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Institutional, Organizational and Market Aspects of Successful ITS Deployment: A Case Study Analysis

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INSTITUTIONAL, ORGANIZATIONAL AND MARKET ASPECTS OF SUCCESSFUL *ITS* DEPLOYMENT

A Case Study Analysis

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Abstract

This research follows on a previous study to explore key aspects of successful Intelligent Transportation Systems (ITS) deployment within existing institutional, organizational and market environments. The researcher developed three additional case studies of successful ITS deployment in the U.S. and Europe, and revisited one case from the previous work. Results from literature searches and surveys were analyzed, and findings on institutional, organizational and market factors are presented.

Key words: ITS, deployment, institutional, value, business models, benefits, highway capacity

Executive Summary

This project follows on previous PATH research to explore key aspects of successful Intelligent Transportation Systems (ITS) deployment within existing institutional, organizational and market environments. In the course of the prior work (under Task Order (TO) 4145), it became clear that political/ institutional, organizational and market environments in Europe, as they relate to transport, system management and ITS deployment, are comparable to those of the U.S. and California. Issues, policy objectives, processes and the stage of ITS research and deployment are quite similar, even as some interesting and informative differences exist. This was not expected at least to the extent of the similarities found. Furthermore, significant program and project initiatives were identified that were beyond the scope of that project. Specifically, the use of ITS for integration of existing national systems to "build" a trans-European road network, and the use of ITS by private toll road operators in France for customer-oriented services (e.g., system level-of-service maintenance and in-vehicle services) are two efforts that could have direct relevance to California and the U.S., and are examined here.

In addition, this research allows follow up with Southern California Priority Corridor principals on the IMAJINE project - expanding the scope of responses to include a state perspective; and examines a Texas project, the San Antonio traffic management center/system (Transguide), to expand the U.S. case study base to include a medium-sized urban area.

The systems and projects chosen for this research are profiled in the main body of this report, and include technical system overviews, institutional arrangements and history/background development.

The analytical framework and survey instrument of the TO 4145 project was reviewed and customized for each of the four case studies before distribution. Results from literature searches and responses from the surveys were analyzed as to institutional, organizational and market factors surrounding ITS deployment and to address the special area of interest specific to each case study.

Key findings include: European partners feel that ITS is contributing to building a seemless Trans-European Road Network and there is an expectation of significant capacity enhancements; Cofiroute, a private toll road operator in France, confirms the value of traveler information and other ITS services to its overall market package, making its network more attractive and competitive; medium-sized urban areas can enjoy benefits from ITS applications similar to larger regions and may have an advantage with less complex institutional environments; and, a significant factor for successful ITS deployment is the provision for operations and maintenance (O&M) funding and delineation of O&M responsibilities within and among partner agencies.

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Introduction and Project Overview

This project continues exploration, initiated in previous research, of factors contributing to successful deployment of Intelligent Transportation Systems (ITS). ITS deployment has three primary aspects not found in traditional transportation solutions: 1) advanced technology insertion, interoperability and maintenance; 2) system approaches at the planning, operational and service connectivity levels; and 3) private industry products and services linked to public infrastructure and services.

The previous research project, conducted with France INRETS under PATH Task Order (TO) 4145, addressed institutional and organizational factors in successful ITS deployment. To this end four case studies are were analyzed:

- Traffic Management: SIRIUS/IPER (Ile de France/Paris)
- Safety: Digital Tachograph for Commercial Trucks (European Commission)
- Transit: LePilote/Loriev (Marseilles)
- Integrated ITS: IMAJINE (Los Angeles)

The analysis was based on responses by case study principals to a questionnaire developed in that project, interviews with high-level French transport ministry and INRETS officials on ITS activities and issues in France and the European Union (EU), and a broad literature review of similar activities and issues focused on the U.S., Europe and Japan. The analysis addressed five institutional aspects :

- Planning and Financial ("programming") Processes
- Decision Support Tools (ITS architecture, benefit-cost methods, performance standards/measures, etc.)
- Deployment Agency Characteristics (structure and competencies)
- Partnership Arrangements (public-public)
- Incorporation of Private Sector Mobility Products/Services

The analysis and findings based on that research, incorporated into PATH Working Paper UCB-ITS-PWP-2002-8, should be useful in identifying ITS deployment success factors and in developing recommendations for establishing nurturing environments for ITS deployment.

In the course of this prior work, it became clear that political/ institutional, organizational and market environments in Europe, as they relate to transport, system management and ITS deployment, are comparable to those of the U.S. and California. Issues, policy objectives, processes and the stage of ITS research and deployment are quite similar, even as some interesting and informative differences exist. This was not expected at least to the extent of the similarities found. Furthermore, significant program and project initiatives were identified that were beyond the scope of that project. Specifically, the EU's use of ITS for integration of existing national systems to "build" a trans-European road network, and the use of ITS by private toll road operators in France for customer-oriented services (e.g., system level-of-service maintenance and in-vehicle services) are two efforts that could have direct relevance to California and the U.S., and are examined here.

In addition, this research allows follow up with Southern California Priority Corridor principals on the IMAJINE project - expanding the scope of responses to include state and local partners; and examines a Texas DOT project, the San Antonio traffic management center/system (Transguide), to expand the U.S. case study base in refining the findings and recommendations from the previous research.

METHODOLOGY

Profile the Selected Systems/Projects

A comprehensive literature search on ITS efforts in Europe and the U.S. was conducted in the TO 4145 project. Therefore, only the systems and projects chosen for this research needed to be profiled. The profiles, incorporated into the main body of this report, include technical system overviews, institutional arrangements and history/background development. The four systems/projects chosen were:

- Trans-European Road Network (TERN) – the Centrico case
- French Private Toll Road System and Traveler Information Services - Cofiroute
- Transguide, the San Antonio Transportation Management System
- IMAJINE and related ITS activities within the Los Angeles Region (follow-up)

Refine Analytical Framework and Survey Instruments

The analytical framework and survey instruments of the TO 4145 project were reviewed and customized (as appropriate) for each of the four case studies before distribution. These are included in the appendix.

Analysis, Findings and Recommendations

The system/project profiles and responses from the surveys were analyzed as to institutional and organizational factors surrounding ITS deployment and to address the special area of interest specific to each case study:

- TERN/Centrico - contribution of ITS in “building” an integrated highway system
- Cofiroute Toll Road System - value of traveler information to total market package
- Transguide – U.S. medium-sized urban area experience
- IMAJINE - California state perspective (follow-up)

From this analysis, findings were developed, and previous ones reviewed and refined/revised as indicated. Based on these findings, a “strawman” set of initiatives was developed with the federal surface transportation act reauthorization, scheduled for late 2003, in mind.

Trans-European Road Network: the Centrico Case

PRIMARY INTEREST OF CASE: Use of ITS to "build" a highway system

PROJECT/SYSTEM PROFILE

Background/History

The European Union (EU) has undertaken a substantial ITS deployment initiative to realize a core policy mission – integration of the disparate national systems into a pan-European road network (TERN). One of the more interesting strategic aspects of the TERN development effort is that it is a visible and significant case of applying ITS approaches to create a major highway network where only disjointed elements exist. While “concrete” elements are necessary, they are not seen as sufficient to provide effective system capacities commensurate with the EU’s economic and social needs/goals. The outcome by mid-decade of this initiative should be particularly enlightening to the system performance/ management dialogue now taking place in California and the U.S. It seems clear even now, however, that European officials and many in the Member States have accepted ITS-enhanced operational approaches as an attractive policy to help “build” capacity and expand mobility options within a growth environment.

While portions are already operational, work continues into the next round of TERN deployment funding. It should be noted that the EU funds are provided only on a matching basis, and that the deployment initiatives are left to individual Member State budgets.

Technical Overview

Six projects form the core of EU efforts to establish an integrated network on the trans-European road network. All have similar ITS applications – traffic/system monitoring infrastructure, pre-trip and in-trip information, coordinated (cross-border) traffic management and incident response planning, and control centers upgrades/networking. Some have an integrated electronic fee/toll payment application.

The six are distinguished mostly by the geographical areas covered and the special needs/environments of those areas (e.g., weather info in VIKING):

ARTS	Southwest Europe: Atlantic coasts of France/Spain/ Portugal
CENTRICO	Central Europe: Benelux/Germany/France/Netherlands/UK
CORVETTE	Alpine: Austria/Germany/Italy/Switzerland
SERTI	Southern Europe: France/Germany/Italy/Spain
VIKING	Northern Europe: Germany/Denmark/Scandinavia
STREETWISE	United Kingdom and Republic of Ireland (new)

Accomplishments claimed for these EU-supported projects through 2000 include:

- Cross-border user surveys of functional needs;
- Definition of cross-border traffic management schemes which allow for rerouting on European corridors during major road blockage events;

- Installation of traffic monitoring/data collection infrastructure;

- Establishment of a European network of traffic management centers using the DATEX specification for information exchange (developed in R&D and other projects);

- Transnational route information (via Internet and other media); and

- Definition of interoperability for electronic toll collection.

These projects are to continue into the EU's next funding cycle under the new TEMPO program for 2001-06 (see below).

Institutional/Funding Framework

The Treaty of Maastricht (1991), which established the European Union, also incorporated the concept of a trans-European transport network and infrastructure, which could be supported (at least partially) with EU funding.
The current EU role in transportation, therefore, is emerging to be somewhat similar to that of the U.S. federal government – establishing policy directions and encouraging policy implementation through funding support that preserves regional/local discretion and flexibility. The initatives outlined above are manifestations of a notable event under the EU's first common transport policy – the adoption by the Parliament and Council of Ministers in 1996 of guidelines for the development of a trans-European transport network.

The EU's new transport investment program, the Multi-annual Indicative Program (MIP), is designed to carry out the objectives of a common EU transport policy and to stimulate ITS deployment across surface, air and marine modes. Within the MIP, the program specifically dedicated to road ITS deployment, TEMPO, initially increases funding to 190 million (from the previous 125 million) euros over the five-year period. As before, half of this funding is provided by the EU Commission's Directorate General for Energy and Transport and half by Member States. This funding contributes to a total budget of 1.2 billion euros over the same period for the five core TERN projects (continued under TEMPO) and for the new STREETWISE project in the United Kingdom and the Republic of Ireland. Essentially the same set of ITS road applications included in these projects are identified as the priority applications under TEMPO.

The Commission has specified a list of measures /user services eligible for funding under the MIP - actions within the same application domains of the six projects, plus

project management and "horizontal issues" activities including those addressing coordinated planning, technical interoperability, system architecture, organizational issues, enforcement, human factors, and evaluation . It is not clear at this time how many projects will be funded beyond the core six, or how much more EU funding will be made available beyond the 190 million euros.

As in the U.S., surface transport systems are designed, implemented and operated by "state" (national), regional and local agencies. ITS, therefore, is actually deployed within the EU's Member States. For example, the French transport ministry developed a Strategic Road Management Plan (SDER) in 1997. The ministry gave first priority under SDER to developing advanced traffic management systems in TERN corridors and on peripheral motorways around the larger metropolitan areas. Much of this has already been accomplished, including SIRIUS in Paris (one of the ITS case studies cited in the TO 4145 report), Coraly in Lyon and Marius in Marseilles; five others are on-line in smaller cities and more planned for the future. As with California, France plans to have an advanced traffic management system functioning in every medium-to-large metropolitan area. These state centers will exchange information with those of local operators (using the DATEX specification); and feed information directly to motorists through variable message signs and in-vehicle radios (using the RDS-TMC European standard), to a parallel system of Regional Road Information and Coordination Centers (involving other ministries including the police), and through private traveler information services.

With EU funding, France is developing a comprehensive national ITS architecture called ACTIF (building on the EU project KAREN which first defined a European functional ITS architecture).

The Centrico System

To address the aspects of ITS deployment of interest in the TERN experience, but in a manageable setting, the Centrico system was selected for investigation. Centrico stands for the "Central European region transport telematics implementation coordination." This transnational network in the heart of Europe provides a representative subset of the overall TERN. Centrico partners are road administrators from Belgium, France, Germany, Luxembourg, the Netherlands and the United Kingdom (southeastern England). These administrators are responsible for trans-European, interurban and regional roads within their respective countries.

FINDINGS

The following is based on responses to the survey from the IBI Group, one of the consultant teams associated with Centrico, and a web-based literature search (in addition to that of the TO 4145 project - see Bibliography).

SPECIFIC INTEREST AREA: *Use of ITS to "build" highway system*

Given that the Centrico program is not yet fully developed and deployed, and still in the early stage of evaluation, it is premature to identify actual capacity impacts on the overall network. However, a review of the literature confirms the expectation on the part of the partners of significant capacity enhancement from ITS deployments. A report by the TENT-T* Expert Group on ITS for Road Traffic Management, published by the European Commission in April 2000, is particularly illuminating on this point. Following are some excerpts from this report:

- "The key efficiency issue in which ITS has a role to play is the optimisation of road capacity and the optimisation of passenger and freight flows"
- "In all transport modes, the lack of interoperability leads to inefficiencies, and a key aim …. is to increase this through the provision of harmonised standards and continuous service levels across borders"
- "The challenge is to employ ITS to effectively increase the capacity of existing roads"
- "Traffic control ….aims to increase the capacity and safety of the network"
- "The EU's policy objective is to create a Trans-European Road Network (TERN) offering a high level of service (by increasing efficiency and safety) and cross-border continuity"

Related to this last item, in the survey response, it was felt that the Centrico program was contributing to building a seemless Trans-European Road Network. Promotion of this network and the level of cooperation between participating nations are, in fact, two of the primary qualitative measures of effectiveness for Centrico. The capability for communication between traffic control centers is a primary quantitative measure. The exchange of ideas among these partners on operating approaches and priorities was cited as the most satisfying institutional aspect of the program. This was also noted, along with the development of a generalized ITS architecture, as the process that best supports Centrico's ITS/system management efforts. However, it was further noted that government could be more proactive in setting some standards.

Improved understanding of long-distance trucking movements and traveler information needs were cited as accomplishments, as were the development of some multilingual information services (including cross-border). Long-distance traffic for private and business cars is 5-10% of average daily traffic (ADT) on Centrico corridors. Long-distance freight vehicles comprise 5% of ADT, which is 20-30% of total freight traffic on the corridors. These have been targeted for international traffic management such as corridor re-routing (using variable message signs) and incident management. Predefined traffic management plans have already been set up for the cross-border Brussels-Nancy corridor (involving France, Belgium and Luxembourg). Such plans will be developed and put in operation on all Centrico corridors. Interestingly, this is a similar approach taken by France DOT with the City of Paris for urban traffic

* Trans-European Transportation Network, a superset of the TERN

management in the Ile de France region (see TO 4145 report, SIRIUS case study). In fact, a related EU effort, called CARISMA-Transport, addressed the interconnection of TERN long-distance and local/regional transportation networks across modes.

Formal evaluations are conducted by independent experts. Evaluations done on initial individual Centrico projects would indicate that expected improvements in efficiency and safety are being realized. It was noted that it would be difficult to separate impacts from EU investments in Centrico from mainstream national investments.

OTHER SURVEY RESPONSES

- ITS research products were being utilized, with DATEX and RDS-TMC being most notable. While research outputs were useful, such efforts could be more focused on direct applications.

- Technical competency gaps were noted in some software and architectural areas. External consultants are employed. (similar issue/approach noted in TO 4145 cases)

- EU Centrico funds cannot be used to cover system O&M expenses.

- Efforts are being made to simplify administrative and decision-making procedures. One effective action noted was the delineation of decision making from routine information flow processes.

- More emphasis could be placed on user services, less on technology (note that this is the approach taken in the U.S. by ITS America and USDOT).

- Public outreach efforts include brochures, a web site and program video.

French Private Toll Roads: the Cofiroute case

PRIMARY INTEREST OF CASE: Value of advanced traveler information services (ATIS) to total market package

PROJECT/SYSTEM PROFILE

Background/History

European efforts to supply real-time traffic information to private information service providers have been substantial but have not resulted in a viable pay-for-services market - data gaps and quality may have contributed to this as well as competition from free governmental services. At the same time, France's private toll road operators (who directly control the quality of data on their systems) do utilize intensive management for maintaining level of service, and provide value-added information services on their system, in part to maintain customers and attract new users from non-toll national highways.

Here, then, is an example of an alternative ATIS private market strategy, one that uses ATIS as a value-added element within a larger set of services. As opposed to a stand-alone ATIS service, French toll road operators use ATIS to augment customer service to improve their competitive edge as a whole.

Technical Overview

Intercity toll road systems, called autoroutes, have been constructed throughout France and extensively incorporate ITS for both basic functions (e.g., traffic surveillance and management, toll collection) and value-added services (e.g., in-vehicle information). While more than ten toll road operators exist in France, one such system - Cofiroute - will provide the case study.

Cofiroute is responsible for the construction and operation of approximately 900 centerline kilometers (about 550 miles) of autoroutes, with another 200 kilometers under construction. Its highway network links the Paris region with the western, southwestern and central regions of France. In addition, Cofiroute is now constructing an 11 km tunnel for the completion the second ring road around Paris.

The physical network incorporates various data collection technology (traffic/ weather and cameras with automatic incident detection), call boxes every 2 km, standard variable message signs (VMS) at some key decision points (typically at the highway entrance) complemented with small, one-line VMS every 10 km, 46 toll stations, 60 rest areas and 42 service areas (for fuel, food, etc).

The electronic toll collection (ETC) system is the "Liber-t" (tag) system that is common to all toll roads in France, which for the driver means only one tag, one contract and one bill for autoroute travel throughout France. ETC toll lanes have been installed on each toll plaza, with 14 customer service centers established for the distribution of tags and assistance to subscribers.

The Cofiroute network is overseen by 12 traffic operation centers, each responsible for the operation of about 70 km of highway and divided into 4 main groups:

- Tolls: 24-hour collection and management
- Safety/Viability: network surveillance, customer assistance, etc.
- Road Works: operational maintenance and organization and management of large infrastructure maintenance programs
- Maintenance and procurement of equipment

A traffic information center oversees collection, validation and processing of the real-time information and distribution of it through various media. This structure allows for the regional integration of all traffic surveillance and other information, and the coordination of traffic control, incident response/ management and information dissemination. Cofiroute uses this information dissemination to actively maintain service levels by balancing flows on the network and rerouting travelers around incidents.

Information is disseminated to customers for both pre-trip and enroute purposes. Delivery mechanisms include internet (including a webcam), a telephone server (COFIROUTEL), variable message signs and in-vehicle through “Autoroute FM” - dedicated to traffic information - and a RDS (radio data system) digital channel. Traffic updates and alert overrides are provided on 107.7 FM throughout the French national and toll road systems and can be received on the RDS radios now standard on European cars. Information can be obtained on traffic conditions for the specific area of travel or for the entire network. Software called "Maestro" uses an expert system to forecast traffic conditions based on historical data.

Cofiroute is also heavily involved in research and development projects, both at the French and European levels. In the past few years, it has been coordinating the EU's five-nation "MARTA" project which focused on developing traffic and travel information services around the 5.8 GHz DSRC radio interface, making use of in-vehicle navigation units for real-time route guidance. The technical implementation of DRSC-based services was made within the “AIDA” project, which also involved the two French car manufacturers and an equipment supplier. Developments were also made on the Digital Audio Broadcast (DAB) for the broadcasting of a real-time multimedia program.

Institutional/Funding Structure

The French toll roads, tunnels and bridges association - ASFA - represents and promotes the toll road sector, facilitates joint policy development and executes studies, surveys and research in support of this mission. All autoroute operators in France are members.

Cofiroute is a private-law company. The vast majority of the company is held by private interests, who are all from the road construction and civil works sector. Cofiroute is a concessionary company of the state (concession ends in 2030 for the

interurban network) responsible for the financing and construction of the autoroutes within its regional service area, their operation and security, and service to their customers. Cofiroute handles almost 100 million toll transactions per year, of which about 15% are heavy trucks. The company employs over 2000 workers.

In some cases, the French government or European Commission provide funding. This public support is limited to 50% participation for studies and 10% for investments. Also, partnerships are sometimes considered for project cost sharing.

FINDINGS

The following is based on survey responses from Cofiroute and a web-based literature search (in addition to that of the TO 4145 project - see Bibliography).

SPECIFIC INTEREST AREA: *Value of traveler information to total market package*

From customer surveys conducted by Cofiroute, drivers indicate that they do use the toll highways because of ATIS and other ITS-related services. They feel that, with ATIS, they can better manage their trips (e.g., reroute), particularly in case of an incident, and are more confident in the safety level of the highway network.

Being a private, for-profit entity, Cofiroute continuously measures customer desires and reactions. These surveys are conducted within the framework of structured evaluations which can vary depending on the nature and status (experimental or operational) of the service or system. Evaluators external to Cofiroute are typically used. Surveys are conducted before service design to identify customer needs and a more detailed evaluation is done after service launch. An example cited in Cofiroute's response is the Autoroute FM service. An evaluation is done every year through interviews/ questionnaires, with the same method and evaluator to help track changes. Among the questions asked of customers:

- Brand recognition of the service
- Amount of use
- Satisfaction with/quality of service
- Willingness to pay
- Recommend to others
- Other services expected

Most relevant to the specific interest area here, Cofiroute believes that their customer surveys confirm the value of ATIS and other ITS services to their overall market package. That is, they feel that these services make their toll road network more attractive and competitive with the free national highway system and, therefore, worth the investment.

There is another aspect pertaining to ITS' market value for Cofiroute. The responses indicated that the availability of quality traffic and weather condition data

enables them to make predictions. This, in turn, allows the organization to adjust operations staff levels based on anticipated demand, take preventative measures for snow/ice conditions and to schedule road work for minimum disruption. The result, according to Cofiroute, is improved internal (cost) efficiencies, fewer accidents and maintenance of effective road capacities.

OTHER SURVEY RESPONSES

- As noted, Cofiroute has participated in ITS research and development. In addition, they have extensive interaction with other road operators on ITS experience and with the ITS community through conferences, workshops, etc.

- Research and development proposals (with estimated benefits/savings) are reviewed and prioritized by a high-level investment committee as part of the annual budget cycle.

- Telecom and IT engineers were hired to enhance the organization's ITS technical competency. While Cofiroute participated in the development of the French ACTIF (ITS) architecture, they find some of it too complex and difficult to apply – user training/guidelines and a simplified model for use are suggested (note: a similar issue existed with U.S. national system architecture user friendliness).

- External partnerships and coordination was seen as having only positive impacts on the organization, including better corporate image and frequent communication and cooperation with involved parties.

- Internally, Cofiroute has addressed ITS implementation with increased communication among the impacted departments, including development, operations, technical and marketing functions. Key questions asked when considering a project/service:
  - is there a rel customer need?
  - will this help the operations staff?
  - how to operate and maintain?
  - is it interoperable, expandable to other ndetworks?

- Policy actions cited to better support ITS/system management were:
  - privacy regulations needed updating to allow for advanced traffic surveillance
  - harmonisation of regulations at the European level for toll violation enforcement (e.g., license plate recognition)
  - frequency allocation for vehicle-infrastructure and vehicle-vehicle communications
  - incentives for the development of emergency alert systems with AVL and interoperability at the European level
  - clear rules regarding the use of cell phones/telematics while driving

San Antonio Transportation Management System: Transguide

PRIMARY INTEREST OF CASE: U.S. medium-sized urban area experience

PROJECT/SYSTEM PROFILE

Background/History

Transguide is an advanced Transportation Management Center (TMC) and system in San Antonio, Texas. Although predating the federal program launched in 1996, it is one of the "ITS Model Deployment Initiatives" (MDI). These initiatives, similar to Priority Corridor showcases, were intended to demonstrate the use of ITS for integrated transportation management. As with the Priority Corridors, formal evaluations have been completed.

The Transguide TMC has now been in operation for about five years, while its system reach continues to expand. Transguide incorporates ITS technologies and systems to collect and analyze data, manage freeway traffic, coordinate with local signal control, inform travelers and provide for a range of innovative motorist assistance services. As such, it is an excellent case study to supplement the analysis done in the TO 4145 project for SIRIUS/IPER, presenting a U.S. traffic management case; and also IMAJINE, providing a medium-sized city case study. It's voluntary use of "toll tags" (although no toll roads or bridges exist) for link speed data collection is of particular interest.

Technical Overview

The Transguide TMC is a stand-alone, emergency-services building located in metro San Antonio adjacent to a freeway interchange. This advanced center has several wall-mounted graphic displays and numerous computer terminals to support the individual functions of transportation system management. Ultimately, the TMC will connect with, and manage, a smart roads system covering some 190 centerline miles of highway, with slightly less than half that currently completed or in the construction phase. Another 100 miles of local roads will be connected.

Transguide technical / functional elements were designed and developed primarily by the Southwest Research Institute and include:

- Loops, cameras and many thousands of (toll tag) probe vehicles for data collection.
- Tag readers/antenna overhead and roadside with GPS/AVI software at TMC data server for link travel time calculation from probes and for emergency vehicle/transit fleet management (see also below).
- 911 interface with city police for accident identification/information.
- Transit bus on-board cameras with direct feeds to TMC.

- Acoustic and Doppler radar along railroad tracks to alert motorists to railroad crossing delays and provide alternative route information (through CMS)

- "LifeLink" network that enables audio/video/data links between ambulances, TMC and hospitals for injury accident response.

Traveler information is disseminated through broadcast, internet and kiosks as well as through CMS, which display link travel times. Route guidance is provided to emergency, transit and other vehicles equipped with in-vehicle navigation units through FM subcarrier (102.7). An Area Wide Data Server provides a single source of multiagency data, including the data transmitted to private information service providers.

Communication media within the Transguide network include broadcast/subcarrier, wireless, phone, fiber, ethernet and low power TV (LPTV) for camera feeds to the public (UHF Channel 54).

San Antonio freeways do not have ramp meters, but do have changeable “lane (arrow) signals” for lane closure control and efficient merging.

Institutional/Funding

As with many medium-sized cities, the institutional structure for managing San Antonio's transportation systems is fairly simple (as opposed to, for example, a Dallas or Los Angeles). Because of this, traffic and other transportation management functions can more easily be coordinated across jurisdictions and modes. Transguide, therefore, can serve both as a case study of integrated ITS applications and a model for medium-sized cities in California and elsewhere.

The Transguide partners include the Texas Department of Transportation, the VIA Metropolitan Transit and the City of San Antonio (public works, police, fire, emergency medical services). Importantly, all of these jurisdictions have core operations physically located within the Transguide center, facilitating a study of coordinated, multi-jurisdictional operations.

Transguide system development and expansion is funded primarily by Texas DOT from federal (80%) and state sources. Each partner agency, including Texas DOT, funds its own operations and maintenance of the MDI systems.

FINDINGS

The following is based on survey responses from Texas DOT and Transguide documents provided to the researcher or available on the web (see Bibliography).

FINDINGS ON SPECIFIC INTEREST AREA: *U.S. medium-sized urban area experience*

Medium-sized urban areas can enjoy benefits from ITS applications similar to larger regions. In the San Antonio case, the transportation sector's institutional environment is less complex than many larger regions, facilitating the creation of informal partnerships and efficient and effective ITS deployment. While pre-existing organizational policies and procedures were not designed to support such partnership arrangements (a condition found in all local/regional cases studied), Texas DOT has been able to develop and maintain the ITS partnership within agency guidelines and has become more of a "team player" because of this. Local agencies are in the process of developing a formal incident management plan. It is felt that the San Antonio MDI has enabled each of the partner agencies to better perform their functions, resulting in an improved transportation system for the region.

The sharing of data in the Area Wide Data Server and the installation of in-vehicle navigation units in public agency vehicles were identified as the most effective aspects of private sector teaming. Beyond this, the MDI was essentially a public sector partnership.

Public outreach, explaining and demonstrating the benefits of ITS services, was another critical factor. A private advertising firm was engaged to develop Transguide informational brochures, public service announcements and videos. Because of this, the MDI partners were able to solicit and obtain the public's participation in a voluntary vehicle-as-probe program to enhance the quality and amount of real-time information for travelers. Some 70,000 "toll" tags were distributed for this purpose to drivers in the San Antonio area, although no toll facilities exist. When the privacy issue was raised in the press, Texas DOT attempted to answer all concerns and explain the technology's capabilities/benefits and limitations. Briefings on the overall Transguide effort were given to local agency decision makers to garner their support.

The primary problem identified was restricted funding, particularly for maintenance of field equipment including available methods for implementing maintenance contracts. A revision to existing policy allowed traditional computer contracting methods to be used for ITS field equipment maintenance. Texas DOT created job classifications for ITS operations and maintenance technicians and provides ongoing training on ITS components. It has also established funding programs for ITS construction, operations and maintenance. Such dedicated funding for ITS was identified as the most desirable policy/process/funding change at various levels of government.

OTHER SURVEY RESPONSES

- The ITS experiences of others was used in developing MDI services, particularly that of Houston for AVI and in-vehicle systems receiving wirelss traffic data feeds. No planning or analytical tools designed specifically for ITS/system management were utilized, nor were any research products.

- The national architecture was of marginal value because the San Antonio MDI was in its planning stages before the architecture was available.

Southern California ITS Priority Corridor: the IMAJINE Project

PRIMARY INTEREST OF CASE: California state perspective (follow-up)

PROJECT/SYSTEM PROFILE

Background/History

The Southern California ITS Priority Corridor was one of four corridors established under the federal surface transportation act of 1991 (ISTEA). The term "corridor" is a misnomer because, under the guidelines of ISTEA, the program area covers most of the urban areas of Southern California – from Ventura to the Mexican border. The Priority Corridor program encompasses both an ITS strategic and deployment planning element and a multi-user service "showcase" or demonstration element. Over twenty state, regional and local transportation agencies are involved in the program, including all four California DOT (Caltrans) districts in Southern California.

Two guiding principles of the program - "all modes/all roads" and "design once/implement many times" – reflect the broad range of ITS applications and jurisdictions involved, and the objective of integration/interoperability using a common architecture.

The "IMAJINE" project, a subset of the Priority Corridor showcase element, is itself an integrated, multi-jurisdictional initiative in the Los Angeles (Caltrans District 7) portion of the corridor. This was a case study within the TO 4145 research project. Given the small number of questionnaire responses (e.g., no Caltrans response) and lack of opportunity for an in-person interview, the project is revisited here to round out the previous analysis.

Technical Overview

The IMAJINE Project brings together four existing local transportation management facilities in the Los Angeles region:

- Caltrans District 7 freeway management system
- Los Angeles County Metropolitan Transportation Authority (LACMTA) fixed-route bus operations center and database
- Access Service Incorporated (ASI) demand-based paratransit fleet management system
- City of Los Angeles South Gate arterial traffic signal control system

This project integrates freeway and arterial street operations in the southeast Los Angeles County along with the LAMTA bus operation database. This includes the synchronization of local and state signals, the adjustment of signal coordination to allow minimum delay in transit operations, and coordination of paratransit with fixed route bus operations.

The project successfully completed its final acceptance test in September 2001. This acceptance test incorporated the machines in each of the agencies, interfacing with the available legacy systems and the communications network. Also tested was the "1.0 Kernel" integration architecture for interoperability of systems across modes and jurisdictions in Southern California (an element of the Southern California ITS Priority Corridor). The objective of the "kernel-seed" mechanism for interoperability is to allow "plug and play" applications.

Institutional/Funding Structure

The IMAJINE project is coordinated with other Priority Corridor projects and activities through a steering committee comprised of representatives from all participating agencies. In addition to federal transportation officials, a small number of private sector interests are committee members on an ex-officio basis. The committee membership has a mix of planning and engineering disciplines. Technical support is provided primarily by contractors. Formal evaluations are required for all showcase projects.

The IMAJINE project involves Caltrans, the Los Angeles Metropolitan Transportation Authority, the City of Los Angeles, ASI, and the Southern California Association of Governments and other Southern California ITS Priority Corridor participants. LACMTA manages the project. Technical services are provided by contract.

IMAJINE is supported by a mix of funds from the Priority Corridor showcase (federal), and state and local sources.

From the initial IMAJINE effort, the County has launched a locally funded "Regional Integration of ITS (RIITS)" initiative, including development of a configuration management plan and projects funding evaluation criteria.
Also established is an ongoing Regional ITS Coordinating Committee.

As with all Priority Corridor showcase projects, IMAJINE is linked to an ITS early deployment planning (federal program) effort for the local region.

Institutional/organizational issues and obstacles identified in the TO 4145 work include:

- Partnership challenges vary by location and political environments
- Technology system operations/maintenance (O&M) funding not solved
- Gap between ITS benefits analysis and common regional performance measures and transportation models
- Technical support resource gap

FINDINGS

The following is based on survey responses from Caltrans (in addition to those submitted for the TO 4145 project).

FINDINGS ON SPECIFIC INTEREST AREA: *California state perspective (follow-up)*

The follow-up responses from the state indicated no substantial differences in perspective from that submitted by the local and regional agencies under the TO 4145 project. However, significant additional information was provided and some specific areas emphasized.

The area particularly stressed by Caltrans is the need to address operations and maintenance (O&M) of ITS software and hardware. In IMAJINE, each agency pays for its own O&M expenses. This issue was identified as the most significant barrier to successful ITS deployment, and the provision for O&M funding and delineation of O&M responsibilities identified as a needed funding/process initiative. It was noted also that the O&M issue will be addressed by regional government through the developing regional ITS architecture (note that federal conformity requirements are currently satisfied by the development of regional architectures consistent with the national ITS architecture).

Interestingly, many of the evaluation parameters identified in the responses relate to the O&M of hardware and software, including:

- Mean time between failure
- O&M costs (including electricity and telecommunications)
- Number of staff required to operate equipment
- Training or special skills required to operate/maintain IMAJINE
- Interagency agreements required to operate/maintain IMAJINE

Other measures of effectiveness address mobility and safety effects such as changes in incidents/accidents, travel time/delay, transit on-time performance and ridership, and vehicle emissions.

A freeway performance measurement system – “PeMS” - is being used to analyze traffic data in support of program evaluation. PeMS was developed through the PATH program so also serves as an example of an ITS research product being deployed.

OTHER SURVEY RESPONSES

- The national/regional ITS architecture was identified as the existing program/ process that best supported ITS/system management/partnership efforts. This is also being used to interface legacy systems incorporated in IMAJINE.

- A core team was established to deal with multi-agency interoperability issues.

- A System Engineering process is employed in the development of the advanced transportation management system (ATMS).

- The partnership arrangement in IMAJINE was not entirely new, since some of the same agencies were involved in the Santa Monica Smart Corridor cooperative effort, starting in the 1980's. Nevertheless, it was indicated that the IMAJINE project did enhance Caltrans' position as a "team player".

- No changes in either resource allocation or internal organizational processes (in support of ITS/system management) as a result of this project were noted.

- Training for new systems was identified as required to support technical competency.

- A consultant was hired to conduct a project outreach program. Target audiences included elected officials and transportation agencies.

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APPENDIX

ITS CASE STUDY QUESTIONNAIRE

INTRODUCTION

The application of advanced computing, communication, sensing and control technology to surface transportation has been an area of significant global interest and effort for more than a decade, no more so than in Western Europe and the United States (U.S.). Under the umbrella of Intelligent Transportation Systems (ITS), user services and service "packages" or "bundles" (mutually-supportive services such as traffic management and traveler/ driver information) have been defined, information needs/flows identified, many enabling technologies developed and tested, and ITS architectures and standards developed or in development. Transnational (European Union - EU), national and state/regional programs have tended to view ITS, not as a random mixture of technologies, but as an expanding technology toolbox and a structured framework for supporting mobility services which improve system productivity, connectivity and safety, and user convenience and comfort.

ITS implementation or deployment has three primary aspects not found in traditional transportation solutions: 1) advanced technology insertion, interoperability and maintenance; 2) system (often multijurisdictional) approaches at the planning, service connectivity and operational levels; and 3) private industry products and services linked to public infrastructure and services. All three have institutional (across agencies and sectors) and organizational (internal) implications. To better understand these, and how they can be effectively addressed, this research project will study cases of successful deployments across various ITS application areas and institutional environments in both the EU and the U.S. Your program has been identified as a successful deployment of _____.

PROJECT/PROGRAM OVERVIEW

This section incorporated project/program profiles very similar to those contained in the main body of this report under each case study. Respondents could then review and revise overviews as necessary; any revisions are reflected in the main body text.

QUESTIONNAIRE

A. Planning and Funding Process

1. How is this program currently funded?

2. How are the technical system operations and maintenance (O&M) handled – both as to funding and technical support?

PLEASE BRIEFLY EXPLAIN any special issues, including any shared funding/tech/service arrangements with partners.

B. Measures of Effectiveness/Success

1. What parameters/attributes (qualitative and quantitative) does your organization use to measure/evaluate the effectiveness/success of ITS-related systems, strategies and services?
   - for highway operations *(COFIROUTE ONLY)*
   - for customer services *(COFIROUTE ONLY)*
   - for your market performance/profitability *(COFIROUTE ONLY)*

   PLEASE LIST, with some indication of importance.

2. Is there a plan/element to evaluate existing and new systems/strategies/ services? If yes, PLEASE BRIEFLY EXPLAIN including whether you use an external evaluator.

3. What type of Benefit-Cost methodology do you use? Was it developed to specifically address ITS and related technology/ system management/ private market applications? PLEASE BRIEFLY EXPLAIN, including data sources. *(COFIROUTE ONLY*): Do you evaluate individual elements on their own merits and/or do you look at the element within a market package?

4. Did you use a transportation performance measurement system to help evaluate effectiveness? (If yes, please briefly explain specific measures and data sources) *(Transguide and IMAJINE only)*

5. Has any ITS evaluation framework developed been extended to other projects/programs and/or to “mainstream” planning or funding processes within your organization? If yes, results so far? *(Transguide and IMAJINE only)*

6. Do you conduct user or customer surveys before (for design), during or after (acceptance/satisfaction) the initiation of an ITS-related strategy/service?

C. Evaluation Results

1. What have been the results to date of evaluations related to ITS systems/ strategies/services (referencing the parameters of effectiveness above)?

Results specific to commercial trucking? *(CENTRICO ONLY)*

Results specific to cross-border transport? *(CENTRICO ONLY)*

2. Given results related to highway productivity, could you or your partners claim that the program's use of ITS effectively or virtually "built" new capacity? If yes, is this a generally accepted result among partners? *(CENTRICO ONLY)*

   Given the results related to highway productivity, could you claim that the use of ITS/system management has improved vehicle throughput (or effective capacity) on your autoroutes? If yes, PLEASE BRIEFLY EXPLAIN. *(COFIROUTE ONLY)*

3. Given results, could you or your partners claim that the program's use of ITS is helping effectively or virtually create a new highway network (i.e.TERN) where only disjointed elements previously existed? If yes, is this a generally accepted result among partners? *(CENTRICO ONLY)*

   Given results related to traveler information services, do you feel that these have added sufficient value to your overall service package to be cost-effective (e.g., attracted new customers)? PLEASE BRIEFLY EXPLAIN. *(COFIROUTE ONLY)*

D. ITS Architecture/Standards and Decision-Support Tools

For system design/operation does your organization employ:

1. ITS experiences ("lessons learned") from other, similar operations/ programs? If yes, PLEASE BRIEFLY EXPLAIN.

2. Specific ITS, technology or system management planning/analytical tools (models, etc)? If yes, PLEASE BRIEFLY EXPLAIN. *(CENTRICO not asked)*

3. Products or results from ITS research? If yes, PLEASE BRIEFLY EXPLAIN.

4. ITS architectural framework and / or standards? If yes, PLEASE BRIEFLY EXPLAIN, including sources and any regional tailoring required.

5. General observation on usefulness of these and any recommendations to improve. PLEASE BRIEFLY EXPLAIN.

E. Institutional/Partnerships

1. How new was the project/program's institutional arrangement given the traditional modes of the entities involved? *(Transguide and IMAJINE only)*

2. What were the most and least effective/satisfactory aspects of the teaming/coordination arrangements: among public entities? Between public and private entities (if applicable)?

3. What changes were made to address problems? How well did these work? *(COFIROUTE not asked)*

4. Did your organization become more of a "team player" with other transport agencies because of the project/program? *(Transguide and IMAJINE only)*

F. <u>Organizational (Internal) Aspects</u>

1. Did the external partnership/coordination arrangements have any positive or negative impacts on the operation of your agency's transport system? *(Transguide and IMAJINE only);* *(Transguide only):* How beneficial is the multijurisdictional co-location at the TMC?

2. Did the external partnership/coordination arrangements have any positive or negative impacts on internal organizational processes or competencies within your agency/organization? *(CENTRICO not asked)*

3. What internal organizational processes were undertaken before, during or after the project/program's launch to better support ITS/system management goals and execution? Which have been effective? Others being considered?

4. Given the nature of the technologies involved, what technical competency gaps were identified and how were these addressed within your agency/organization (new staff added, contractors hired, etc.)?

5. Has there been a change of resource allocations to ITS/system management as a result of this or other successful projects/programs? *(COFIROUTE not asked)*

G. <u>Public and Political Support</u> *(COFIROUTE not asked)*

1. Did your program include a public education ("outreach") element? If yes, PLEASE BRIEFLY EXPLAIN, including effectiveness and status.

2. What, if anything, was done to garner support from public officials/decision-makers (elected or appointed)? If yes, PLEASE BRIEFLY EXPLAIN, including effectiveness and status.

3. How did you handle the privacy issue surrounding the use of probe vehicles? *(Transguide only)*

H. <u>General Observations and Recommendations</u>

1. Based on your experience, which existing EU, national and/or regional policies/programs/processes best support your ITS/system management/partnership efforts? PLEASE LIST.

2. What are the most significant policy/process barriers? PLEASE LIST.

3. What policy/process/funding changes, initiatives or incentives would you like to see and at what level of government:
   - to better support ITS/system management?
   - to better utilize private sector products/services?
   PLEASE LIST.

4. Observations/recommendations on ITS technology insertion (investment) and technology operations & maintenance needs/support?

5. Any other observations/recommendations relevant to this study?

THANK YOU FOR YOUR ASSISTANCE