# Integrated Corridor Management Initiative: Demonstration Phase Evaluation

## Dallas Institutional and Organizational Analysis Test Plan

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16. Abstract

This report presents the test plan for conducting the Institutional and Organizational Analysis for the United States Department of Transportation (U.S. DOT) evaluation of the Dallas U.S. 75 Integrated Corridor Management (ICM) Initiative Demonstration. The ICM projects being deployed in Dallas include a suite of strategies aimed at balancing U.S. 75 corridor transportation supply and demand to promote overall corridor efficiency and safety. Operational strategies to be deployed in the Dallas U.S. 75 highway corridor include: simulations to predict travel conditions for improved incident response, interdependent response plans among agencies, traffic diversion to frontage roads and strategic arterials, traveler mode shift to the light rail system during major freeway incidents, and comparative travel time information to the public and operating agencies for freeway, HOV lanes, frontage roads, arterial streets, and light-rail transit lane. Technologies that will be used to carry out these strategies include a Decision Support System, a 511 traveler information system (telephone and website), a regional center-to-center information exchange network, dynamic message signs, parking management systems, transit signal priority and responsive traffic signals. This Institutional and Organizational Data Test Plan is based on the ICM Initiative Demonstration National Evaluation Framework. This test plan provides an overview of the Institutional and Organizational Analysis and describes the specific qualitative and quantitative data that will be collected to support the analysis. Data analysis methodologies as well as risks and mitigations associated with this evaluation analysis are also discussed in this test plan.

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| AMS | Analysis, Modeling and Simulation |
| DART | Dallas Area Rapid Transit |
| DSS | Decision Support Systems |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| GUI | Graphical User Interface |
| HOT | High-Occupancy Tolling |
| HOV | High-Occupancy Vehicle |
| I-15 | Interstate 15 |
| I-635 | Lyndon B. Johnson Freeway |
| ICM | Integrated Corridor Management |
| ICMS | Integrated Corridor Management System |
| ITS | Intelligent Transportation Systems |
| KTT | Knowledge and Technology Transfer |
| LRT | Light Rail Transit |
| MOE | Measure of Effectiveness |
| NCTCOG | North Central Texas Council of Governments |
| NTTA | North Texas Tollway Authority |
| RITA | Research and Innovative Technology Administration |
| TEARS | Targeted Event Accelerated Response System |
| TMC | Transportation Management Center |
| TxDOT | Texas Department of Transportation |
| U.S. DOT | U.S. Department of Transportation |
| UPA/CRD | Urban Partnership Agreements/Congestion Reduction Demonstration |
| VMT | Vehicle Miles Traveled |
| Volpe Center | John A. Volpe National Transportation System Center |

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# 1.0 INTRODUCTION

This report presents the plan for conducting the Institutional and Organizational Analysis, one of seven analyses that comprise the United States Department of Transportation (U.S. DOT) national evaluation of the Dallas Integrated Corridor Management (ICM) Initiative demonstration phase. The ICM demonstration phase includes multi-modal deployments in the U.S. 75 corridor in Dallas, Texas and the Interstate 15 (I-15) corridor in San Diego, California. Separate evaluation test plan documents are being prepared for each site. This document, which focuses on Dallas, is referred to as a "test plan" because, in addition to describing the specific data to be collected it describes how that data will be used to test various evaluation hypotheses and answer various evaluation questions.

The primary thrust of the national ICM evaluation is to thoroughly understand each site's ICM experience and impacts. However, it is expected that various findings from the two sites will be compared and contrasted as appropriate and with the proper caveats recognizing site differences.

The remainder of this introduction chapter describes the ICM program and elaborates on the hypotheses and objectives for the demonstration phase deployments in Dallas and San Diego, as well as the subsequent evaluation analyses. The remainder of the report is divided into five sections. Chapter 2 summarizes the Institutional and Organizational Analysis overall. Chapters 3 and 4 describe the quantitative and qualitative data that will be used in this analysis. Chapter 5 describes how the data will be analyzed. Chapter 6 presents the risks and mitigations associated with institutional and organizational data.

## 1.1 ICM Program[1]

Congestion continues to be a major problem, specifically for urban areas, costing businesses an estimated $200 billion per year due to freight bottlenecks and drivers nearly 4 billion hours of time and more than 2 billion gallons of fuel in traffic jams each year. ICM is a promising congestion management tool that seeks to optimize the use of existing infrastructure assets and leverage unused capacity along our nation's urban corridors.

ICM enables transportation managers to optimize use of all available multimodal infrastructure by directing travelers to underutilized capacity in a transportation corridor—rather than taking the more traditional approach of managing individual assets. Strategies include motorists shifting their trip departure times, routes, or modal choices, or transportation managers dynamically adjusting capacity by changing metering rates at entrance ramps or adjusting traffic signal timings to accommodate demand fluctuations. In an ICM corridor, travelers can shift to transportation alternatives—even during the course of their trips—in response to changing traffic conditions.

[1] This section has largely been excerpted from the U.S. DOT ICM Overview Fact Sheet, "Managing Congestion with Integrated Corridor Management," http://www.its.dot.gov/icms/docs/cs_over_final.pdf, developed by SAIC for U.S. DOT. At the direction of U.S. DOT, some of the original text has been revised to reflect updates and/or corrections.

The objectives of the U.S. DOT ICM Initiative are:

- Demonstrate how operations strategies and Intelligent Transportation Systems (ITS) technologies can be used to efficiently and proactively manage the movement of people and goods in major transportation corridors through integration of the management of all transportation networks in a corridor.
- Develop a toolbox of operational policies, cross-network operational strategies, integration requirements and methods, and analysis methodologies needed to implement an effective ICM system.
- Demonstrate how proven and emerging ITS technologies can be used to coordinate the operations between separate multimodal corridor networks to increase the effective use of the total transportation capacity of the corridor.

The U.S. DOT's ICM Initiative is occurring in four phases:

- Phase 1: Foundational Research – This phase researched the current state of corridor management in the United States as well as ICM-like practices around the world; conducted initial feasibility research; and developed technical guidance documents, including a general ICM concept of operations to help sites develop their own ICM concept of operations.
- Phase 2: Corridor Tools, Strategies and Integration – U.S. DOT developed a framework to model, simulate and analyze ICM strategies, working with eight Pioneer Sites to deploy and test various ICM components such as standards, interfaces and management schemes.
- Phase 3: Corridor Site Development, Analysis and Demonstration – This phase includes three stages:
    1) Concept Development – Eight ICM Pioneer Sites developed concepts of operation and requirements documents.
    2) Modeling – U.S. DOT selected Dallas, Minneapolis and San Diego to model their proposed ICM systems.
    3) Demonstration and Evaluation – Dallas and San Diego will demonstrate their ICM strategies; data from the demonstrations will be used to refine the analysis, modeling and simulation (AMS) models and methodology.
- Phase 4: Outreach and Knowledge and Technology Transfer (KTT) – U.S. DOT is packaging the knowledge and materials developed throughout the ICM Initiative into a suite of useful multimedia resources to help transportation practitioners implement ICM.

An on-going ICM Initiative activity, AMS is very relevant to the evaluation. AMS tools were developed in Phase 2 and used by the sites to identify and evaluate candidate ICM strategies. In Phase 3, the proposed Dallas and San Diego ICM deployments were modeled. As sites further refine their ICM strategies, AMS tools continue to be used and iteratively calibrated and validated, using key evaluation results, in part. The AMS tools are very important to the evaluation for two reasons. First, the evaluation will produce results that will be used to

complete validation of the AMS tools, e.g., assumptions related to the percentage of travelers who change routes or modes in response to ICM traveler information. Second, AMS tools will serve as a source of some evaluation data, namely the corridor-level, person-trip travel time and throughput measures that are difficult to develop using field data.

## 1.2 ICM Demonstration Phase Deployments[2]

This section summarizes the Dallas ICM deployment and briefly contrasts it with the San Diego deployment.

### 1.2.1 Overview of the Dallas ICM Deployment

The U.S. 75 ICM project is a collaborative effort led by Dallas Area Rapid Transit (DART) in collaboration with U.S. DOT; the cities of Dallas, Plano, Richardson, and University Park; the town of Highland Park; North Central Texas Council of Governments (NCTCOG); North Texas Tollway Authority (NTTA); and the Texas Department of Transportation (TxDOT).

U.S. 75 is a north-south radial corridor that serves commuter, commercial, and regional trips, and is the primary connector from downtown Dallas to the cities to the north. Weekday mainline traffic volumes reach 250,000 vehicles, with another 30,000 vehicles on the frontage roads. The corridor (travelshed) has 167 centerline-miles (269 kilometers) of arterial roadways.

Exhibited in Figure 1-1, the U.S. 75 corridor has two concurrent flow-managed, high-occupancy vehicle (HOV) lanes, light rail, bus service, and park & ride lots. The corridor sees recurring congestion and a significant number of freeway incidents. Light rail on the DART Red Line is running at 75 percent capacity, and arterial streets are near capacity during peak periods and are affected by two choke points at the U.S. 75/Lyndon B. Johnson Freeway (I-635) interchange and U.S. 75/President George Bush Turnpike interchange.

DART and the regional stakeholders will contribute $3 million to the $8.3 million ICM deployment. The Dallas ICM deployment focuses on the four primary ICM goals shown in Table 1-1: improve incident management, enable intermodal travel decisions, increase corridor throughput, and improve travel time reliability. The Dallas site team intends to utilize a variety of coordinated, multi-modal operational strategies to achieve these goals, including:

- Provide comparative travel times between various points of interest to the public via the 511 system for the freeway, strategic arterial streets (i.e., Greenville Ave.), and light-rail transit line, as well as real-time and planned events status and weather conditions. Operating agencies plan to have real time status of all facilities within the ICM corridor.
- Use simulations to predict travel conditions for improved operational response.
- Implement interdependent response plans among agencies.

[2] Information in this section has been excerpted from "Integrated Corridor Management," published in the November/December 2010 edition of Public Roads magazine. The article was authored by Brian Cronin (RITA), Steve Mortensen (FTA), Robert Sheehan (FHWA), and Dale Thompson (FHWA). With the consent of the authors, at the direction of U.S. DOT some updates or corrections have been made to this material.

- Divert traffic to strategic arterials and frontage roads with improved, event-specific traffic signal timing response plans.
- Shift travelers to the light-rail system during major incidents on the freeway.

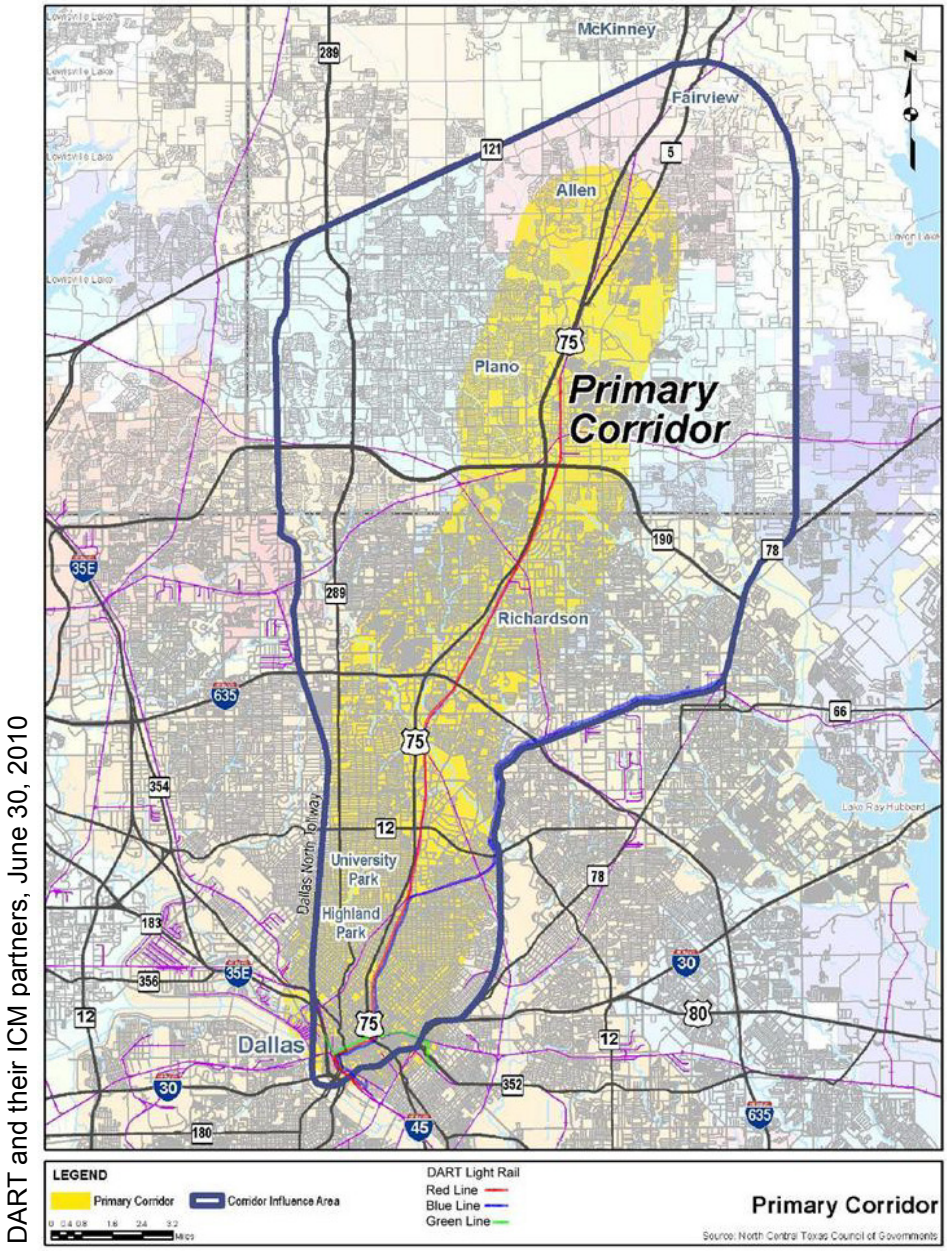


**Figure 1-1. U.S. 75 Corridor Boundaries of Dallas ICM Deployment**

**Table 1-1. Dallas ICM Project Goals**

| | |
|---|---|
| **Goal #1** | Improve Incident Management<br>• Provide a corridor-wide and integrated approach to the management of incidents, events, and emergencies that occur within the corridor or that otherwise impact the operation of the corridor, including planning, detection and verification, response and information sharing, such that the corridor returns back to "normal." |
| **Goal #2** | Enable Intermodal Travel Decisions<br>• Provide travelers a holistic view of the corridor and its operation through the delivery of timely, accurate and reliable multimodal information, to allow travelers to make informed choices regarding departure time, mode and route of travel. In some instances, the information will recommend travelers to utilize a specific mode or network. Advertising and marketing to travelers over time will allow a greater understanding of the modes available to them. |
| **Goal #3** | Increase Corridor Throughput<br>• Agencies within the corridor have worked to increase throughput on their individual networks from supply and operations points of view, and will continue to do so. The ICM perspective builds on these network initiatives, managing delays on a corridor basis, utilizing any spare capacity within the corridor, and coordinating the junctions and interfaces between networks in order to optimize the overall throughput of the corridor. |
| **Goal #4** | Improve Travel Time Reliability<br>• The transportation agencies within the corridor have done much to increase the mobility and reliability of their individual networks, and will continue to do so. The integrated corridor perspective builds on these network initiatives, managing delays on a corridor basis, utilizing any spare capacity within the corridor, and coordinating the junctions and interfaces between networks, thereby providing a multimodal transportation system that adequately meets customer expectations for travel time predictability. |

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Technology investments that are being implemented as part of the ICM deployment in Dallas and which will be used to carry out ICM operational strategies include:

- A Decision Support System (DSS) that will utilize incoming monitoring data to assess conditions, forecast conditions up to 30 minutes in the future, and then formulate recommended response plans (including selecting from pre-approved plans) for consideration by operations personnel. Table 1-2 summarizes expected Dallas DSS functionality.
- Enhancement of the SmartNET regional information exchange network, a system that was recently implemented using non-ICM funding and which is being enhanced using ICM funding, including expanding the number of agencies able to exchange data through the system. SmartNET is a commercial data integration and dissemination tool with a common graphical user interface (GUI). SmartNet provides a conduit for input, fusion and shared, multi-agency access to a variety of transportation condition data.

- A 511 telephone and web-based traveler information system for the region.
- Development of new, event-specific traffic signal timing plans to support traffic diversions onto Greenville Avenue (termed the "Targeted Event Accelerated Response System," or TEARS).
- Arterial street monitoring system, including additional travel time detectors (Bluetooth).
- Using non-ICM funds, various supporting transit improvements including mobile data terminals and automatic vehicle location system replacement.
- Parking management systems for key park & ride lots.

It is expected that the various Dallas ICM system capabilities and strategies will be utilized in several different contexts and timeframes. These contexts and timeframes are expected to become more definitive and elaborated as the sites proceed with the design and implementation of their systems. Further, these uses are expected to evolve as the sites work through their six-month "shakedown" periods following the initial system go-live dates, and possibly, continuing to some extent into the 12-month post-deployment data collection period. Currently, it is expected that the ICM system will be applied in at least the following general contexts and timeframes:

1. In "real time" (or near real time), in association with an unplanned event like a traffic incident.
2. In advance, e.g., pre-planned:
    a. Anticipating a specific, atypical event, such as major roadway construction or a large sporting event; and
    b. Periodic or cyclical (e.g., seasonal) adjustments to approaches based on lessons learned and evolution of the ICM strategies and/or in response to lasting changes in transportation conditions. These lasting changes may be either directly related to ICM strategy utilization (e.g., drivers who may have switched to transit during a specific ICM-supported traffic incident choosing to continue to use transit on a daily basis) or to other, non-ICM related changes such as regional travel demand.

**Table 1-2. Summary of Dallas DSS Functionality**

| Functionality | Summary |
|---|---|
| Modularization of Response Plan Recommendation Functionality and Predictive Functionality | Dallas has explicitly separated the functionality required to select candidate response plans based on real-time conditions from the functionality associated with predicting future conditions. The former functionality resides in the Expert System DSS subsystem and the latter resides in the Prediction subsystem. These functions have been modularized so that the DSS will still be able to recommend response plans in the event that the mesoscopic traffic model used in the Prediction sub-system is not able to run faster than real-time, that is, to not only monitor current conditions but also to forecast conditions X minutes into the future. Dallas is anticipating their Predictive subsystem will ultimately be capable of running faster than real-time but they need to complete the design and testing phases of Stage 3. The decision to separate response plan selection functionality from prediction functionality was also based on prediction accuracy considerations. Another important part of the DSS Expert System module is the periodic (most likely monthly or if feasible every 2 weeks) post-review of action plans implemented and modifying them as needed. |
| Real-time Monitoring of Transportation System Conditions | The real-time data is collected by the Integrated Corridor Management System (ICMS) Data Fusion subsystem. The Expert System subsystem of the Dallas DSS will monitor conditions from the Data Fusion subsystem in real-time and, based on key real-time system performance indicators, select one or more pre-defined, proposed response plans for consideration by the ICM Coordinator. |
| Prediction and Prioritization of Emerging Transportation System Problems | The Dallas ICMS will continuously monitor conditions. This will be augmented with the deployment of Bluetooth readers for a real-time arterial monitoring system. When events such as significant changes in demand, incidents (planned or not planned), or inclement weather occur, the Dallas DSS will initiate an analysis for possible operational strategies to improve corridor operation. The analysis of operational strategies is planned to include a prediction of future conditions under possible strategies. The Dallas ICMS is not currently planned to continuously predict future conditions. The Predictive subsystem is only executed as part of an evaluation of possible strategies. Although it is possible that the Dallas ICMS may be used in such a capacity at some point within or beyond the evaluation period, it is not an explicit design objective of the Dallas DSS to continuously predict conditions or anticipate developing problems. The Dallas ICMS, will however, have to account for multiple events occurring in the corridor and be able to prioritize which events need to be addressed or assess the interaction of strategies to different events. |
| Prediction of the Impact/Performance of Response Plans | The Prediction subsystem of the Dallas DSS will be capable of being used at regular time intervals or “on the fly” during an event to determine whether the net impacts/benefits of a candidate response plan recommended to the ICM Coordinator by the Expert System will be positive given current transportation system conditions and expected travel demand X minutes into the future. That is, prediction of the impacts of a response plan will be used in the decision of whether to recommend a candidate response plan by the Expert System. Further, if it is found that the Prediction subsystem is able to operate in faster-than-real-time mode—that is predict conditions X minutes into the future—the recommendation of response plans by the Expert System subsystem (and potentially the refinement or re-selection of response plans over the course of a long event) will incorporate predictions of transportation conditions and/or response plan impacts X minutes into the future. |

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### 1.2.2 Dallas ICM Deployment Schedule

Table 1-3 presents the latest, formal, U.S. DOT-approved Dallas ICM deployment schedule. As is often the case with large, complex technology deployments, it is quite possible that this schedule may slip over time. The schedule of data collection and analysis activities presented throughout this test plan reflect the latest schedule but they will be adjusted as necessary in response to any future changes in the deployment schedule.

As indicated in Table 1-3, individual components of the deployment will be completed in a phased manner, with full ICM system operations currently scheduled to commence in early April 2013. The Dallas site team has indicated that they do expect, to at least some degree, to begin using individual components and associated ICM strategies as they become available prior to the overall system go-live. The approach to this analysis attempts to take that phasing into consideration. Since both the completion dates of the individual ICM components and the Dallas site team's utilization of them are expected to evolve as the ICM system design, implementation and shakedown period progress, the approach presented in this test plan may flex somewhat in response.

**Table 1-3. Dallas ICM Deployment Schedule**

| Activity | Completion Date |
|---|---|
| Complete Planning Phase | December 2010 |
| Complete Design Phase | February 2012 |
| Build Phase (complete unit testing): | |
| Arterial Street Monitoring System | April 2012 |
| Mobile Web | April 2013 |
| 511 Interactive Voice Response (phone) | |
| My 511 (Web) | |
| Social Networking | |
| Transit Signal Priority | August 2012 |
| Event Specific Traffic Signal Timing Plans (Targeted Event Accelerated Response System) | September 2012 |
| Parking Management Information | October 2012 |
| DART Data Portal | |
| Video Sharing | |
| SmartNET/Smart Fusion (including all integration of new ICM data) IT Infrastructure | |
| Decision Support System | November 2012 |
| Complete Integration Testing | January 2013 |
| Complete Acceptance Testing/Operations Go Live | April 8, 2013 |
| Complete Shakedown Period | October 8, 2013 |
| Complete Evaluation One Year Operational Period | October 7, 2014 |

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### 1.2.3 Comparison to the San Diego ICM Deployment

The overall objectives of the Dallas ICM deployment are similar to those in San Diego and many of the same general operational strategies are planned, focusing on improving the balance between travel supply and demand across multiple modes and facilities, including highways, arterial streets and transit. The major distinctions in the ICM strategies to be utilized by each site generally flow from the differences in their transportation systems:

- The Dallas U.S. 75 corridor includes the Red Line light rail transit (LRT) service whereas the I-15 corridor in San Diego will include extensive bus rapid transit (being implemented separately from and immediately prior to ICM).
- The Dallas U.S. 75 corridor includes concurrent flow HOV lanes whereas the San Diego corridor includes concurrent flow high-occupancy tolling (HOT)/managed lanes:
    - The San Diego corridor includes a recently expanded four-lane managed lane system in the I-15 median that is variably priced high occupancy tolling and includes two reversible center lanes. The San Diego site team does not expect ICM to impact their variable pricing decisions but it will impact their use of the four configurable managed lanes.
    - The Dallas U.S. 75 corridor includes access-controlled, high-occupancy vehicle lanes located in the median, although, like San Diego, they do not expect ICM to impact their HOV occupancy requirement decisions.
    - Both sites currently lift HOV restrictions during major incidents.
- Both sites include major arterials that run parallel with the freeways. However, while the arterial in Dallas is continuous for the length of the corridor, there is no single continuous arterial running parallel to I-15 in San Diego; Black Mountain Road, Pomerado Road, and Centre City Parkway are parallel arterials in the I-15 corridor. The San Diego corridor includes ramp meters on I-15 and so their traffic signal timing strategies include ramp meter signals. Dallas does not use ramp meters.
- The Dallas corridor includes an extensive frontage road system, while the San Diego I-15 corridor includes auxiliary lanes between most freeway interchanges that function similarly, though with less capacity.
- Both sites include responsive traffic signal control. Dallas is not upgrading any traffic signal controllers, but has responsive traffic signal control along the major parallel arterial, Greenville Avenue, through the Cities of Dallas, Richardson and Plano. The San Diego deployment includes responsive traffic signal control along Black Mountain and Pomerado Roads, both of which are major arterials that parallel I-15.

## 1.3 National Evaluation Objectives and Process

This section summarizes key aspects of the overall ICM national evaluation. A more comprehensive discussion is contained in the National Evaluation Framework document and the details of individual analyses are documented in this and other test plans.

### 1.3.1 U.S. DOT Hypotheses

The U.S. DOT has established the testing of eight "hypotheses" as the primary objective and analytical thrust of the ICM demonstration phase evaluation, as shown in Table 1-4. There are a number of cause-effect relationships among the U.S. DOT hypotheses; for example, enhanced response and control is dependent on enhanced situational awareness. These relationships will be examined through the evaluation in addition to testing the individual hypotheses. Another important relationship among the hypotheses is that DSS is actually a component of enhanced response and control and, depending on the specific role played by the DSS, may also contribute to improved situational awareness.

**Table 1-4. U.S. DOT ICM Evaluation Hypotheses**

| Hypothesis | Description |
|---|---|
| The Implementation of ICM will: | |
| Improve Situational Awareness | Operators will realize a more comprehensive and accurate understanding of underlying operational conditions considering all networks in the corridor. |
| Enhance Response and Control | Operating agencies within the corridor will improve management practices and coordinate decision-making, resulting in enhanced response and control. |
| Better Inform Travelers | Travelers will have actionable multi-modal (highway, arterial, transit, parking, etc.) information resulting in more personally efficient mode, time of trip start, and route decisions. |
| Improve Corridor Performance | Optimizing networks at the corridor level will result in an improvement to multi-modal corridor performance, particularly in high travel demand and/or reduced capacity periods. |
| Have Benefits Greater than Costs | Because ICM must compete with other potential transportation projects for scarce resources, ICM should deliver benefits that exceed the costs of implementation and operation. |
| The implementation of ICM will have a positive or no effect on: | |
| Air Quality | ICM will affect air quality through changes in Vehicle Miles Traveled (VMT), person throughput, and speed of traffic, resulting in a small positive or no change in air quality measures relative to improved mobility. |
| Safety | ICM implementation will not adversely affect overall safety outcomes, and better incident management may reduce the occurrence of secondary crashes. |
| Decision Support Systems* | Decision support systems provide a useful and effective tool for ICM project managers through its ability to improve situational awareness, enhance response and control mechanisms and provide better information to travelers, resulting in at least part of the overall improvement in corridor performance. |

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* For the purposes of this hypothesis, the U.S. DOT considers DSS functionality to include both those carried out by what the sites have labeled their "DSS" as well as some related functions carried out by other portions of the sites' ICM systems.

### 1.3.2 Evaluation Analyses

The investigation of the eight U.S. DOT evaluation hypotheses have been organized into seven evaluation "analyses." Table 1-5 associates six of those seven analyses with specific U.S. DOT hypotheses; the seventh analysis not shown in Table 1-5 investigates institutional and organizational issues and relates to all of the hypotheses since the ability to achieve any intended ICM benefits depends upon successful institutional coordination and cooperation.

**Table 1-5. Relationship Between U.S. DOT Hypotheses and Evaluation Analyses**

| U.S.DOT Hypotheses | Evaluation Analysis Area |
|---|---|
| • Improve Situational Awareness<br>• Enhance Response and Control | Technical Assessment of the Capability to Monitor, Control, and Report on the Status of the Corridor |
| • Better Inform Travelers | Traveler Response (also relates to Enhance Response and Control) |
| • Improve Corridor Performance | Quantitative Analysis of the Corridor Performance – Mobility |
| • Positive or No Impact on Safety | Quantitative Analysis of the Corridor Performance – Safety |
| • Positive or No Impact on Air Quality | Air Quality Analysis |
| • Have Benefits Greater than Costs | Benefit-Cost Analysis |
| • Provide a Useful and Effective Tool for ICM Project Managers | Evaluation of Decision Support Systems |

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The evaluation features a "logic model" approach in which each link in the cause-effect sequence necessary to produce the desired impacts on transportation system performance is investigated and documented, beginning with the investments made ("inputs"), the capabilities acquired and their utilization ("outputs") and traveler and system impacts ("outcomes").

Collectively, the results of the eight evaluation analyses will provide a comprehensive understanding of the ICM demonstration phase experience:

- What ICM program-funded and other key, ICM-supporting investments did the Dallas and San Diego site teams make, including hardware, software, and personnel (inputs)?
- What capabilities were realized through those investments; how were they exercised and to what extent did they enhance previous capabilities (outputs)?
- What were the impacts of the ICM deployments on travelers, transportation system performance, safety and air quality (outcomes)?
- What institutional and organizational factors explain the successes and shortcomings associated with implementation, operation and effectiveness (inputs, outputs and outcomes) of ICM and what are the implications for U.S. DOT policy and programs and for transportation agencies around the country (Institutional and Organizational Analysis)?

- How well did the DSS perform (DSS Analysis)?
- What is the overall value of the ICM deployment in terms of benefits versus costs (Benefit-Cost Analysis)?

### 1.3.3 Evaluation Process and Timeline

Figure 1-2 shows the anticipated sequence of evaluation activities. The evaluation will collect 12 months of baseline (pre-ICM deployment) data and, following a 6-month shakedown period, 12 months of post-deployment data.

The major products of the evaluation are two interim technical memoranda after the end of the baseline and post-deployment data collection efforts and a single final report documenting the findings at both sites as well as cross-cutting results. Two formal site visits are planned by the national evaluation team to each site: as part of evaluation planning during national evaluation framework development and test planning-related visits. Additional data collection trips will be made by various members of the national evaluation team during baseline and post-deployment data collection.

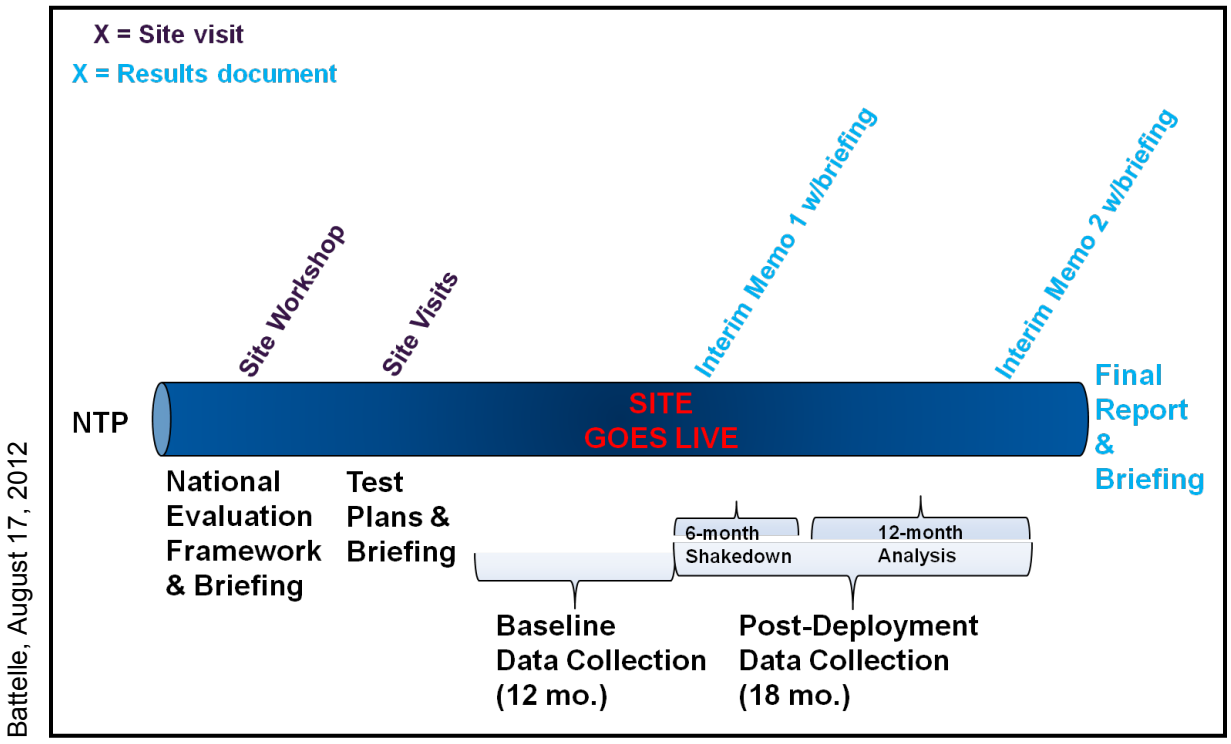


**Figure 1-2. Sequence of Evaluation Activities**

Based on current deployment schedules for both Dallas and San Diego, the anticipated schedule for major evaluation activities is as follows:

- Finalize test plans – Summer 2012
- Collect baseline (pre-ICM deployment) data – Spring 2012 through Spring 2013
- Complete Interim Technical Memorandum on baseline data – Spring 2013
- Collect post-deployment data – Fall 2013 – Fall 2014
- Complete Interim Technical Memorandum on evaluation results – Fall 2014
- Complete Final Report – Spring 2015

### 1.3.4 Roles and Responsibilities

The U.S. DOT ICM Management Team is directing the evaluation and is supported by the Volpe National Transportation Systems Center (Volpe Center), Noblis and ITS America. The national evaluation team is responsible for leading the evaluation consistent with U.S. DOT direction and is responsible for collecting certain types of evaluation data—namely partnership documents and conducting workshops and interviews. The national evaluation team is also responsible for analyzing all evaluation data—including that collected by the national evaluation team as well as the Volpe Center and the Dallas site team—preparing reports and presentations documenting the evaluation results, and archiving evaluation data and analysis tools in a data repository that will be available to other researchers. The Dallas site team is responsible for providing input to the evaluation planning activities and for collecting and transmitting to the national evaluation team most of the evaluation data not collected directly by the national evaluation team. The Volpe Center is providing technical input to the evaluation and will carry out the traveler survey activities discussed in the Traveler Response Test Plan. The U.S. DOT Analysis, Modeling and Simulation contractor, Cambridge Systematics, will provide key AMS modeling results to the evaluation, namely person-trip measures that cannot be feasibly collected in the field, and will utilize certain evaluation outputs, such as those related to traveler response, to calibrate the AMS tools post-ICM deployment. In the case of Dallas, the Dallas site team will execute the model runs that will generate the performance measures provided by Cambridge Systematics.

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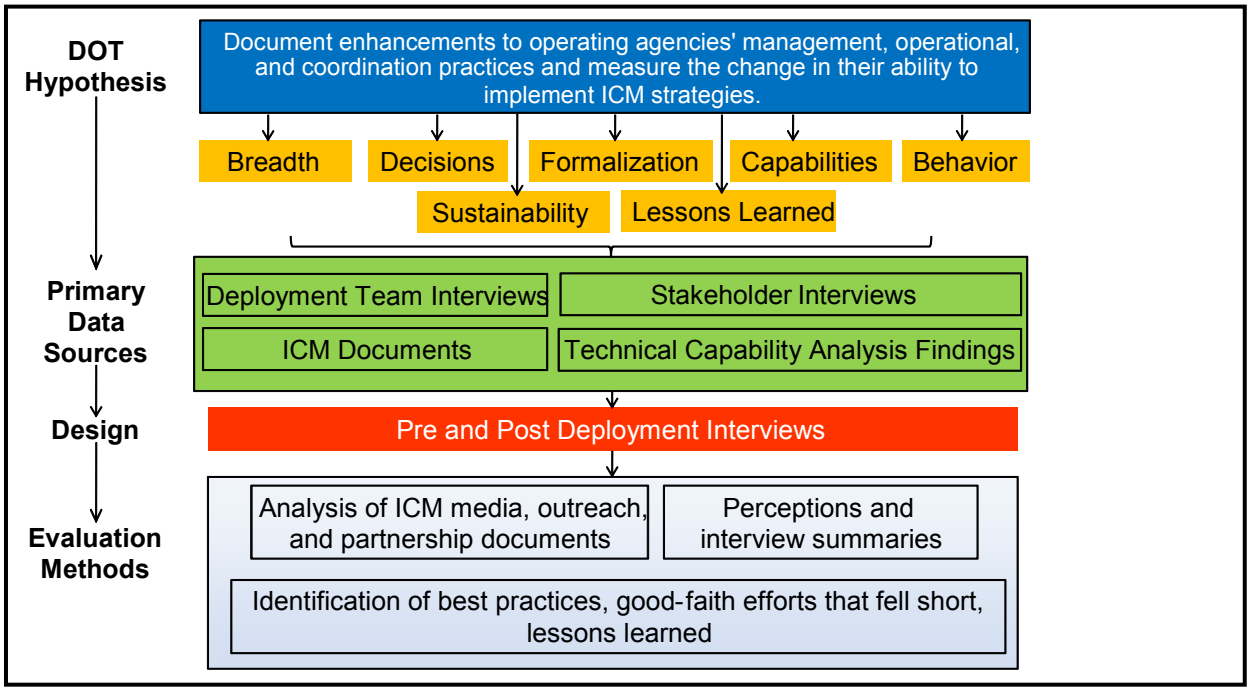
# 2.0 ANALYSIS OVERVIEW

This chapter provides a high-level overview of the approach to the Institutional and Organizational Analysis, including a discussion of evaluation hypotheses to be tested and measures of effectiveness (MOEs).

Figure 2-1 graphically summarizes the approach to this analysis. This analysis focuses on the U.S. DOT ICM evaluation hypothesis pertaining to how ICM-related enhancements to agencies' practices impact their ability to carry out ICM strategies. As indicated in the second tier of boxes in Figure 2-1, this high-level U.S. DOT hypothesis has been decomposed into more specific evaluation hypotheses focusing on areas such as increases in the breadth of agency partnerships and the sustainability of ICM-related agency coordination structures. Major data sources for this analysis (which are elaborated in detail in Chapter 3) include various Dallas site team partnering documents, interviews with Dallas site team members and impacted parties, and findings and conclusions from the Technical Capability Analysis. The overall analytical design for all parts of this analysis involves observations and tracking changes in a before vs. after comparison.




Battelle, August 17, 2012

**Figure 2-1. Overview of Institutional and Organizational Analysis**

The data elements to be collected for the Institutional and Organizational Analysis are listed in Table 2-1 with any associated MOEs and hypotheses. Note that there are a few data elements such as media coverage and Dallas site team outreach materials that do not have MOEs per se or hypotheses. Rather, the national evaluation team interest in these items is two-fold: 1) To simply document (for the benefit of other potential deployers) the approach the Dallas site team used to informing the public and building support for ICM (outreach); and 2) To provide a context that may aid the interpretation of other evaluation findings. For example, if the results from various evaluation analyses suggest that the technology performed well and that the agencies operated their systems as planned but travelers did not seem to respond as intended, understanding outreach and media coverage could be useful. Finally, note that capturing a wide range of technical and institutional "lessons learned" is an important part of this analysis but there are no specific lessons learned MOEs or hypotheses. Most of the data elements collected for this analysis will inform lessons learned, stakeholder interviews particularly so.

**Table 2-1. Institutional and Organizational Analysis Data Elements, MOEs, and Hypotheses**

| Data Element | | MOE | Hypotheses |
|---|---|---|---|
| **Quantitative Data** | | | |
| This test plan utilizes no quantitative data | | | |
| **Qualitative Data** | | | |
| 1. Stakeholder Interviews | 1.1 The number and perceived nature of ICM-related agency agreements and participating agencies | • Change in the number of new agreements in the region<br>• Change in the nature of new agreements between partnering agencies<br>• Percentage of "total" and "active" agencies participating in ICM, based on the initial ICM proposal and day-to-day activities. | • Breadth and number of partnerships will increase over the course of the ICM project from project initiation |
| | 1.2 Dallas site team and U.S. DOT opinion on quality and value of arrangements in ICM cooperative agreements for improved coordination | • Changes in perceptions of deployment agencies on efficacy and satisfaction of arrangements | • DOT and the local deployment agencies will find new cooperative arrangements to be effective and implemented appropriately |
| | | • Changes in perceptions of U.S. DOT on efficacy and satisfaction of arrangements | |
| | | • Changes in agency perceptions of the ICM over the demonstration phase | • The ICM demonstration will be consistent with the expectations of each agency |
| | | • Adoption of a regionally agreed upon shared vision | • A shared vision for the corridor will be adopted by the partners |
| | 1.3 Perceived staff time utilization | • Reduction in the percentage of time spent on issues during incidents | • Resource allocation across the corridor will improve as a result of ICM |
| | 1.4 View of agency structures and roles | • Changes in decision-making roles and responsibilities<br>• Changes in organization and institutional structures | • Joint decision-making will improve in the corridor<br>• New management structures, e.g., new personnel and/or changes in roles and responsibilities of personnel, will be developed for ICM |
| | 1.5 General lessons learned | • N/A | • N/A |

**Table 2-1. Institutional and Organizational Analysis Data Elements, MOEs, and Hypotheses (Continued)**

| Data Element | | MOE | Hypotheses |
|---|---|---|---|
| **Qualitative Data (Cont.)** | | | |
| 1. Stakeholder Interviews (cont.) | 1.6 Level of comfort with, value of, and utilization of ICM coordinated strategies, systems and tools | • Level of comfort in the capacity to use ICM during complex situations | • Individual agencies' level of comfort in decision-making will increase throughout the evaluation |
| | | • Perceptions and comfort level with inter-agency device control and sharing | • Resource allocation across the corridor will improve as a result of ICM |
| | | • Systems and technologies developed for ICM will be used by agencies in day to day operations | • Participating agencies will accept and utilize the ICMS |
| | | • Reliability and value assessment of ICMS and other tools | • ICM will be viewed as reliable and value-added by agencies |
| | | • Changes in conflict identification, logging, and resolution approaches | • Agency conflicts in corridor management strategies will be reduced |
| | 1.7 View of changes and quality of funding arrangements | • Incorporation of organizational structures and personnel requirements into agency budgets | • Organizational structures set-up for the ICM demonstration will be sustained |
| | | • Changes in O&M practices to focus on corridor-critical resources | • O&M practices of individual agencies will change to accommodate corridor performance sustainability |
| | | • Diversity and stability of funding beyond the demonstration phase for ICM | • ICM will be viewed as sustainable from a funding standpoint |

**Table 2-1. Institutional and Organizational Analysis Data Elements, MOEs, and Hypotheses (Continued)**

| Data Element | | MOE | Hypotheses |
|---|---|---|---|
| **Qualitative Data (Cont.)** | | | |
| 2. Analysis of ICM Documentation | 2.1 Partnership documents | • Changes in perceptions of deployment agencies on efficacy and satisfaction of arrangements | • DOT and the local deployment agencies will find new arrangements to be effective and to implemented appropriately |
| | | • Changes in perceptions of U.S. DOT on efficacy and satisfaction of arrangements | |
| | | • Change in the number and level of new agreements in the region<br>• Percentage of "total" and "active" agencies participating in ICM<br>• Changes in the number of third parties, e.g., accessing data feed | • Breadth and number of partnerships will increase over the course of the ICM project from project initiation |
| | | • Changes in decision-making roles and responsibilities<br>• Changes in organization and institutional structures | • Joint decision-making will improve in the corridor<br>• New management structures, e.g., new personnel and/or changes in roles and responsibilities of personnel, will be developed for ICM |
| | 2.2 Outreach documents | • Change in the number and level of new public/user promotional and educational materials on ICM benefits and functions | • The ICM project will result in the development of new traveler information materials or interactive media that helps users understand how to use the ICM corridor |
| | 2.3 Media coverage | • Local media coverage explains ICM objectives, improvements, and new user tools | • The ICM project will generate media coverage that explains the objectives, improvements, and new user tools |

**Table 2-1. Institutional and Organizational Analysis Data Elements, MOEs, and Hypotheses (Continued)**

| Data Element | | MOE | Hypotheses |
|---|---|---|---|
| **Qualitative Data (Cont.)** | | | |
| 3. Findings from Technical Capability Analysis | 3.1 Findings pertaining to Situational Awareness Capabilities | • Changes in the situational awareness capabilities of partner agencies | • ICM will result in new capabilities to monitor, control, and report at each agency |
| | 3.2 Findings pertaining to Agency Coordination and Communication | • Change in number and nature of communications between transportation partners for daily operations | • Agencies will enhance the nature and increase the number of communications in the corridor<br>• Joint decision-making will improve in the corridor |
| | | • Number of predefined strategies for coordinated action | • Improved agency coordination and communication will result in a set of predefined, agreed-upon strategies for coordinated action |
| | | • Reduction in the percentage of time spent on issues during incidents<br>• Changes in conflict identification, logging, and resolution approaches | • Resource allocation across the corridor will improve as a result of ICM<br>• Agency conflicts in corridor management strategies will be reduced throughout the evaluation |

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# 3.0 QUANTITATIVE DATA

No quantitative data elements are currently required for use in the Institutional and Organizational Analysis Test Plan.

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# 4.0 QUALITATIVE DATA

This chapter identifies the qualitative data elements to be used in the Institutional and Organizational analysis. Table 4-1 summarizes key attributes of each data collection activity, e.g., interviews and analysis of ICM documentation and the sections that follow provide additional detail for each activity, including interview questionnaires.

**Table 4-1. Qualitative Data Summary**

| Data Collection Activity | Data Collection Periods | | Data Collection Schedule | | Data Collection Responsible Party | Data Transmittal |
|---|---|---|---|---|---|---|
| | Baseline | Post-Deployment | Baseline | Post Deployment | | |
| ICM Participants & Impacted Parties Interviews via Phone | X | X | Mar 2013 (shortly before expected overall ICMS go-live) | • Round 1: Oct 2013 (end of shakedown period)<br>• Round 2: Oct 2014 (near end of post-deployment operations period) | National Evaluation Team | National Evaluation Team will conduct interviews |
| Local Media Coverage Documents | X | X | From beginning of ICM project coalition building | Oct 2014 (Through end of one-year post-deployment evaluation period) | Dallas Site Team | Quarterly (Email to National Evaluation Team) |
| Partnership Documents | X | X | From beginning of ICM project coalition building | Oct 2014 (Through end of one-year post-deployment evaluation period) | Dallas Site Team | Quarterly (Email to National Evaluation Team) |
| Outreach Documents | X | X | From beginning of ICM project coalition building | Oct 2014 (Through end of one-year post-deployment evaluation period) | Dallas Site Team | Quarterly (Email to National Evaluation Team) |
| Findings from Technical Capability Analysis | X | X | N/A | N/A | National Evaluation Team | National Evaluation Team will have the findings |

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The Institutional and Organizational Analysis leverages and enhances the model used for the Urban Partnership Agreements/Congestion Reduction Demonstration (UPA/CRD) evaluation featuring pre- and post-deployment stakeholder interviews and analysis of partnership documents, outreach (e.g., marketing) materials, and media coverage of the ICM project. The following paragraphs provide some details on the data collection approach for the data elements shown in Table 2-1.

## 4.1 Stakeholder Interviews

### 4.1.1 Purpose

Interviews will be conducted by phone with the Dallas site team (primarily the main project partners) and other stakeholders (including senior agency decision makers who authorized ICM funding and representatives of other organizations that are part of the ICM effort) by Battelle as part of the evaluation. These interviews will assist with gathering perceptions of agencies of pre- and post-ICM operations, and serve as a reference for not only the system's impact but also ICM tactics that may be adjusted in order to improve it.

### 4.1.2 Approach

Interviews will be conducted once in the pre-deployment phase and twice in the post-deployment phase. Note that the time period intended to be covered by pre-deployment interview questions actually extends prior to the one-year baseline, pre-deployment period; in many cases, questions will cover a period extending to when the decision was made to engage in ICM. These will be one-on-one interviews or, in some cases, small group interviews, e.g., two or three people from a single agency.

The list of interviewees will include three levels of agency personnel:

1. Agency Decision-Makers: These include decision-makers in terms of agency budgets and other resources at each of the partner agencies. Interviews will focus on the sustainability of the Integrated Corridor Management System (ICMS), the partnerships and the degree of formalization due to the demonstration. The objective of the interviews is to assess how the decision-makers in the region view the demonstration and their support for such efforts.
2. Planners, implementers, and operators: This group represents the personnel who have been active in the planning and the operation of the ICMS including project partners, operating staff, and the U.S. DOT. Interviews in this group will ascertain the effectiveness of arrangements, the improvements in capabilities and decision-making, and the changes in behavior and roles and responsibilities.
3. Others indirectly impacted by ICM: The third group is important for seeing the spillover effects of ICMS on other groups such as maintenance, traffic engineering, construction, and their perceptions of ICMS.

Overall, the national evaluation resources are sufficient to support about a dozen total interview sessions during each round of interviews. The length of interview will vary by group but is estimated to be about 30-60 minutes. Overall, the interviews are expected to be shorter in the baseline than in post-deployment, and will ultimately vary based on the amount of discussion, particularly as it pertains to lessons learned. The interviewee list will ultimately be grouped and/or refined by eliminating individual interviewees so as to keep the number of total interviews manageable. Table 4-2 presents a list of interview participants provided to the national evaluation team by the Dallas site team.

**Table 4-2. Tentative List of Interview Participants**

| Organization | Interviewee Name |
|---|---|
| DART | Koorosh Olyai |
| | Tim Newby |
| | Larry Gaul |
| | Donnie Thompson |
| | Abed Abukar |
| | Alan Gorman |
| NCTOG | Marian Thompson |
| | Natalie Bettger |
| TxDOT | Rick Cortez |
| | Andy Oberlander |
| | Joe Hunt |
| City of Dallas | Ron Patel |
| City of Plano | Lloyd Neal |
| City of Highland Park | Meran Dadgostar |
| North Texas Tollway Authority | Yang Ouyang |
| Texas Transportation Institute | Christopher Poe |
| | Edward Seymour |
| Southern Methodist University | Khaled Abdelghany |
| University of Texas Arlington | Sia Ardekany |

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### 4.1.3 Questionnaire

The list of interview questions may evolve over time to some extent based on how the Dallas ICM deployment progresses. Presented here are the proposed questions, loosely sorted into categories for different types of interviewees. The questions asked of any given interviewee will be selected from this list based on the interviewee's specific role. No interviewee will be interviewed more than once per interview "round" (i.e., pre-deployment) and so, in cases where an interviewee represents multiple roles (i.e., "key agency decision maker " as well as "planner/implementor/operator") a single set of interview questions will be used that includes all of the relevant questions pertinent to each interviewee role, with no duplication of questions. Approximately 6 weeks in advance of each round of interviews the national evaluation team will initiate coordination with the Dallas site team to finalize the list of interviewees, questionnaires and scheduling protocols (e.g., whether the national evaluation team will contact each interviewee separately to schedule the interview).

Each interview session will include the following introductory information from the interviewer:

- Explain the National ICM Evaluation purpose, scope, and sponsors.
- Describe the purpose and process for the stakeholder interviews.
- Note that the interviews are confidential. Responses will not be attributed to specific individuals.

Given the evolving and the continuous nature of institutional changes, if required, use the following rating scale to assist with answering questions:

| Stage of Development | Establishing (1) | Functioning (2) | Maturing (3) | Sustaining (4) |
|---|---|---|---|---|
| Description | Initial formation with small leadership core working on mobilization and direction | Follows the completion of initial activities, focus on structure and more long range programming | Stabilized roles, structures, and functions; Confronted with conflicts to transform and "growing pains" | Established organization and operations, focus on higher level changes and institutionalizing efforts |

**Proposed Interview Questions Specific to Decision-Makers**

Baseline

1. What were the factors that led to your agency's decision to invest in the ICM project?
2. What is your organizations' objective(s) in participating in the ICM? What were your expectations going into the ICM project? Did you have expectations regarding specific objectives, such as corridor performance or congestion? Have these expectations changed at all during the planning and pre-deployment process? If so, what has changed and why?
3. What would constitute success from the ICM project for you and your agency? Has your view of what constitutes success changed during the planning and pre-deployment process? If so, in what way and why?
4. Did you already have institutional agreements in place prior to ICM? If yes, please describe. What institutional agreements were necessary for the ICM project?

Post-Deployment

1. How would you rate the ICM demonstration? Very successful, somewhat successful, no impact. Why did you rate it at this level? Were some aspects more successful than others? If so, which ones and why? Were other aspects less successful? If so, which ones and why?
2. Do you see the potential for the deployment of ICM on other corridors in your region?
3. How do you think ICM can be improved in this corridor? How could it be improved for future deployers in other parts of the country?

4. Would you continue to fund the operations and maintenance of ICM? Why or why not?
5. What changes to your organization, if any, were implemented as a result of ICM, if any?
6. Based on your experiences to date on the ICM project, what are the major lessons learned from the ICM project?

**Proposed Interview Questions Specific to Planners, Implementers and Operators**

Baseline Only

1. Please describe your agency's role in the ICM project.
2. What is your organizations' objective(s) in participating in the ICM? What benefits did you expect to be realized when you decided to participate? Have these expectations changed at all during the planning and pre-deployment process? If so, what has changed and why?
3. What would constitute success from the ICM project for you and your agency? Has your view of what constitutes success changed during the planning and pre-deployment process? If so, in what way and why?
4. Looking at the provided list of ICM partner agencies, which of the partner agencies have you worked with prior to ICM and in what capacity? How would you characterize those past partnerships—successful, unsuccessful, mixed? How is an incident on U.S. 75 managed (pre-ICM)? What level of coordination is present between agencies? Rate the nature and extent of communications between agencies.
5. What factors were most critical to successfully organizing the local ICM partnership team? What do you think will be the key factors to maintaining the partnerships?

Baseline and Post-Deployment[3]

1. For each ICM partnership agreement your agency currently has, list the partner agency and describe the stage of development in your own words. Select the rating that best describes the current stage of development: establishing, functioning, maturing, sustaining.
2. Rate how satisfied your agency is with the ICM-related agreements it has made: very satisfied, satisfied, neutral, dissatisfied, very dissatisfied. Explain. Are there aspects with which you are more satisfied with than others? Are there aspects that you are particularly dissatisfied with? Explain.
3. Rate how effective you think the ICM-related agreements will be in achieving the stated project goals (remind interviewee of project goals): Very effective, somewhat effective, not too effective, not at all effective.
4. Have your agency and partner agencies agreed upon a shared vision for the ICM corridor? If yes, are you pleased with that vision? If no, why not?

[3] Questions may be revised slightly based on whether they are asked in the baseline or post-deployment phase.

5. Have decision-making roles and responsibilities shifted as a result of ICM? If so, how? Also if so, rate the stage of development for these changes: establishing, functioning, maturing, sustaining.
6. Are new institutional and organizational structures being developed for ICM? If so, what is being changed? Also, if so, rate the stage of development of the new institutional and organizational structures: establishing, functioning, maturing, sustaining. Did your agency have to hire additional staff for ICM? If so, how many additional staff members were hired?
7. Based on your experiences to date on the ICM project, what are the major lessons learned from the ICM project in terms of institutional issues?
8. Based on your experiences to date on the ICM project, what are the major lessons learned from the ICM project in terms of technical issues?
9. How do you think ICM can be improved in this corridor? How could it be improved for others in the future?
10. What are or were the major challenges you faced with the ICM project? How have those challenges been addressed and have they been overcome?
11. How have you educated and engendered support for ICM among various audiences, including senior decision makers, travelers, and the media? What has been successful/unsuccessful and why? Do you have plans for future outreach efforts of this nature? What level of effort would you say is being devoted to outreach? What types of resources are being devoted to outreach? Have you hired a contractor to perform outreach activities?
12. Based on your experience to date, would you do anything differently in planning, deployment and operating the ICMS? What if the project as a whole had twice the funding? What if the project as a whole had half the funding?

Post-Deployment Only

1. How would you rate the ICM demonstration? Very successful, somewhat successful, no impact. What factors are most responsible for the success or lack of success? Why did you rate it at this level? Were some aspects more successful than others? If so, which ones and why? Were other aspects less successful? If so, which ones and why?
2. Explain how your agency has or has not benefitted from each partnership agreement as intended?
3. Rate the level of use of the ICMS in day to day operations: Frequently used, used sometimes, barely used.
4. Rate the reliability of ICMS: Extremely reliable, somewhat reliable, somewhat unreliable, very unreliable. Explain.
5. Do you think the ICMS was a valuable investment for your agency? Why or why not?
6. Looking at the list of ICM partner agencies provided you, which partner agencies do you work with in ICM and in what capacity? How would you characterize these

partnerships—successful, unsuccessful, mixed? How is an incident on U.S. 75 managed with ICM? What level of coordination is present between agencies? Rate the nature and extent of communications between agencies.

7. Do you think ICM-related corridor management strategies have reduced conflicts between your agency and other agencies? If no, why not?
8. Rate your agency's comfort level regarding allowing device control and sharing resources with partner agencies: very comfortable, somewhat comfortable, somewhat uncomfortable, not at all comfortable. Explain. Has the sharing of resources with partner agencies worked better for some situations or resources than for others? If yes, please explain.
9. Has ICM reduced the amount of time operators spend on tasks related to routine issues, e.g., for incident or congestion management?
10. Rate whether or not ICM has made it easier for your agency to make tough decisions involving other agency assets or in making proactive decisions, e.g., selection of different response options for other agencies, making decisions based on prediction of impacts etc: easier, no impact, harder. Explain.
11. Rate your agency's comfort level with using ICM during complex situations, e.g., major incident requiring interagency cooperation for diversion efforts: very comfortable, somewhat comfortable, somewhat uncomfortable, not at all comfortable. Explain. Are you comfortable using ICM for some situations more than others? Please explain.
12. Has your agency changed the way that it approaches performance assessment during a given incident as a result of ICM agreements? Explain.
13. Has your agency changed its O&M practices to focus on corridor-critical resources? Explain.
14. [Based on the response from baseline and post-deployment question 6] Have ICM-related changes in organizational structures been incorporated into your agency's budget? If no, why not?
15. Have ICM-related changes in personnel requirements been incorporated into your agency's budget? If no, why not?
16. Have general ICM-related needs been incorporated into your agency's budget? If no, why not?

**Proposed Interview Questions for Others Indirectly Impacted by ICM**

Baseline

1. Are you aware of the ICM project? Yes/No
2. If yes, What are your expectations of the impacts that the ICM project will have in to the corridor?
3. What impacts do you think this project will have on your role/operation? Positive Impacts (if any), Negative Impacts (if any)

4. What do you think of your agency's decision to commit resources to the ICM project? Please explain.
5. Are there any additional activities or responsibilities you have had to assume because of the ICM project? Please describe.

Post-Deployment

1. How would you rate the ICM demonstration? Very successful, somewhat successful, no impact. Why did you rate it at this level? Were some aspects more successful than others? If so, which ones and why? Were other aspects less successful? If so, which ones and why?
2. What impacts did this project have on your role/operation? Positive Impacts (if any), Negative Impacts (if any)
3. Have you changed any practices to focus on corridor-critical resources? Explain.
4. What do you think of your agency's decision to commit resources to the ICM project?
5. What do you think are some lessons learned from the ICM project?

## 4.2 Analysis of ICM Documentation

### 4.2.1 Purpose

The purpose of analyzing ICM documentation is to discern through a study of archived documents the efforts made by the partners to make their ICM projects successful. This documentation will assist with determining the keys to success and associated lessons learned to assist U.S. DOT and other state and local transportation agencies engage in similar programs in the future.

### 4.2.2 Approach

The analysis of ICM documentation will investigate two key questions: 1) what did the partners do to try to make their ICM projects successful?; and 2) what were the keys to success and what are the associated lessons learned that will be useful to U.S.DOT and other state and local transportation agencies? Three key types of ICM documentation are identified for analysis:

1. **Outreach Materials/Activities** – To the extent possible, all outreach materials (e.g., press releases, pamphlets, flyers) related to the ICM project that are created and distributed by local partner agencies (or their marketing/communications contractors) will be compiled, archived and transmitted by the Dallas project partners to the national evaluation team in electronic format during both baseline and post-deployment periods. In addition, any outreach activities (e.g., open houses, town hall meetings) conducted by the partner agencies or their contractors will be logged and reported by the project partners to the national evaluation team during these same periods.
2. **Partnership Documents** – To the extent possible, all ICM partnership documents will be archived and given by project partners to the national evaluation team in electronic format during the baseline stage. Partnership documents include the original proposal to

and teaming agreement with U.S. DOT, communications among partners during the proposal development and through the planning, implementation and operations stages. Those communications include things like memoranda of understanding and other agreements.

3. **Media Coverage** – From its first occurrence, all local, regional, and national media coverage of the ICM will be sought for the national evaluation. The primary source for the data will be the Dallas site team who will provide media clippings from local media sources pertaining to the ICM project. The national evaluation team will also capture online (Internet) coverage of the Dallas ICM project using Google Alerts.

The national evaluation team will examine each of these three types of ICM documentation. In the case of the outreach and partnership documents, the emphasis will be on understanding and describing in the evaluation results report what the Dallas site team did and how those actions impacted the results that they obtained. In the case of media coverage, the national evaluation team's review of the material will be similar to, but somewhat less rigorous than, a formal "content analysis"—a social science technique in which various aspects of communication content (text or speech) are formally parsed and analyzed. The national evaluation team's review of media coverage will seek to understand trends such as the proportion of coverage that was supportive of ICM as well as identifying the specific aspects of the ICM deployment that received the most attention, but a formal content analysis framework yielding quantitative measures will not be utilized.

## 4.3 Findings from the Technical Capability Analysis

### 4.3.1 Purpose

The Technical Capability Analysis investigates improvements in the ability to monitor, control and report on the corridor. Findings in those areas will serve as input to the Institutional and Organization Analysis to assess the realization of new capabilities in the corridor and assess if the investments and inputs occurred as planned. Specifically, findings pertinent to situational awareness, i.e., understanding whether operators realize a more comprehensive and accurate understanding of underlying operational conditions considering all networks in the corridor, and agency coordination and communication will be examined.

### 4.3.2 Approach

The Technical Capability Analysis incorporates surveys and analysis of interagency communications, strategies for coordinated action, and logged agency responses to various incidents using the ICMS. Findings and conclusions from that analysis will directly answer questions contained in the Institutional and Organizational Analysis, addressing specific hypotheses that investigate whether, how, and why operators used the ICMS.

To assess the ability to monitor, control, and report in the corridor, a variety of quantitative and qualitative data will be considered. Quantitative data will come from SmartNET data. These data records are expected to be large databases containing records of each of a variety of actions taken by transportation operators, while qualitative data to test response and control hypotheses

will come from transportation management center (TMC) operator surveys and Commercial Traveler Information Provider interviews. The national evaluation team will parse through those data records, categorizing each record into its appropriate MOE, tabulate totals by MOE, and then compare baseline and post-deployment totals. Standard statistical practices shall be used in all calculations to ensure consistent comparisons across all MOEs. When changes are detected, statistical significance of the change shall be calculated to ensure the national evaluation team does not misrepresent the change as meaningful when it is not.

Regarding situational awareness, quantitative data to be used includes SmartNET and DART system data, while qualitative data consists of results from the TMC operator and ICM Coordinator surveys. Data analysis methods for the respective types of data will be essentially the same as described above. Quantitative analysis will focus on tabulating MOEs based on individual system data records; qualitative analysis will entail typical survey analysis techniques such as calculation of average responses and response ranges. Results will be presented graphically and in hybrid graphical/report formats where key findings and outliers are highlighted and elaborated as appropriate.

More information can be found in the Technical Capability Analysis Test Plan.

# 5.0 DATA ANALYSIS

This section describes how the gathered institutional and organizational data will be analyzed. Specifically, the approach to testing the hypotheses relevant to the Institutional and Organizational Analysis and drawing conclusions will be discussed. Generally, the data will be analyzed for expected outcomes or changes on a qualitative scale or simple affirmation of hypotheses. No exogenous factors have been identified for the Institutional and Organizational Analysis. In fact, the examination of institutional and organizational issues—the Dallas site team interviews in particular—will be helpful in gathering information on exogenous factors that will be helpful to the other evaluation analyses.

## 5.1 Analysis Methods

The Institutional and Organizational Analysis will use analysis methods appropriate to the textual, qualitative nature of the data. Those methods are not expected to include statistical analysis. In the case of the Dallas site team interviews, the national evaluation team will compile notes from the interviews and identify common themes, areas of agreement among different stakeholders, areas of disagreement, and key individual findings related to specific institutional or technical areas. The implications of the interview results will be identified for both the specific Institutional and Organizational Analysis hypotheses as well as for U.S. DOT, other researchers and ICM deployers (actual or potential, including the Dallas and other U.S. DOT ICM Pioneer sites).

Analysis of ICM documentation will be carried out in a similar fashion—documents will be carefully read and the implications for both the Institutional and Organizational Analysis hypotheses and knowledge and technology transfer will be identified. This will include identifying the degree of agency participation in the ICM demonstration and any changes made within agencies as a result of various agreements entered that helped contribute to the success of the ICM project. The review of partnership documents will focus on identifying key themes and individual findings pertaining to how the Dallas agencies were or were not able to establish the high level of agency coordination believed necessary for ICM success. Review of outreach materials will focus on how the Dallas partners educated and engendered support among a variety of audiences, including political representatives, travelers and the media. Review of media coverage will focus on how the ICM project was perceived by the media and the role of the media in advancing or impeding education and support-building among travelers and the general public.

The analysis of findings from the Technical Capability Analysis will center on reviewing and organizing those findings so that they may be aligned with various Institutional and Organizational hypotheses. Those findings directly address a couple of hypotheses related to use of ICM to improve agency coordination but will also provide a general context in which to interpret a range of Institutional and Organizational Analysis results.

## 5.2 Relationship to Hypotheses

Many of the hypotheses will draw upon more than one of the data sources that are utilized within the Institutional and Organizational Analysis; Table 2-1 (presented previously) emphasizes some of the more direct relationships between specific data and individual hypotheses. Although not a hypothesis, all of the Institutional and Organizational Analysis data are expected to provide overall lessons learned for knowledge and technology transfer activities. The Institutional and Organizational Analysis will not seek to quantify the degree of success for each measure of effectiveness as much as identify whether expected changes took place, how, and why.

Interview responses, collected content, and findings and conclusions from the Technical Capability Analysis, as well as outreach documents and media coverage will be examined for lessons to be learned from this ICM deployment. Specifically, suggestions by interviewees, observations of good-intentioned efforts that were particularly successful or fell short, and the ability of agencies to guide media coverage will be assembled to indicate ways to improve ICM for future deployments for knowledge and tech transfer activities.

# 6.0 RISKS AND MITIGATIONS

No specific, significant challenges or issues have been identified. As with all of the analyses, the success of this analysis depends on the cooperation of the local partners in providing data (materials for the analysis of ICM documentation and making themselves available for interviews). That risk is being mitigated through the explicit identification, in this test plan, of the national evaluation data needs and expectations of the Dallas site team's role in this analysis.

One other specific risk associated with this analysis pertains to the inherent challenges in drawing conclusions based on the subjective and sometimes conflicting input received through interviews. That risk will be mitigated by carefully crafting interview questions, using good interview technique that avoids leading questions, and giving due consideration to areas of agreement and disagreement when presenting findings.

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