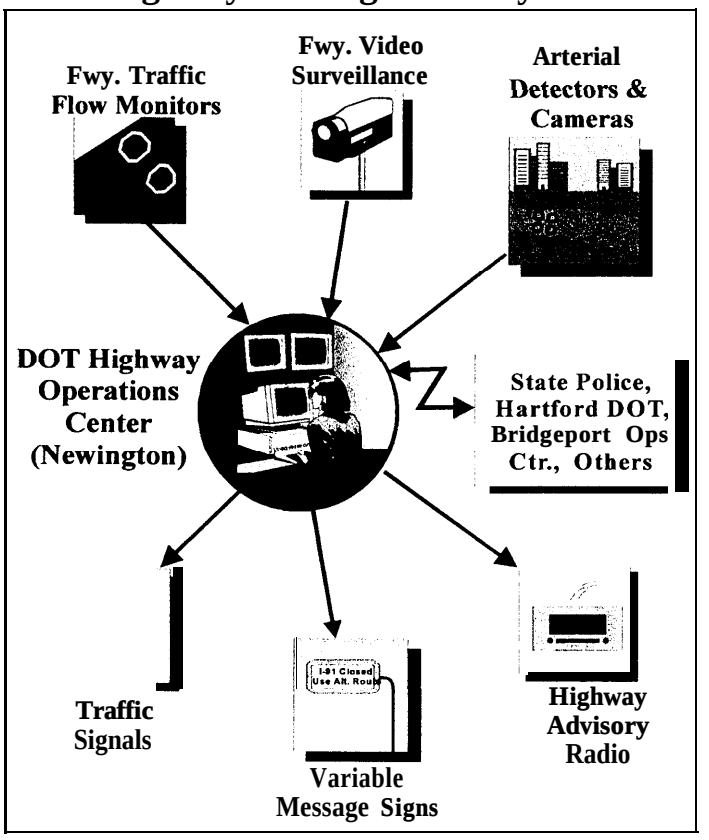
Highway Operations Center. *The* ConnDOT *Newington Highway Operations Center* serves as the focal point for coordination of incident and highway management activities within the Capitol Region. The continued implementation of highway management system components will require that the configuration, design, and staffing of the Highway Operations Center be modified to accommodate system expansion. *Interagency communication links* will be established to exchange video and highway management system information with other entities such as the City of Hartford Operations Center, the DOT Bridgeport Operations Center, and State Police Troop H barracks. Long-term expansion could include connections to the Bradley Airport Operations Center and future operations centers located in Massachusetts.

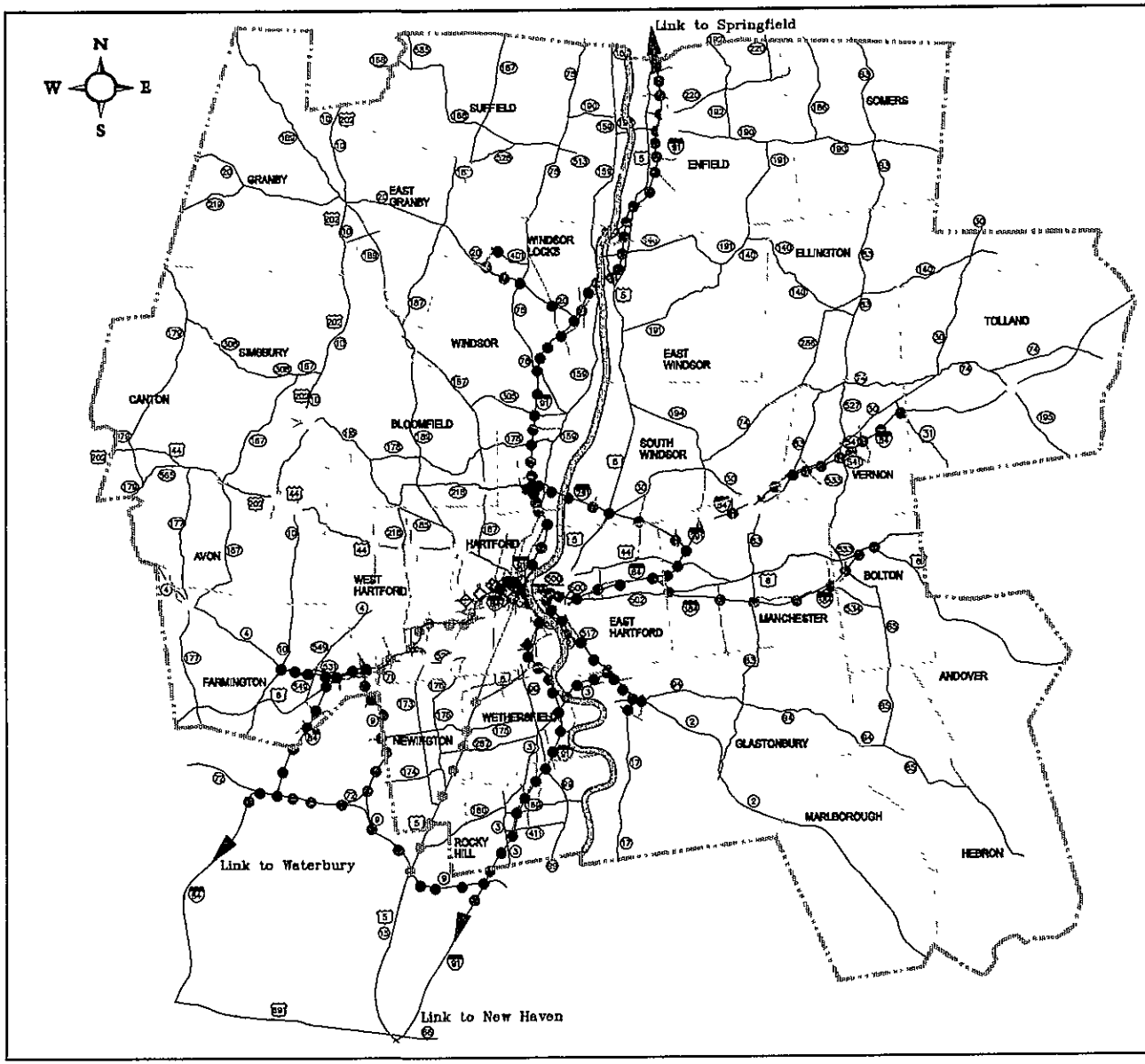
Traffic Control. The Capitol Region has already made a major investment in traffic control systems on arterial roads. The existing computerized traffic signal systems must be maintained and upgraded as needed. *ConnDOT's computerized signal systems* using outdated UTCS control equipment will be upgraded so that they can continue to provide useful service. Older, mainframe computer-controlled system locations will be converted to PC-based closed loop systems. *A study of municipal traffic signal operations* will be conducted for communities with a large number of town-owned signals, in order to identify coordination needs. The feasibility of implementing freeway traffic control devices such as *ramp metering* and *lane control signs* will be examined in a *regional study.*

HIGHWAY MANAGEMENT SYSTEM RECOMMENDATIONS

Communications Network. A communications network is required to link the highway management system components to the ConnDOT Highway Operations Center. It is recommended that *fiber optic trunk lines* (see Figure 5) be installed along the major freeways and some of the adjacent arterial roads to serve the communications needs of the video camera, traffic monitor, VMS and HAR systems. Public agencies may be able to enter into partnerships with private sector communications companies to reduce or eliminate the cost of fiber optic cable infrastructure, exchanging access to highway rights-of-way for communication cable installation and maintenance.

Highway Management System





Legend

- ◆ Existing – State of Connecticut
- ◇ Existing – City of Hartford
  (Only those cameras with freeway coverage are shown. Other City-owned cameras are not shown)
- ❄ Pending Commitment
- ● Proposed Phase 1
- ● Proposed Phase 2
- ● Proposed Phase 3

Proposed Arterials

Note. Icons represent area covered and phasing only. Actual number and placement to be determined by Design

Figure 1

Video Surveillance Cameras

INTELLIGENT TRANSPORTATION SYSTEMS
A STRATEGIC PLAN FOR THE
CAPITOL REGION

Connecticut
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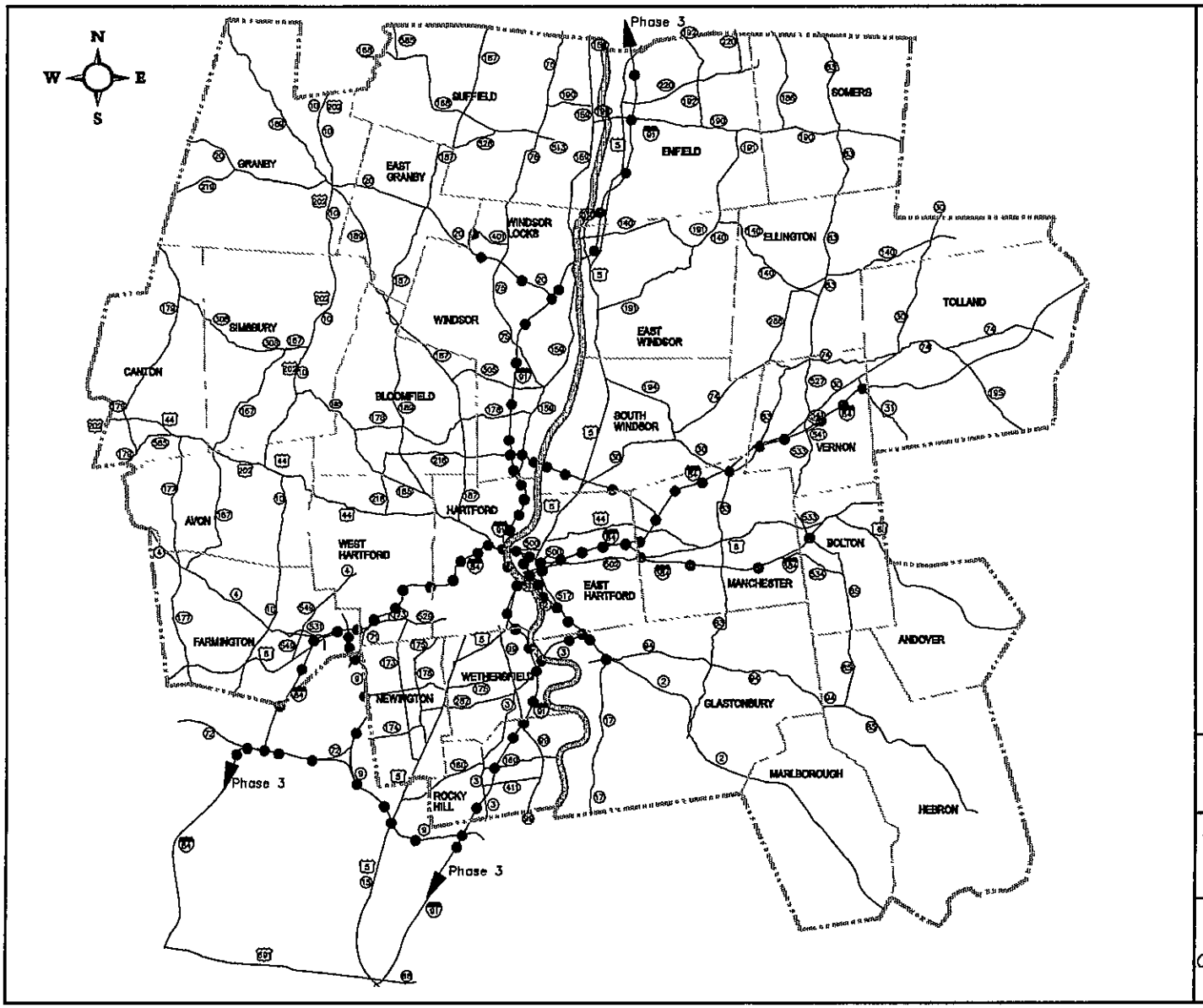

Legend:

- Existing
- Proposed Phase 1
- Proposed Phase 2
- Proposed Phase 3

Figure 2

Traffic Flow Monitors/Detectors

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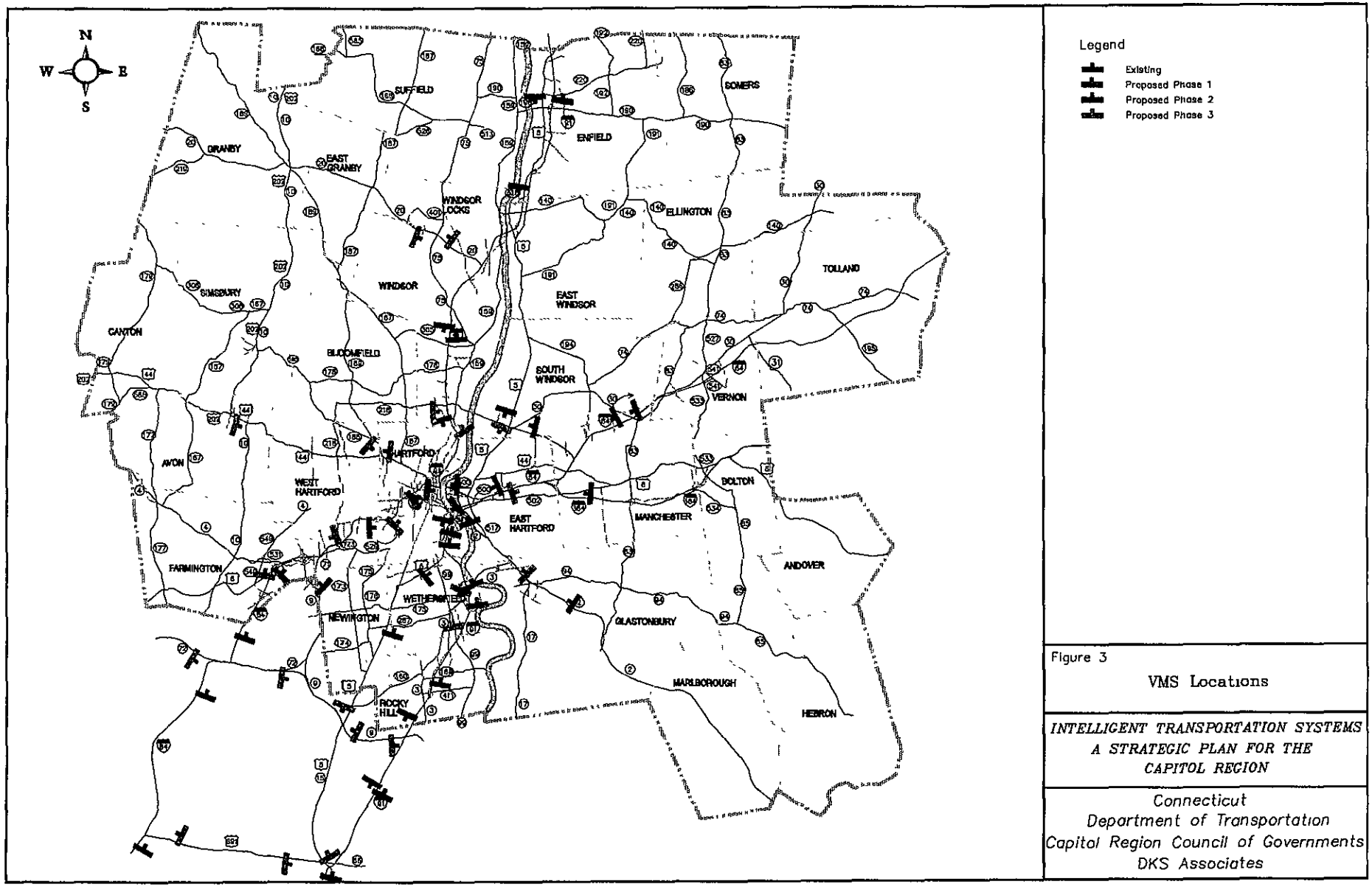

Figure 3

VMS Locations

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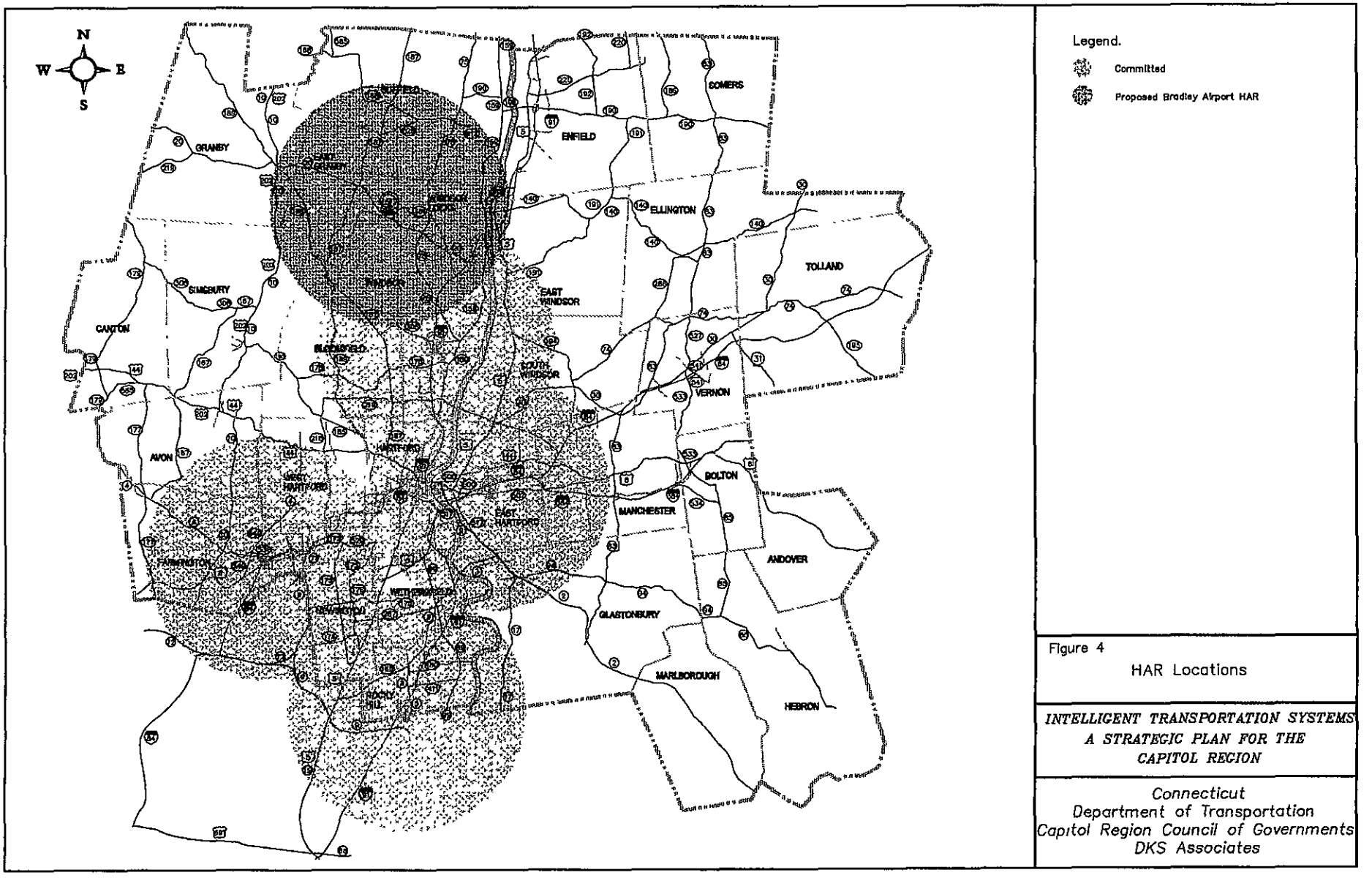

Figure 4
HAR Locations

INTELLIGENT TRANSPORTATION SYSTEMS
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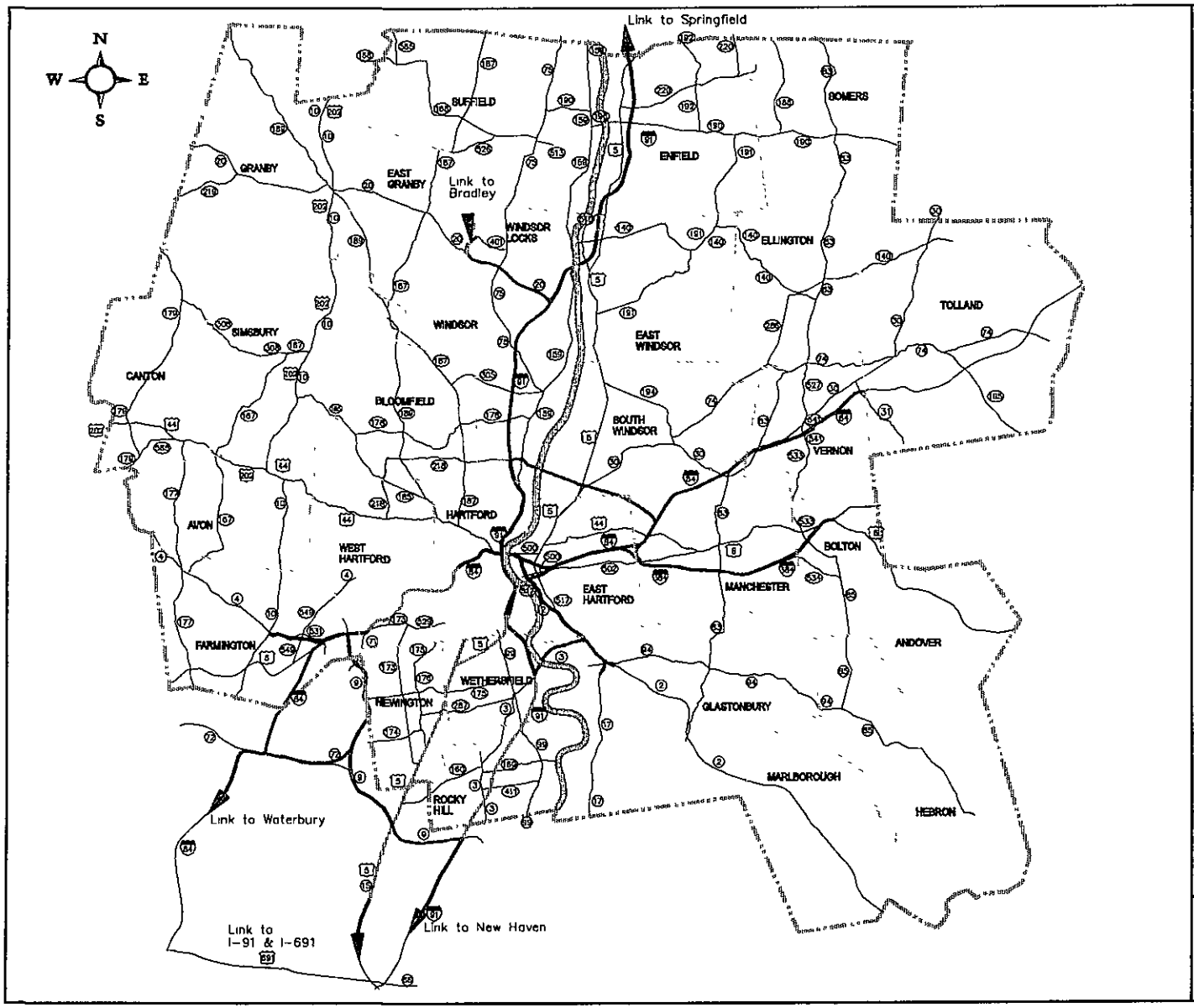

Legend

- Committed Fiber Optic Conduit + Cable
- Proposed Fiber Optic Conduit + Cable Phase 1
- Proposed Fiber Optic Conduit + Cable Phase 2
- Proposed Fiber Optic Conduit + Cable Phase 3

Figure 5

Communications Infrastructure

INTELLIGENT TRANSPORTATION SYSTEMS
A STRATEGIC PLAN FOR THE
CAPITOL REGION

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INCIDENT MANAGEMENT SYSTEM RECOMMENDATIONS

Reducing congestion due to highway incidents is an important goal of the Strategic Plan. Incident management involves the coordinated, preplanned use of human and technical resources to restore full use of a highway after an incident. Recommendations include improving interagency coordination, creating a regional radio system for incident management, and instituting highway service patrols.

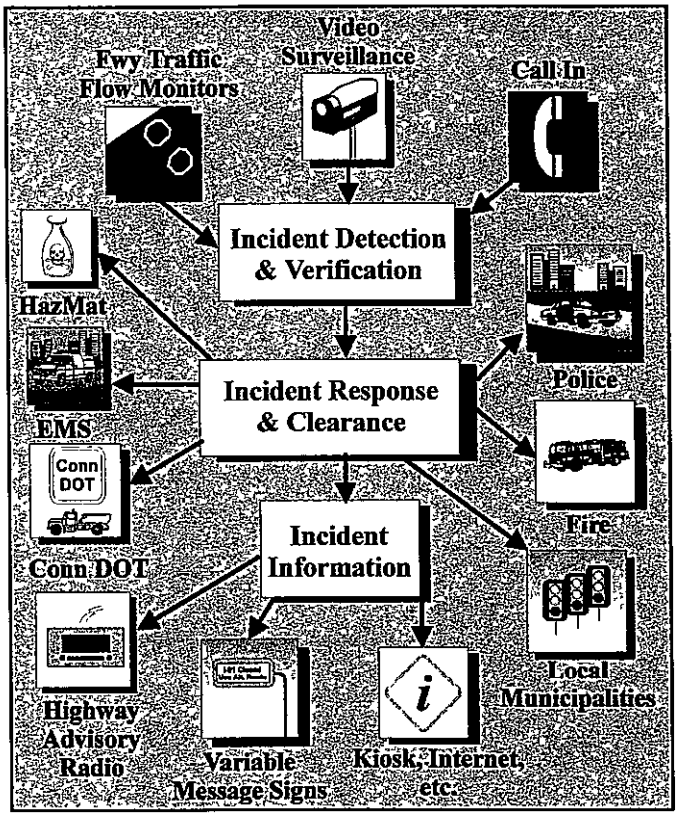
Interagency Coordination. A *regional incident* management *task force* will be established to improve the interagency coordination and planning required to effectively respond to a highway incident.

Regional Radio System. Establishment of a regional ***radio*** system is recommended to improve multi-agency responses to highway incidents. This effort will include modification of the existing regional police radio system by adding a third radio frequency and adjusting radio transmitters to provide complete area coverage. ***Portable radios*** will be provided to those agencies that do not currently have portables.

Interagency Communications. A special DOT-State Police ***direct communications link*** will be installed to enhance agency coordination. It will be possible to share video images and traffic information between agencies.

Service Patrol Program. It is recommended that a *freeway* service *patrol program* be initiated. It should be based on the successful "CHAMP" program operated by ConnDOT on I-95 in southwestern Connecticut. Coordination between DOT and the State Police will be important to the success of the service patrols.

Incident Management System



PROGRAM COSTS

A cost summary is provided below More detailed cost information is contained in the phasing recommendations which follow The total capital cost for the ten-year program (Phase 1 and Phase 2) is $38,388,000 On an annual basis, the cost is an average of $3,840,000 per year

Cost Summary

	PHASE 1	PHASE 2	PHASE 1+2
Travel Information	800,000	440,000	1,240,000
Transit & Rideshare Management	626,000	3,165,000	3,791,000
Highway Management	11,368,000	21,534,000	32,902,000
Incident Management	390,000	65,000	455,000
TOTAL	**13,184,000**	**25,204,000**	**38,388,000**

PHASE 1 RECOMMENDATIONS: INDIVIDUAL PROJECTS

The most critical elements of the ITS system are included in Phase 1 of the Plan These are either high priority projects. or they arc the initial steps that must be taken in a logical construction sequence The Highway Management System is focused on the Core Area in Phase 1.

Phase 1: Years 1-5	**$13,184,000**
Travel Information System	$800,000
- Provide real-time traffic information on the Internet	25,000
- Place 50 static information kiosks at major transit sites	250,000
- Install communication links between ConnDOT Highway Operations Center & City of Hartford DOT	25,000
- Establish regional travel information data base	500,000
Transit & Rideshare Management System	$626,000
- CT Transit install video cameras on 80 buses	196,000
- Place CT Transit bus schedule on the Internet	25,000
- Implement statewide "1-800" number for transit & rideshare information	50,000
- Transit District. install onboard data terminals with AVL capability on 60 vans	250,000
. Rideshare: initiate dvnamic ridesharing	65,000
- Study fare coordination among transit & rideshare providers	40,000
Highway Management System	**$11,368,000**
- Install video surveillance in core area	1,480,000
. Install traffic flow monitors in core area	1,212,000
- Install fiber optic cable network in core area	4,468,000
- Add 8 new VMS, replace 16 older VMS, relocate 1VMS	2,548,000
- Add 2 new HAR sites locations, revise 2 existing HAR's *(funding committed)*	0

- Install HAR transmitter at Bradley Airport	100,000
- Upgrade existing ConnDOT Highway Operations Center	660,000
- Interim upgrade of older computer signal systems	400,000
. Study to identify municipal signal coordination needs	300,000
- Feasibility study of ramp metering & lane control signs	200,000
Incident Management System	$390,000
- Organize Incident Management Task Force	0
- Adapt regional radio system for incident management	120,000
- Provide portable radios to those agencies without them	40,000
- Install DOT-State Police direct communications link	30,000
- Initiate service patrol program (CHAMP)	200,000

PHASE 2 RECOMMENDATIONS: INDIVIDUAL PROJECTS

Phase 2 includes years SIX through ten (6-10) of the program The elements and locations in Phase 2 are considered important to the overall transportation management strategy. However, they are of lower priority, outside the core area, and can be scheduled in the second phase of the program

Phase 2: Years 6-10	$25,204,000
Travel Information System	$440,000
. Convert 8 static information kiosks to real-time electronic kiosks at 4 additional transit hub stations, 1 downtown site, and 3 rail stations	320,000
- Install real-time electronic kiosks at 3 sites	120,000
Transit & Rideshare Management System	$3,165,000
- CT Transit install basic AVL in 240 buses	1,500,000
- CT Transit: integrate basic AVL with Smart Bus features	1,500,000
- Transit District install vehicle weather and road condition service	165,000
Highway Management System	$21,534,000
. Extend video surveillance coverage	2,640,000
- Extend traffic flow monitor coverage	900,000
- Add 9 new VMS sites, relocate 3 VMS	1,900,000
. Extend fiber optic cable network coverage	6,394,000
- Permanent upgrade of older computer signal systems	9,700,000
Incident Management System	$65,000
. Add additional service patrol vehicle (CHAMP)	65,000