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Testing A Proposed Decision-Oriented Framework to Understand ITS Deployment Issues: A Case Study of the TravInfo ATIS Project

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Framework To Understand ITS Deployment
Issues:**

A Case Study of the TravInfo ATIS Project

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November 24, 1998

ABSTRACT

Deployment is at the forefront of current activity in California in the field of intelligent transportation systems. It is important to understand the multitude of issues associated with such deployment to increase the likelihood of a successful deployment initiative. A review and synthesis of the literature on deployment issues have been performed. This served as a basis for development of a proposed decision-oriented framework that may be used to recognize and organize issues for the deployment of intelligent transportation systems.

The applicability of this framework to intelligent transportation systems is examined and tested. The test focuses on the specific case of the TravInfo Advanced Traveler Information System deployment based in the San Francisco Bay Area.

TravInfo was a Field Operational Test sponsored by the Federal Highway Administration and was organized as a public/private partnership to capitalize on the different talents of both the public and private sectors. TravInfo was initially conceived in 1992, funded by the Federal Highway Administration's Field Operational Test program in 1993, began operation in September 1996 and recently completed its Field Operational Test phase in September 1998. The objective of the TravInfo FOT was to collect, integrate and broadly disseminate timely and accurate multimodal traveler information through a range of products and services, with different prices and capabilities, to meet consumer needs. TravInfo has an open-access database and architecture that allows the private sector participants to retrieve the data free of charge and re-package it for its ultimate dissemination to travelers via their commercial products and services.

After the Field Operational Test concluded, the scope or magnitude of TravInfo entered a transitional phase and continues "as-is" relative to operations, administration, and management. During this phase it focuses on achieving additional objectives in the areas of expanding data coverage, upgrading data processing, marketing, management and administration.

Key Words: Intelligent Transportation Systems, Advanced Traveler Information Systems, deployment, decision-oriented framework, TravInfo

EXECUTIVE SUMMARY

Deployment is at the forefront of current activity in California in the field of intelligent transportation systems (ITS). It is important to understand, to the extent possible, the multitude of issues associated with ITS deployment in order to increase the likelihood of a successful deployment initiative(s). The literature contains numerous sources which delve into the deployment area. This has been the basis for the development of a decision-oriented framework to help people recognize and organize issues relative to the deployment of intelligent transportation systems.

As this framework has been developed as part of this project (MOU 275), it has yet to be “road tested” with an actual deployment. The focus of the work reported in this document is just such a test to assess the performance of this framework as a tool for determining the feasibility of a deployment strategy.

The development of this framework and the test described in this report comprise a two-volume set from the full documentation for this project. The first volume consists of a detailed description of the framework and should be consulted to obtain a complete understanding of the framework dimensions before delving into the application of the framework, which is described in this report, i.e., the second volume.

This framework is examined to measure the extent to which it is applicable in recognizing and organizing ITS deployment issues as well as being used to help evaluate ITS deployment strategies. The test focused on the specific case of the TravInfo Advanced Traveler Information System deployment based in the San Francisco Bay Area.

TravInfo was a Field Operational Test sponsored by the Federal Highway Administration and was organized as a public/private partnership to capitalize on the different talents of both the public and private sectors. TravInfo was initially conceived in 1992, funded by the Federal Highway Administration’s Field Operational Test program in 1993, began operation in September 1996 and recently completed in September 1998. The objective of the TravInfo FOT was to collect, integrate and broadly disseminate timely and accurate multimodal traveler information through a range of products and services, with different prices and capabilities, to meet consumer needs. TravInfo has an open-access database and architecture that allows the private sector participants to retrieve the data free of charge and re-package it for its ultimate dissemination to travelers via their commercial products and services.

After the Field Operational Test concluded, the scope or magnitude of TravInfo entered a transitional phase and continues “as-is” relative to operations, administration, and management and uses the transitional period to focus on achieving additional objectives in the areas of expanding data coverage, upgrading data processing, marketing, management and administration.

The framework dimensions consist of 1. need, 2. solution, 3. decision-maker/organization, 4. decision-making, 5. decision-influencing, 6. time, 7. risk management, and 8. synergy.

Transportation needs certainly were considered over the course of TravInfo’s development, design, testing, and evaluation. Other needs have also driven the project. There are numerous transportation agencies and organizations, both public and private, in the San Francisco Bay Area. Such a multitude of entities obviously do not always agree on all issues and have

different agendas. Another need, the “institutional” need, is in the area of developing improved relationships and connections among the transportation-related organizations so that a more systems-approach is used to solve the region’s transportation problems.

TravInfo is being implemented in an environment in which not only an Advanced Traveler Information System (ATIS) is being deployed but other prospective solutions, ITS as well as more conventional ones as well. The current state of TravInfo as it nears the completion of its Field Operational Test, is not an end state, but rather an intermediate state of the ATIS solution, whose characteristics have been determined. A deployment strategy is currently in the process of development.

There is a clearly defined set of champions for the TravInfo project as well as major stakeholders including members of the public as well as private-sector organizations with a business interest in the transportation/ITS field. There are numerous decision-makers participating in the TravInfo project, both individually and organizationally, primarily consisting of the champions and stakeholders. Regarding the decision-making process itself, at this stage of TravInfo, it is not clear to what extent all aspects of the decision-making process have been considered and addressed *for each major stakeholder*. The decision-making process should be considered as iterative in nature. More information will be gained as TravInfo completes the testing and evaluation stages and enters the transition to full deployment stage.

The champions of TravInfo have embarked on influencing other stakeholders as well as sometimes influencing each other. The ability to influence stems at least in part from the institutional stature and experience of these organizations before as well as since the start of TravInfo. Some means of influencing, however, have been more effective than others.

The deployment process thus far has encompassed over six years covering the design, development, testing, and evaluation. After the testing and evaluation phases are complete, TravInfo will enter a transition phase of approximately nine months to carry TravInfo to full deployment. Thus there have been and will continue to be intermediate states for TravInfo.

From the perspective of the primary champions of TravInfo, major technical and non-technical uncertainties overall have likely been identified through a process of 1. absorbing lessons learned and information sharing from ATIS FOTs outside the Bay Area by attending meetings and conferences, and reading other project documentation, 2. seeing the results of the official TravInfo evaluation, and 3. seeing events unfold over the course of the FOT.

While it is important to be sensitive to exogenous events and allow for contingency plans to deal with them, it is also difficult to accomplish this with confidence in all cases. Some exogenous event types may be planned for, if not specific individual events, since such event types have already occurred such as the BART strike and the El Niño storms. Other exogenous events, such as the Internet, the World Wide Web and their ramifications for potential applications to TravInfo were not foreseen five or six years ago during the developmental stages of TravInfo. There are, however, Internet sites using TravInfo data that provide Bay Area traffic information. A pro-active strategy of being aware of and understanding current events in the computer, telecommunications, and cable television industries could help increase the likelihood of remaining sensitive to such exogenous events.

TravInfo has also capitalized on the synergistic effects in the domains of technology, needs and solutions, and geography. From the start of TravInfo, members of both the public and

private sector companies with a potential business interest in ITS were thought of as two core constituents for TravInfo. The multitude of transportation agencies and organizations in the San Francisco Bay Area do not always work in concert with each other from a regional perspective for the betterment of the entire Bay Area. Institutional synergy has also taken place by means of developing improved relationships and connections among the transportation-related organizations in the Bay Area so that a more systems approach is used to solve the region's transportation problems. The development of partnerships, whether public-public, public-private, or private-private, have been the result. The fact that public access to TravInfo is possible via a single 7-digit phone number without a need for an area code throughout the region is an attempt to address an often-heard complaint about the region's transportation services with regard to interoperability.

The proposed decision-oriented framework provides a way to categorize issues when examining the deployment of Intelligent Transportation Systems. The categories or dimensions used provide necessary though not sufficient conditions for a successful ITS deployment. This framework should not be used as the sole predictive tool for successful deployment, nor was it developed for this purpose.

Of the proposed decision-oriented framework's dimensions, there are two of them, need and synergy, that could be enhanced if they were to include an institutional perspective. Another suggestion to refine the framework is to partition the dimension focusing on risk management into smaller components as this dimension seems to be a bit unwieldy and very large in scope.

Based on the TravInfo case examination of the framework, overall, it provides a useful methodology to coalesce issues into a more cohesive whole to help assess the likelihood of a successful deployment. Some refinements of the framework components are suggested, however, which could lead to an improved product. This examination has provided basically only a single data point for evaluating the effectiveness of the framework; additional case study examinations are encouraged.

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1. INTRODUCTION

Certain elements of Intelligent Transportation Systems (ITS) have existed for more than fifteen years in parts of the United States. For example, the California Department of Transportation (Caltrans) has had changeable message signs and ramp metering deployed on certain Southern California freeways for over fifteen years. The Advanced Traffic Signal and Control (ATSAC) system, under the direction of the Los Angeles City Department of Transportation, has been in operation in Southern California ever since the Los Angeles Olympic Games in 1984. While the ATSAC system's initial deployment was focused near and around Olympic sites, the system has grown steadily ever since and was used extensively in the aftermath of the 1994 Northridge earthquake to help travelers cope with the temporary loss of the Santa Monica Freeway (Interstate 10).

A concerted and integrated national effort began, however, with the establishment first of Mobility 2000, then the Intelligent Vehicle Highway Systems (IVHS) Society of America, and finally the ITS Society of America which has been in existence for fewer than ten years. Yet, in this relatively short period of time, ITS has undergone significant changes and has transitioned from a purely research and development endeavor, through a period of field testing and evaluation by means of the federal Field Operational Test (FOT) Program, to deployment by means of the federal Model Deployment Initiative and Priority Corridor Programs.

In California there are currently nine federally or state funded FOTs:

- San Diego Smart Call Box
- Los Angeles Spread Spectrum Signal Control
- Anaheim Advanced Traffic Control
- Orange County Mobile Surveillance
- Irvine Integrated Ramp Control
- TransCal
- TravInfo
- Yosemite Area Traveler Information System
- Otay Mesa Electronic Clearance

A brief description of each of these tests may be found in (1). These tests are all within the area of Advanced Traffic Management and Traveler Information Systems (ATMIS). Also in California is one of only four nationally sponsored Priority Corridor Programs, the Southern

California Priority Corridor. Seventeen projects have been identified by the Southern California Priority Corridor Steering Committee and, while funding for all these projects has not yet been secured, the goal is to carry them to full deployment. These projects are also in the ATMIS area.

In addition to these local and regional ITS testing and deployment projects, there is an on-going Statewide effort led by the California Alliance for Advanced Transportation Systems (CAATS) with the primary purpose of “aligning support for broad-based participation in the creation of initiatives for the deployment of Intelligent Transportation Systems (ITS) in California” to accelerate the realization of ITS benefits in the State (2). An expert panel of both public sector transportation professionals and private sector companies with ITS experience met several times in 1997 and 1. developed a vision of the deployment initiatives and what they could accomplish, 2. investigated the qualities and functions that need to be considered in deploying ITS, 3. recommended issues for further exploration, and 4. developed a framework for a longer term work plan. The work plan will ultimately consist of the following (3):

- User needs report
- Consensus concepts of operation for user services
- Transportation systems status report
- Analysis of private sector market initiatives
- Inventory of California ITS assets
- California system architecture
- High-level system design
- Detailed project configuration descriptions with estimated costs and financing plans and estimates of expected benefits and returns on investment.

Thus, deployment is at the forefront of current ATMIS activity in California. It is important to understand the multitude of issues associated with ITS deployment in order to increase the likelihood of a successful deployment initiative(s). The literature contains numerous sources which delve into deployment (e.g. (4, 5)). A review and a synthesis of this literature has been performed as another task for this project and has resulted in the development of a proposed framework with which to assist a user in recognizing and organizing issues for the deployment of intelligent transportation systems. In this framework, decision-makers, decision-

making, and decision influencing play important roles. The framework helps to recognize and organize issues for ITS deployment. It consists of issue categories and can be used to investigate an ITS deployment strategy with respect to whether or not the issues identified in the framework have been addressed.

As this framework has been developed as part of this project, it has yet to be “road tested” with an actual deployment. The focus of the work reported in this document is just such a test to assess the performance of this framework as a tool for determining the feasibility of a deployment strategy.

The development of this framework and the test described in this report comprise a two-volume set from the full documentation for this project, MOU 275. The first volume consists of a detailed description of the framework and should be consulted to obtain a complete understanding of the framework dimensions before delving into the application of the framework, which is described in this report, i.e., the second volume.

The remainder of this report contains the following sections: Section 2 briefly describes Early Deployment Plans within California focusing on the San Francisco Bay Area. Section 3 describes the context within which the framework is tested, i.e. a description of the deployment strategy. Section 4 discusses the assessment of the framework. Conclusions are offered in Section 5.

2. EARLY DEPLOYMENT PLANS

Caltrans works with several metropolitan areas to develop and implement strategic Early Deployment Plans (EDPs) of ITS. These areas include the San Francisco Bay Area, Fresno County, Kern County, Sacramento County, and jurisdictions in the Southern California Priority Corridor. Targeting ITS technologies to solve problems at the local level, these plans assist local agencies with guidance for incorporating ITS into overall transportation plans and improvement programs, with deployment being the primary objective. The plans identify the ongoing projects involving application of ITS technologies, and evaluate whether these projects meet declared goals. The deployment

planning process is a major outreach tool because it focuses on “getting stakeholders involved with real problems and alternative ITS solutions in the mainstream decision making environment” (6). Regional transportation planning agencies and other regional agencies that deal with transportation and air quality are also actively involved. Moreover, private-public partnerships are emphasized in the plans.

The following sub-section provides a summary of the EDP for the Metropolitan Transportation Commission (MTC), the Metropolitan Planning Organization in the San Francisco Bay Area, including the EDP’s primary goals and elements of the EDP planning process. Full details for the MTC EDP may be found in (7). This example is provided because the focus of the remaining portion of this report is on an ITS deployment strategy in the San Francisco Bay Area.

2.1 Metropolitan Transportation Commission 1996 Early Deployment Plan

This EDP has defined priorities for use of ITS, particularly electronic and communications technologies, in the region over the next five to ten years.

There are three principal goals established for this EDP:

- Provide information about ITS to, and solicit ideas/concepts from, a broad range of stakeholders, and enable participants to gain ownership to the EDP.
- Build a regional consensus on an Action Plan for early ITS deployment, and support the Metropolitan Transportation System management strategy and Regional Transportation Plan goals.
- Develop public/private partnership for ITS deployment. This partnership is to permit innovative joint arrangements for ITS deployment.

There are four major top-level elements of the EDP planning process:

- Identify transportation problems facing the Bay Area.

Such problems could be related to lack of facilities, travel delays, lack of information, safety and security, regulation and charges, comfort, convenience, ease of use, and environmental impacts.

- Identify ITS services that can address those problems.

Examples of ITS Services include traffic-responsive signal timing, traffic-responsive freeway ramp metering, real-time transit operations control, transit priority at traffic signals, incident diagnosis and response, real-time transit information, real-time roadway information, electronic transit fare payment, electronic toll collection, and non-stop compliance checks for trucks.

- Identify and evaluate ITS projects that can provide needed services
- Develop an action plan for implementing the projects critical for the region
 - Action plan envisions a substantial expansion of ITS deployment
 - Action plan includes a rough estimate of deployment cost, not specific funding sources for implementation
 - Each project in the Action Plan requires a project sponsor from a local or regional agency, state agency, or partnership of local agencies
 - Projects considered in the Action Plan have highest priority and significance to the region
 - Deploy a probe vehicle system
 - Expand the freeway traffic operations systems
 - Deploy advanced transit signal systems
 - Deploy transit fleet management systems
 - Deploy corridor transportation management systems
 - Expand TravInfo
 - Deploy the TransLink Joint Electronic Transit Fare Card
 - Enhance rideshare matching services

3. DESCRIPTION OF THE ATIS DEPLOYMENT STRATEGY: THE CASE OF THE TRAVINFO PROJECT

The feasibility test of the proposed decision-oriented framework focuses on a specific ITS deployment strategy in the field of Advanced Traveler Information Systems (ATIS) in the San Francisco Bay Area, namely, the TravInfo Project. A complete picture of the deployment strategy should encompass the period prior to and during the Field Operational Test as well as after the FOT. In fact, the period encompassing the design and implementation phases of the TravInfo FOT would encompass what Caltrans has called the Initial Deployment Phase, consisting of pilot program deployment at the local level in selected regions and corridors only and may be accomplished by means of FOTs (6).

3.1 Background and History of TravInfo Through the Field Operational Test

TravInfo was a Field Operational Test sponsored by the Federal Highway Administration (FHWA) and was organized as a public/private partnership to capitalize on the different talents of both the public and private sectors. TravInfo was governed by a public sector Management Board led by the TravInfo Project partners: Caltrans (District 4), MTC, and the California Highway Patrol (CHP) (Golden Gate Division). The Management Board established an Advisory Committee¹ with strong representation from the private sector to assist in the design and execution of TravInfo. Much of the project direction has come from a Steering Committee that also includes strong participation from Value-Added-Resellers (VARs) also known as Information Service Providers (ISPs), companies that intend to develop ATIS products and services.

The objective of TravInfo is to collect, integrate and broadly disseminate timely and accurate multimodal traveler information through a range of products and services, with different prices and capabilities, to meet consumer needs. The public sector component includes the Traveler Information Center (TIC), which collects and integrates both static and dynamic traveler information, and the Traveler Advisory Telephone System (TATS), which provides information to travelers through a touch-tone telephone service. The unique aspect of TravInfo, however, is its open-access database and architecture that allow VARs to retrieve the data free of charge and re-package it for its ultimate dissemination to travelers via their commercial products and services. The TravInfo partners intend to make the results of the project accessible to others across the nation who may wish to engage in similar enterprises.

TravInfo was initially conceived in 1992, funded by the FHWA's FOT program in 1993, began operation in September 1996 and concluded in September 1998 as an official FOT. TravInfo began baseline operations more than two years behind the initial proposed schedule date due primarily to unavoidable (on the part of TravInfo) external problems.

An essential element of TravInfo is to centralize and fuse data sources and provide standardized access. In this way public agencies only have to provide data to TravInfo and

¹ The Advisory Committee was subsequently renamed the Information Service Provider (ISP) Forum.

private sector participants do not have to go to multiple sources to obtain data, only to TravInfo. The Traveler Information Center (TIC) is this centralized data fusion hub.

As part of this FOT, an independent evaluation is being conducted to provide input to both the TravInfo partners (MTC, Caltrans, and CHP) as well as to designers and planners of similar projects in other parts of the country². Since the FOT just recently completed its two year duration and the TravInfo evaluation not yet complete, it would be premature to offer any final conclusions or final lessons learned at this time. Achievements and problems may, nevertheless, be described that could play a beneficial role in understanding the TravInfo setting and assist in the investigation of the decision-oriented framework (Section 4). These observations are not meant to be exhaustive but only illustrative of some examples of both achievements and problems associated with TravInfo.

Since TravInfo began operations, call volume into TATS has remained fairly steady at between 1,700 and 2,100 calls per day or between 50,000 and 60,000 TATS calls a month from an estimated upper bound of 8,500 different callers³, except during the BART strike (September 1997) and the El Niño generated rainstorms (February 1998). Neither of these external events had any permanent effect on increasing TATS call volume. These volumes are far less than that envisioned in the goals set out for the TravInfo Field Operational Test. Based on a survey of TATS callers conducted during April 1997, respondents indicated their general satisfaction with the TravInfo TATS service, however, they had not heard much about TravInfo. This finding seems to indicate more of a marketing problem than a TravInfo service quality problem (8). Indeed, most people involved with TravInfo believe that the initial marketing campaign conducted between January and March 1997 was ineffective in generating increases in TATS call volume greater than the amount that existed prior to the start of the advertising campaign. During the BART strike in September 1997, TravInfo received a lot of free advertising, especially on television where it was referred to primarily as a “transit hotline”. During the rainstorms in February 1998, TravInfo received another batch of free advertising, and it was then more

² The California PATH Program is the TravInfo evaluator and this author is a member of the evaluator team.

³ For these external events, TATS call volumes increased to approximately 200,000 and 170,000 during September 1997 (BART strike) and February 1998 (rainstorms), respectively.

correctly⁴ labeled as a “traffic information hotline”. Yet within three weeks of the end of the most severe rainstorms, TATS call volumes reverted to their pre-storm and pre-BART strike levels. Thus, the problem is not just one that a single marketing campaign may help resolve, but a sustained marketing campaign may help to resolve. It must be noted, however, that by its very nature, the TATS survey compiled information from TATS users. Thus, it was not possible with that survey instrument to inquire of former users about why they stopped using TATS. This will be possible, however, at the end of the FOT when a much broader survey is conducted and inquiries of non-TATS callers are possible and will pertain to whether or not they had ever used TATS and if they had, then why they had stopped.

It must also be mentioned that during the FOT, transit calls have comprised approximately two-thirds to three-fourths of all calls, primarily because a single transit service provider (AC Transit) uses the TravInfo TATS phone number as its sole outlet for callers to access this transit property. Moreover, AC Transit began marketing the TravInfo TATS phone number approximately nine months before TravInfo went on-line, so callers were very familiar with the TATS phone number. Thus, the overall call volume is “anomalously” skewed upwards because of this phenomenon. Only fifteen percent of TATS calls are for traffic-related information. Thus, real-time data is being disseminated even less than other types of data hence frustrating part of another TravInfo goal, i.e. to provide timely and accurate traveler information.

Data access by the private sector has also been very limited. Access by the private sector participants is essentially limited to four ISPs (Etak, Daimler-Benz, Contra-Costa Times, and Maxwell), one of which downloads approximately 90% of all data accessed. Although TravInfo has managed to involve some private sector participants in the FOT, it has so far not reached its second goal of stimulating and supporting the deployment of a wide variety of ATIS products and systems. Troubling for TravInfo is the fact that approximately 85% of data accessed by ISPs is speed and congestion data, which relies on loop sensors 75% of which have not been

⁴ If a TravInfo TATS caller selects “transit” and a specific transit service provider (TSP), then he/she is taken out of TravInfo and sent to that TSP. For some TSPs, the TravInfo phone number is not the sole means of accessing them. So, essentially, TravInfo does not provide transit-related information, it is more aptly the gateway to that information.

allowed to feed data into the TIC because of accuracy problems with the Traffic Operating System (TOS) loop detector system. This loop sensor data problem has likely led to limited data use on the part of ISPs. Other potential reasons for their limited data use may include concerns on the part of the private sector about 1. the geographical nature of TravInfo and prospects for the TravInfo model to remain a regional enterprise or “go” national, and 2. the temporal nature of TravInfo, i.e. the prospects for TravInfo to continue after the two-year FOT. The latter point may have been a concern early in the FOT, but over the course of the last year it should have faded in importance because there has been a vigorous effort to help secure continued funding for TravInfo operations by the Management Board (9). Metro Networks, the operations contractor, has the task of developing a business plan and MTC has the task of developing the implementation strategy and the public sector financial or funding plan for the transition of TravInfo from an FOT to a deployed system (Section 3.2). A more definitive investigation into ISP views of TravInfo will be made in the second ISP survey to be conducted in 1998. Final conclusions and lessons learned will be forthcoming in the final TravInfo Evaluation Report in the first quarter of 1999.

TravInfo has undoubtedly helped foster strong business relationships among private sector participants that are beneficial toward the long-term deployment prospects of ATIS in the San Francisco Bay Area, if not the near-term likelihood. An example of such ties is the relationship between Etak and Metro Networks which has led to a joint effort for a nationwide deployment of commercial Advanced Traveler Information Services (10, 11).

TravInfo has also resulted in a few ISPs, namely Etak, Maxwell, and Contra Costa Times, using TravInfo data to create a product on the internet via their web sites. Though the number of these web site accesses or “hits” is unknown, it is clear that TravInfo data are being disseminated to the public via media other than TATS⁵.

3.2 TravInfo Deployment Plan for the Post-FOT Period

This section provides a brief summary of the current version of MTC’s TravInfo Deployment Plan that will be implemented at the conclusion of the Field Operational Test. Full

details may be found in (12). The deployment plan consists of two parts: 1. Transitional Period Implementation Strategy, and 2. Target System Definition. The Transitional Period Implementation Strategy depicts the actions to be taken during the nine months immediately following the conclusion of the Field Operational Test. The Target System represents what TravInfo will look like as a fully deployed system.

3.2.1 Transitional Period Implementation Strategy

The objectives of TravInfo will narrow somewhat and focus primarily on TravInfo as a public service that attempts to provide comprehensive, accurate, multimodal travel information. The scope or magnitude of TIC operations will be to continue in an “as-is” mode and use the transitional period to focus on achieving the Target System (Section 3.2.2). MTC will apply for public funding to support TravInfo through its regular funding programs rather than seeking either dedicated federal ITS funding or private sector contributions. Data will continue to be disseminated in the “as-is” mode, i.e. at no cost to all interested parties on an equal basis, and MTC will participate in statewide asset management plan development (See Section 1 and (3)). The asset management plan will determine to what extent TravInfo will be able to recover costs of future dissemination of its data. The current internal institutional arrangements, i.e. Management Board, Steering Committee, and the ISP Forum, will give way to a different structure. The new arrangement will consist of 1. an executive board with the same voting members as currently exist on the Management Board and will focus on policy issues, and 2. a project administration group to focus on more detailed issues. The current project administrative framework will be maintained with only minor modifications as necessary. TravInfo will also retain the current contract administration and contractors for the transitional period.

3.2.2 Target System Definition

The following comprise the core elements of the Target System and should be viewed as objectives with varying degrees of certainty as to their feasibility:

- Data coverage

⁵ The internet web addresses for Etak, Maxwell, and Contra Costa Times are, respectively, <http://www.etaktraffic.com/>, <http://www.maxwell.com/yahootraffic/SF/>, and <http://www.hotcoco.com/traffic/>.

- ◆ automated feeds that provide real-time information for specific corridors
- ◆ continued use of manually-entered data where necessary
- Data processing
 - ◆ enhancing automated linkage between TravInfo and the CHP
 - ◆ enhancing automated linkage between TravInfo and Octel (contractor for TATS voice processing system)
 - ◆ system operating with 99% reliability
- Marketing
 - ◆ establish a continuous marketing effort with intra- and inter-agency coordination
- Management and administration
 - ◆ determine permanent location of the TravInfo TIC
- Development of other plans
 - ◆ data coverage and improvement
 - ◆ marketing
 - ◆ standards migration/architecture compliance (to achieve consistency with national ITS Systems Architecture)

4. TESTING THE PROPOSED DECISION-ORIENTED FRAMEWORK AGAINST THE ATIS DEPLOYMENT STRATEGY

This section tests the deployment strategy for the TravInfo ATIS against the proposed decision-oriented framework. This test consists of 1. examining each of the issue categories in the framework and assessing whether such issues have been considered and/or addressed in the TravInfo case, and 2. determining whether the TravInfo case suggests modifications to the framework. It should be emphasized that this is not an evaluation of the deployment of TravInfo. With the FOT only recently having been completed and TravInfo having just entered the post-FOT phase, it is premature to judge the success of the TravInfo deployment.

4.1 Framework Dimensions

Since a complete exposition of each of these issue categories or dimensions is part of another task for this project, such descriptions will not be repeated here, except for a listing of

the framework dimensions, as follows: 1. need, 2. solution, 3. decision-maker/organization, 4. decision-making, 5. decision-influencing, 6. time, 7. risk management, and 8. synergy.

4.1.1 Need

Were the following questions addressed?: 1. To what degree were the transportation needs in the San Francisco Bay Area considered for the TravInfo project? and 2. Has the deployment of TravInfo been driven by these needs? Transportation needs certainly were considered over the course of TravInfo’s development, design, testing, and evaluation. Though it was also realized early in the development of the evaluation plan for TravInfo that it would likely not have a demonstrable effect on the performance of the transportation system, e. g. congestion. Moreover, TravInfo was likely to have only minimal impact on travel mode choice.

Certainly TravInfo has been driven by the Bay Area’s transportation system needs, however, other needs have also influenced the project. There are numerous transportation agencies and organizations, both public and private, in the San Francisco Bay Area. Such a multitude of entities obviously do not always agree on all issues and have different agendas whereby in some cases the travel interests of their own constituency have taken precedence over the travel interests of the entire Bay Area. Another need, perhaps more aptly termed “institutional”, is in the area of developing improved relationships and connections among the plethora of transportation-related organizations in the Bay Area so that a more systems-oriented approach is used to solve the region’s transportation problems. The development of partnerships, whether public-public, public-private, or private-private, has also driven TravInfo. Finding solutions to such institutional needs could have beneficial impacts on the day-to-day travel experiences of the public.

4.1.2 Solution

TravInfo is being implemented in an environment in which not only an ATIS is being deployed but other prospective solutions (ITS as well as more conventional ones). Advanced Traffic Management Systems, in the form of 1. loop detectors, 2. ramp metering, and 3. changeable message signs, are also being deployed in the San Francisco Bay Area as part of an overall strategy to address the area’s transportation problems. Also of note is the fact that

Electronic Toll Collection (ETC) will soon be implemented on bridges throughout the Bay Area⁶. Additional details of the region's ITS-related solutions to transportation problems may be found in Section 2.1 and (7). More conventional solutions to transportation problems, such as High Occupancy Vehicle (HOV) facilities on Interstate 80, 880, and U.S. 101, have also been planned for and have either already been implemented, are under construction, or have been funded.

The current state of TravInfo, i.e. recently completed its FOT phase, is certainly not an end state, but rather an intermediate state of the ATIS solution, whose characteristics have been determined. A deployment strategy is currently in the process of development (Section 3.2). It may still, however, be too early to determine whether such a deployment strategy is deterministic or stochastic in nature.

4.1.3 Decision-Maker/Organization

There is a clearly defined set of champions for the TravInfo project. There is the team of locally based project partners: Metropolitan Transportation Commission, Caltrans (District 4 and the Office of New Technology & Research), and the California Highway Patrol (Golden Gate Division). Another champion is the TravInfo TIC's operations' contractor: Metro Networks. Finally, another champion is the Federal Highway Administration who is funding the FOT phase of TravInfo. Among the project partners, MTC and Caltrans could justifiably serve in the role of "champions among champions" due to at least a seemingly greater level of investment, very long-standing interest in the ITS field in general and its implementation in the San Francisco Bay Area in particular. Major stakeholders have been identified including members of the public as well as private-sector organizations with a business interest in the transportation/ITS field. While the set of decision variables (controllable, influencable, exogenous) has certainly been considered, no complete set of such decision variables has been determined since the TravInfo project is still in the midst of its deployment scenario. The determination of such variables is likely to require a multi-iterative process encompassing the following phases of TravInfo: design, development,

⁶ To date, ETC is deployed on only one of the Bay Area's eight bridges, namely the Carquinez Bridge, in the form of the *FasTrak* program.

testing, implementation, evaluation, transition to stable deployment, and stable deployment. The Management Board serves as the champions' organizational entity.

4.1.4 Decision-Making

There are numerous decision makers participating in the TravInfo project, both individually and organizationally, primarily consisting of the champions and stakeholders discussed in Section 4.1.3. This dimension raises the issue of the importance of understanding the decision-making process to the fullest extent possible. Numerous issues have been suggested as essential in this examination and include primarily an understanding of the nature of the process itself for each major stakeholder. Other issues include the uncertainties and risks associated with each decision-making process, a determination of a cost-benefit-risk analysis for each stage of the solution set from the perspective of each major stakeholder, the degree to which possible relationships (competitive, partnership, and coalition) have been formed, and understanding the personal character and the institutional culture of the participants. At this stage of TravInfo, it is not clear to what extent all the issues raised in the discussion of the decision-making dimension have been considered and addressed *for each major stakeholder*. Some stakeholders, however, have examined numerous issues, e.g. members of the Management Board and members of the private sector with potential business interests in ITS. The decision-making process should be considered as iterative in nature. More information will be gained as TravInfo completes the testing and evaluation stages and enters the transitional stage to full deployment.

4.1.5 Decision-Influencing

The champions of TravInfo, especially the three primary and locally based TravInfo partners (MTC, Caltrans, and CHP). have embarked on influencing other stakeholders as well as sometimes influencing each other. The ability to influence stems at least in part from the institutional stature and experience of these organizations before as well as since the start of TravInfo. Some means of influencing, however, have been more effective than others.

For example, MTC has a consultant⁷ who provides MTC the technical expertise that is needed to remain “on top” of all technical issues. The consultant’s tasks include the monitoring of data quality from Caltrans’ loop detectors and technical discussions with project contractors.

Another example concerns the initial marketing campaign for TravInfo. It proved ineffective in educating the public about TravInfo as measured by the call volume into TravInfo coupled with the results of the first caller survey in which callers felt satisfied with the service but felt the word about TravInfo was just not getting out. The lessons learned had to do with the substance of the campaign and its longevity (Section 3.1) and these lessons are being applied in another marketing campaign that has just commenced. Collaborative and partnership type of decision-making has played an important role over the course of TravInfo via such institutional organs as the Management Board, the Steering Committee, and the ISP Forum.

4.1.6 Time

The deployment process thus far has encompassed over six years covering the design, development, testing, and evaluation. After the testing and evaluation phases are complete, TravInfo will enter a transition phase of approximately nine months to carry TravInfo to full deployment. Thus there have been and will continue to be intermediate states for TravInfo and such states are properly defined. Major implementation issues such as 1. paying for TravInfo, 2. ownership of TravInfo, and 3. linkages with the legislative process have been considered by the Management Board, again with additional leadership provided by MTC.

4.1.7 Risk Management

From the perspective of the primary champions of TravInfo, major technical and non-technical uncertainties overall have likely been identified through a process of absorbing lessons learned from ATIS FOTs outside the Bay Area by attending meetings and conferences, reading other project documentation; reviewing the results of the official TravInfo evaluation; and seeing events unfold over the course of the FOT. For example, market uncertainties with respect to the public sector and the use of the TATS were identified by means of lessons learned from the initial marketing campaign that proved ineffective, evaluation results indicating overall

⁷ SRI, Inc. of Palo Alto, California

satisfaction with the TATS service, and observing no long-term sustained increases in TATS call volume as a result of two major exogenous events (BART strike, El Niño rainstorms). Such factors also provide an informational foundation with which to use to remedy these uncertainties in the next marketing campaign.

While it is important to be sensitive to exogenous events and allow for contingency plans to deal with them, it is also difficult to accomplish this with confidence in all cases. Some exogenous event types may be planned for, if not specific individual events, now that such event types have already occurred. For example, the El Niño storms and the BART strike should have prepared the TravInfo team for how the TATS service would deal with similar type of emergency type of events. In fact, a recent shooting on I-80 in the East Bay led to a two-fold increase in TATS inquiries for that route over the expected number of calls on a more “normal” day. While the I-80 event was very localized and not a regional emergency, the public reaction through the increase in TATS call volumes indicated that even such an apparently local and relatively minor event generated heightened interest to find out information, hence, use TravInfo’s TATS service. Other exogenous events, such as the Internet, the World Wide Web and their ramifications for potential applications to TravInfo were not foreseen five or six years ago during the developmental stages of TravInfo. However, the few ISPs that do have a product or service are mainly those with web pages that use TravInfo data as input and provide information on their web sites about traffic conditions in the Bay Area. A very pro-active strategy of being aware of and understanding current events in the computer, telecommunications, and cable television industries could help increase the likelihood of remaining sensitive to such exogenous events.

4.1.8 Synergy

The notion of synergy or taking advantage of synergistic effects is discussed in the technological, need(s) and solution(s), and location contexts. While TravInfo is officially the deployment of an Advanced Traveler Information System, it may also be viewed as a multi-technology system of systems. For example, the TIC is TravInfo’s central information acquisition, processing, and dissemination system. It has a multi-faceted technological

foundation, encompassing 1. the TIC operator in relatively low-tech and very human-centered tasks for entering some data into the TIC and into TATS for public dissemination as well as 2. fully automated data acquisition and dissemination subsystems. As TravInfo nears the conclusion of the FOT and enters its transitional phase, technological modifications are being planned to address system weaknesses observed over the course of the FOT.

A need/solution synergy has occurred with respect to who has the need. From the start of TravInfo, members of the public and private sector companies with a potential business interest in ITS are thought of as the two core constituents for TravInfo. Developing solution strategies to 1. address the transportation-related problems of the public through a system of collecting, integrating, and broadly disseminating timely and accurate traveler information and 2. help germinate a budding ATIS industry in the San Francisco Bay Area are two key objectives of the FOT.

The concept of interoperability may be viewed as a form of cross-location synergy. As discussed in Section 4.1.1, the multitude of transportation agencies and organizations in the San Francisco Bay Area do not always work in concert with each other from a regional perspective for the betterment of the entire Bay Area; i.e. a “turfdom” mentality asserts itself. The fact that access to the TravInfo TATS is possible via a single 7-digit phone number without a need for any area code throughout the region⁸ (817-1717) is an attempt to address an often-heard complaint about the region’s transportation services with regard to interoperability.

Another synergy, perhaps aptly termed institutional synergy, has taken place by means of developing improved relationships and connections among the transportation-related organizations in the Bay Area so that a more systems-oriented approach is used to solve the region’s transportation problems. The development of partnerships, whether public-public, public-private, or private-private has been the result.

⁸ This remained true even in the case of the new “650” area code resulting from the “415” split during the FOT. The same policy is being sought for the “510” split as well.

4.2 Results of the TravInfo Examination: The Need for Framework Modifications

Of the proposed decision-oriented framework's dimensions, two of them, namely need and synergy, would be enhanced if they were to include an institutional perspective (See Sections 4.1.1 and 4.1.8).

As in the case of the "need" dimension, where it is stated that "An ITS user service will likely not be deployed simply for the sake of deployment.", so too in this case, this framework for recognizing and organizing issues for deploying ITS should not be changed simply for the sake of changing it. The following exercise, however, was used to help determine what, if any, changes to the framework should be suggested. Thus the objective of the exercise was to determine whether or not the framework could encompass all possible issues that might arise in the deployment of TravInfo. The framework categorized decision variables and events as either controllable, influencable, or exogenous — a three-part grouping that is exhaustive and non-overlapping. This same grouping was used as a backdrop when considering some general, unspecified issues. If such an issue were controllable by or under the control of the champion or set of champions, then the issue would fall within the decision-making dimension (Section 4.1.4). If the issue were not controllable, yet was influencable, then it would fall within the decision-influencing dimension (4.1.5). If the issue were neither controllable nor influencable, but rather exogenous, then the issue would fit within the context of the risk management dimension (4.1.7).

Within the risk management dimension, a single question is posed that encompasses a vast domain of issues: *Is the Deployment Plan sensitive to exogenous variables and events?* This dimension is potentially so vast and all inclusive that on the one hand, it would be difficult to find an issue that could not ultimately fit into this category; however, since it is so big, it may be too unwieldy. There could be a benefit by partitioning this dimension into more tractable components. The other seven dimensions are considerably more narrowly cast than the risk management dimension and splitting the latter dimension might create a modified framework based on more equally significant components.

5. CONCLUSIONS

The proposed decision-oriented framework provides a way to categorize issues when examining the deployment of Intelligent Transportation Systems. The categories or dimensions used provide necessary though not sufficient conditions for a successful ITS deployment. This framework should not be used as the sole predictive tool for successful deployment nor was it developed for this purpose.

Based on the TravInfo case examination of the framework, overall, it provides a useful methodology to coalesce issues into a more cohesive whole to help assess the likelihood of a successful deployment. Some refinements of the framework components are suggested, however, which could lead to an improved product. Since this examination has provided basically only a single data point for evaluating the effectiveness of the framework, additional case study examinations are encouraged.

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