

**Formulate Approach for 511 Implementation  
in New England**

**Dr. Paul Shuldiner, PI  
Gregg Loane, P.E., Co PI  
Randy Knapick, AICP, Co PI**

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# SI\* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
<u>LENGTH</u>				
in	inches	25.4	millimetres	mm
ft	feet	0.305	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km
<u>AREA</u>				
in <sup>2</sup>	square inches	645.2	millimetres squared	mm <sup>2</sup>
ft <sup>2</sup>	square feet	0.093	metres squared	m <sup>2</sup>
yd <sup>2</sup>	square yards	0.836	metres squared	m <sup>2</sup>
ac	acres	0.405	hectares	ha
mi <sup>2</sup>	square miles	2.59	kilometres squared	km <sup>2</sup>
<u>VOLUME</u>				
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	Litres	L
ft <sup>3</sup>	cubic feet	0.028	metres cubed	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.765	metres cubed	m <sup>3</sup>
NOTE: Volumes greater than 1000 L shall be shown in m <sup>3</sup>				
<u>MASS</u>				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
<u>TEMPERATURE (exact)</u>				
°F	Fahrenheit temperature	5(F-32)/9	Celsius temperature	°C

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
<u>LENGTH</u>				
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi
<u>AREA</u>				
mm <sup>2</sup>	millimetres squared	0.0016	square inches	in <sup>2</sup>
m <sup>2</sup>	metres squared	10.764	square feet	ft <sup>2</sup>
ha	hectares	2.47	acres	ac
km <sup>2</sup>	kilometres squared	0.386	square miles	mi <sup>2</sup>
<u>VOLUME</u>				
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m <sup>3</sup>	metres cubed	35.315	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	metres cubed	1.308	cubic yards	yd <sup>3</sup>
<u>MASS</u>				
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
<u>TEMPERATURE (exact)</u>				
°C	Celsius temperature	1.8C+32	Fahrenheit temperature	°F

°F	32	98.6	212
°C	-40	0	100
°C	-40	20	80
°C	-20	40	100
°C	0	60	160
°C	37	98.6	212

\* SI is the symbol for the International System of Measurement

## ABSTRACT

This report explores needs and challenges related to the development of an integrated regional 511 telephone traveler information infrastructure for the six New England states (CT, MA, ME, NH, RI, VT). The relatively small scale of individual states, and the significant cross-border economic and transportation integration influences traveler information needs of the general public in New England. Development of a New England-wide vision for 511 deployment is recommended in order to address the traveler information and traffic management needs of this region. The suitability of various technical approaches using call transfers, data transfers, and/or data linking are weighed. The report recommends that the region adopt a hybrid approach incorporating both call transfer capabilities (for misdirected calls) and Voice XML data linking (for information of regional importance). Future 511 integration should be founded on further interstate coordination and a regional vision backed by formalized agreements.

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# 1. INTRODUCTION

## 1.1 OVERVIEW

The New England Transportation Consortium (NETC) has commissioned a study (NETC 02-2) to examine inter-state approaches to implementing 511 telephone traveler information systems within the six-state New England region.

The 511 program is a U.S. Department of Transportation (USDOT) initiative to provide a single, nationwide telephone number to provide multimodal travel information in a reliable, accurate, and consistent presentation throughout the United States. Significant progress towards this goal has been made since the designation of 511 as the national telephone traveler information number by the Federal Communications Commission (FCC) on July 21, 2000.

The vision of the 511 Deployment Coalition, a national consortium spearheaded by USDOT, the American Public Transportation Association (APTA), ITS America, and the American Association of State Highway and Transportation Officials (AASHTO), is as follows:

*511 will be a customer driven multi-modal traveler information service, available across the United States, access via telephones and other personal communications devices, realized through locally-deployed interoperable systems, enabling a safer, more reliable and efficient transportation system.*

The 511 service provides an array of real-time and static multi-modal traveler information including roadway and weather conditions, transit information, traveler services, and other information that is deemed relevant by local deployment hosts.

511 is provided free of charge to the public, aside from any fees assessed by the user's telecommunications provider to access a local call (e.g., mobile phone users will pay for normal airtime and roaming charges according to their wireless service contracts).

### 1.1.1 511 IN THE NEW ENGLAND CONTEXT

In one sense, the six New England states (Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont) face the same challenges as the rest of the United States relative to 511 deployment and operations. Among these are technical challenges: collecting data from diverse sources and disseminating meaningful traveler information to end users; negotiating with local telecommunications providers; and developing strategies to manage normal and surge call volumes for example. Other challenges include determining how best to present information to end users (e.g. menu structure), transferring calls and/or data to 511 systems in adjoining regions or states, and marketing the 511 brand to the traveling public as the source of choice for reliable, timely, and comprehensive traveler information.

An extensive and growing body of national and New England operating experience, peer-to-peer support, and published information is available to support individual states as they address these challenges in their own 511 deployments. The 511 Deployment Coalition actively evaluates deployment activity across the United States for purposes of promoting best practices and continuing evolution of the national network.

On the other hand, there are a number of unique attributes to the New England transportation landscape that distinguish this region from many other parts of the country. These attributes suggest that for 511 deployment, as with many other transportation initiatives, there may be distinct advantages to approaching 511 from a regional perspective:

- **Compact Geography and Population Density:** The six New England states fall within an area of approximately 66,000 square miles, nearly half of which (31,000 sq. miles) is in the State of Maine. By comparison, New York contains nearly 49,000 sq. mi., Pennsylvania 46,000 sq. mi., Virginia 43,000 sq. miles, and California 164,000 sq. miles. The region is also populous, with approximately 14.2 million inhabitants, or 4.9% of the U.S. population<sup>1</sup> in 1.9% of the total land area of the United States. The coastal Mid-Atlantic region (NY, NJ, PA, DE, MD, DC, VA) is the only other portion of the United States comparable in terms of both population density and the close proximity of so many states.
- **New England Transportation and Economic Integration:** The New England region experiences a significant volume of interstate passenger and commercial traffic related to both daily commuting and long-distance transportation. For example, nearly 5.5% of the Massachusetts workforce (176,741 persons per day) commutes from out of state (primarily from NH and RI). A smaller but notable volume (101,081 persons per day) commutes from Massachusetts to neighboring states (in particular to CT, NH, and RI).<sup>2</sup>

Furthermore, the U.S. Census definitions of New England's Metropolitan Statistical Areas (MSAs) and Consolidated Metropolitan Statistical Areas (CMSAs), as well as cooperative economic partnerships such as the Hartford (CT)-Springfield (MA) "Knowledge Corridor," are illustrative of the high degree of interstate population and economic integration that drives transportation demand.

- **Permeable Border with the Northeast Corridor:** New England encompasses the northern end of the highly urbanized northeastern coastal corridor extending from approximately Richmond, VA through Washington, D.C., Baltimore, Philadelphia, New York City, Hartford, Boston, and Portland, Maine. As such, the interstate transportation and economic linkages discussed above for the New England region are extensible to an even larger scale.

Adjacent states form a "chain" of interrelationships along the length of the corridor, complicating the demarcation of discrete 511 deployment regions within this mega-corridor. For example, northern Connecticut has strong ties to Massachusetts, but the populous southwestern counties of Connecticut are integral to the CT-NY-NJ metropolitan area. Yet New Jersey also has strong economic linkages to southeastern Pennsylvania, and so on down the Eastern Seaboard. The I-95 Corridor Coalition has undertaken a peer-to-peer 511 deployment initiative to promote cross-fertilization of 511 deployment experience and ideas among corridor member states.

- **Benefits for Regional Traffic Management:** The density and diversity of the transportation network in New England facilitates large-scale route choice by informed travelers. For example, consider the diversity of driving and transit options between Boston and New York City. A summertime backup on the westbound Massachusetts Turnpike may compel a New York bound traveler to consider a coastal route, or vice versa.

Depending on the severity, duration, and location of those traffic or weather incidents, real-time traveler information may even affect mode choice in the urbanized centers of New England, particularly for daily commuters. The ability of travelers to easily obtain accurate and timely information on the region's primary travel corridors through integrated 511 complements the incident and traffic management efforts of state DOTs (and other authorities) by alleviating bottlenecks and delays in network 'hot spots.'

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<sup>1</sup> U.S. Census Bureau, 2003 Estimate.

<sup>2</sup> The Massachusetts Institute for a New Commonwealth (MASSINC) and University of Massachusetts, MASS Commuting, October 2004.

There is an important connection between well-informed travelers and the impact of traffic and incident management programs, due to the ability of such travelers to postpone or divert trips away from problem areas in the network. Regional 511 integration is a promising tool to reach travelers at a point in their journeys where route, time, and mode choice are viable options for avoiding such disruptions.

The above factors suggest that an integrated approach to 511 deployment would maximize the value of the system for its users by aligning traveler information content and presentation with the needs and expectations of its New England users—including the substantial numbers of travelers entering and exiting the region through its porous boundaries.

#### 1.1.2 FORMULATING A REGIONAL 511 DEPLOYMENT VISION

Consider a hypothetical scenario in which a traveler is departing Providence, Rhode Island for Portland, Maine, a relatively short journey but one involving travel on congested highway corridors in four states. Information of interest to this traveler might include, for example:

- Local rush hour traffic and weather conditions exiting the Providence region;
- Traffic and weather conditions in the Boston area, to help identify the best route across eastern Massachusetts;
- Potential delays at the I-95 Hampton toll barrier in New Hampshire;
- Traffic and weather conditions in southern Maine;
- Connecting Casco Bay ferry services out of Portland, including parking conditions;
- Information on traveler services and tourism attractions en route; and
- Alternative modes of transportation (e.g. motor coach, Amtrak) for completing this journey.

Even if some of this information is obtained en route while the traveler is physically within the state for which information is sought, the respective 511 systems of each state must offer an accurate, easy-to-use presentation of information to an unfamiliar user.

To take integration a step further, one can envision regional “value added” 511 services that provide a conditions summary along this entire stretch of the I-95 corridor, or comparative conditions on alternative driving routes between (for example) Boston and New York City. These examples are extensible to any number of major corridors and commuter-sheds throughout the region.

For all of its potential benefits, achieving this vision of regional 511 integration is a substantial undertaking with significant geographic, technological, financial, and institutional complexity. To achieve the maximum benefits of regional 511 integration, there may be a need for a distillation of state level ‘data’ to corridor-level ‘information’ of utility to the interstate traveler.

There is a precedent for interstate 511 integration through the tri-state Condition Acquisition and Reporting System (CARS-511) project undertaken by Vermont, New Hampshire, and Maine, and through the subsequent adoption of this platform by Rhode Island. However, many of New England’s most traveled interstate corridors, particularly those involving Connecticut and/or Massachusetts, have yet to be addressed. Moreover, a true regional 511 platform will be independent on any one specific platform.

Fully defining the vision for regional 511 integration is beyond the scope of this study. An ongoing regional dialogue among relevant stakeholders from across New England is critical to better understanding user needs and define and fulfill a collective vision for integrated 511 services. The authors encourage any and all efforts to this end.

### 1.1.3 STUDY OBJECTIVES

The intention of this study is to examine a sub-set of the issues related to 511 integration across the New England region.

As noted above and described more fully in following sections, four states (Maine, New Hampshire, Rhode Island and Vermont) have deployed 511 systems using the CARS-511 platform. Currently, the three northern New England systems provide access to other CARS-511 systems in adjacent states, where applicable, via a “call transfer” capability. Currently, Connecticut and Massachusetts are not involved in this call transfer process, as they have yet to deploy their 511 systems. This fact prohibits Rhode Island from providing adjacent-state call transfer at the present time.

A goal of this study is to determine whether the present practice of call transfer is the most efficient and/or customer-focused solution to information sharing, and to assess whether there are reasonable alternatives to navigating through multiple state 511 menus. Therefore, this project has focused on the challenges surrounding information sharing in a region with many operating authorities.

The approach to 511 implementation in the New England states has been developed in accordance with the following study tasks, which correspond to subsequent sections of this report:

- Develop a description of the existing 511 systems and services in New England;
- Develop a review of anticipated user needs in the area;
- Define the problems involved with the transfer of traveler information across state lines;
- Identify technical solutions to the challenge of transferring traveler information across state borders;
- Assess the relative merits of these technical solutions for information sharing; and
- Recommend an approach to implementing effective and customer-friendly 511 information sharing among the New England states.

## 1.2 BACKGROUND

### 1.2.1 THE U.S. DEPARTMENT OF TRANSPORTATION 511 INITIATIVE

As mentioned previously, 511 is a U.S. Department of Transportation initiative being spearheaded by a 511 Deployment Coalition, led by USDOT in cooperation with other major transportation organizations. This organization has developed national 511 deployment guidelines and assists individual regions and state with the development of their systems.

The Coalition has defined a set of “Key Characteristics” that should be incorporated into any local 511 deployment:<sup>3</sup>

- Customer focus;
- Functional and content relevance to local travelers, visitors, and through (long distance) travelers;
- Ubiquitous brand awareness and coverage;
- Timely, accurate, and reliable information;
- Consistency in content, interface, and quality of service;
- Being ‘mission critical’ to travelers, transportation system operators, emergency and homeland security providers, and the information services industry;
- Presenting a mixture of ‘public good’ and ‘value added’ information;
- Sustainability and permanence;
- Subject to constant improvement;
- Customer satisfaction; and
- National interoperability.

#### 1.2.2 511 SYSTEM BENEFITS

For the traveling public, 511 has the potential to become a powerful, pervasive traveler information tool that offers a number of benefits:

- Use of an established, widely available technology (the telephone) which travelers can use as a primary mode of obtaining traveler information. Telephone technology allows access to both pre-trip and en-route traveler information virtually anywhere through mobile and land-line connections;
- Ease of 3-digit dialing due to the FCC N11 designation;
- Nationwide consistency – 511 replaces thousands of local numbers and promotes user comprehension across the interstate transportation network;
- Faster and more convenient access to information; and
- Availability of multimodal travel information from a single source, which is of particular benefit to travelers in larger metropolitan areas as well as those unfamiliar with available local transportation services.

For transportation system operators, 511 provides a means of reaching the traveling public to provide real-time travel, weather, and event information. This allows travelers to better respond to network conditions, improving incident response and improving system efficiency.

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<sup>3</sup> Source: 511 Deployment Coalition

The high visibility of the 511 program (including a special, nationally branded logo) provides a “public face” to Advanced Traveler Information Systems as well as ITS in general, and has demonstrated that these systems can offer tangible everyday benefits to travelers. With this, however, comes the burden of providing timely, relevant information in order to build and maintain the relevance of the system to the traveling public.

### 1.2.3 NATIONAL AND REGIONAL DEPLOYMENT STATUS

The 511 Deployment Coalition has established a number of goals for the national 511 program:

By 2005:

- Operating 511 systems in at least 25 states;
- 30 of the 60 largest metropolitan areas, and over 50% of the population, will have access to 511;
- Public awareness of 511 among 25% of the U.S. population; and
- Customer satisfaction rate of 90% or higher.

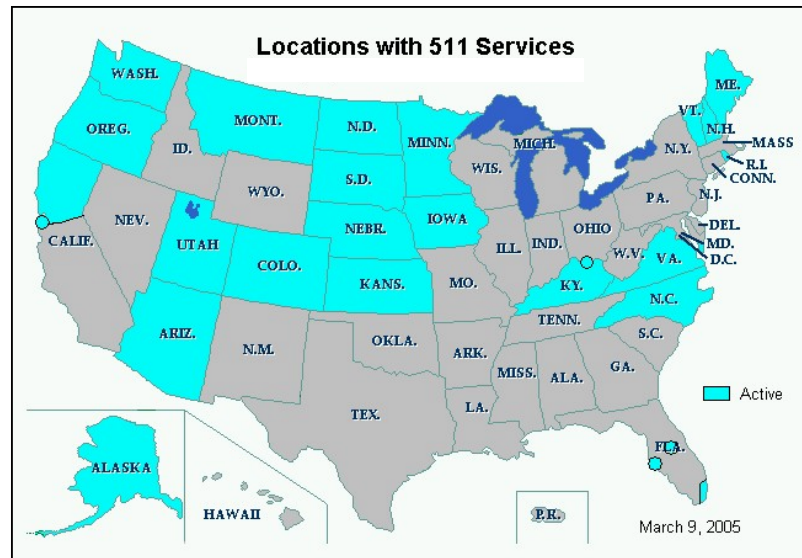
By 2010:

- 511 operational throughout the United States;
- Public awareness of 511 among 90% of the U.S. population; and
- Complete customer satisfaction with 511 services.

The USDOT vision for a nationwide three-digit traveler information number is being realized as more states implement operational 511 deployments every year. As of 2005, a majority of states have leveraged funding under the 511 Planning Assistance Program and have deployed, or are actively deploying, 511 systems (Exhibit 1-1).

As of the time of writing, four New England states (i.e. Maine, New Hampshire, Vermont, and Rhode Island) have operational 511 systems.

**Exhibit 1-1: 511 Deployment Status (early 2005)<sup>4</sup>**



Both Connecticut and Massachusetts are in the planning stages for their 511 deployments. The key neighboring states of New York and New Jersey are planning a 2005 launch of their respective 511 systems.

A number of pre-511 legacy telephone traveler information systems exist throughout the region, notably regional systems (e.g. SmarTraveler in metropolitan Boston and the UMass Regional Traveler Information Center in Amherst, MA), agency- or facility-specific numbers (e.g. transit authorities, airports), and weather hotlines.

It is telling to note that most of the states in the urbanized northeast corridor, with its high concentration of urbanized areas, high population density, multi-modal transportation system, and multiple state jurisdictions, are relative latecomers with regard to 511 deployment. This may be testament to the complexity of the deployment issues in this region. However, it also suggests an opportunity to coordinate 511 deployment initiatives within this vital corridor where there is a substantial volume of cross-border transportation (both commuter and long distance, passenger and freight) on a daily basis.

Additional state-by-state 511 deployment details for the New England region are discussed further later in this report.

#### 1.2.4 REGIONAL INTEROPERABILITY – NATIONAL GUIDANCE

The 511 Deployment Coalition has published many Deployment Assistance Reports (DARs) aiming at assisting deployers in their system implementation efforts. The DARs have resulted from the focused efforts of Coalition volunteers to assemble their collective “lessons learned” concerning 511 deployment.

Deployment Assistance Report #4, 511 Regional Interoperability Issues, outlines the challenges associated with sharing data between 511 deployments through either call transfers or through transfer of data. The report outlines principles for data sharing based on the overall vision for 511. These principles are discussed elsewhere in this document.

<sup>4</sup> Source: 511 Deployment Coalition

## 2. EXISTING TELEPHONE TRAVELER INFORMATION SERVICES IN NEW ENGLAND

This section briefly outlines the telephone-based Advanced Traveler Information Systems (ATIS), including active and planned 511 services, currently provided in the six New England states.

Four of these states (Maine, New Hampshire, Rhode Island and Vermont) currently have 511 systems deployed. Each of these existing deployments uses the Conditions Acquisition and Reporting System (CARS) 511 interface (CARS-511). The CARS-511 system has been developed through a pooled funding consortium involving a number of states across the U.S.

The remaining states, Massachusetts and Connecticut, each have traveler information systems deployed and are currently in the process of planning their own statewide 511 systems. The following section describes the organization, content and access numbers for each of these existing systems.

A number of other “legacy” telephone traveler information systems, either manual or automated, operate within the New England region. These serve specific modes (transit, rail, ferry, etc.) or destinations but are omitted here, as they do not meet 511 criteria for ‘one-stop,’ intermodal traveler information. However these systems, and the information databases behind them, may serve as vital sources of data for 511 systems in either the short or long term.

A key observation is the variation in the content and presentation of information among the many New England 511 and pre-511 telephone traveler information systems.

### 2.1 CONNECTICUT

Connecticut does not currently operate a telephone-based ATIS. However, the ConnDOT website provides various traveler services via a ‘Travel Information Gateway’<sup>5</sup> including:

- Traffic Cameras;
- Current Traffic Incidents, including accidents, construction, etc.
- 2002 Connecticut Transportation Maps organized by sub-region of the state;
- Connecticut Highway Assistance Motorist Patrol (CHAMP) coverage areas and schedules;
- Connecticut Park & Ride Locations;
- Connecticut Rest Areas;
- Road Construction Updates;
- Public Transportation links and contact information;
- Connecticut weather, including current conditions and short-range forecast; and

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<sup>5</sup> ConnDOT Travel Information Gateway URL: [www.ct.gov/dot](http://www.ct.gov/dot)

- ConnDOT 'Weather Round Up' providing temperature and precipitation totals by small geographic area through the winter months.

ConnDOT is currently in the planning stages of their statewide 511 deployment. The state faces challenges related to its geographic location and user needs that are closely integrated with both the other southern New England states as well as the metropolitan New York City region.

## 2.2 MAINE 511

Maine DOT organizes its 511 (or 1-866-282-7578 for out of state) telephone service information into eight main categories. The categories accessible by the user are:

- "Highway Traffic" offers reports about construction and other delays.
- "Road Weather" provides reports on adverse driving conditions.
- "Regional Summary" presents urgent and routine reports around a specific city that is selected.
- "Acadia National Park" provides information on the park, the Bar Harbor region and real-time departure information on the Island Explorer transit system.
- "Tourism" provides a toll-free transfer to the Department of Tourism's recording of on-going events updated monthly.
- "Ferry and Transit" informs the caller about the major ferry services that operate in Maine and public transit transportation choices.
- "Other States" provides information for other states by transferring callers to their 511 system.
- "Help with 511" gives a quick summary of how to use the system.

The system is voice command activated, but defaults to touchtone keypad use where it has difficulty interpreting the voice command.

**Exhibit 2-1: Maine 511 Routes<sup>6</sup>**



## 2.3 MASSACHUSETTS

Massachusetts currently operates two telephone-based ATIS systems: SmarTraveler in Eastern Massachusetts, and the UMass Regional Traveler Information Center (RTIC) in the Pioneer Valley of Western Massachusetts.

### 2.3.1 SMARTRAVELER

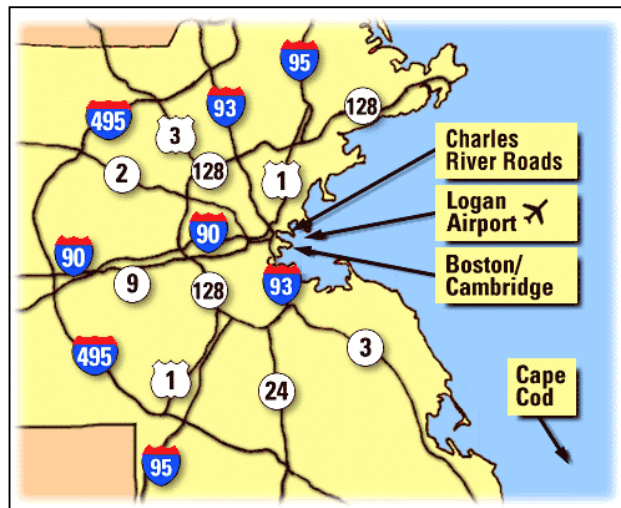
SmarTraveler (1-617-374-1234) that is operated out of a dedicated SmarTraveler Operations Center. This telephone service is organized into the following general categories:

- Route information for various regions covering eastern Massachusetts (including Cape Cod and the islands);
- Massachusetts Bay Transit Authority (MBTA) information concerning current commuter rail, subway, water transit conditions, transit schedules, special event and holiday services, and a transfer capability to the MBTA call center;
- A message box capability for reporting litter and debris on the road network;
- "Construction and road disruptions" presenting reports on planned events affecting travel;
- Information on car and van pools operated by MassRides; and
- All reports are followed by current weather conditions, a weather forecast for the day, and contact information for the SmarTraveler Operations Center (inviting event reporting).

The system offers information via voice commands or by using a touchtone keypad.

<sup>6</sup> MaineDOT Travel Information Service URL: [www.maine.gov/mdot-stage/](http://www.maine.gov/mdot-stage/)

## Exhibit 2-2: Massachusetts SmarTraveler Routes<sup>7</sup>



### 2.3.2 UMASS REGIONAL TRAVELER INFORMATION CENTER (RTIC)

The Regional Traveler Information Center (RTIC) is operated by the University of Massachusetts Transportation Center in cooperation with the Massachusetts Highway Department. RTIC provides information on real-time traffic conditions and planned events in the Pioneer Valley of Western Massachusetts.

RTIC has deployed an Interactive Voice Response (IVR) telephone hotline (413-549-RTIC) which provides the following information:

- Current real-time travel time information for a congested segment of MA Route 9 Amherst and Northampton, MA;
- Schedule maintenance and construction activities in the region;
- Major schedule events;
- Transfer options to other services;
- Local weather forecasts; and
- Telephone directory assistance.

## 2.4 NEW HAMPSHIRE 511

New Hampshire organizes its 511 (or 1-866-282-7579 for out of state) telephone service information into eight main categories:

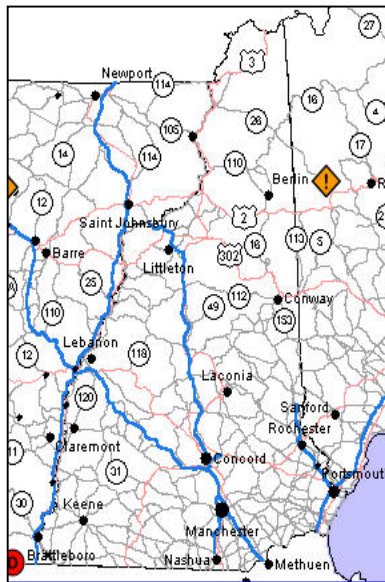
- "Highway Traffic" offers reports about construction and other delays;

<sup>7</sup> SmartRoutes Boston ATIS 'SmarTraveler' URL: [www.smartraveler.com](http://www.smartraveler.com)

- "Road Weather" provides reports on adverse driving conditions;
- "Statewide Summary" presents state-wide reports and summaries;
- "Regional Summary" presents urgent and routine reports around a specific city that is selected;
- "Transit" informs the caller about the public transit transportation choices;
- "Tourism" provides a toll-free transfer to the Department of Tourism's recording of on-going events updated monthly;
- "Other States" provides transfers to the 511 systems of adjacent states; and
- "Help with 511" gives a quick summary of how to use the system.

The system is voice command activated, but defaults to touchtone keypad use where it has difficulty interpreting the voice command.

**Exhibit 2-3: New Hampshire 511 Routes<sup>8</sup>**



<sup>8</sup> New Hampshire DOT Traveler Information URL: [www.nh.gov/dot/511](http://www.nh.gov/dot/511)

## 2.5 RHODE ISLAND 511

Rhode Island organizes its 511 (or 1-888-401-4511 for out of state) telephone service information into eight main categories:

- “Highway Traffic” reports major events by roadway;
- “Road Weather” provides reports on adverse driving conditions;•
- “Statewide Summary” provides a summary of statewide reports and also lets the user hear routine reports on select routes;•
- “Regional Summary” allows the user to hear urgent and routine reports around a specific city;•
- “Transit” lets the user hear information about public transportation choices;•
- “Tourism” provides regional tourism information;
- “Other States” provides phone numbers allowing users to manually access information for nearby states; and
- “Help with 511” provides hints on using the system.

The system is voice command activated, but defaults to touchtone keypad use where it has difficulty interpreting the voice command.

**Exhibit 2-4: Rhode Island 511 Routes<sup>9</sup>**



<sup>9</sup> Rhode Island DOT 'Rhodeways' URL: [ww2.tmc.state.ri.us](http://ww2.tmc.state.ri.us)

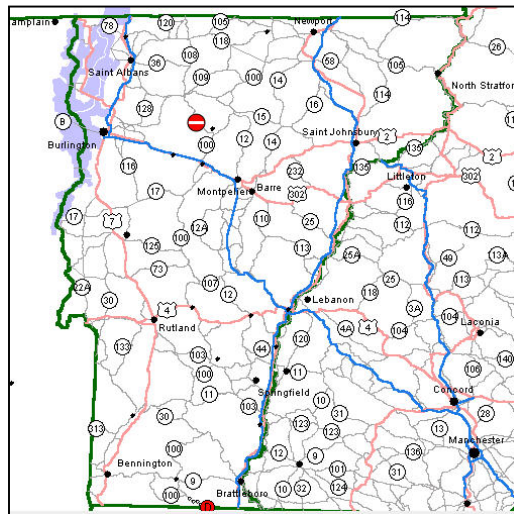
## 2.6 VERMONT 511

Vermont organizes its 511 (or 1-800-429-7623 for out of state) telephone service information into ten categories:

- "Highway Traffic" offers reports about construction and other delays;
- "Road Weather" provides reports on adverse driving conditions;
- "Regional Summary" presents urgent and routine reports around a selected city;
- "Statewide Summary" presents state-wide reports and summaries;
- "Ferries" informs the caller about the major ferry services;
- "Transit" informs the caller about the public transit transportation choices;
- "Tourism" provides a toll-free transfer to the Department of Tourism's recording of on-going events updated monthly;
- "Other States" transfers callers to 511 systems in adjacent states;
- "Help with 511" gives a quick summary of how to use the system; and
- "Comment on 511" provides the caller the option to leave comments regarding the 511 service.

The system is voice command activated, but defaults to touchtone keypad use where it has difficulty interpreting the voice command.

**Exhibit 2-5: Vermont 511 Routes<sup>10</sup>**



<sup>10</sup> Vermont DOT Travel Information Service URL: [www.aot.state.vt.us](http://www.aot.state.vt.us)

### 3. IDENTIFICATION OF USER NEEDS

In establishing local 511 services, each state has assessed its user's needs and offers services to meet these needs accordingly. However, it is also necessary to establish a common understanding concerning the degree of interoperability that is desired among the New England 511 providers. This will primarily be a function of the individual states' perceived user needs for information beyond the borders of their state. These respective user needs will reveal points of commonality, and where there is a need to provide services that are common among the participating states.

The sharing of data and/or information products is key to the objective of interoperability. Designing the data sharing process around known customer needs is vitally important to the success of the initiative. It is, therefore, important for the New England states to understand and identify (a) the most common 511 customers with multiple jurisdiction information needs, and (b) the types of information that these customers would normally want to access. These are discussed in the following sections.

#### 3.1 WHAT ARE NEEDS OF INTERSTATE CUSTOMERS?

In general, the types of information that can be presented through an interstate 511 system differ little from those of individual state 511 systems operating around the country. These include:

- Traffic and transit conditions;
- Planned and active events that affect transportation;
- Travel weather conditions; and
- Services and tourist attractions.

Rather, the major differences in provided interstate 511 services within a compact region such as New England, as opposed to within an individual state, is in terms of the **Cross-Border Availability, Seamlessness, Accessibility, and Symmetry** of traveler information:

- **Cross-Border Availability** refers to the ability of a user in one state to access information of interest while physically located in another state in the region. Cross-Border Availability provides user benefits by allowing travelers to better plan route, departure time, and travel mode based upon knowledge of network conditions elsewhere in the regional transportation system.
- **Seamlessness:** As a customer-driven service, 511 information of data should reflect users' own mental mapping of the transportation network, regardless of where jurisdictional boundaries may fall. From a user perspective, jurisdictional boundaries (state lines, DOT/Turnpike Authority, road/transit, public/private) are arbitrary distinctions in the performance of the integrated transportation network serving the traveling public. On the roadway side, this may mean presenting information in terms of frequently traveled interstate or commuting corridors, which may involve more than one state, as well as major incident information at network decision points in adjacent states.
- Related to **Accessibility** speaks to the need for common information delivery and menu format to increase the legibility of 511 systems to users who are unfamiliar with these systems. For example, the benefit to a vacationing traveler from Connecticut while traveling along the Maine coast is dependent upon that traveler's ability to quickly find meaningful information about travel conditions in that state. The public user may only attempt to access

an unfamiliar 511 system once in order to determine its relevance to their needs; if this experience disappoints the customer the credibility and effectiveness of the 511 brand will be compromised. The intuitiveness and consistency of 511 information presentation is crucial in this regard.

- **Symmetry** of information implies that traveler information provided through one state's 511 system should be in agreement with the information being presented by other 511 systems for a given corridor or service. This is important for maintaining the credibility of the information being provided. Achieving this characteristic requires consistency and coordination among public providers, as through center-to-center coordination, mutual operations protocol and information delivery policies, and/or pooling of information in a shared database.

Clearly, achieving all of these characteristics on a regional scale has significant implications for interagency 511 coordination, including system architectures, technology choices, and real-time system operations. This speaks to the need for a coordinated regional vision about what 511 *can* and *should* provide to New England travelers as a common basis for policy-making, implementation, and ultimately service delivery to the public.

## 3.2 WHO ARE THE CUSTOMERS?

Once can reasonably hypothesize, based upon the national experience, that there are a few discernible user groups with interstate 511 information needs: Long-Distance Travelers; Interstate Commuters; and Commercial Travelers.

As with any 511 deployment, travelers from all three categories place an emphasis on the timeliness and accuracy of traveler information as well as service quality (including ease of use, intuitiveness of the navigation, speed of data access, and quality of support) – although the definition of these criteria may differ among user groups.

### 3.2.1 LONG-DISTANCE TRAVELERS

Long-distance travelers include business and personal trips across one or more state boundaries. Because of the high likelihood that these travelers will be unfamiliar with host states' 511 services, legibility and consistency among services is critical. Furthermore, because of this unfamiliarity with local congestion hotspots, these travelers will benefit most if critical information on events, incidents, and weather is “pushed” to those users rather than requiring those users to identify such hotspots on their own.

Specific services that these travelers will be looking for include:

- Information on major through corridors spanning multiple states (e.g. I-95, coastal tourist routes, etc.). This includes live traffic information (e.g. travel times, congestion levels, etc.), and alternate routes, and weather / road conditions. Additional examples of these interstate corridors are discussed in Section 4.2;
- Wide-area information on metropolitan area traffic conditions to facilitate route choice decisions about the best way to travel into, out of, or around major cities and congestions hotspots;
- Tourism and traveler services information, including information on large-scale attractions, seasonal destinations, and special events;

- Roadway weather information across the region, particularly for primary travel corridors through coastal or mountainous areas prone to severe weather; and
- Intercity alternative transportation information, including airports and private providers.

### 3.2.2 INTERSTATE COMMUTERS

Interstate commuters are those who make regular trips across one or more state boundaries, as for work or school trips. New England examples include: New Hampshire to Eastern Massachusetts; the Pioneer Valley of Massachusetts to the Hartford/New Haven region, and Southwestern Connecticut to the New York City region.

These travelers will have the greatest interest in travel departure time, route, and mode choice decisions for their familiar routes, and want to be able to conveniently “pull” this information from the system. Exceptional events that affect routes that normally do not experience significant delays should be “pushed” to these users. Comparative information providing concise summaries of alternative routes and modes would be highly useful to this traveler group.

Specific services that these travelers will be looking for include:

- Easy-to-access information on roadway, incident, and weather status for the portions of the journey in each of the states (e.g. corridor-based travel information); and
- Intermodal and public transportation service updates.

### 3.2.3 COMMERCIAL OPERATORS

Commercial operators will have many of the same needs as both long-distance and commuter travelers, depending on the frequency of their route, time of day, and points of origin and destination.

Specific services that these travelers will be looking for to assist with their trip needs include:

- Corridor-related information for major commercial corridors connecting multiple states (e.g. I-95, 84, 91, etc.). This includes live traffic information (e.g. travel times, congestion levels, etc.), alternate routes, and weather / road conditions;
- Travel information and restrictions specific to commercial vehicles, including weather-induced travel bans, roadside parking information, and information about trucking-related services and intermodal rail, port, and aviation facilities; and
- Information concerning Canadian customs and border crossing traffic.

### 3.2.4 OPERATING AUTHORITIES

Operating authorities in New England also have a stake in the functionality of a regional 511 network. As discussed earlier in this report, the availability of traveler information benefits traffic and incident management efforts of the operating entities, improving overall system efficiency while reducing customer delays.

The needs of operating authorities provide another lens through which to examine interstate 511 traveler information needs and presentation. Specifically, the traffic management objectives of

these agencies, including provision of traveler information at key regional transportation decision points, can help to define a New England 511 vision and architecture.

The information types required by operating entities are varied, and are typically delivered to the public over multiple means of data dissemination (e.g. 511, VMS, website, etc.). Consequently, the most user-focused solution to the data sharing issue (i.e. the solution that best meets these user needs) may not be strictly a telephony-based solution. Ideally, the information shared would be available for presentation over non-telephone means of communication. However, as there is an immediate need to resolve the data sharing issue, fulfilling these broader ATIS needs is considered a secondary issue, and should be considered as a longer-term objective to better meet user needs.

### 3.3 GRANULARITY OF EXCHANGED INFORMATION

Not all information in a particular state's 511 system is necessarily of relevance to travelers in another New England state (e.g. a long-distance traveler). Such information may be irrelevant either because of the level of detail provided or its time-sensitivity (i.e. real-time information that will be inaccurate by the time the user interacts with a particular service).

The process of providing increasingly higher levels of detail with proximity to the subject service is often referred to as the 'granularity' of information. The level of detail required for a particular traveler information report is generally inversely proportional to the traveler's distance from the subject location. If a particular event is of immediate impact to the travel decisions of a traveler, then a high level of detail is required to alert the traveler to the nature of the event, its anticipated timeline, and options for alternate routes. Conversely, if an event is remote from a traveler, then the level of detail required is lower and may be used predominantly for broader travel choices (e.g. very broad route selection or pre-trip departure time or mode selection).

There has been little success in the provision of fully automated granularity of travel information, as this is not typically a feature supported by highway traffic management systems. Where implemented, it has more commonly been achieved through manual manipulation of the data stream. Examples include the San Francisco Bay Area 511 and the United Kingdom's Highway Agency Information Line (HAIL). However, a simpler approach to automated granularity may be achieved by simply omitting certain information types when sharing data with more remote 511 systems.

Once again, the information exchange approach should be contingent upon a definition of specific regional traveler needs, which will provide significant guidance as to the traveler decisions that 511 is supporting. As an example, an interstate information exchange need identified to facilitate daily commuting from southern New Hampshire to the Boston area would focus primarily on macroscopic traffic, road condition, and transit information from Massachusetts, providing information that supports departure time, travel route, and mode choice decisions.

### 3.4 511 SYSTEM OPERATIONAL SUPPORT

If there is to be an increased effort to share data among the New England 511 systems, there will be a need to establish formal operational relationships between the operating authorities. Continued coordination of services and operation and maintenance activities surrounding the proposed data streams would necessitate the following types of on-going institutional support:

- To avoid interruptions in shared data streams, each agency must monitor any changes in their user needs and communicate these changes to all other affected agencies prior to modifying their processes or systems;

- The participating agencies must ensure a close coordination concerning data standards, data dictionaries, custom configurations and related updates to these standards to avoid incompatibilities in data streams; and
- The participating agencies must maintain an open and on-going dialogue concerning anticipated common future user needs as this would allow for coordinated systems planning exercises.

Ideally, each participating state would support a lead contact / representative who would coordinate such operation and maintenance activities with the other New England states.

### 3.5 COORDINATION WITH THE I-95 CORRIDOR COALITION

The I-95 Coalition's vision for the Information Exchange Network (IEN) focuses on the importance of information exchange. It is important for the New England operating authorities to ensure continued support and coordination with the I-95 Corridor Coalition. Such coordination should include consideration of the I-95 Coalition's particular information needs, and recognize its stated operating objective to achieve intra-agency data interfaces that would allow the automation of data inputs (e.g. incident information, construction activity, etc.) into the IEN.

## 4. ISSUES IN PROVIDING REGIONAL TRAVELER INFORMATION

The interoperability of the 511 systems between New England states presents a unique challenge due to the multiple borders a traveler may cross during a given day. The presence of these six states in such close proximity to each other necessitates the mutual access of information, either through data transfer, call transfer, or direct system access.

The “Deployment Assistance Report #4: 511 Regional Interoperability Issues” was issued by the 511 Coalition in April 2003. This document identifies a number of the issues and concerns that commonly arise where two or more 511 systems are adjacent. The following section elaborates on the issues raised in this DAR and illustrates how some of the challenges associated with the provision of coordinated 511 services apply to the New England situation.

### 4.1 WIRELESS CALL MISDIRECTION NEAR STATE BORDERS

Currently, wireless 511 calls are sometimes misdirected when a wireless call is placed near a state border—in other words, a traveler calling the 511 number is not connected to the system which he or she was expecting, or is not connected to a 511 system at all. This occurs because the closest wireless tower will handle the call and this tower may be physically located in an adjacent state. The result is that:

- For adjacent states with 511 – A tower in the adjacent state picks up the 511 call and interprets the call as a request to connect with the adjacent state’s 511 system. The New England states with existing 511 systems each offer users the option of connecting to ‘Other States’, and thus the caller may transfer back to their intended state; or
- For adjacent states without 511 – Calls are picked up by a tower in an adjacent state, but the 511 number has not been enabled by the carrier responsible for that tower. Specifically, the carrier will not have established the switching that recognizes the 511 number and reroutes it to the appropriate ‘back door’ number for the appropriate traveler information system. The caller may receive an error message from the wireless carrier. This is a temporary circumstance that will be resolved when all states in the region formally establish 511 numbers.

Given the relative density of state boundaries in New England and proximity to metropolitan areas, particularly in southern New England, this issue is anticipated to be somewhat more significant in this region than in many other regions of the country.

The difficulties associated with misplaced wireless calls near state lines are an unfortunate side effect of the architecture of the wireless communication tower system, which is indifferent to the precise location of state boundaries. The resolution of the broader problem of wireless coverage areas and how they relate to state 511 coverage is beyond the scope of this report. However, there are information sharing strategies outlined in the following sections that may provide assistance to travelers who are caught within these ‘misdirection’ zones. In the longer term, work to improve the accuracy of locating 911 calls from mobile phones may offer solutions to this challenge.

### 4.2 INTERSTATE CORRIDOR TRAVEL

As discussed earlier in this report, a distinguishing characteristic of the New England region is the level of interstate travel along key corridors. In these situations, the ability to access out-of-state conditions by simply dialing 511 would be highly desirable.

Examples of New England travel corridors where convenient access to interstate information would be extremely valuable include:

- Providence-Boston (I-95 Corridor)
- Southern New Hampshire – Boston (I-95 Corridor)
- Boston – Seacoast NH – Portland (I-95 Corridor)
- Hartford-Springfield (I-91 Corridor)
- Coastal MA-RI-CT (I-95, I-195 Corridors)
- Upper Connecticut Valley (VT-NH-MA, I-91 Corridor)

Boundaries with adjacent states include:

- Southwest Connecticut – New York City Region (I-95, Merritt Pkwy, I-84 Corridors, including transit connections)
- Massachusetts Turnpike – New York Thruway (I-90 Corridor)
- Trans-Champlain Ferries (VT-NY)
- U.S. Route 4 (VT-NY)

Also, travelers destined to and from the U.S. / Canadian border crossing sites may benefit from crossing condition information. Such information may include time-to-process, special advisories, general customs information, and alternate route advisories. These data may be of particular benefit to commercial vehicle operations in the states bordering Canada, and elsewhere within New England.

The current 511 deployments in Maine, New Hampshire and Vermont provide access within this group through an 'Other States' menu option. While access is rapid, there is a degree of inconvenience for the user. For example, if looking for I-95 information between Maine and Massachusetts, users must navigate through four menu selections to get from I-95 in Maine to I-95 in New Hampshire.

Currently, there are no call transfer capabilities between Massachusetts and any of the other states. Also, while Rhode Island is part of the CARS-511, group for out-of-state information it offers only the telephone number for SmarTraveler in Massachusetts.

## 4.3 INFORMATION ARCHITECTURE WITHIN STATE SYSTEMS

One factor affecting the operation of both data and call transfers is the organization of information in the individual system's information databases behind their respective 511 systems.

Slight differences in the kinds of services provided from state to state, or differences in the way this information is communicated, may lead to fundamental differences in the way the information is stored in system databases. This may make retrieval of desired information from a neighboring state difficult to achieve.

For example, if State A is to retrieve road conditions (e.g. icy, foggy, etc.) from State B's meteorological database, but State B only stores this information together with air temperature

because this suits its purposes, then State A may have difficulty using this information without first manipulating it in some manner.

## 5. CALL TRANSFER SOLUTIONS TO SHARING INFORMATION

As noted earlier, the 511 Deployment Assistance Report #4 “511 Regional Interoperability Issues” was issued by the 511 Coalition in April 2003 and provides valuable insight into 511 interoperability issues, with particular emphasis on two topics: (a) data transfers and sharing, and (b) call transfer issues. These remain the two principal means to share information among 511 systems.

Call transfers, or the redirection of calls to 511 systems in other states through a system transfer of the telephone call itself is discussed within this section. The technology and processes required to complete such transfers is well understood. However, there are a number of considerations that affect the desirability of such an approach.

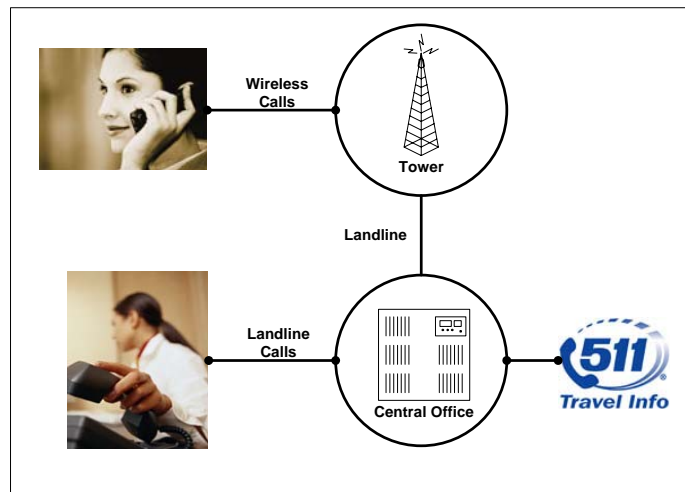
### 5.1 HOW DO CALL TRANSFERS WORK?

#### 5.1.1 CALL ROUTING

Landline telephone routing is a complex process that involves multiple steps. When a telephone call is placed, it is routed to the local ‘central office’ (CO). From there, the CO routes the call to a 511 system within the local area. Alternatively, depending on the location, routing through another CO may be necessary before reaching the intended 511 system.

When transferring calls between large cities or states, multiple CO's may be involved to route a call to its destination.

**Exhibit 5-1: Call Routing Process**



For landline N11 calls (911, 411, 511, etc.), a translation at the CO interprets the three digit number as a standard 7 or 10-digit number. This translated call is then routed by the CO to the proper destination.

A 511 wireless call is routed in a very similar fashion to a landline call. The only difference is that the call is routed via a tower location where a mobile telephone switching office initiates the routing process.

### 5.1.2 APPROACHES TO CALL TRANSFER

There are two broad approaches to transferring calls between state 511 systems: 'Direct Call Transfer' and 'Call Transfer Disconnect':

- **Direct Call Transfers** send the caller to the destination system and maintains the original connection. This type of connection uses two telephone lines – the original line and second for the transfer to the destination system. An advantage to this approach is that the user can transfer back into the original system.
- **Call Transfer Disconnects** send the caller to the destination system and terminate the original connection. This has the advantage of freeing the original telephone line for reuse. However, this would require the user to hang up and re-dial to return to the originating 511 system.

The type of call transfers possible is dependent on the telephony switching used for the originating 511 system. The two types of telephony switches are:

- Private Branch Exchange (PBX) system; and
- Centrex system

Private Branch Exchange (PBX) system users can use either a Call Transfer Disconnect or a Direct Call Transfer, while Centrex system users can only use Call Transfer Disconnect.

#### 5.1.2.1 Private Branch Exchange (PBX) System

A Private Branch Exchange (PBX) is a telephone switch, usually located on a customer's premises, connected to the telephone network but operated by the customer. A PBX provides pooled access to a given number of inside (extension) lines and a smaller number of outside lines (trunks). Often, outgoing calls are dialed directly, while incoming calls are handled by an operator or routed automatically by the PBX software.

When using a PBX for 511 transfer purposes, a Direct Call Transfer may route the caller to a destination without dropping the original line. The call is then transferred via another trunk line and the call is then occupying two lines (i.e. the original and the transfer line). This is called 'tromboning'.

Some PBX software has the ability to detect tromboning and release the affected lines (thus creating a Call Transfer Disconnect), while other PBX software can use features on the common carrier line to perform a transfer via a single line (i.e. the original line is dropped).

#### 5.1.2.2 Centrex Systems

Centrex is a generic term for a telephone company-based PBX-like service. Centrex service is a partition of a local Central Office switch that emulates the functions of an on-premises (PBX) switch. In some cases, the Centrex service is provisioned from electronics located on the subscriber's premises. In all cases, the subscriber pays a fee for the use of the Centrex service, but does not own or maintain the switch. Centrex lines are run from the CO to each user's phone. Centrex provides features such as transfer, conference, speed dial, etc. as offered on a PBX.

#### 5.1.2.3 'Blind Transfer' vs. 'Intelligent Transfer'

Whenever a telephone call is transferred from one location to another, one of two general processes occurs:

- A 'blind transfer', whereby the call is transferred and received with no accompanying information concerning the source of the transfer or the origin of the call; or
- An 'intelligent transfer' whereby information concerning the origin of the transfer is provided.

Blind transfers are commonly used for call transfers, require little specialized system development, and are generally inexpensive to operate. However, as no information is transferred from the originating system to the destination system, the nature of the user's call (i.e. their need) is unknown. Thus, the caller would be provided with the destination system's parent (main) menu, requiring additional menu choices to reach the information of interest. In some instances (e.g. misdirected wireless calls), this may be the objective of the caller. In other instances, the caller may be looking for specific information and a blind transfer to a parent menu may necessitate that the caller re-specify information. This 'double entry' of search information may result in user frustration.

Intelligent transfers include additional information concerning the nature of a user's call that may provide assistance (or shortcuts) in the navigation of the destination system. Using intelligent transfers, the nature of the user's call may be included in the transfer. For example, the fact that the user is transferring to obtain out-of-state information for a specific route may be known from the user's selection within the menu structure of the originating system. This information could be used by the destination system to route the transferred call to an appropriate menu selection automatically.

There are a number of mechanisms by which this type of transfer may be accomplished. In each instance, a form of CTI (Computer Telephony Integration) is required to carry the specific information parameters related to the caller. Typically, this integration will occur using either:

- "Out-of-band signaling" that provides data over the telephone line that the user cannot hear; or
- A secondary data link may be provided between these two locations.

Both these technologies are in common use and the selection of the appropriate technology is a function of the anticipated volume of call traffic as well as budget considerations.

## 5.2 DO CALL TRANSFERS MEET USER NEEDS?

A primary consideration in the decision whether to use call transfers for traveler information sharing is their ability to solve the customer services issues outlined in Section 4 of this report while meeting the user needs defined in Section 3 (Identification of User Needs). The call transfer process must be accomplished in a manner that maximizes user utility and minimizes frustration and call time for the user. If the call transfer process cannot meet these tests, then the process will lead to user frustration and customer dissatisfaction.

### 5.2.1 UTILITY FOR MISDIRECTED CALLS

Call transfer capability is a vital feature at this time as it is the only means to address all of the needs of users whose wireless calls have been misdirected, as described above in Section 4.1. For the reasons outlined in Section 6 (Data Transfer Solutions), data transfers to adjacent states are unlikely to adequately serve the potential range of needs for users whose calls have been misdirected. Unless a different solution to this particular problem is identified, call transfer capability will remain the simplest means to address these specific users' needs.

## 5.2.2 MEETING THE NEEDS OF INTERSTATE TRAVELERS

For other users (i.e. users who wish to access out-of-state 511 information for reasons other than their call being misdirected), the benefits of call transfer are not as immediately apparent. By providing the ability to access all of another states' information, most of the user needs outlined in Section 3.2 may be satisfied, although not in a manner that is 'user-friendly', as described below.

### 5.2.2.1 Access to Corridor Information

Using call transfer, a user attempting to access information for a corridor across multiple states will indicate their need for other state's information, and be forwarded accordingly. The existing 511 systems do not currently present multi-state corridor information, nor do they instruct the user on a means of obtaining such information. In this way, each system is 'stand-alone', and to access corridor information, a user must transfer using the 'Other States' menu options and then select the same corridor within the out-of-state system. This process provides access to all the information required, but requires several extra steps for each state accessed. Therefore, the process described here does not adequately address the user need for 'ease of use'.

### 5.2.2.2 Continuity of Presentation

Should a user navigate through one system, and then transfer into a second system to retrieve information for an adjacent state, there may be certain expectations concerning menu structure and presentation. Differences between the presentation of information, and the structure of IVR menu systems in particular, may affect the user-friendliness of the 'call transfer approach'. From a user perspective, it will always be desirable to have a consistent menu structure among the several 511 systems as this would allow for ease of use and familiarity with the structure. The ground-up approach to system development, combined with unique regional service needs, makes this ideal goal improbable to achieve. Therefore, unless there is a significant level of design and operational coordination, users who are transferred between systems are likely always going to have to deal with dissimilar data presentation structures.

### 5.2.2.3 'Deep Linking' of Call Transfers

One possible means of addressing the above-noted issues is to allow for call transfers that 'deep link' like-information among the NETC member 511 systems. Deep linking would allow the user to directly access specific information within an out-of-state 511 system without having to navigate through the upper menu layers of the desired states. Some IVR systems allow for simultaneous access to specific data fields in two ways: (a) through the navigation from a parent menu, and (b) through CTI as described in Section 5.1.2, whereby some data is transferred from the original call using an 'intelligent transfer'.

In this way, having accessed information for a particular interstate corridor, users may be prompted:

- 'Would you like information for <CORRIDOR NAME> in other states?'; and
- If yes, 'For which state?'

The system would then transfer the call to the unique number for that corridor's information in the state selected. The process could then be repeated if information in further states were required.

While this approach may simplify access to corridor information using call transfers, some drawbacks to the methodology remain:

- The ability to return to the 'home state' 511 system to access other types of information is dependent upon the system configuration, as described in Section 5.1;

- There is still a certain amount of additional navigation required to access information within a single corridor.

Therefore, the solution presented here does not completely address the user need for 'ease of use'. Further, it should be noted that at this time, it is not known whether the existing 511 systems' IVR(s) have this functionality. If considered desirable, such functionality could be built into the systems currently under development.

### 5.2.3 COMPATIBILITY OF INFORMATION PRESENTATION AMONG 511 SYSTEMS

The process of call transferring alleviates the need to coordinate data standards, as no data is shared. Instead, users access required information on the system where it resides. In this manner, call transfer relieves the operating agencies of the requirement to coordinate in terms of the design and operation of their respective 511 systems.

## 5.3 COSTS ASSOCIATED WITH CALL TRANSFERS

### 5.3.1 SYSTEM COSTS

There are system development costs associated with system solutions that enable call transfers among New England 511 systems. Very generally, these cost considerations include:

- Ensuring the telephony system used can process the call transfers appropriately;
- Ensuring the telephony system is appropriately sized (e.g. number of lines, PABX) to handle the anticipated volume of call transfers; and
- Understanding the operational and maintenance costs associated with the potentially significant expansion to the menu structure and telephony solution.

As described in Section 5.1, both Centrex PBX systems ('blind' and 'intelligent' transfers) may use Call Transfer Disconnect. This means that the same number of lines could be used in either case, even with Direct Call Transfer. Therefore, the type of switching system used does not affect the costs associated with sizing the system.

The magnitude of these sizing costs and operational issues must be understood prior to pursuing this approach to meeting user needs. While the states with existing 511 systems may have spare capacity for the services described above, the impact of adding additional partner systems (each with information demands on the existing systems) should be carefully considered. Of particular note is the Massachusetts 511 system that will replace the existing SmarTraveler system. SmarTraveler is a mature system with particularly high usage and will generate significant additional demand for the other New England 511 systems.

### 5.3.2 CALL COSTS

#### 5.3.2.1 Call Transfer Costs

The costs associated with call transfer vary depending on the functionality required for the call transfer. For example a Direct Call Transfer may cost more than a Call Transfer Disconnect. Depending on the agreement with the carrier, costs may also be incurred for the duration of the call transfer (e.g. an 800 number), or there may be a one-time charge per call incurred by the system provider.

It is important to understand the system needs prior to entering into any agreements with the carriers. Some carriers may not incur any extra costs due to the call transfer, instead the cost would be included in the monthly line subscription, while others may apply a per usage cost.

#### 5.3.2.2 Long Distance Costs

It is understood that the user will be responsible for the cost of the local call, and any wireless roaming charges incurred.

If a user calls one 511 system, and then transfers to another state's 511 system, there may be long-distance charges applied by the carrier. The magnitude of these call costs must be understood prior to pursuing this approach. Further, the NETC members need to agree on the assignment of responsibilities for these costs (e.g. may be shared with the originating and terminating states).

To maintain equity in call cost assignment, there is a need to establish an agreement among the 511 operators in this regard. Also, the contract arrangements between the CARS-511 states and Castle Rock Consultants, Inc. (the operator for CARS) should be investigated to determine if there are any associated impacts of assigning such costs.

## 5.4 PROS AND CONS OF CALL TRANSFERS

The following exhibit summarizes the pros and cons of the call transfer approach.

**Exhibit 5-2: Summary of Pros & Cons Associated with Call Transfers**

	Pros	Cons
<b>Functionality</b> (ability to meet user needs)	<ul style="list-style-type: none"> <li>• Transfer Back Option</li> <li>• Real-Time Information by transferring directly into the other State's system</li> <li>• Fewer concerns regarding nomenclature and local pronunciation.</li> </ul>	<ul style="list-style-type: none"> <li>• User friendliness for corridor information</li> <li>• Telecom Coordination</li> </ul>
<b>Costs</b>	<ul style="list-style-type: none"> <li>• System Costs (though dependent on sizing issues)</li> </ul>	<ul style="list-style-type: none"> <li>• System Long Distance Costs</li> </ul>

## 6. DATA TRANSFER SOLUTIONS TO SHARING INFORMATION

The 511 Deployment Coalition has stated that the national 511 Vision will be achieved through “locally deployed interoperable systems”. This represents an important step in the provision of customer-oriented traveler information. It means that these 511 systems should and will look beyond the strict boundaries of their immediate jurisdiction and provide information that the customer would like to hear for other jurisdictions. The operational vision above uses very broad wording and is left open to interpretation. With the ‘data transfer’ process, there are diminishing returns (and diminishing customer intuitiveness) of having certain pieces of information available at very remote distances. The question is: ‘How far outside is far enough?’ Deploying agencies should be careful not to adopt too literal an interpretation of this vision, as the cost impacts may be very large relative to the potential benefits.

Once individual state needs are known, the act of transferring the relevant data presents a number of challenges for the parties involved. The following sections identify the issues and considerations in using data transfers to achieve interoperability.

### 6.1 HOW DO DATA TRANSFERS WORK?

#### 6.1.1 OVERVIEW

This approach presumes that the local agencies will be collecting comprehensive data sets from their data-sharing partners with the intent of recreating the information presentation structure of the out-of-state system, either by corridors or for the full system (as discussed further in Section 6.1.4).

#### 6.1.2 COMMUNICATIONS

Information exchange can be accomplished over a variety of forms of communication. While secure LAN connections have been the norm in the past, it is now common to use Virtual Private Networks (VPNs) to exchange data over the Internet in a secure environment.

#### 6.1.3 DATA STANDARDS

To accommodate data transfers, two systems must either have common data message set structure and ‘diction’—technologically speaking, the two systems must ‘talk the same language’—or alternately provide translation capabilities so that the received information can be used.

In support of data transfers among 511 systems, the 511 Deployment Coalition has adopted the SAE J2354 ATIS Data Dictionary standard (which in turn incorporates the appropriate components of the draft Traffic Management Data Dictionary, or TMDD). Use of this standard in data transfer will ensure consistent nomenclature between the New England states. This has become the common standard for new 511 deployments and is already in use within the CARS application deployed by Maine, New Hampshire, Rhode Island, and Vermont for their 511 systems. It is also the standard planned for deployment in Massachusetts.

#### 6.1.4 DATA COLLECTION

##### 6.1.4.1 General

The ‘data transfer’ approach would use frequent polling of out-of-state systems for all required information. This information would be collected, stored and maintained locally for use when

needed. There are two specific levels (or 'layers') of data detail that may be collected from out-of-state systems:

- 'Raw data' collected directly from the out-of-state system's data warehouse. This is information that has undergone relatively limited processing and is not yet in 'presentation layer' format (as described below); or
- 'Presentation layer data' collected from the out-of-state voice application server. This is information already processed into voice messages and stored in a common file standard (e.g. WAV or MP3).

The data must also use a common data dictionary, such as the TMDD, as noted in Section 6.1.3 above. Using this approach, this information would be stored locally in the receiving agency's system using a suitable database structure that recreates the information organization of the out-of-state system.

There is a need for open discussion between data sharing partners regarding the specific data requirements, method of transfer and the transfer medium. Further, these discussions must establish mutually agreeable conditions surrounding use of data, branding, and protection of privacy (where applicable), as discussed further below.

#### 6.1.4.2 Raw Data

When accepting or polling raw data from information sharing partners, the amount of data being received can be a major design consideration for some 511 operators. The type and volume of data being shared has a bearing on:

- The bandwidth needed to communicate the data;
- The storage structure, storage space and related processing required on the receiving end;
- The data fusion processes needed to manipulate the data into useful products;
- The volume of information to present by the receiving agency; and
- On-going operational coordination to ensure parity between the menu structures, standards, etc.

While frequent polling for comprehensive data presents these challenges, it also opens opportunities to use the information for purposes other than a 511 system alone.

First, as part of this approach, the receiving operating agency will create its own information products from the data received. For this reason, the receiving operating agency ultimately has control over the information that will be disseminated over its system.

Also, this degree of information sharing is the basis for 'center-to-center' (or C2C) technology that allows traffic management centers to exchange data for the purposes of better managing the road network. Through C2C technology, operating authorities with overlapping geographic responsibilities (e.g. state and municipal operating authorities) can share data to receive a more comprehensive understanding of conditions in their area. Similarly, adjacent jurisdictions responsible for different parts of the same corridor can coordinate operations. Ultimately, the goal with such systems is to provide better service to travelers through coordinated operations on the road network.

It should be noted that the use of 'real-time', or as-needed transfers of data (either raw or presentation level data) would not be considered a viable alternative. While this approach would avoid the bandwidth or data storage challenges by leaving the data on the originating database until required, there would be significant system latency concerns associated with this approach. Where raw data is to be accessed, the data must be transferred, a data fusion process would follow that would create the information product from that raw data, and then it would be presented to the user over the 511 IVR. This process may take an unacceptable amount of time. Industry literature, including the 511 Deployment Coalition's DAR#4, legitimately expresses concern that real-time polling of raw data could not be accomplished with sufficient speed and would result in unacceptable pauses or delays in information access. This would, in turn, result in poor system performance and user dissatisfaction.

#### 6.1.4.3 Presentation Layer Data

Frequent polling may also be used to retrieve 'presentation layer' information from out-of-state systems. This would overcome many of the operational challenges associated with a more comprehensive set of data, as a significantly lower volume of data is transferred. As such, the related issues surrounding bandwidth, storage capacity and processing time would be mitigated.

However, in either instance (i.e. frequent polling of raw data or presentation layer data), the following issues remain:

- The significant system development issues described above would remain. Furthermore, there would be on-going operational coordination required to ensure menu structure parity between systems; and
- As final information products are being exchanged, the receiving operating agencies would have a diminished level of control over the information content on their system.

Therefore, while participating agencies may be willing to share all their data, massive transfers of 511 data, and the reconstruction of out-of-state menu structures, are not always necessary, practical, or desirable. Rather than transferring all data from all adjacent agencies to cover all contingencies, the specific needs of the participating agencies must be examined to determine the appropriate approach. Exhibit 6.1 summarizes the relative impacts of transferring raw data versus presentation layer data.

As part of this examination of needs, it is vitally important to determine the range of potential uses for the data exchanged. As has been discussed herein, there is the potential to share data between states for broader traffic management purposes. It must be determined whether this is a common objective among the participating NETC members. The exchange of raw data would facilitate a closer operational integration between adjacent traffic management systems. The participants must determine if there is a desire to use raw data from adjacent systems to declare events, set VMS, set Amber Alerts, etc. on local traffic management systems. However, there would also be implications with respect to operational requirements, deployment schedule, and costs.

Clarity in these areas will determine whether the exchange of raw data is preferred over the exchange of presentation layer data (i.e. information products). Should the exchange of raw data be seen as the desirable approach, a broader investigation of database needs and traffic management system capabilities would be required.

**Exhibit 6-1: Summary of Data Layer Types**

Raw Data	Presentation Layer Data
<ul style="list-style-type: none"> <li>• Data may be used for other traffic management and traveler information purposes.</li> <li>• Data fusion processing required.</li> <li>• Better control over what information is presented.</li> <li>• Operational and cost considerations.</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid processing, fewer operational and cost considerations.</li> <li>• Data not as useful for broader traffic management and traveler information purposes.</li> </ul>

#### 6.1.5 APPROACHES TO DATA PRESENTATION

There are two broad approaches to presenting information that has been shared between 511 systems. These include:

- Full or partial reconstruction of 'originating 511 system' presentation structure; and
- Integration with local structure.

These approaches to data presentation are independent of the data collection procedures discussed in the previous section.

##### 6.1.5.1 Full or Partial Reconstruction of 'Originating 511 System' Presentation Structure

Earlier studies have argued that to offer truly interoperable systems, states sharing information should recreate the out-of-state menu system as a menu option locally. However, a complete reproduction of the out-of-state menu tree is not required, nor advisable, for the following reasons:

- Not all information in the neighboring state is of use to the local traveler;
- It negatively impacts the size and complexity of the local system database;
- It increases the communications costs and time;
- As the number of states included increases, the size and user-friendliness of the menu system may become unwieldy. While using an IVR lends assistance in this regard, the need to address touchtone compatibility means that deployers must consider the size of the touchtone menu structure; and
- It requires close coordination to ensure that any menu structure updates are communicated to all parties with whom that state is sharing data.

#### 6.1.5.2 Integration with Local Structure

A second approach to the presentation of out-of-state information is the 'pairing' of this information with like-information in the local system. For example, a user may access a local system looking for information on a particular corridor that is common to the two states (e.g. I95). At the point where that information is offered, or immediately after providing that information, the local system may prompt the user for information for that same route in adjacent states. This approach has the advantages of being more intuitive for the user and eases navigation of the system when attempting to access like-information from multiple states.

#### 6.1.6 EXTENT OF GEOGRAPHIC COVERAGE

Each state will need to determine the extent of geographic coverage it intends to offer. One state may wish to offer information for all routes in adjacent states, while a second state may wish to offer information only for key routes (e.g. commuter, popular tourism routes, etc.) extending into adjacent states. Some of the factors associated with a decision on geographic coverage include:

- If polling the information from multiple sources, the ability to retrieve the information in a timely fashion must be considered;
- The potential benefits of having extensive coverage (versus select coverage) should be weighed against the related costs;
- Larger geographic coverage will likely result in a larger menu structure;
- Live traffic information for areas remote from the caller's current location may be of limited relevance to the caller. Within an 'all information, all states' approach, there would be a need to provide carefully considered 'granularity' of presentation (see Section 3.3). This means that distant information would be provided with less detail, whereas information concerning closer events would provide additional detail; and
- The larger the distribution, the larger the originating state's potential concerns regarding use of the information, protection of privacy, and intellectual property rights, as discussed below.

#### 6.1.7 INSTITUTIONAL CONSIDERATIONS

An important difference between the Data Transfer and Call Transfer processes is the requirement for continued operational liaison using a Data Transfer process. The states currently using the CARS application access a common database and thus share common standards, system platform, and approach to information presentation. However, for these states to share information with other New England or adjacent states that are not part of this consortium, establishment of an inter-jurisdictional operating working group is needed to define mutual needs and ensure on-going and open technology and policy dialogue. The consequences of poor inter-agency communications include failure to address user needs, broken data linkages, and potential system unavailability.

To assist in this regard, the NETC member agencies should develop and execute Memoranda of Agreement (MOA) with each other to gain agreement on:

- Intellectual property rights (data ownership);
- Operating standards; and
- Protection of privacy.

These potential MOA components are discussed in more detail below.

#### 6.1.7.1 Intellectual Property Rights

Data sharing partners should identify and assign ownership for all participating agencies' Intellectual Property (IP) that is created for, used by, or provided to any participating 511 system. Such IP may originate with any of the following groups:

- The 511 system providers;
- Any third-party contractors; and/or
- Any third-party data sources (e.g. the National Weather Service).

Also, in designing, developing, implementing, operating, modifying and maintaining their respective 511 systems, the local 511 system provider should ensure that there is no misappropriation, infringement or other violation of any IP rights of any third party. The local provider should be responsible for obtaining all required licenses to ensure that there is no misappropriation, violation or other infringement of any IP rights.

#### 6.1.7.2 Operating Standards

To successfully implement and sustain the data transfer processes described in this report, operating authorities must have a common understanding of each participant's roles and responsibilities, and they must share a commitment to the on-going support of the data sharing agreement. This includes the identification of personnel to act as liaison, assignment of funding support where appropriate, commitment of resources, etc.

Participating NETC member agencies should endeavor to ensure the highest possible level of accuracy in the shared data stream. As part of the Memoranda of Agreement (MOA), data sharing partners should stipulate that the data provided is (to the best of their knowledge) accurate. Participants should also commit to resolving any data quality issues in a timely fashion upon detection of a problem.

Participating NETC members should also endeavor to ensure that the information provided in the system is presented in a timely fashion. In addition to accuracy, timeliness of the travel information provided is also of significant importance.

Also, participating NETC members should each prepare a Quality Assurance and Control process that allows them to track and identify any potential problems with respect to either the accuracy or timeliness of the data streams used within its 511 system.

#### 6.1.7.3 Protection of Customer Privacy

Appropriate measures should be taken to protect the right to privacy of individuals while maintaining a reasonable level of access to the information for all public and private sector partners and clients. ITS America's 'ITS Fair Information and Privacy Principles' report represents a good starting point for discussion in the preparation of the above-noted MOA.

## 6.2 DO DATA TRANSFERS MEET USER NEEDS?

#### 6.2.1 UTILITY FOR MISDIRECTED CALLS

At first glance, data transfers allow system operators to recreate the intended state's menu system, and thereby appear to fulfill the misdirected user's information needs. However, the specific needs

of an out-of-state user can best be served by the system for which their call was intended. Unless adjacent states fully recreate their neighbor's menu structure (with all the associated operational implications), the data transfer approach may not address their needs. This is particularly true if the user has multiple needs and the receiving system has not fully recreated the out-of-state services locally.

Therefore, data transfer does not serve this purpose as well as the call transfer approach.

## 6.2.2 MEETING THE NEEDS OF CORRIDOR TRAVELERS

### 6.2.2.1 Access to Corridor Information

The ease of navigation and intuitiveness for the user allows the 'data transfer' approach to meet 511 user needs better than the 'call transfer' approach. Using data transfer, a user attempting to access information for a corridor across multiple states must specify the need for other state's information. In this instance, the system will provide the user with the desired information directly, whereas the call transfer process would then have to forward the request to an out-of-state system. Therefore, data transfer better addresses user needs in this regard, particularly where information for multiple states is desired.

### 6.2.2.2 Continuity of Presentation

In using raw data transfers, there is flexibility in the presentation of information. However, in exchanging information at the 'presentation layer' level, there is a need to ensure continuity in style, tone, and nomenclature used. Specifically, the purpose of a specific menu item must exactly match that of the originating system. Otherwise, the message provided may be inconsistent in its provision of information, or not match the intent of the menu selection. Therefore, data transfers result in a need to coordinate among the NETC members to (a) closely match menu structures, and (b) ensure that their out-of-state information is presented in a consistent manner.

### 6.2.2.3 Other Applications for Data Transfers

While the real-time transfer of presentation layer information seems well suited for the delivery of 511 information services, the transfer of comprehensive raw data better suits the overall needs of the traveler as it would support broader traffic management and traveler information objectives and functionality (as described in Section 6.1.4).

## 6.2.3 COMPATIBILITY OF INFORMATION PRESENTATION AMONG 511 SYSTEMS

Technological, organizational, and operational compatibility are more important when using data transfers than with call transfers. Call transfers send users to a completely separate system, thereby eliminating the need for compatibility. To successfully implement and sustain the data transfer processes described in this report, operating authorities must work together to resolve operational issues and support common ATIS standards.

# 6.3 COSTS ASSOCIATED WITH DATA TRANSFERS

## 6.3.1 SYSTEM DEVELOPMENT COSTS

There are system development costs associated with developing a solution that will enable data transfers among the NETC member 511 systems. These costs will vary considerably depending on the type of data transferred (i.e. raw data or presentation layer data). Specifically, some related cost considerations include:

- Establishing adequate and rapid communication linkages with data sharing partners;
- Creating data warehousing systems to store shared data;
- The potential data fusion processing needed to manipulate raw data into useful products; and
- The potential to develop a C2C interface that supports broader traveler and agency needs, including the I-95 Corridor Coalition.

The magnitude of these costs and operational issues must be understood prior to pursuing this approach to meeting user needs.

#### 6.3.2 OPERATIONS & MAINTENANCE COSTS

Of particular note in describing the operational and maintenance costs needed to support the data transfer process, are those costs associated with staff resources. There would be a need to provide resources for the supporting the on-going development and maintenance of interface standards and the operational coordination activities described in 6.1.7 (Institutional Considerations).

## 6.4 PROS & CONS OF DATA TRANSFERS

The following exhibit summarizes the pros and cons of the data transfer approach.

**Exhibit 6-2: Summary of Pros & Cons Associated with Data Transfers**

	Pros	Cons
<b>Functionality</b> (ability to meet user needs)	<ul style="list-style-type: none"> <li>• Potentially better access to travel information (no need for call transfer).</li> <li>• Promotes dialogue and cooperation between adjacent states.</li> <li>• More intuitive than call transfers for the end user.</li> <li>• Using raw data transfer, data may be used for other traffic management and traveler information purposes.</li> </ul>	<ul style="list-style-type: none"> <li>• For 'mirrored' menu structures, size and maintenance of system may become problematic.</li> <li>• More difficult to expand.</li> <li>• Requires a significant degree of operational coordination.</li> <li>• Use of presentation layer information prevents the use of this information for other traffic management and traveler information purposes.</li> </ul>
<b>Costs</b>		<ul style="list-style-type: none"> <li>• Capital costs of set up are higher than call transfer</li> <li>• Longer implementation time</li> <li>• Significantly more operational labor / effort</li> </ul>

## 7. DATA LINKING SOLUTIONS TO DATA SHARING

### 7.1 HOW DOES DATA LINKING WORK?

#### 7.1.1 OVERVIEW

This approach presumes that the local agencies will query out-of-state systems in real-time (and on an as-needed basis) to retrieve user-specified information items. In this instance, the local voice browser would link to the out-of-state system and request specific VXML information with certain qualifiers or parameters. This process is analogous to using an Internet browser to query a remote server for web pages that fulfill certain user defined search criteria.

#### 7.1.2 COMMUNICATIONS

As with data transfers, information exchange can be accomplished over a secure LAN connection or a Virtual Private Network (VPN) using the Internet.

#### 7.1.3 DATA STANDARDS

As with data transfer, data linking would be accomplished through a common file standard (i.e. VXML) and would again incorporate the SAE J2354 ATIS Data Dictionary standard.

#### 7.1.4 DATA COLLECTION

For data linking, real-time polling would be used to collect 'presentation layer' information from out-of-state systems. Through menu options, users would initiate this as-needed polling of out-of-state systems to collect specific information. Upon request by a user, the local voice browser would link to the out-of-state system and request specific VXML information with certain qualifiers or parameters. The information requested be generated by the out-of-state system into VXML pages and then made available by the out-of-state voice application server for viewing by the requesting system. Information would continue to reside on the original out-of-state system with very little transferred (buffered) information being stored locally. This methodology is commonly referred to as 'deep linking'.

For example, the request may come from Massachusetts for out-of-state information from New Hampshire. In this example, the user was accessing I-95 information; the parameters provided to New Hampshire's system may provide the clarification that the out-of-state information to be provided should be configured for I-95 information specifically. This information would then be buffered (stored temporarily) on the Massachusetts system and presented to the user. The information would not actually be stored on Massachusetts' system. This data will only reside permanently on the out-of-state system.

The data collection challenge here will be to establish the message standards that define the exact information being requested from the out-of-state system. This will allow the out-of-state system to build the appropriate VXML materials.

Where deep linking is used to draw the 'presentation level' information from the out-of-state system, it would overcome many of the operational challenges associated with both frequent polling and polling to retrieve a more comprehensive set of raw data. There would be a low volume of data actually transferred (thereby addressing issues surrounding bandwidth and storage capacity), fewer data standards issues, and the processing (fusion) time would be eliminated. This would facilitate swift access to information in other systems over a VPN connection. However, the issues

surrounding system access time would remain. It would be necessary to establish a communication process that permits a rapid connection set-up, as the time normally required to establish a VPN authentication would be unacceptable.

#### 7.1.5 APPROACHES TO DATA PRESENTATION

As noted in Section 6.1.5, information pairing (or the provision of out-of-state information with like-information in the local system) best meets user needs in terms of ease of access. This approach has the advantages of being more intuitive for the user and eases navigation of the system when attempting to access like-information from multiple states. Data linking facilitates this type of data presentation by quickly retrieving information from out-of-state systems only upon a user request.

#### 7.1.6 EXTENT OF GEOGRAPHIC COVERAGE

Each state will need to determine the extent of geographic coverage it intends to offer. One state may wish to offer information for all routes in adjacent states, while a second state may wish to offer information only for key routes (e.g. commuter, popular tourism routes, etc.) extending into adjacent states. Some of the factors associated with a decision on geographic coverage include:

- If polling the information from multiple sources, the ability to retrieve the information in a timely fashion must be considered;
- The potential benefits of having extensive coverage (versus select coverage) should be weighed against the related costs;
- Larger geographic coverage will likely result in a larger menu structure;
- Live traffic information for areas remote from the caller's current location may be of limited relevance to the caller. Within an 'all information, all states' approach, there would be a need to provide carefully considered 'granularity' of presentation (see Section 3.3). This means that distant information would be provided with less detail, whereas information concerning closer events would provide additional detail; and
- The larger the distribution, the larger the originating state's potential concerns regarding use of the information, protection of privacy, and intellectual property rights, as discussed in Section 6.1.7 (Institutional Considerations).

Based on the above, despite the data sharing process, data linking does not alleviate the concerns associated with menu reconstruction. This is another reason to consider the use of 'data pairing', as discussed above.

#### 7.1.7 INSTITUTIONAL CONSIDERATIONS

With data linking, there would still a requirement for continued operational liaison between participating agencies. The establishment of an inter-jurisdictional operating working group would be needed to define mutual needs and ensure on-going and open technology and policy dialogue. As with the data transfer approach, this working relationship would be supported by the execution of Memoranda of Agreement (MOA) that establish mutual understandings concerning intellectual property rights, operating standards, and protection of privacy.

## 7.2 DOES DATA LINKING MEET USER NEEDS?

### 7.2.1 UTILITY FOR MISDIRECTED CALLS

As with data transfers, data linking would provide quick access to the intended state's information, and thereby appears to fulfill the misdirected user's information needs. However, unless the entire state's system is recreated, the specific needs of an out-of-state user can best be served by the system for which their call was intended. This is particularly true if the user has multiple information needs. Therefore, data linking does not serve this purpose as well as the call transfer approach.

### 7.2.2 MEETING THE NEEDS OF CORRIDOR TRAVELERS

The ease of navigation and intuitiveness for the user allows the 'data linking' approach to meet 511 user needs better than either of the 'call transfer' or 'data transfer' approaches. The data linking approach is easier to navigate and faster than the call transfer approach, and provides faster access to information than the data transfer approach. Therefore, data linking better addresses user needs for corridor traveler information, particularly where information for multiple states is desired.

### 7.2.3 COMPATIBILITY OF INFORMATION PRESENTATION AMONG 511 SYSTEMS

Technological, organizational, and operational compatibility are more important when using data linking than with call transfers. To successfully implement and sustain the data linking processes described in this report, operating authorities must work together to resolve operational issues and support common ATIS standards.

## 7.3 COSTS ASSOCIATED WITH DATA TRANSFERS

### 7.3.1 SYSTEM DEVELOPMENT COSTS

The system development costs associated with developing a data linking solution would be significantly less than the data transfer approach. These costs would be related primarily to the establishment of adequate and rapid communication linkages between data sharing partners. The magnitude of these system costs must be understood prior to pursuing this approach to meeting user needs.

### 7.3.2 OPERATIONS & MAINTENANCE COSTS

The staff resource costs associated with the operation and maintenance of the data linking approach would be similar to that of the data transfer approach. Specifically, there would be a need to provide resources to support the on-going development and maintenance of interface standards and the operational coordination activities described in Section 6.1.7.

## 7.4 PROS & CONS OF DATA LINKING

The following exhibit summarizes the pros and cons of the data linking approach.

**Exhibit 7-1: Summary of Pros & Cons Associated with Data Linking**

	Pros	Cons
<b>Functionality</b> (ability to meet user needs)	<ul style="list-style-type: none"> <li>• Best access to travel information (no need for call transfer).</li> <li>• Promotes dialogue and cooperation between adjacent states.</li> <li>• Most intuitive for the end user.</li> </ul>	<ul style="list-style-type: none"> <li>• More difficult to expand – requires significant coordination.</li> <li>• Use of presentation layer information prevents the use of this information for other traffic management and traveler information purposes.</li> </ul>
<b>Costs</b>	<ul style="list-style-type: none"> <li>• Operational costs are lower</li> </ul>	<ul style="list-style-type: none"> <li>• Longer implementation time</li> <li>• More operational labor / effort Than call transfers</li> </ul>

## 8. RECOMMENDATIONS

### 8.1 TOWARD 511 INTEGRATION IN NEW ENGLAND

An exploration of 511 service delivery across multiple jurisdictions in the compact New England region quickly provides an appreciation for the multitude of ways in which the transportation network generally, and traveler information specifically, is perceived and used by the traveling public. This in turn leads to host of system architecture and technical decisions about how to best provide information that is both useful and accessible to the target audiences.

At the present time, 511 is in a state of partial deployment across New England, with four of the six states offering operational systems. Nonetheless, many of the key state boundaries which experience significant interstate traffic flows and information sharing issues have not been addressed because both sides of these state lines are not yet 511-enabled. Namely, Massachusetts and Connecticut, which share porous borders with other New England states, have not yet implemented operating 511 systems. Thus significant needs and opportunities remain in the short and medium terms to compel further discussion about interoperability among the region's 511 systems.

National 511 Deployment Coalition guidance is a tremendous resource for helping New England states learn from the experiences of peers on many of the most common (yet still challenging) 511 implementation issues. Nonetheless the study team recommends that further regional dialogue and coordination ensue in order to better define New England scale 511 needs and services, as well as the most advantageous and practical technological approach for achieving this collective vision.

#### 8.1.1 DEVELOPMENT OF A LONG-TERM REGIONAL VISION

Absolutely essential to New England 511 integration is the articulation of a comprehensive vision for what regional 511 can and should offer to the public. In the absence of such a vision, buttressed by formalized agreements, technical standards, deployment timelines, and representation in respective statewide ITS architectures, the opportunity to develop regional 511 services in line with New England travelers' habits and expectations may be compromised as states pursue individual or sub-regional courses of action.

The primary goal of an integrated regional 511 system is to allow convenient, intuitive access to traveler information for public users in a manner that reflects the interstate commuting and long-distance travel patterns of the New England region and beyond. These patterns are a result of both the compact geography as well as the economic integration of the New England states, and reflect a larger-scale integration of the economies and transportation infrastructure of the broader New England region.

An integrated regional 511 system might include (for example) synthesized "value added" traveler information products derived from multiple state's 511 data, giving corridor-level snapshots of travel conditions across two, three, or even four states in close proximity. Furthermore, consistency in the presentation of traveler information among individual state systems (at least on the higher levels of a menu structure) will be important to ensuring that these systems are accessible to the region's mobile residents, commercial shippers, and visitors from outside of the region.

Realizing such a vision will require a detailed analysis of user needs as well as significant coordination among state agencies related to institutional, operational, financial, and technological issues. The study team recommends a continuing dialogue among 511 interests in New England to develop a mutual framework for regional 511 integration. A defined set of regional 511 deployment

objectives would enable interstate information sharing and the possibility of other enhanced corridor-specific information capabilities in the future.

The telephone-based 511 system is not the only ITS application that would benefit from increased interstate data sharing. Data sharing among New England states would ideally allow each operating authority to use that data to accomplish broader Traffic Management and Traveler Information objectives. It is recommended that the NETC members determine if there is a common longer-term desire for closer operational integration between adjacent traffic management systems through a center-to-center (C2C) or equivalent connection.

#### 8.1.2 511 INTEGRATION BEYOND NEW ENGLAND

Given the porous nature of New England's borders with New York State and the remainder of the Northeastern U.S. (and to a lesser extent, Canada), interstate 511 integration within New England must also consider the needs of the large number of travelers who cross into and out of this region on a daily basis – including many commuters to and from the metropolitan New York City area.

Connecticut, in particular, will face challenging 511 deployment questions regarding the needs of its New York-focused users and those in other parts of the state who would benefit more from a pan-New England approach. This furthers the suggestion that a basic 511 framework may be best defined at the Northeast Corridor level, a model akin to the deployment of electronic tolling through the E-ZPass program.

This northeastern mega-region has a platform for dialogue and coordination on 511 deployment through the I-95 Corridor Coalition, in particular its Inter-Regional Multimodal Traveler Information (IMTI) program track. Decisions arising from this I-95 dialogue may act as a model for other interstate corridors in the region.

New England states should coordinate their integration efforts with those of the I-95 Coalition to ensure that the two bodies are working towards compatible visions and operational goals. In particular, the I-95 Coalition's vision for the Information Exchange Network (IEN) focuses on the importance of information exchange. There is significant opportunity to further integrate the IEN with the information systems of the NETC member states.

## 8.2 INFORMATION SHARING STRATEGY

There are two distinct objectives driving the selection of the most appropriate information sharing strategy:

- The provision of out-of-state corridor, location and event information for users traveling through multiple states; and
- The provision of in-state information to users whose calls have been misdirected to an out-of-state 511 system.

The strategy and follow-up actions outlined below describe the recommended approach to providing this improved access to 511 traveler information in the New England region in the short to medium term.

### 8.2.1 PROPOSED STRATEGY

The option of transferring to a neighboring state should be offered to all users contacting any 511 system. This will best serve the needs of those users whose calls have been misdirected, as only their intended 511 system will be able to meet the full range of traveler information services.

However, call transfer is not recommended as the preferred solution for corridor information as it is an inefficient and non-customer-focused means of accessing such information. Instead, the use of 'data linking' to voice XML pages for other states should be used to provide access to comprehensive information for key out-of-state corridors, places and events. It is further recommended that the New England states focus on the provision of 'paired information' along key corridors instead of full menu reconstruction for out-of-state systems.

The combination of these two approaches would provide the best level of service for the traveling public, commercial traffic and agencies operating 511 systems.

### 8.2.2 REQUIRED FOLLOW-UP INVESTIGATIONS - CALL TRANSFERS

As noted previously, a number of follow-up investigations are required to implement full call transfer capability between adjacent states in the New England region. These include:

- An investigation to estimate the potential volume of call transfers between states;
- An analysis of the existing and future 511 systems capacities to handle the anticipated volume of call transfers;
- Establishment of a common understanding concerning the use of call transfer disconnect;
- The potential development of a common call transfer user interface template (allowing for consistency of information presentation among the participating states); and
- The preparation of estimates and budget associated with this development work.

Lastly, Connecticut, Massachusetts and Vermont should consider a similar series of investigations concerning call transfer capabilities with New York State.

### 8.2.3 REQUIRED FOLLOW-UP INVESTIGATIONS - DATA LINKING

Similarly, a number of follow-up investigations are required to implement 'data linking' with out-of-state systems. These include:

- An establishment of a common understanding concerning data standards and related parameters to facilitate information exchange;
- A determination regarding communication connectivity to ensure the satisfactory responsiveness of the system;
- Establishment of a common understanding surrounding use of data, branding, and protection of privacy (where applicable);
- A determination regarding information service requirements for each state to define what data is to be shared. This will determine the function and geographic range of information desirable for each state, and the availability of this data from the source state; and

- The establishment of a formal operational relationship between the participating operating authorities that would define each state's commitment to the operation and maintenance activities surrounding the proposed data streams.

#### 8.2.4 STANDARDS

A detailed discussion of technical standards is premature and beyond the scope of this document. However, as technological compatibility is important to realizing any integrated 511 vision, the study team recommends that all states explore the formal adoption of the SAE J2354 ATIS Data Dictionary standard to ensure consistent message nomenclature across the New England region. Use of this standard presents significant traveler information and ATMS benefits beyond 511 interoperability.