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16. Abstract <p>The formal goals set forth in 1996 by the U.S. Department of Transportation regarding the deployment of intelligent transportation system (ITS) technologies, accompanied by TEA-21 funding support for these deployments, has resulted in significant progress for ITS in the United States in recent years. The next several years, however, represent a new and critical phase for ITS deployment – one where such deployment can no longer rely on public funds as the sole source of financial support. In order to achieve the ultimate goal of a “fully-integrated system” of transportation technologies, new strategies, approaches and/or opportunities must be identified or developed.</p> <p>The objective of this research project was to examine a variety of approaches and alternatives for acquiring future funding for ITS deployment within the State of Texas. This objective was accomplished through the following activities: 1) identifying important cross-cutting issues; 2) summarizing the best existing resources for information on this topic; 3) identifying alternative funding solutions; and 4) dividing new funding alternatives and/or concepts into near-term opportunities versus long-term strategies.</p>					
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AN EXAMINATION OF ALTERNATIVE FUNDING SOLUTIONS FOR ITS DEPLOYMENT

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TABLE OF CONTENTS

	Page
List of Figures.....	xi
List of Tables	xii
Chapter 1: Background.....	1
Introduction/Purpose of Study	1
Current Status of ITS Deployment	1
ITS Vision For The Future.....	3
A National Perspective	3
A Vision Framework for Texas	5
Chapter 2: Important Cross-Cutting Issues.....	9
The Importance and Role of ITS Successes	9
Benefit-Cost Information/Promotion of ITS.....	10
Study for CALTRANS: "Mainstreaming Intelligent Transportation Systems"	10
Development of Promotional Material for Texas Use.....	13
Intelligent Transportation System Deployment Analysis (IDAS).....	14
TxDOT's New Project Funding Process	15
California	16
Colorado.....	17
Florida.....	18
Michigan	18
Washington.....	19
Key Needs of TxDOT Staff.....	23
Chapter 3: Existing Resources for ITS Funding Insights	25
Funding Procurement.....	25
General Information on ITS.....	26
Chapter 4: Near-Term Opportunities for ITS Funding.....	27
Re-Authorization of TEA-21 (TEA-LU).....	27
Collaboration With Florida ITS Model Deployment.....	27
Background.....	27
Key Issues	30
Opportunities.....	31
Improve Software quality and Reduce Long-Term Software Cost	31
Share Software Investment Costs with other Agencies	32
Conversion Of DalTrans Software To "Open Source" Status	32
Background.....	32
Recommendation	33
Discussion of the Recommendation.....	33
Open Source Software	33

TABLE OF CONTENTS (Continued)

	Page
Tools for Open Source	35
Implementation	35
Energy Service Companies (ESCOs) & Tax Credits.....	36
Energy Service Company (ESCO).....	36
Tax Credits/Incentives for Using Energy-Efficient Equipment.....	37
New Toll Road Construction	38
House Bill 3588	38
Cost Sharing of ITS Deployment with Toll Road Developers	39
Federal ITS Initiatives.....	41
New USDOT ITS Initiatives.....	41
Federal Emphasis on Safety.....	41
Rural ITS.....	43
Chapter 5: Long-Term Strategies	45
Leasing and Related Financing Options	45
Complexities of Leasing in Texas.....	46
The Constitution.....	46
Local Government Codes	46
Why Lease?.....	48
Commercial Lease Versus Municipal Lease.....	48
Cash-flow and Time Management.....	49
Fixed Rate Financing and Time Value of Money.....	49
Access to New Technology and Ability to Offset Technical Obsolescence	50
Lease versus Bond	50
Lease Industry Concerns.....	52
Leasing of ITS Components	52
Using Solar-Powered Equipment in Rural Areas	53
Energy-Efficiency Projects and Municipal Leasing	53
Options for Creating New Revenue.....	55
Subscription Services.....	55
Data Exchange	57
Traffic Reporters and Websites	58
Naming Right, Sponsorships, Royalties, 511 Charges	59
Other Possibilities	59
Miami-Dade	59
Inter-Agency Partnerships	59
Military Applications.....	60
NAFTA Transportation Corridors and Related ITS Strategies.....	60
Identifying NAFTA Trade Corridors in Texas	61
Benefits of a Unified NAFTA ITS Strategy	63
What Is Known	63
What Is Less Obvious	64

TABLE OF CONTENTS (Continued)

	Page
Funding Sources.....	64
Trans-Texas Corridor and the Use of Intelligent Transportation Systems	65
Homeland Security/Evacuations.....	68
Chapter 6: Conclusions and Key Action Items	73
References.....	75
Appendix A - New TxDOT Funding Categories and Description.....	83
Appendix B - Survey of TxDOT District Staff.....	91
Appendix C - "Fact Sheet" for Traffic Management Centers	97

LIST OF FIGURES

	Page
Figure 1. Illustration of Florida Regional ITS Deployment	30
Figure 2. Preliminary Plans for SH 130 Layout and Project Schedule.....	40
Figure 3. Dominant U.S. - Mexico Highway Trade Corridors	61
Figure 4. Conceptual Illustration of Tran-Texas Corridors	66

LIST OF TABLES

	Page
Table 1. Summary of ITS Funding and Contact Information for Other States.....	20
Table 2. Summary of Survey Respondent General Characteristics.....	23
Table 3. Finance Now or Wait for Cash?	51
Table 4. ITS Capabilities for Homeland Security.....	71

CHAPTER 1: BACKGROUND

INTRODUCTION/PURPOSE OF STUDY

The formal goals set forth in 1996 by the U.S. Department of Transportation regarding the deployment of intelligent transportation system (ITS) technologies, accompanied by TEA-21 funding support for these deployments, has resulted in significant progress for ITS in the United States in recent years. The next several years, however, represent a new and critical phase for ITS deployment – one where such deployment can no longer rely on public funds as the sole source of financial support. In order to achieve the ultimate goal of a “fully-integrated system” of transportation technologies, new strategies, approaches and/or opportunities must be identified or developed.

The objective of this research project was to examine a variety of approaches and alternatives for acquiring future funding for ITS deployment within the State of Texas. Researchers accomplished this objective through the following activities: 1) identifying important cross-cutting issues; 2) summarizing the best existing resources for information on this topic; 3) identifying alternative funding solutions; and 4) dividing new funding alternatives and/or concepts into near-term opportunities versus long-term strategies. The material presented in this report is structured to reflect these topics and order of discussion and ends with concluding comments and key action items. For additional material and information regarding this project view the project website located online at <http://san-antonio.tamu.edu/4451/>. The material is current as of August 2004.

CURRENT STATUS OF ITS DEPLOYMENT

There is currently a wide variety of ITS technologies. These applications include vehicle-based systems – referred to as telematics – that make driving an automobile or truck safer and more secure; AMBER alert systems that use ITS message signs to help find kidnapped children; transit technologies that provide reliable schedule information; traffic monitoring systems that mitigate congestion and help to secure our bridges and tunnels; and wireless

communications systems that help to monitor hazardous materials shipments, just to name a few examples. A thorough listing of ITS benefits and costs organized around thirteen program areas can be found at <http://www.benefitcost.its.dot.gov> . This report contains many example projects including their costs, scope of activities and estimation of their benefits.

While the goal of full deployment of ITS in both urban and rural areas remains to be achieved, the significant investments in ITS noted previously have already produced important results. A recent review of noteworthy progress includes the fact that 55 of the 75 largest metropolitan areas had met the goal of medium-to-high deployment of ITS on both roads and in transit systems. Following are a few specific major milestones:

- Electronic toll collection has been installed on 73 percent of existing toll road mileage.
- Centralized or closed loop control has been installed at 49 percent of signalized intersections.
- Computer-aided dispatch has been installed in 67 percent of the emergency management vehicles, and 36 percent have in-vehicle route guidance.
- Traffic Management Centers have been established in two-thirds of urban areas in the U.S., with these systems monitoring freeway traffic and providing early notification of incidents.
- Over 384 public transit systems nationwide have installed, or are installing, components of ITS to provide the public with safer and more effective public transportation. Examples include: advanced communication systems are installed at 213 transit agencies; automatic vehicle location systems are installed at 154 agencies; electronic payment systems are installed at 108 transit agencies; automatic passenger counters installed at 154 transit agencies; automated transit information is available at 163 transit agencies; computer-aided dispatch systems are available at 152 agencies; traffic signal priority is available at 55 agencies.

ITS VISION FOR THE FUTURE

A National Perspective

In order to achieve the ultimate goal of a “fully-integrated system” of transportation technologies, new strategies, approaches and/or opportunities must be identified or developed. ITS systems can continue to provide multiple benefits of congestion mitigation, safety and enhanced security only if states and localities are provided with or otherwise secure adequate resources for investment in these technologies. Hopefully, Congress will continue its historical commitment to transportation technology by funding a robust federal ITS program in the reauthorization of TEA-21.

The bold transportation vision of the mid-20th century – building the Interstate Highway System – set the direction and spurred many of the transportation institutions of the past 50 years. But now that the Interstate System is essentially complete, a *new* bold transportation vision is needed to set the direction and mold the institutions of the next 50 years. This new bold vision is based on the availability and management of information, on connectivity, and on system control and optimization. The reauthorization of TEA-21 specifically provides the opportunity to support the creation of an Integrated Network of Transportation Information that would help fulfill this vision.

Once deployed, this Network would link all existing and future transportation systems in the nation into an integrated yet distributed data network, capable of collecting, sharing, delivering, analyzing, and archiving transportation system traffic condition and performance information. The creation of this nationwide Network (commonly referred to as the INFO structure by the Federal Highway Administration) should be a cornerstone of the federal role in the future of ITS.

Like the Internet which is comprised of many smaller computer networks, this will be a distributed network of networks, with many systems capable of feeding data and information through their own collection schemes and accessible at various levels and combinations. And as

with the Internet, where individual web pages have value, but access to a variety of websites transforms the way we receive and use information, the capability of the Integrated Network of Transportation Information will be much greater than the sum of its parts. Just as the inherent utility of owning a telephone increases exponentially as more and more people own them and communicate with them, so too will the utility of individual ITS technologies be enhanced as they are linked into this larger network of ITS systems. Such a network will provide travelers, transportation operators and planning officials with access to this rich data stream.

The applications that will arise because of this wide variety of data can provide the opportunity for dramatic advances in transportation, including a dramatic reduction in accidents, and seamless movement of people and goods, with the potential to save billions of gallons of fuel each year. The return on investments can be realized in many critical areas, including safety, mobility, security, environmental mitigation and economic efficiency benefits.

The creation of this Network is a component of the *National ITS Program Plan: A Ten-Year Vision*, submitted to the U.S. Department of Transportation by ITS America in January 2002 in the capacity as a utilized Federal Advisory Committee. As described in this plan, it is envisioned that this Network will combine private and public resources and services. It will consist of information on system performance delivered through a variety of technologies, including but certainly not limited to vehicle-based data probes, infrastructure-based sensors, closed circuit television cameras, electronic payment systems, in-vehicle telematics devices, weigh-in-motion stations, transit smart cards and cargo security sensors.

ITS systems already deployed in metropolitan and rural areas will become the foundation of this Network. These systems assist in monitoring of critical infrastructure, traffic safety improvements, congestion mitigation, weather information, and traveler information. The continued deployment of ITS traffic management, incident response and traveler information systems nationwide will provide transportation professionals with a necessary baseline of data to securely and efficiently operate our surface transportation system as well as to plan for future capacity needs.

Once integrated into an information network, seemingly distinct technologies will become part of a nationwide intelligent transportation system, multiplying the inherent utility of each individual technology. Instead of reading electronic signs that say “congestion ahead,” drivers might receive information on alternate routes, alternate modes of transportation and forecasted travel times individually tailored to their trip or commute.

Vehicles and personal wireless devices can further serve as a means for gathering critical transportation network operational data, including travel times, micro-weather forecasting and automatic vehicle collision avoidance in the future. Geo-spatial digital maps and location technologies will also be integrated into this network.

If deployment of ITS is to continue successfully, the following are believed to represent some of the key areas that will need to be emphasized: 1) enhancing safety with intelligent vehicles and integrated ITS; 2) a continued commitment to optimizing transportation system operations and management; 3) improved traveler information; and 4) commercial vehicle operations and intermodal transportation systems. With these thoughts in mind, [Chapters 4 and 5](#) contain additional useful information regarding ITS funding – specifically ideas, concepts and strategies that TxDOT may wish to pursue in order to acquire additional funding for ITS deployment. Prior to these chapters, however, [Chapters 2 and 3](#) convey some fundamental cross-cutting issues and existing resources that will, regardless of the ITS technology being deployed, be important to those individuals or departments pursuing funds to accomplish such deployment.

A Vision Framework for Texas

In Texas, TxDOT has been the agency that has typically taken the lead in funding ITS systems. This has created a number of challenges within the agency, because funding has to cover three key elements of ITS deployment and operations. First, the initial cost of deploying the system has to be met, and this cost has frequently been substantial. Second, the system has to be maintained over its physical life, which requires constant attention to routine maintenance, accident repairs, system breakdowns and general care. Finally, ITS elements ultimately need replacement as a consequence of obsolescence and rising lifecycle costs. Since advanced

technologies are an inherent element of ITS, the decreasing lifecycle of these systems creates an unusual burden with regard to funding – particularly in comparison to traditional transportation projects.

As will be discussed in more detail later in this report, the new TxDOT funding process and associated categories fail to explicitly recognize ITS, forcing the pursuit of funds to be spread through other categories. This creates new challenges for funding ITS projects, as no specific funds are set aside for such projects, leaving them to compete with traditional construction and maintenance projects. It is likely that future ITS funding, especially that related to maintenance, will need to be addressed in different ways to those currently followed in Texas. Leasing, may well be a new and effective funding tool for ITS programs.

Currently, ITS programs are most typically characterized by networks of hardware and software reporting data to a central facility. In the course of this study, it has become apparent that ITS architecture is changing in ways that might well simplify the Department’s funding burden and so allow greater ITS coverage in the state. The research team defines these thoughts as a “two decade vision” and offers the following description of what we believe could be its most important stages.

1. Texas completes large-scale metropolitan ITS programs based on capital-intensive systems reporting data to a regional “control center” that operates 24 hours per day/seven (7) days per week.
2. Texas completes smaller city ITS programs, based on specific city needs and operating a limited control center, handing off to the nearest large 24/7 regional center.
3. Texas then has an emerging, partially integrated, state-wide network with centers sharing relevant information. With this stage comes the opportunity to “piggy back” specific ITS rural operations on the intercity links.
4. New vehicle technologies related to both auto and trucks allow vehicles to share certain information directly, without the system hardware needed today. This reduces

- the need to build and then enlarge capital-intensive hardware systems as part of ITS programs.
5. Texas then has an ITS monitoring system for both metropolitan areas and transportation corridors that is capable of tracking all user types. These, including trucks, will use technologies that allow the vehicles and system to interact and so promote the management of freight corridors in an effective and efficient manner. The trucking information may well be done through using small samples of vehicles as “probes” to monitor traffic flows and report speed profiles and time reliability. In this latter stage of the development of the Texas ITS vision, there are a number of beneficiaries from the adoption of ITS, which lays the groundwork for possible partnering and cost sharing, thereby easing the bulk of the burden from the shoulders of TxDOT.

This vision/framework suggests that the funding needs for ITS – the prime focus of this research and the most intractable challenge to the Department at this time – may well diminish through partnering and the adoption of less expensive technical solutions. Near-term opportunities and new longer-term ideas and strategies are presented later in this report that can be considered by the Department as tools in achieving the goals outlined in this framework.

CHAPTER 2: IMPORTANT CROSS-CUTTING ISSUES

THE IMPORTANCE AND ROLE OF ITS SUCCESSES

In the pursuit of ITS deployment funds, it will be helpful to have information available for decision-makers that relates to the past success of ITS. Noted below are some general examples of successful ITS deployment around the U.S that has yielded significant increases in safety and efficiency while improving the environment.

- In Minneapolis-St. Paul, ramp metering has reduced freeway travel time 22 percent producing an annual savings of 25,121 vehicle-hours.
- The Georgia Navigator (an integrated traffic management system) supported incident delay reductions for an annual savings of \$44.6 million. Advanced traffic surveillance and signal control systems have resulted in travel time improvements of up to 25 percent. Freeway management systems, primarily through ramp metering, have reduced crashes by 24 to 50 percent while handling 8 to 22 percent more traffic at speeds 13 to 48 percent faster than pre-existing congested conditions.
- In Los Angeles, optimal traffic signalization has decreased air emissions by 14 percent, reduced vehicle stops by 41 percent, reduced travel time by 18 percent, increased average speed by 16 percent, and decreased delay by 44percent.
- The I-95 Traffic Incident Management System in Pennsylvania has cut lane closure time resulting from incidents by 55 percent.
- New York State Thruway statistical data show that the throughput for passenger vehicles at toll plazas using E-ZPass electronic payment systems increased 300 percent and for commercial vehicles by 500 percent. This means that in the same time taken for one cash transaction, three passenger cars or five commercial vehicles could be processed by E-ZPass.
- Improvements to traffic signal control systems have reduced fuel consumption by up to 13 percent. TransGuide in San Antonio, Texas reports estimated fuel consumption

savings of up to 2,600 gallons per major incident as a consequence of reduced congestion during incident response and clearing.

BENEFIT-COST INFORMATION/PROMOTION OF ITS

One fundamental strategy for easing ITS funding shortages is to enlighten the public and key decision-makers about the benefits of ITS investments, so as to increase their willingness to fund such improvements. Extensive evidence of these benefits has been compiled for public access at <http://www.benefitcost.its.dot.gov>, and some examples of such evidence were provided earlier in this document. An additional source of valuable information on this particular issue, and one that points out the importance of improvement needs with regard to ITS success can be found in a study recently conducted for the California Department of Transportation (CALTRANS). This study found some skepticism among leaders as to the *net* benefits of ITS investments (net of costs), and identified this as a significant obstacle to “mainstreaming” ITS (*I*). A brief summary and discussion of that study follows.

Study for CALTRANS: “Mainstreaming Intelligent Transportation Systems”

The initial phase of the study entailed review of the literature on ITS applications, benefits and costs. A key finding from this review was that ITS publications tend to be too technical for policy-makers and planners, or highly promotional with inattention to ITS costs. Exceptions noted were the USDOT Early Development reports and studies prepared by the Volpe Center.

In the CALTRANS study’s next phase, the researchers explored the perspectives on ITS held by key decision-makers, staff members and opinion leaders. Interviewed or surveyed were three distinct groups:

1. Fifty-one California “leaders,” who were “elected officials, senior staff in charge of engineering and planning operations in cities and counties, MPO executives and/or interest group leaders”;

2. Transportation engineers and planners working for California local governments and transit authorities; of the 396 surveys mailed out to this group, 228 were returned completed; and
3. Twenty national experts with extensive experience in managing transportation organizations, intergovernmental cooperation, planning and programming, and project finance.

Interviews with the first of these groups, the “leaders,” revealed that the interviewees already knew a fair amount about ITS. It also emerged that many of the interviewees shared the following assessments of the ITS literature:

- The literature is too promotional and jargon-laden.
- Reliable information on ITS benefits and costs is scant.
- The focus is too much on system performance rather than on benefits to users.

The mail survey of the second group, the transportation engineers and planners, revealed mixed views about the value of “success stories” as a promotional tool for ITS. On other points, however, the answers to the survey displayed a fair degree of consensus:

- The main near-term ITS opportunity is improvements to traffic operations, especially advanced systems for traffic signal timing.
- Ignorance of ITS among the public and decision-makers is an impediment to acceptance.

Among the national leaders, a number of them saw a need for improved evaluations of ITS investments, and several thought that transportation agencies suffer from a pro-ITS bias. One of the interviewees gave the example of a DOT investment in roadside telephones; allegedly, the investment was made after the spread of cell phones had already obviated most of the need for roadside phones. The interviewee went on to say that unrealistic assumptions about the value of the roadside phones to the public had produced the high benefit-cost ratio in the benefit-cost analysis performed before the phones were installed.

Several of the interviewed national leaders emphasized the need for more evaluation of implemented ITS projects, to see whether expectations had been realized. Concerns about expectations exceeding reality were expressed about traveler information in particular. One interviewee commented:

“Worthless information undermines the value of variable message signs, e.g., signs that say ‘construction next five miles’ placed at the start of construction zone where you can see the construction yourself. The same holds true for traveler information systems that give bad information—tell you there will be delays due to construction and when you get there, having left half an hour early, you see that they aren’t working that day.”

The final phase of the study for CALTRANS entailed the development of brief summaries about various applications of ITS (2). The materials were designed to avoid the hype, technicality and overly optimistic predictions about which participants in the earlier phases of the study complained. The target audience included local government officials, senior managers, and new hires in both engineering and planning departments of state and local agencies. The summaries offered (where possible) information on the benefits and limitations of an application, and examples of deployment experience. Following is a listing of ITS applications for which summaries were prepared.

1. On-Board Safety Systems
2. Variable Message Signs
3. Highway Advisory Radio
4. 511 Traveler Information
5. Road Weather Information Systems
6. Advanced Signal Timing
7. Pedestrian Detection Systems
8. Inductive Loops for Bicycles
9. Ramp Metering
10. Transportation Management Center
11. Integrated Transportation Management - Traveler Information

12. IMAJINE
13. PeMS
14. Cost-Benefit Analysis
15. Smart Corridors
16. Electronic Toll Collection
17. I-15 HOT Lane and Managed Lane Concept
18. SR-91 Congestion Pricing
19. Roadway Weather Management Systems
20. Smart Snowplowing
21. Smart Cards for Transit
22. Transit Information Systems
23. NextBus
24. Bus Rapid Transit
25. Smart Taxis
26. Car Sharing
27. Smart Cards for Parking
28. Parking Guidance Systems
29. Automatic License Plate Reading
30. Red Light Camera Enforcement
31. Commercial Vehicle Operation
32. CVISN
33. I-95 Coalition
34. European Experience
35. Rural Applications
36. Security Applications

Development of Promotional Material for Texas Use

These summaries prepared within this recent CALTRANS study of ITS applications could be adapted and further developed for use in Texas. What is needed are summaries that are promotional they increase willingness to provide funding – without being misleading. A good

strategy would be to develop an enhanced summary for a few selected ITS applications, and then to pilot test the summary on decision-makers in Texas. Feedback from the pilot test could be used in developing the final versions.

An important part of this effort would be a review of the models and other tools that have been used for ITS evaluations. Without such a review, misleading claims for ITS can result from uncritical acceptance of the findings. The following section contains a critique of one important evaluation tool, the Intelligent Transportation Systems Deployment Analysis (IDAS).

Intelligent Transportation Systems Deployment Analysis (IDAS)

IDAS is a post-processor for traditional 4-step transportation planning models (3). The model contains an “ITS library” with default values for input parameters; these represent generalizations based on review of the relevant studies. The users must supply data on travel within the transportation network being analyzed and on the characteristics of the ITS deployments.

A nice illustration of the model’s workings and potential can be found in Sadek and Baah, who evaluated the cost-effectiveness of potential ITS applications in Chittendon County, Vermont (4). One of the applications was the deployment of Automatic Vehicle Location (AVL) capabilities on the county’s transit buses. AVL capabilities combined with central software enhance the planning of routing, scheduling (including temporary changes), and driver assignment. As a result, transit time declines and some travelers switch mode to transit. In the study under discussion, the IDAS simulation captured this modal substitution response and its consequences for vehicle miles of travel and speeds. From the impacts on vehicle miles of travel and speeds, the changes in vehicle emissions, fuel consumption and accident frequency were estimated as well.

The inputs to the AVL simulation included user-supplied information on the number of transit vehicles with and without AVL capabilities, the relevant origin-destination zones, the annual capital cost per vehicle, and the annual operating costs for the transit authority. The other

inputs were the IDAS default values that quantify the transit savings due to the AVL deployment – the reductions in fleet size, operating costs, and in-vehicle travel time (in- and out-of-vehicle separately).

The bottom line of the evaluation was that the estimate that deployment of AVL on Chittendon County transit would yield benefits – savings in transit operating costs and in travel time (on transit and off) – that would be about five times greater than the costs of deployment (benefit-to-cost ratio = 5.08). It is important to note that IDAS is but one example of an ITS evaluation tool and may not be the correct tool and/or necessarily applicable in some cases. It is presented here as an example of a tool or approach that is available to aid the process of assessing ITS benefits (prospective or otherwise).

TxDOT's NEW PROJECT FUNDING PROCESS

Over the past two years, fundamental changes have been developed that have modified the Unified Transportation Program (UTP) and the process by which federally-programmed funds are distributed amongst transportation projects in Texas on a fair and equitable basis. Prior to these proposed changes, prospective projects typically fell into one of 34 categories. In an effort to streamline this funding process, a new funding plan was developed that transformed the old (34) categories and processes into 12 new categories. The proposed categorical consolidation and associated supplementary information is included in [Appendix A](#).

As opposed to past categorical definitions that were sometimes driven by the type or specific “source” of funding, the new categories are oriented with regard to “purpose.” These “purpose themes” include: 1) Plan it; 2) Build it; 3) Maintain it; 4) Use it; and 5) Manage it.

Based upon the current working version of the proposed new categories, many of the ITS projects directed at rehabilitation of traffic management systems (old Category 10-B) would now be funded under the new Category 1 – Preventative Maintenance & Rehabilitation. It further appears that the following new categories might offer prospective funding for ITS projects: 1) Category 2 – Metropolitan Area (TMA) Corridor Projects; 2) Category 3 – Urban Area (Non-

TMA) Corridor Projects; 3) Category 4 – Statewide Connectivity Corridor Projects; 4) Category 8 – STP Safety; and/or 5) Category 11 – District Discretionary. Look online at <http://www.dot.state.tx.us/moneymatters/moneymatters.htm> for additional information. More specific information regarding project ranking indices and allocation formulas can also be viewed online at <http://txdotutp.tamu.edu> .

A cursory review of the new categories and related information does, however, seem to make it less clear where ITS projects and their prospective funding may fall. It further appears that ITS projects may have an even more difficult time (relative to recent years) competing with more traditional transportation system improvements (e.g., pavement overlays/rehab., additional capacity, bridge rehab./replacement, etc.), as there is no distinct category for ITS-type projects, and they are presumably combined in the categories highlighted previously. As such, a more proactive approach to conveying ITS benefits and costs may be necessary for future ITS deployment to compete for state funds – particularly in the near-term. This issue will require further attention subsequent to the final approval of new categories, etc. associated with the new funding process.

It is anticipated that this new approach will likely result in making the funding of ITS projects through these traditional funding streams even more difficult. If this indeed turns out to be the case, and the Department desires to maintain its commitment to deploying and maintaining ITS in Texas, consideration of alternatives to the new (current) funding process – particularly modification(s) that may create a category and/or clear source of funds for ITS – may be useful. To aid this potential activity, the research team conducted a review of how other states in the U.S. deal with the funding of ITS projects. A summary of associated findings is provided subsequently.

California

ITS funding in California comes in a variety of mechanisms. For example, under its State Highway Operation and Protection Program, which has six categories for highway funding, the sixth category - mobility - is available to fund ITS projects (5). The State Transportation

Improvement Program (STIP) has six funding elements. Three of these STIP elements are for transit, but the first two (“interregional road systems” and “flexible congestion relief”) both provide funding assistance for ITS projects (6). The Surface Transportation Program (STP), Traffic Congestion Relief Program and CMAQ funding are also used for ITS projects (7). California also provides specific guidance regarding ITS through its Local Assistance Program Guidelines (8).

Colorado

Colorado Department of Transportation (CDOT) has an impressive ITS Strategic Work Plan and ITS business plan. The ITS Strategic Work Plan was developed and created in 1998. It provides vision, mission goals, and objectives to give direction to CDOT’s ITS activities. A business plan for 1999-2003 was laid out for ITS using the ITS Strategic Work Plan. Seven program areas were developed to directly support the ITS Strategic Plan. These ITS Program elements are: 1) system maintenance; 2) operation and integration; 3) traveler information – collection and dissemination; 4) active system management – traffic and travel; 5) incident management, 6) commercial vehicle operations and 7) updating legacy systems (9). ITS projects were also identified within the statewide plan (10).

Colorado laid out a more simplified transportation investment strategy in its 2020 Statewide Transportation Plan: Investing in Colorado’s Future. There are five investment categories, which will be used to measure performance. These are safety, system quality, mobility, strategic projects and program delivery. All CDOT programs are placed into one of these categories and ITS falls within the “safety” and “mobility” categories (and is a specific sub-category). According to the STP, ITS is an important statewide initiative and is listed as a program/element of this plan. A total of \$590 million was awarded to ITS projects within the constrained element of the program, while an additional \$22 million in ITS projects went unfunded.

Florida

Florida adopted a Statewide ITS Strategic Plan in 1999 (11) which created, a centralized ITS office and district ITS offices. The ITS Strategic Plan has also provided guidance for planning and implementation of ITS. The ITS Strategic Plan runs in conjunction with the Statewide Long-Range Plan. ITS is funded as a stand-alone component within the overall work program. The program has 13 categories which are created annually and guide the department's tentative work program (12). An annual amount of at least \$25 million has been set aside for ITS since 2002. These funds are used on highest priority ITS projects and on the Florida Intrastate Highway System. ITS is also funded under CMAQ, the Mobility 2000 program (which eases urban congestion relief by using technology to move traffic) and through Transportation Outreach and other dedicated funding projects. There is also a rural component within the ITS Strategic Plan with a proposal to integrate the system as a whole in the future (13). A County and Small County Incentive Program were created to assist these rural areas in improving facilities to relieve congestion and improve safety.

Michigan

Michigan Department of Transportation (MDOT) does not currently have a direct ITS funding category (14). ITS is, however, listed as one of the 10 critical elements in the Five-Year Road and Bridge Program which Michigan has been undertaking since 1999. Within the current 2003-2007 Road and Bridge Program, Michigan, is focusing on the Governor's "Preserve First" strategy, which aims to improve and preserve the existing highway and bridge network. Capacity building-programs have been put on hold while preservation, maintenance and improvement projects have been accelerated. The current five-year program does not list any specific ITS programs. A 2002 White Paper on ITS pre-deployment, noted that one of the challenges MDOT faced was integrating ITS funding into MDOT's Road and Bridge Program (15). ITS projects, operations and maintenance have primarily been funded through the CMAQ program in recent years with matching funds coming from the Michigan Transportation Fund.

Washington

Washington has rolled-out a significant ITS program, in both rural and urban areas (16). In 1994 it adopted an ITS Statewide Strategic Plan to guide and develop policy. Currently, the State is involved in ensuring that rural and urban systems are folded into the statewide system. Washington is also updating their Statewide ITS Strategic Plan, and developing a Statewide Communications Plan (17).

Washington funds ITS through a variety of mechanisms. The overall State Transportation Program consists of 17 categories that are referred to “by letter.” Program C (information technology) and Program Q (traffic operations) fund ITS projects (18, 19). For example, under Program Q – whose aim is to maximize highway transportation system safety and efficiency through a statewide program – minor operational enhancement projects can be undertaken. These projects include driver guidance projects such as traffic signals/signal system upgrades, roadside guidance and ITS. Under this program, these minor enhancements are funded through task orders which the State and/or regional Traffic Engineer can authorize.

ITS is also funded within the STIP, the State Highway System Plan 2003-2022, Highways and Local Programs plan, (20) and the 20-Year Plan Needs by Program (21). ITS is given a high profile in all of these programs and dedicated titles and funding (Federal, State and Local).

Key points of contact and other potentially helpful information gathered in this task are summarized in Table 1.

Table 1. Summary of ITS Funding and Contact Information for Other States.

State	Division	Sub-Division	Contact Name	Title	Contact Number	Email/Website
California	Traffic Operations	ITS Projects and Standards	Kim Nystrom	Program Manager, Traffic Operations		http://www.dot.ca.gov/hq/traffops/
	Local Assistance		Brian Smith	Deputy Director	(916) 654 6592	http://www.dot.ca.gov/hq/LocalPrograms/index.html
	Local Assistance		Terry Abbot	Division Manager	(916) 653 1776	
	Transportation Planning		Joan Sollenberger	Division Manager		http://www.dot.ca.gov/hq/tpp/
Colorado	Transportation Management Center	ITS	Ron Mead	Transportation Manager		Rod.Mead@dot.state.co.us http://www.cotrip.org/its/default.html
	Statewide & Regional Transportation Planning		Kathy Engelson	Manager	(303) 757 9770	kathy.engelson@dot.state.co.us http://www.dot.state.co.us/StateWidePlanning/PlansStudies/Contacts.htm
Florida	Intelligent Transportation Systems Office		Elizabeth Birriel PE	Deputy State Traffic Engineer/ITS	(850) 410 5600	elizabeth.birriel@dot.state.fl.us http://www.dot.state.fl.us/IntelligentTransportationSystems/default.htm http://www.dot.state.fl.us/IntelligentTransportationSystems/ITS%20contact.htm http://www.dot.state.fl.us/IntelligentTransportationSystems/Online%20Documents/documents/Vision%20and%20Goals.htm
			Gene Glotzbach	FDOT Central Office Coordinator/ITS Engineer Administrator	(850) 410-5616	gene.glotzbach@dot.state.fl.us http://www.dot.state.fl.us/IntelligentTransportationSystems/ITS%20contact.htm

Table 1. Summary of ITS Funding and Contact Information for Other States.

State	Division	Sub-Division	Contact Name	Title	Contact Number	Email/Website
	Office of Planning		David Lee	Statewide Planning & Policy Analysis	(850) 414-4800	david.lee@dot.state.fl.us http://www.dot.state.fl.us/planning/default.asp
			Bob Romig	Director		robert.romig@dot.state.fl.us
Michigan	Bureau of Transportation Planning	ITS	James Schultz		(313) 256-9800	Schultzj3@michigan.gov http://www.michigan.gov/mdot/0,1607,7-151-9621_11041_14581---,00.html
	Multi Modal		Rob Abent	Bureau Director, Multi-Modal Transportation Services Bureau	(517) 335-9568	abentr@michigan.gov http://www.michigan.gov/mdot/0,1607,7-151-9623_26680_30159---,00.html
		Planning & Programming	Lori Hostetler	Departmental Manager, responsible for development and monitoring of the statewide public transportation program and administrative budget, and contracts.	(517) 373-2907	hostetlerl@michigan.gov
Washington	Advanced Technology Branch	Manages WSDOT's ITS Program				http://www.wsdot.wa.gov/biz/atb/
	Highways and Local Programs Division				(360) 705-7372	http://www.wsdot.wa.gov/TA/HOMEPAGE/HL.PHP.html

Table 1. Summary of ITS Funding and Contact Information for Other States.

State	Division	Sub-Division	Contact Name	Title	Contact Number	Email/Website
	Planning and Capital Program Management				(360) 705-7921	LeonarJ@wsdot.wa.gov http://www.wsdot.wa.gov/PPSC/default.htm
	Strategic Planning and Programming	Transportation Planning	Elizabeth Robbins	Planning Manager	(360) 705-7371	RobbinS@wsdot.wa.gov http://www.wsdot.wa.gov/ppsc/planning/

KEY NEEDS OF TxDOT STAFF

In an effort to identify specific ITS funding needs and priorities for TxDOT staff, a survey was conducted as part of this project. At the request of the project advisory panel, the research team sent the survey to the following nine TxDOT Districts: Amarillo, Corpus Christi, El Paso, Laredo, Odessa, Pharr, Tyler, and Wichita Falls. These Districts were selected based upon their relative stage of ITS deployment. Most of these Districts are still at the early stage of ITS deployment and have recently completed their ITS Regional Architecture Plans. The current versions of the plans, which have been recently completed are posted on the project website noted previously (<http://san-antonio.tamu.edu/4451/>). The survey was designed to be completed either by hand (hard copy) or on-line via the project website. A complete copy of the survey is included in [Appendix B](#).

Six (6) responses were received from five (5) different Districts. Noted in [Table 1](#) is a summary of the general characteristics of survey respondents. Working knowledge of ITS for survey respondents was typically “fair,” with the number of years of working experience with ITS averaging six (6) years. In comparison, survey respondents averaged twice as much (i.e., 13 years) experience in the general field of transportation.

Table 2. Summary of Survey Respondent General Characteristics

Respondent	Years of Experience in Transportation	Years of Experience with ITS	Working Knowledge of ITS
1	17	10	Fair
2	16	10	Fair
3	18	5	Fair
4	4	4	Excellent
5	12	2	Fairly Limited
6	13	5	Pretty Good
Averages	13	6	

Note: Results shown are from Survey of TxDOT District staff by Texas Transportation Institute research team.

With regard to how difficult it has been for them to obtain funding for ITS projects, 83 percent (5 out of 6) indicated that it has been at least “somewhat difficult.” Specific challenges that were cited with regard to obtaining ITS funding included: 1) competing with other operating

agencies; 2) competing with “traditional” transportation projects (e.g., adding roadway capacity, pavement overlays, bridge maintenance/re-construction, etc.) for limited funds; 3) ongoing maintenance of ITS equipment; and 4) the lack of understanding among decision-makers regarding the benefits of ITS.

An example of the “fact sheets” like those developed (and cited previously) by CALTRANS was provided with the survey. The specific fact sheet provided with the survey was for traffic management centers and is included in [Appendix C](#). All survey respondents indicated that having access to such fact sheets would be very helpful. Of particular interest was having a fact sheet for wireless technologies and their role in ITS applications.

Survey recipients were also asked to prioritize ITS components and/or applications as an indicator of what they would likely choose to deploy if funding were available. The highest relative priority ranking of importance in the survey was “critical”, and the following three items were noted as such: cameras, fiber communications, and dynamic message signs.

CHAPTER 3:

EXISTING RESOURCES FOR ITS FUNDING insights

FUNDING PROCUREMENT

Once funding has been secured for an ITS project, the next step in the process is to procure the materials and services to build, design, and install the equipment and/or related software. A common pitfall that has plagued several agencies in their attempts to procure ITS-related projects is the belief that these projects must be awarded on the same basis as standard construction projects (i.e., lowest responsible bidder). The procurement of ITS projects in this manner could result in low-quality equipment that is not properly installed and has poor interoperability with other systems.

If federal-aid money is used to fund the project, the lowest bid system must be used for all construction projects. Fortunately, several mechanisms are in place to avoid the competitive bidding process that can lead to problems. When projects include more than just installing devices in the field, then the project is not considered a construction project. Projects that meet this description would be those that include software components or integration with a control center or communications system. For these projects, there is greater flexibility in awarding the contract, which includes utilizing the state's procurement system (rather than the federal aid procurement practices), treating the project as an engineering or design service (which can use other factors besides cost), or utilizing the Special Experimental Project number 14 (SEP-14) process that also looks at factors other than cost.

Texas law also provides the needed procurement flexibility when the funding source is not federal aid or if state procurement methods are chosen over the federal aid procurement practices. When materials that are highly technical in nature are to be procured, the Competitive Sealed Proposal procurement process may be used. Under this process, a request for proposal (RFP) is made which details the basis on which the contract will be awarded. Items that are commonly considered are cost, previous experience, years of operation, etc. Negotiations are

then held with the firm that submitted the top proposal or proposals based on the stated criteria to further define the terms of the contract.

Utilizing the more flexible procurement procedures that are already in place can help make the “hard to find” funds for ITS projects go further. Services provided by an inexperienced contractor or firm may have a lower price tag in the beginning but often require much higher maintenance and repair costs (for which funding is often not available) over the life of the project. More information on best practices in ITS procurement are available from the *ITS/Operations Resource Guide* published by the Federal Highway Administration and available online at <http://www.its.dot.gov/guide.html>. This resource is also posted on the website (noted previously) that was established for this research project. For more information on the Competitive Sealed Proposal process in Texas visit <http://www.tbpc.state.tx.us/stpurch/rfp-1.html>.

GENERAL INFORMATION ON ITS

With regard to additional valuable existing resources, one of the most information-rich sources of information on ITS can be found at <http://www.benefitcost.its.dot.gov> . This website went through a major update in the Spring of 2004 and contains a wide variety of valuable information on this subject. Another site that references numerous documents that have been published about ITS in recent years and is a great one-stop source of related information can be found at <http://www.mitrotek.org/home.nsf/transportation/itspublicationlist> .

CHAPTER 4: NEAR-TERM OPPORTUNITIES FOR ITS FUNDING

RE-AUTHORIZATION OF TEA-21 (TEA-LU)

During the course of this research project, it was anticipated that the re-authorization of the Transportation Equity Act (TEA-21) would have been accomplished, and that the research team and advisory panel would have the chance to help TxDOT staff identify opportunities to fund ITS deployment related to the new re-authorization. Unfortunately, at the time this report is being written, a new transportation bill has not been re-authorized. What is known at present is that the current House Bill (HR 3550, TEA-LU) being considered allocates (in Section 1205) approximately \$3 billion over the next six years for ITS. An alternative bill being considered as a proposal from USDOT suggests (in Section 1703) a funding level of \$810 million for ITS over the next six years.

It also appears that Texas will remain a “donor state” – although the current state of affairs in the debate over a “compromise bill” includes House Majority Leader, Representative Tom DeLay insisting that a bill be passed that assumes a minimum 95 percent return for donor states. A new bill is expected to be passed in the next few months. Regardless of the outcome, once a new re-authorization has been accomplished, it would benefit TxDOT’s ITS funding efforts in Texas to quickly identify opportunities (and/or constraints) that may exist in the new re-authorization bill.

COLLABORATION WITH FLORIDA ITS MODEL DEPLOYMENT

Background

Like Texas, the State of Florida is pursuing development of ITS software using a statewide integrator contract mechanism. Their program is called the Florida Statewide Transportation Management Center Software Library System (STMCSLS). In a 2002 AASHTO

Report (22), Chester Chandler with the Florida DOT described the objectives of this software program as follows.

The proposed integrated Statewide Transportation Management Center Software Library System will provide a unifying platform to ensure that technologies work together smoothly and effectively. The selection of a common traffic management center (TMC) software system will allow TMCs, toll collection, freeway incident management, traveler information, vehicle information, wireless microwave, and fiber-optic communications to function seamlessly. The proposed software library system will provide new TMCs with statewide integration functions and features and will prepare existing TMCs with migration paths. The project will save the State of Florida multiple millions of dollars in redundant TMC software development costs for each new TMC. This project will also provide systematic statewide software requirements analyses and configuration management.

The State's 237-page Invitation to Negotiate (ITN) solicitation and the six addenda are posted on the following Florida web site:

<http://www11.myflorida.com/IntelligentTransportationSystems/Architect%20&%20Standards/ITS%20Software.htm>

That web site also contains a comprehensive slide presentation (in PDF format) dated May 14, 2003. This presentation summarizes the history of the procurement, its objectives, partnerships and funding. Excerpting from the Florida DOT procurement request, the objectives of the program include the following.

The STMCSLS must include baseline software and modules that provide:

Operations management and control for intelligent transportation systems field elements such as inductive loops, microwave radar traffic monitoring systems, video image detection systems, closed-circuit television cameras, dynamic message signs, highway advisory radios, and road weather information systems;

1. Expert systems and databases with the algorithms to support automated incident detection and response;
2. Data archiving of incident and traffic that can be used for advanced traveler information systems (ATIS) and stored in a statewide data warehouse; and
3. Data archiving of incident and traffic that can be used for ATIS and stored in a statewide data warehouse; and
4. Configuration management of the STMCSLS and electronic documentation of the software.

Southwest Research Institute (SwRI) and PB Farradyne have been chosen as the statewide integrator team in Florida.

In addition to the statewide ITS integration and software activities noted previously, Florida has also recently initiated a major ITS model deployment that is being called Florida. This statewide ITS deployment entails 24 specific projects that address a wide variety of issues that are also of interest and benefit to the State of Texas. The funding for this effort totals \$21 Million and is being supported (in part) by federal funds. Some of the major ITS-related components are focused on the following areas/topics: 1) metropolitan area ITS deployment; 2) statewide ITS deployment; 3) major evacuation; 4) weather; 5) advanced traveler information system (ATIS); 6) homeland security; 7) data archiving/management; and 8) evaluation. Several of the geographic areas of focused deployment for these noted topics are highlighted in [Figure 1](#).

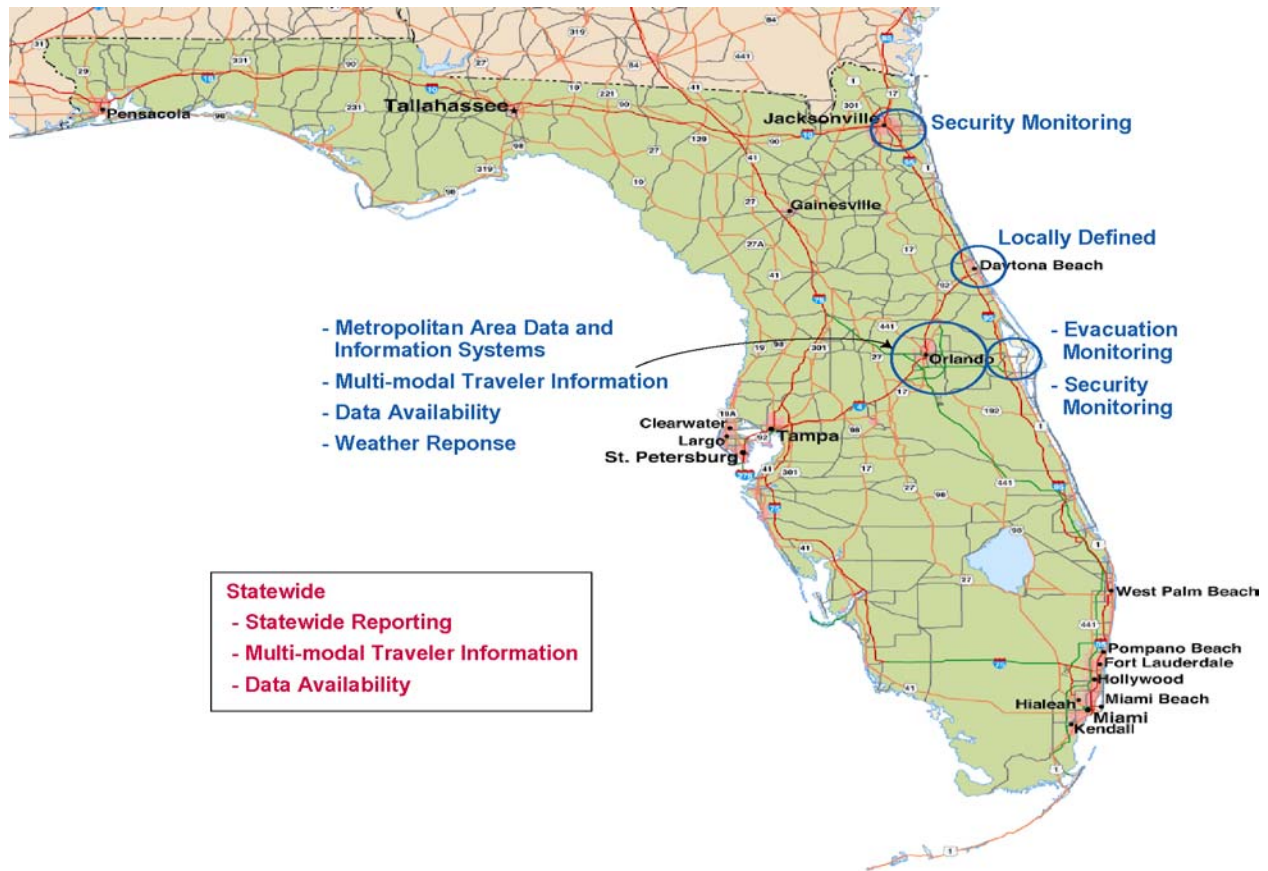


Figure 1. Illustration of Florida Regional ITS Deployments

Key Issues

- Partnership Status with Florida and Michigan DOT.* The State of Florida and Michigan DOT are identified as partners in the Florida Statewide Transportation Management Center Software Library System. The May 14, 2003, presentation identified Michigan’s financial commitment as follows (23). On February 13, 2002, the Michigan DOT affirmed its commitment to co-sponsor this activity. In addition to FDOT’s monies, MDOT has committed \$500,000 in each of these five fiscal years and beyond. TxDOT may want to formalize its relationship with FDOT so that Texas’s contributions and role in establishing software priorities is improved and/or otherwise advanced.
- Distribution of Software.* During the procurement phase of the Statewide Transportation Management Center Software Library System addendum #4 said the following. The

Department expects full ownership of the software with the right to distribute the software to other governmental agencies, both within Florida and outside of Florida, at no charge. TxDOT is pursuing a path that involves distribution of software through licenses. TxDOT may want to work with Florida DOT to ensure that a consistent approach toward distribution of software is established with respect to licenses, source code, documentation, and configuration management.

Opportunities

Improve Software Quality and Reduce Long-Term Software Cost

Because the TMC operations in Texas and Florida have many parallels, there is an opportunity to effectively manage costs by improving the quality of software. Software that more closely matches user needs will require less maintenance and less spending. Seeking broader multi-state input into the definition of requirements, user interfaces, and operational strategies could help the states to build systems that provide greater effectiveness and user satisfaction.

For instance, in October of 2002 the Florida DOT (FDOT) developed a 63-page ranking of Transportation Management Center (TMC) requirements (24). TxDOT is developing software for TMCs and might want to cross-check their requirements with those developed by FDOT.

In another example FDOT hired SwRI to develop a concept of Operations for the Florida Statewide Software Library (25). This analysis was delivered to the State of Florida in May of 2002. An analysis with similar structure and content was also provided to TxDOT by SwRI for the North Texas Region in December 2001 (26). Studies like this might be improved/refined with collective input and interaction. “Innovative funding” is, in the case suggested herein, working together to develop a better product that requires less maintenance.

Share Software Investment Costs with Other Agencies

So far Florida DOT has secured approximately \$6.08 million over a 10-year period to fund its Statewide Transportation Management Center Software Library System. This includes financial support from Michigan DOT (27). Since the functionality of the Florida TMC software parallels TxDOT TMC strategies in many areas, collaborative development could financially benefit both agencies. In addition, Florida has already teamed with Michigan DOT in this effort. Additional public agency participants working toward the same goal could further offset future costs that TxDOT would incur if it did not collaborate. In this case, alternative funding for ITS takes the form of leveraging other agency's funding to collectively work toward a common goal.

CONVERSION OF DalTrans SOFTWARE TO "OPEN SOURCE" STATUS

Background

The existing DalTrans software was developed by TTI using funds provided through interagency contracts with the Dallas District of TxDOT over a number of years. The software is built upon a simple, flexible, and extensible architecture, which enables it to adapt to the requirements of a wide variety of users and hardware. The DalTrans software is also modular and contains many components that by themselves are potentially useful to other ITS deployments.

Several North Texas cities and agencies have already recognized the potential of the DalTrans software and are licensing portions of the software for use in their own centers. Under the terms of the license, agencies are obligated to share with TxDOT and the other licensees the source code for all enhancements made to the software. Cooperative software environments such as this are beneficial to everyone involved.

Unfortunately, executing formal licensing agreements is sometimes challenging and frequently time-consuming for public agencies. Issues regarding liabilities and future use are

significant enough to inhibit wide adoption and growth of the software products. The legal agreements take years to complete and are costly to both TxDOT and the prospective licensees.

In addition within a few years the existing DalTrans software will be replaced by computer code developed by TxDOT's statewide integrator Southwest Research Institute (SwRI). One of the objectives of the new SwRI software is that the code will be "reusable" software that meets the needs of many districts. Given the sequence of traffic management center deployments in the state, it is possible that the DalTrans software will include code that has recently been developed by SwRI in other districts including Austin's Combined Transportation and Emergency Communications Center (CTECC). While some portions of the existing DalTrans code could be incorporated into the new DalTrans traffic management center (TMC), the likelihood is that significant portions of the existing DalTrans code will be abandoned by TxDOT and will have no further value to the agency.

Recommendation

A strategy that may increase the value of the existing TxDOT DalTrans software investment is to convert the software to "open source" status. If this software is available in the public domain, a greater number of agencies are likely to build on its foundation producing components which can be utilized by TxDOT and other agencies. The net result will be a larger number of cities, states and agencies deploying lower-cost traffic management systems which are capable of interacting with one another using the national ITS standards based on a center-to-center communications scheme being pursued by TxDOT.

Discussion of the Recommendation

Open Source Software

According to the Open Source Initiative: "The basic idea behind open source [software] is very simple: When programmers can read, redistribute, and modify the source code for a piece of software, the software evolves. People improve it, people adapt it, people fix bugs. And this

can happen at a speed that, if one is used to the slow pace of conventional software development, seems astonishing.”

Open source software is built and enhanced through public collaboration. It is free in that it gives the user unrestricted access to the source code. The source code shows how the software works in a language that programmers can understand.

In order to use open source software, users must agree to a license, which usually includes the ability to run the program, have the source code, change the source code, and distribute it. When you build something with open source software you have to provide others the opportunity to do the same thing, which is how the software is further developed (28,29). Open source code for TMC centers could provide the following benefits for TxDOT and other traffic management center users.

- Enable other government entities to take advantage of existing TMC software components without difficult and costly legal negotiations. Such negotiations are as expensive for TxDOT as they are for the licensee.
- Make it apparent what components exist and their current status.
- Make it possible for users to find and correct bugs, which results in an improved product for everyone.
- Promote community development where a number of individuals from various organizations contribute to the continuous improvement and expansion of the component library.
- Remove the dependency on a single individual on which the future of the software depends.
- Promote the adoption of center-to-center and other similar technologies by making software that implements these standards readily available.
- Encourage contribution of source code and documentation from equipment manufacturers. Manufacturers could use the existence of open TMC software as a selling point.
- Provide an on-line repository for source code and documentation accessible to everyone at any time.

- Prevent “Black Box” syndrome. By having the source code available, it is possible to perform a thorough inspection and verify the correctness of the algorithm and the implementation scheme used.

Tools for Open Source

There are several online collaborative development environments which facilitate the creation, hosting and management of open-source projects. These services provide tools for source control, bug tracking, and developer interaction, and they encourage communication and a sense of community among participants. Many of the services are free. An example of one such service can be found at:

<http://www.gotdotnet.com/community/workspaces/docs/about.aspx>.

This Microsoft service, termed “GotDotNet Workspaces,” is provided for .Net developers. The existing DalTrans code is structured for a .Net environment. The GotDotNet Workspace provides source control tools (including a history of previous versions), a bug tracker and team communications capabilities.

Implementation

The following steps outline a plan for conversion of the TTI-developed non-SwRI DalTrans software to open-source status. A more detailed implementation plan can be developed if both TxDOT and TTI agree to proceed with this recommendation. Dr. Seymour with TTI has initiated some preliminary discussions with both the TxDOT Traffic Operations Division and the TxDOT Dallas District to assess the feasibility of this recommendation. Responses received to date have been positive.

1. TTI and TxDOT reach consensus on distribution of existing DalTrans code as open-source software.
2. TTI and TxDOT execute applicable documents acknowledging that TTI will distribute the code as open-source software.

3. TTI develops an applicable open source license describing the use of the software in an open-source environment.
4. TTI (or a contractor on behalf of TTI) publishes the existing DalTrans source code to an online collaborative development environment.
5. TTI establishes an auxiliary web site on which to provide additional descriptive information and associated materials which might not be easily publishable on the collaborative service.
6. TTI would then administer the “Open TMC” project, guiding and promoting further development and information sharing.

In order to leverage the benefits of converting the existing DalTrans software to open source, the strategy should be pursued as soon as possible while the software is still in use. Posting software that is in an operational deployment will increase its value and allow TTI to develop documentation and other support tools that will give TxDOT an added measure of protection against potential changes in programming staff.

ENERGY SERVICE COMPANIES (ESCOs) & TAX CREDITS

Energy Service Company (ESCO)

In simple terms, an Energy Service Company (ESCO) is a business that provides energy management services to an energy user (30). Projects that utilize energy-efficient equipment and/or technologies can qualify for funding via an ESCO. Examples of ITS projects and components thereof which are eligible for funding include solar-powered equipment, light-emitting diode (LED), traffic signal heads, etc.

Funding can be acquired for these types of projects from standard performance contract (SPC) sources (31, 32). Specific information on steps to take in these regards can be found in the State Energy Conservation Office (SECO) Energy Savings Performance Contracting Requirements and Guidelines for State Agencies (33).

Tax Credits/Incentives for Using Energy-Efficient Equipment

There are additional federal tax incentives for using solar, geothermal, biomass, wind and water power aimed at all levels of government, and at corporate and residential use. For example, the Green Power Network (34), the Million Solar Roofs Initiative (35), the Wind Powering America Initiative (36), and Energy Star Program (37) all aim to increase use of renewable sources and offer financial, technical, educational and outreach assistance. There are also incentives aimed at clean(er) fuels for example, ethanol, and the use of hybrid technologies. There are also rules, regulations and policies that govern energy-efficient construction and design standards for states and local jurisdictions. A database, called DSIRE, funded by the Department of Energy lists many of these incentives at the Federal and State level (38).

Texas has financial incentives and corporate and property tax incentives to encourage the manufacture, use, installation and maintenance of renewable energy resources. The State Energy Conservation Office (SECO) in Texas (39) offers a variety of incentives to maximize energy efficiency while protecting the environment. One of SECO's tasks is to contribute to the economy by reducing utility operational costs throughout the state in various government entities, school districts, hospitals and small businesses. For example, the LoneSTAR program provides loans to public institutions at low interest rates to implement energy-efficient retrofits (40). SECO also encourages the use of performance contracting by public institutions and local jurisdictions. Performance contracting is a construction method that finances the costs of design, construction and implementation from the energy savings in utility bills that are achieved. It can also be used to retrofit existing buildings. Any project that reduces energy or water use is allowed. The contract may be up to 15 years in length. Using this method allows the local entity to use new technology and equipment now, and avoids asking taxpayers for additional tax dollars.

An example of how this might be applied in an ITS project involves the computers that run the system and are used to view CCTV images that are housed in Traffic Management Centers, or other government buildings. An energy star computer that uses 70 percent less electricity and lower electricity costs could be financed using this mechanism. This is because

the computers not only save electricity cost, but would also contribute to overall savings in the building where they were housed.

Tax exempt lease purchase agreements (where the local jurisdiction purchases the property over the lifetime of the lease) could be used in conjunction with energy services performance contracts. By combining these two elements, one can save on energy and utility costs, use these savings to pay for the leasing costs, and acquire equipment on a faster time-scale. As an added bonus of the interest on the lease is exempt from federal income tax (for public sector entities).

There is an amendment at the Federal level (S.658 - 108th Congress) to extend the authority for energy-saving performance contracts to non-building energy savings contracts (41). In the future it may be possible to finance energy-efficient equipment to any vehicle, device or equipment that is transportable under its own power. This could include for example, vehicles used for maintenance of ITS equipment, emergency response vehicles, and/or ITS equipment that is powered using renewable energy.

NEW TOLL ROAD CONSTRUCTION

House Bill 3588

Passed into law by the 78th Texas Legislature, House Bill (HB) 3588 has been referred to as the most significant transportation legislation in the history of Texas. If successfully translated into action, it appears that this will likely result in the biggest acceleration of transportation infrastructure improvements since the interstate highway system was funded and constructed.

HB 3588 creates several new mechanisms for funding transportation projects. These projects include the: 1) Texas Mobility Fund; 2) Regional Mobility Authorities (RMAs); and 3) Comprehensive Development Agreements (CDAs). These new approaches and/or mechanisms represent unique opportunities to fund future transportation projects.

Cost-Sharing of ITS Deployment with Toll Road Developers

An example of the possible first major regional project to utilize these new funding tools is State Highway 130 (SH 130). Illustrated in [Figure 2](#), the preliminary plans for this new toll road include a northern connection to I-35 near Georgetown and a southern connection to I-10 near Seguin. It is in the vicinity of these major points of connection to the Interstate System, as well as near major interchanges along the route (e.g., SH 130 Interchange with SH 71, US 290, US 79, etc.) that the deployment of ITS technologies such as cameras and dynamic message signs can contribute to improved traffic operations. The capability to monitor and provide valuable information about the real-time status of traffic operations (e.g., location and severity of incidents, travel times along major segments of the toll road and Interstate route, etc.) will result in the best overall utilization of available capacity in such corridors.

This type of ITS deployment will be mutually beneficial to the existing state roadway network as well as new toll roads. As such, there exists a real potential for win-win cost sharing with regard to the deployment of ITS in these cases. It is anticipated that private entities will build and manage many of these new toll roads -- particularly long sections of inter-urban freeway such as SH 130 and other such Trans Texas Corridor-scale developments. Partnering between TxDOT and these private entities as early on in the process as possible is recommended, and stands to represent significant potential for the Department to accomplish additional ITS deployment at a reduced cost. Alternative ITS funding in this case is in the form of additional deployment being accomplished at substantially-reduced costs.

Central Texas Turnpike System

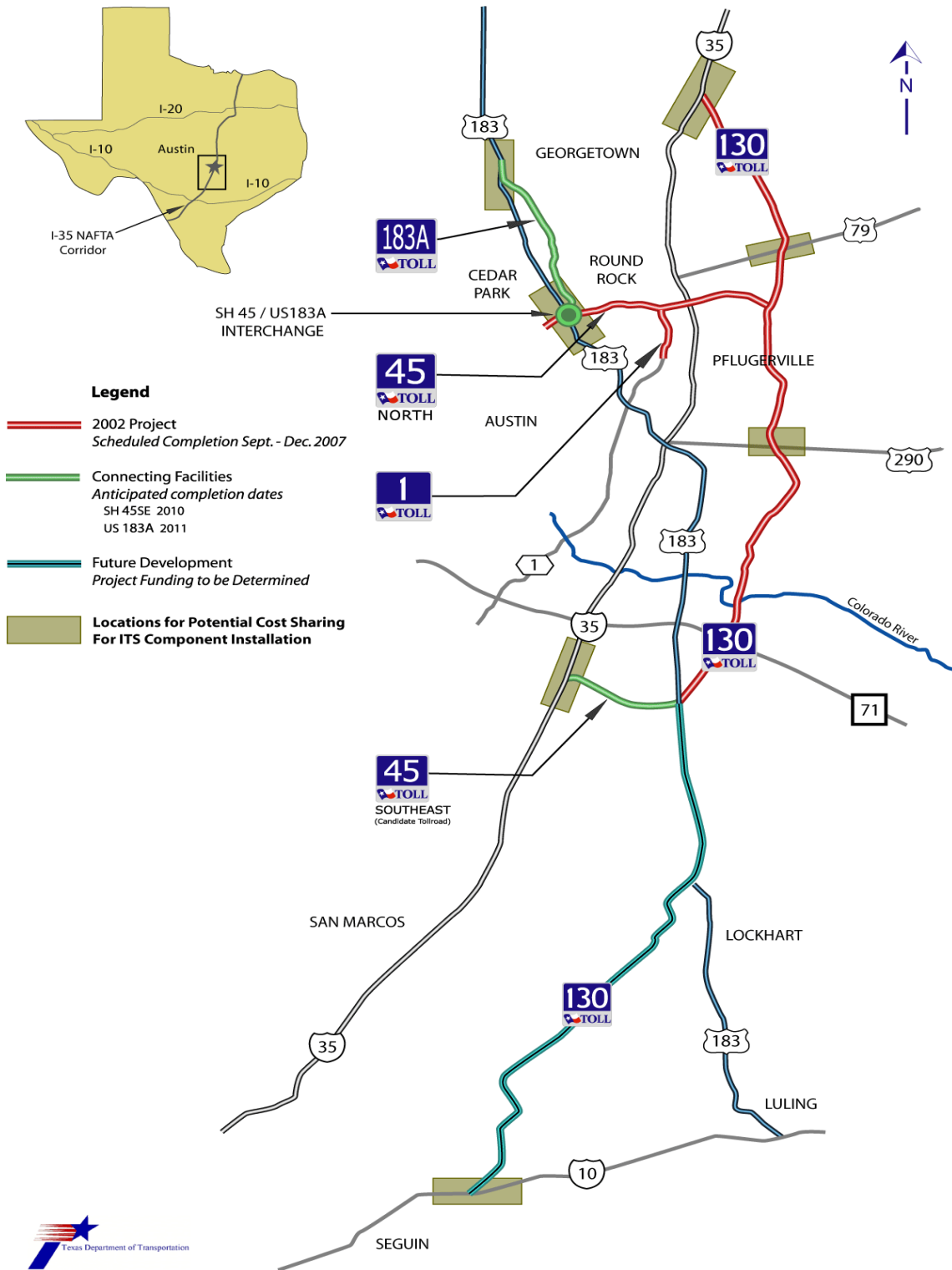


Figure 2. Preliminary Plans for SH 130 Layout and Project Schedule

FEDERAL ITS INITIATIVES

New USDOT ITS Initiatives

In May 2004, the United States Department of Transportation (USDOT) released a plan for new ITS Program major initiatives that entail an emphasis in the following nine (9) focus areas (42:)

1. Integrated Vehicle-Based Safety Systems;
2. Cooperative Intersection Collision Avoidance Systems;
3. Next Generation 9-1-1;
4. Mobility Services for All Americans;
5. Integrated Corridor Management Systems;
6. Nationwide Surface Transportation Weather Observation System;
7. Emergency Transportation Operations;
8. Universal Electronic Freight Manifest; and
9. Vehicle Infrastructure Integration (VII).

While the scope and magnitude of funding that will be allocated to each of these focal areas remains unclear at present, it is likely that such funding for related deployments will be provided in the not-too-distant future. As such, it would be useful for TxDOT to monitor the outcome of these funding outlay decisions and options so as to take full advantage of related federal funding to support ITS deployment in these topic areas. Additional information and continued monitoring of status in these regards can be accomplished online at <http://www.its.gov/press/initiatives4.htm> .

Federal Emphasis on Safety

Each year nearly 43,000 Americans lose their lives in highway crashes. Driver error is cited as the primary cause in about 90 percent of all police-reported crashes involving passenger vehicles, trucks, and buses. More than six million motor vehicle crashes continue to occur on

our highways each year, causing three million police-reported injuries, and costing our economy more than \$230.6 billion per year. Of the over two million vehicle crashes involving injuries that occur every year, approximately 250,000 of these crashes involve life-threatening injuries.

The Intelligent Vehicle Initiative (IVI), first authorized in TEA-21, is a U.S. Department of Transportation program that aims to prevent crashes by helping drivers avoid hazardous mistakes. The Intelligent Vehicle Initiative is a cooperative public-private research program designed to accelerate the development and commercialization of vehicle-based driver assistance products that will warn drivers of dangerous situations, recommend actions, and even assume partial control of vehicles to avoid collisions. Areas of research include forward, rear, and side collision warning systems, automated collision notification systems, lane departure and rollover warning systems. Additionally, the Intelligent Vehicle program has dedicated significant attention to human factors research on the impact of in-vehicle devices on a driver's cognitive abilities.

The National Highway Traffic Safety Administration has estimated that wide-scale deployment of rear-end, lane change, and roadway departure crash avoidance could potentially add up to a reduction in crashes of 1.2 million annually. The wide-scale deployment of these technologies could significantly advance the Federal Highway Administration's stated goal of reducing fatalities and injuries 20 percent by 2008. The next authorization bill should continue and expand the ongoing federal commitment to the Intelligent Vehicle Initiative.

While significant progress has been made in these research areas, more needs to be done. However, research alone will not be enough to encourage commercialization and widespread adoption of potentially life-saving vehicle technologies. Incentives may be required to encourage consumers to purchase proven safety-enhancing intelligent vehicle technologies. As it relates to this research project, this topic area represents an additional item to be monitored closely by TxDOT to assess and leverage any opportunities for ITS funding related to safety.

Rural ITS

Some form of ITS deployment has now been accomplished in the vast majority of “urban areas” in the U.S. As such, in recent years there has been an increased emphasis and federal funding support for ITS deployment in rural areas and/or inter-urban corridors. As part of this research project, the research team and advisory panel collaborated with staff from the Western Transportation Institute (WTI, based at Montana State University) – home of the largest University Transportation Center in the U.S. focused on rural ITS – regarding the current (and expected future) status of rural ITS.

As a result, several useful documents were obtained that are posted on this project’s website (<http://san-antonio.tamu.edu/4451/>). These documents include information on the California-Oregon Advanced Rural Transportation System (COATS) Program, the Montana Total Integrated Emergency Response (TIER) effort, and an excerpt from a recent WTI report that addresses rural ITS funding ideas and approaches.

CHAPTER 5: LONG-TERM STRATEGIES

LEASING AND RELATED FINANCING OPTIONS

Perhaps the most promising long-term strategy for TxDOT in deploying ITS in Texas is that of leasing. This strategy appears to offer several funding advantages (e.g., cost savings) – particularly reductions in lifecycle-related costs associated with quickly-changing technology. This chapter discusses specific strategies and issues related to leasing.

A lease is an agreement between two parties regarding the ownership and use of real and personal property (43, 44). Under a lease, the lessor purchases the property and is the titleholder of the property. The lessee hires the property from the lessor for a payment for a pre-determined time period. The lease is, in essence, a contractual obligation regarding the ownership and use of the property.

Municipal leasing (sometimes called lease-purchase) is a contract that has most of the characteristics found in a standard lease but has three functional differences:

1. The intent is for the lessee to purchase and take title to the equipment at the end of the contract.
2. Lease payments include both principal and interest, with the interest being exempt from federal income taxation to the recipient (which in turn is passed on to the lessee as a lower interest rate).
3. The lease provides for termination for non-appropriation of funds by the government agency.

Commercial leasing (often known as municipal rental) offers similar contract provisions and staggered payments, but title of the equipment resides with the lessor and does not accrue to the lessee at the end of the contract. The interest payments are not exempt from federal income taxation, and therefore, the interest rates are slightly higher than in municipal leases.

Complexities of Leasing in Texas

The Constitution

The major hurdle that any lease has to overcome in Texas is that under the Texas Constitution Article XI §7 “...no debt for any purpose shall ever be incurred in any manner by any city or county unless provision is made, at the time of creating the same, for levying and collecting a sufficient tax to pay the interest thereon and provide at least two per cent as a sinking fund...” The primary question that a local government must then ask at such juncture is what constitutes a debt (45)? The courts have constructed that an obligation that is *not* payable from current revenues (either to hand or reasonably anticipated to be collected during the budget year) is a debt and requires a 2 percent interest and sinking fund (46). The courts have further construed that the repayment of the debt during the current year does not necessarily have to be provided for in the budget at the time the debt is incurred (47). What the courts have held most important at this juncture is that the intent of the parties is such that it was “reasonably” contemplated and anticipated to be repaid *without* the use of future tax revenue (48).

To surmount the constitutional hurdle regarding debt, a lease must include a form of non-appropriation clause within its contents. A non-appropriation clause limits the payment obligation to the lessee’s current operating budget period. A tax-exempt lease-purchase agreement therefore does not constitute a long-term ‘debt’ obligation because of this non-appropriation language. However, traditional commercial leases can be formulated using such language.

Local Government Codes

The Local Government Code provides guidance for Texas governmental agencies regarding purchasing or acquisition of property. According to the Local Government Code Subtitle C Acquisition, Sale or Lease Provisions Applying to More than One Type of Local Government, Chapter 271 Purchasing and Contracting Authority of Municipalities, Counties and Certain Other Local Governments, Subchapter A – Public Property Finance Act (Public Property

Finance Act) §271.005 the governing body of a governmental agency can execute, perform and make payments under a contract for the purchase or other acquisition of any personal property or the ‘financing thereof’ (49, 50, 51). This can be in the form of a lease, a lease with an option or options to purchase, or an installment purchase (52). This, can contain an option or options to renew or extend the term and be made payable from a pledge of all or any part of any revenues, funds or taxes available to the governmental agency for its public purpose (53). The contract may provide for the payment of interest on the unpaid amounts of the contract. However, the net effect of these interest rates cannot exceed the net effective interest rate at which public securities may be issued (54). Such contracts cannot exceed a term of 25 years. Under the Public Property Finance Act, commitment of current revenue is governed by §271.903 (a). Whereby if the contract for the acquisition, including lease of real or personal property, retains to the governing body the continuing right to terminate at the expiration of each budget period of the local government during the term of the contract, and is conditioned on a best efforts attempt by the governing body to obtain and appropriate funds for payment, or contains both the continuing right to terminate and the best effort conditions, then the contract is a commitment of the local government’s current revenues only. Because the Act recognizes the power of the local government to provide for termination of the contract at the end of the budget year, it does not obligate non-current revenues and therefore does not violate the debt provisions under the Texas Constitution.

Under the Public Property Finance Act §271.006, municipalities must also comply with the requirements of Local Government Code Chapter 252 Purchasing and Contracting Authority, and counties must comply with Local Government Code Subchapter C, Chapter 262. Both of these Acts require municipalities and commissioners courts of counties to undertake competitive bidding or competitive proposal systems before entering into contracts.

Under the Local Government Code Title 9 - Public Buildings and Grounds Chapter 203 energy savings performance contracts for local governments can also be undertaken using lease-purchase as a method of financing §302.001(a) (1). The savings that accrue from these contracts can be used to pay for the lease rentals.

Why Lease?

There are many reasons why commercial leases or lease-purchase provide an attractive alternative to outright purchase. Virtually any personal property can be leased, including computers and software, surveillance equipment, heavy equipment, telephone and communications equipment, vehicles and accessories, modular structures and energy management equipment (55). Leasing also proves to be effective for terms under 10 years and less than \$10 million, although leases up to \$20 million have been created. The Equipment Leasing Association (ELA) in its 2004 Report on the Economic Impact of leasing noted that leasing of IT equipment was big business and that half of the \$229 billion additional equipment investment impact due to leasing half was mainly concentrated on computer equipment. The balance, according to the ELA, was made up of industrial equipment categories, including aircraft, transportation and industrial equipment (56). Leasing provides a viable alternative to purchase and allows many industries and companies to spread out IT costs over time, and to position themselves into an IT refresh cycle which is an affordable mechanism to access new technologies.

Commercial Lease Versus Municipal Lease

Notwithstanding the higher costs involved in commercial leases, there are advantages for using this type of contract over a lease-purchase. This type of leasing is eminently suited for agencies that have a limited lifespan or do not wish to own property after a fixed period of time (for example, when a project has a specific life-span). These leases are also well-suited for the acquisition of high-technology equipment that is expensive to purchase, and also is rapidly changing as a consequence of technological advances. Many commercial leases have the option to upgrade equipment and extend for one-year increments at the conclusion of the original lease. The lease can also include an option to purchase with the purchase price being delineated within the contract (57).

Cash-flow and Time Management

Leasing can allow for better time management of cash flow over the short-term and the long-term. It can also free up scarce dollars due to budgetary constraints in cash-strapped times. Leasing payments can be tailored to suit each agency's specific requirements with annual, semi-annual, quarterly or monthly payments. Many leasing companies offer the options of down payments, advance payments and in some cases deferrals. Many leasing programs create a Master Lease (sometimes known as a credit line), which allows multiple draw-downs as and when equipment is required. This master lease also saves money as it does not require separate transactional costs for each draw-down.

Leasing can also provide the opportunity to access new equipment, and technology advances without having to find up-front the large capital outlay that is required for projects. For example, Battle Creek City Commission in Michigan purchased airport snow-clearing equipment on lease-to-own programs in July 2003. The airport operations manager noted that outright purchase was cost prohibitive, but by using a lease-purchase agreement more money could be freed up in the budget each year, and they could access new equipment to replace their 19 year old fleet in a quick turnaround time (58). In most leases the costs of installation and maintenance are included within the payment plan, again saving scarce capital dollars. Most lease purchase agreements also provide the option for early buyout of the lease after the completion of the first year.

Fixed Rate Financing and Time Value of Money

A lease provides fixed rate financing. Interest rates are set at the outset and do not change. This, can give many jurisdictions security in planning operational budgets for the long-term. Leasing also allows an entity to purchase today's equipment using tomorrow's inflated dollars. Typically after the decision is made to use the leasing route access to the equipment is a quick and easy process.

Access to New Technology and Ability to Offset Technical Obsolescence

Leasing allows entities to access new technology, and in some instances to upgrade to newer technology throughout the duration of the lease. Leasing allows a local jurisdiction to stay abreast of new technologies and manage obsolescence in equipment in a more effective and efficient manner (59).

Lease versus Bond

While leasing costs might, at first blush, be more expensive than outright purchase costs, studies have shown that in some instances, the savings that accrue due to quicker access to equipment outweigh the savings in a bond issuance. Zabler and Hatcher argue that there are two factors that must be considered in addition to a lower interest rate: (1) the total borrowing costs and (2) the costs of delay, before determining the ‘best’ financing rate (60). Total borrowing costs include the administrative costs and fees that surround a bond issuance, along with the ongoing costs including trustee fees, compliance reports, footnote disclosure and other audit fees and the periodic ratings and reviews that are required by rating agencies such as Standard & Poor and Moodys. Once these costs are run alongside the interest costs for municipal and commercial leases, leasing provides a credible alternative option vis-à-vis total costs. For example, in a study Zabler and Hatcher performed on financing an energy service performance contract they found that the costs of delay were opportunity losses that were “quite real (61).” Zabler and Hatcher looked at a project costing \$1 million with an energy service performance contract that will give a five year simple payback on a blended average life of eight years. They used a discounted net present value basis over 12 years using a 4 percent borrowing rate as the discount rate. As can be seen in Table 3, financing the project would result in a savings of \$132,373 (\$892,524 minus \$760,151) which is better than waiting for one year and paying the cash.

Table 3. Finance Now or Wait for Cash?

<i>Option A - Fast Track Financing</i>					<i>Option B - Waiting for Cash</i>			
Year	Savings \$	Cost \$	Annual Cash Flow \$	Cumulative Cash Flow \$	Savings \$	Cost \$	Annual Cash Flow \$	Cumulative Cash Flow \$
1	200,000	(164,026)	35,974	35,974	0	0	0	0
2	200,000	(164,026)	35,974	71,949	200,000	(1,000,000)	(800,000)	(800,000)
3	200,000	(164,026)	35,974	107,923	200,000	0	200,000	(600,000)
4	200,000	(164,026)	35,974	143,897	200,000	0	200,000	(400,000)
5	200,000	(164,026)	35,974	179,872	200,000	0	200,000	(200,000)
6	200,000	(164,026)	35,974	215,846	200,000	0	200,000	0
7	200,000	(164,026)	35,974	251,820	200,000	0	200,000	200,000
8	200,000	0	200,000	451,820	200,000	0	200,000	400,000
9		0	200,000	651,820	200,000	0	200,000	600,000
10		0	200,000	851,820	200,000	0	200,000	800,000
11		0	200,000	1,051,820	200,000	0	200,000	1,000,000
12		0	200,000	1,251,820	200,000	0	200,000	1,200,000
	Net Present Value – Option A			892,524	Net Present Value – Option B			760,151

Source: Zabler, N. and Hatcher, K. "Financing Energy Efficiency Projects." *Government Finance Review*. Vol. 19. No 1 (February 2003)

Bond issuance also restricts future bond issuances because of covenant options limiting the amount of bonds that can be issued. Also because the rating of local agencies for bond issuance is related to the issuance of debt, and the payback provisions more issuances can lead to a downgrade in rating which, in turn, affects interest rates for bonds. Each bond issuance also costs money, whereas a master-lease provision allows for multiple draw-downs with no extant costs being incurred. Leasing may help to keep future bond alternatives open. Bond terms can also exceed the life of equipment therefore one is paying for equipment that may be obsolete or unusable.

Leasing also offers other non financial advantages. Voter approval isn't required to lease equipment (which also incurs further costs because bond issuances require an election and advertising). Leasing also deflates the political fallout that accrues from voters rejecting a proposal.

Lease Industry Concerns

While the risk of non-appropriation might appear to be an area of concern for financiers and leasing industries, the chances of non-appropriation are considered to be ‘slim’ by industry analysts. Baystone Financial Group, for example, notes that the risk of non-appropriation, while a valid and real concern for any lender, is statistically speaking very small. They suggest that non- appropriation percentages of less than ¼ of 1 percent of leases would be a reasonable ball-park figure (62). According to Baystone the risk of non-appropriation dramatically increases as the dollar size of the deal decreases. Their reasoning for this anomaly is that smaller transactions are not as well scrutinized as their larger counterparts.

Leasing of ITS Components

In many ways ITS equipment lends itself to leasing. Right-of-Way (ROW), information technology and telecommunications equipment are all elements that could be financed through municipal and/or commercial leases. This is because financing these ITS components is both expensive and requires technology that is continually evolving and improving. Leasing can provide a local jurisdiction with the opportunity to test out expensive ITS equipment before committing to a purchasing regime. Right-of-Way can also be donated by local jurisdictions for telecommunication purposes and can earn revenue for the local jurisdiction.

Rockland County, NY

An aging communications tower required repairs. The Fire and Emergency Services coordinator found a creative way to finance this project and increase revenue capacity. The tower was built by a communications provider who then leased space on the tower to enhance its own service area. Over 25 years this company will pay \$875,020.52 in dues to the county. The county is able to lease or rent the remaining space and keep 100 percent of the revenue.

CHART II – Maryland

Maryland State Highway Administration's Chesapeake Highway Advisories for Routing Traffic used a combination lease/own option to upgrade this system. They opted to not build a fully owned private fiber optic network because it was cheaper to lease telecommunications space from a local provider. Maryland hired a systems integration firm to provide cost-benefit analysis and systems advice. By choosing this route Maryland saved \$72 million. The consultants also advised that leases should not be longer than three years to provide Maryland with options to upgrade to new equipment and avoid obsolescence in broad-band and bit-streaming technology. It also provided options to lease or purchase new telecommunications' networks once de-regulation of the industry had occurred. By choosing a less expensive network option the consultant's argued that Maryland could create an ITS program that would devote more of its budget to ITS functions, (more coverage area, more service units being deployed) and make the program more effective.

Using Solar-Powered Equipment in Rural Areas

New solar-powered equipment is being developed all the time. CCTV, mobile technology, rural road traffic data collection systems and signage (both temporary and permanent) can all be run using solar-powered technology. In rural areas this proves to be invaluable as the equipment does not need to be hooked up to electricity supplies, which can be highly expensive.

Solar Powered Cameras in New Mexico using Private Public Partnerships

A public private partnership was formed between New Mexico's State Highway Department and Verizon Wireless Daly Gedanic to provide real-time images showing weather conditions on I-25 between Santa Fe and Albuquerque. The images are transmitted using high-speed wireless network technology and are available on the DOH website. The camera is mounted on a self-contained, solar powered traffic communications platform known as a smart zone.

Energy-Efficiency Projects and Municipal Leasing

Energy service performance contracts and municipal leasing is another option that local jurisdictions might consider for implementing their ITS projects. Many public agencies have turned to performance contracting when their capital budgets are reduced. Under these contracts, which are only applicable to real property, energy service provision companies upgrade or equip

buildings with energy savings equipment. These upgrades will save utility costs and create water savings. These savings, in turn, finance the projects.

These types of contracts could be used to fund Traffic Management Centers upgrades, or upgrades of existing buildings that will house the ITS equipment. Using this route could save capital budget monies, reduce utility bills, and free up capital in the capital budget so that more ITS equipment could be purchased over the long-run.

Texas actively encourages the use of such contracting to save energy. Local Government Code Title 9 - Public Buildings and Grounds Chapter 203 §302.001(a) (1) energy savings performance contracts for local governments governs the use of lease-purchase as a method of financing. The State Energy Conservation office provides information and guidance for local jurisdictions who wish to undertake these projects.

Leasing in the United Kingdom

Leasing is widely used by local jurisdictions in the United Kingdom (UK) to finance acquisition of equipment. For example, the UK's Finance and Leasing Association figures show that 9 out of 10 local authorities acquire CCTV using leases. Leases in the UK offer a multitude of options, sale and leaseback, operating leases, buyback, upgrade and maintenance leases. Some include options that front or back-load the rental stream (peppercorn agreements). The most popular lease for local authorities is an operating lease. Under this lease, the lessor retains a large residual value in the asset and do not usually turn a profit until the equipment is re-leased or sold (which in turn allows them to deduct 25% as a depreciating asset for tax purposes). This in turn means that the rental stream is lower as a consequence of the ability to use the tax write-off.

Leasing is popular for local authorities because they are limited in the amount of capital expenditure outlays they can undertake (unlike their US counterparts). However, local authorities are able to borrow money – or use credit arrangements to facilitate their business. (Local Government Act 2003, and Statutory Instrument 1997 No. 319 The Local Authorities (Capital Finance) Regulations 1997). Under this legislation local authorities are given wide latitude/prescription to use the best mechanism available in order to undertake their statutory duties while adhering to best value precepts and outcome targets. This is where leasing provides value for money because it frees up capital funds for other projects and provides access to new technology and up-to-date equipment, which in-turn leads to cost savings and energy and manpower efficiencies.

Leasing firms in the UK set up Master-Lease agreements with large credit lines (often up to £1 million) and the authorities lease the equipment they need from vending machines, photocopiers, trash disposal units, pay and display machines, gas/electric heating equipment, crematoria, to IT and ITS equipment.

OPTIONS FOR CREATING NEW REVENUE

Subscription Services

With an increasing abundance of data related to transportation system operations, there are many value-added opportunities to possibly create new funding streams for ITS. Using efficient archiving, processing and reporting, the data can be turned into useful information. The generation of valuable reports provides the basis for selling these reports. The paragraphs below present several different ways in which this can occur.

Commercial Vehicle Subscription Information – Fleet Application

All commercial vehicle operators are in need of good information to conduct their operations profitably. Whether it is a truck or a bus, a significant delay due to congestion or an incident on a road can be very costly. In the cases where there are commodities being moved that are time sensitive, the result of being delayed can be disastrous. For example, produce that arrives at the market past its “fresh” time cannot be accepted. A critical electronic part that misses an airplane connection so a computer system cannot be repaired overnight could cost the IT Company a contract (63).

With just-in-time deliveries still prevalent in many manufacturing segments, a delay can shut down a factory, leaving hundreds of workers without supplies to do their jobs. These situations create an opportunity for the use of ITS data via a subscription service.

As the extent of coverage by cameras and detectors increases, and as vehicles or cell phones are used as probes, there is an increasing wealth of information that can be created that has great value to commercial vehicle operators. The collection of data on both traffic and weather can be processed and sold to these fleet operators in customized form to enable them to do a better job running their businesses.

For example, a trucking company can subscribe to a service where they identify the links in the network that are of most importance to them, or the area that is critical to their movements. Any time there is a report on that link, whether it is construction, an incident, congestion, bad weather, etc., the dispatcher or the driver would receive a notice by the delivery method of choice. In addition, when the system is sufficiently robust, alternate routes can be presented for their consideration and use.

There are variations on this deployment that could also be cost-beneficial to pursue. For example, the current approach is to provide information to a dispatcher. With the proliferation of devices such as wireless handheld computers, more detailed information can be sent to individuals than in the past.

Another possibility could tie in with the Texas kiosk program where there could be a special “dial-in” for registered users to get more detailed information than the average traveler. At rest areas or weigh stations there can be kiosks with general information for the motoring public but customized information for commercial vehicle operators.

Route Information for Cell Phone Subscribers – Cell Service Providers

Cell phone companies are always looking for ways to gain market share. Information is one of those value-added items that can help them to provide services that attract customers. The data collected by TxDOT can be licensed to the providers in raw form for their processing and provision to customers. It is also feasible that if TxDOT were processing the information in a fashion that has commercial value, it could be licensed at a higher fee.

Another approach could be to form a partnership so the provider is given the raw data and provides processed information back to TxDOT. If the processing were previously handled by DOT, the cost savings could be viewed as another form of “innovative funding” as the dollars freed up could be spent on other tasks.

A key component in all of this is the abundance of timely and quality data; TxDOT could also take the approach of allowing limited private entities to place sensors in the rights-of-way to relieve some of that burden from the DOT. The data would be simultaneously provided to both entities and the maintenance cost of the technology could be defrayed by assigning that responsibility to the private sector.

City of Greensboro, NC has a program of co-locating cell towers on city property or co-locating antennas on city-owned towers. Leases require substantial upfront payment of fees to defray construction cost. After that, the on-going fees are a revenue stream for the city. TxDOT has a significant resource in buildings and land where towers could be located (or co-located). In addition to upfront fees, transmission opportunities for TxDOT data could be negotiated in the arrangement.

Data Exchange

Trichord, Inc., is one of three companies that has an arrangement with Virginia DOT. They are permitted to place detectors in the right-of-way at no direct charge to them. In exchange, VDOT receives the data from the detectors at no direct charge. VDOT also has agreements with six companies to use the data and provide it to the public via various mechanisms. Trichord currently has more than 22,000 commuters using their information and believe that represents only a 1% market penetration; this was achieved in eight months of operation (64).

Airsage, based in Duluth, Georgia, has a product based on cell phone tracking. These data could be another source for a partnership with the DOT. Sanitized data can be used to defray select data collection efforts. Planning departments can “purchase” these data by transferring dollars internally and help fund the processing of the data.

In Rhode Island there was a plan to allow the telecom companies to use some of the fibers in the network and charge them on the basis of the number used. Other states were looking into this model.

ITIS Holdings PLC sells traffic information in the United Kingdom and has their business segmented to address specific needs. The four areas were created to achieve a sustainable business model and include:

- Automotive Industry for dynamic navigation systems
- Department of Transport for understand traffic patterns
- Mobile telephone companies for “premium services” similar to 511 and traffic information
- Logistics industry for better distribution plans

Some of the partners include the Automobile Association and a national radio system. The licensing rights were won by ITIS in an auction where the government is paid a fee for the bandwidth and a percentage of the revenues generated (65).

Traffic Reporters and Websites

Ontario, Canada charges news organizations a start-up fee and a monthly fee for camera links. The monthly fee covers the costs of having additional staff to maintain equipment and provide timely responses to minimize outages.

Anne Arundel County, Maryland has an arrangement with the cable television providers to use their cable to transmit government data. In return, the County provided contracting for construction, plan management, communications management and program content management.

The State of Georgia created an authority called GeorgiaNet Authority to sell State information. Web applications are developed and individuals or organizations can subscribe. For example, they have one application called “Lobbyist in a Box” and users are charged a \$50 annual fee. This and other applications have generated approximately \$15 million annually.

Naming Rights, Sponsorships, Royalties 511 charges

Virginia DOT was examining selling the naming rights for major interchanges in a manner similar to baseball stadium. This did not progress past the concept stage but may have some possibilities in Texas. Maryland Transportation Authority (the toll authority) has been working with large companies to establish toll free weekends on the Bay Bridges. The only such event has been sponsored by the Lottery Authority, but MTA continues to this concept.

The State of Massachusetts needed a new revenue management system, but the cost was more than could be afforded. They allowed the developer to retain rights to the application and to license to others for a royalty fee, those helping to pay for initial development. They leveraged \$3.3 million to obtain a \$4.5 million solution. Large ITS applications could fall into the same arena as well as some of the management software that is developed for these programs. West Virginia passed a statute to surcharge cellular phones to establish 911 services. The revenues are sent back to the Counties based on population. Direct access to the Field Service dispatchers could become a service like this, funded by a similar surcharge.

Other Possibilities

Miami-Dade

South Florida ATIS and ATMS upgrades were needed but there were insufficient public sector funds readily available. The information has great value for tourists. A creative source being examined comes from private funding from tourism and the hospitality industry. It is to their advantage to provide good information so that tourists can move more quickly and easily, get to their destinations and begin spending money.

Inter-Agency Partnerships

In Minnesota, the DOT needed more infrastructure to support their ITS operations. However, the cost was more than could be justified. At the same time, the State Department of

Administration was looking for ways to improve statewide telecommunications. The need was addressed by a unique partnership among the two State departments and a private provider. 20% of the capacity of the fiber backbone is assigned to the State and 80% to the telecom providers. “Connecting Minnesota” won an award in 1999 for this successful project (66).

Military Applications

Using GPS as an example, the possible military applications for ITS data should be explored. There was a need for better positioning information for military operations and so GPS was born and fine-tuned; now it is readily and generally available for many other uses. With the quality of the data improving regularly and the need to manage an ever more precious resource of military personnel and equipment, the identification and development of military applications could provide a funding stream through Homeland Security avenues.

NAFTA TRANSPORTATION CORRIDORS AND RELATED ITS STRATEGIES

The dramatic growth in trade between the United States and Mexico, from around \$10 billion in 1977 to \$233 billion in 2001, has focused attention on the potential impacts of this trade on the Texas transportation system. A number of research reports have been sponsored by TxDOT since NAFTA was signed in 1992 (67,68,69,70,71), although none have specifically addressed the benefits of a unified ITS system along the transportation corridors carrying this trade.

Historically, modal use has been dominated by truck flows. Recently, air and rail have increased their modal shares. However, truck use remains the dominant mode for moving this traffic, despite the long length of many of the routes. In 2001, trucks carried an estimated 77 percent of total U.S.-Mexico NAFTA exports and 68 percent of total imports (72).

Large U.S. trucking corporations are driven by the need to make adequate financial returns and are therefore open to any undertaking that will lower costs and improve efficiency. If a unified ITS strategy can be developed, which enables users to capture additional financial

benefits, then ITS implementation along the NAFTA transportation corridors may be financially feasible through user fees.

Identifying NAFTA Trade Corridors in Texas

Texas-Mexico trade crosses at over 20 sites along the 1,220-mile border but is concentrated at the eight major ports of entry highlighted in Figure 2. As it pertains to trucking, by value, accounts for \$59 billion at Laredo, \$38 billion at El Paso, \$15 billion at McAllen, \$11 billion at Brownsville and \$4 billion at Eagle Pass.

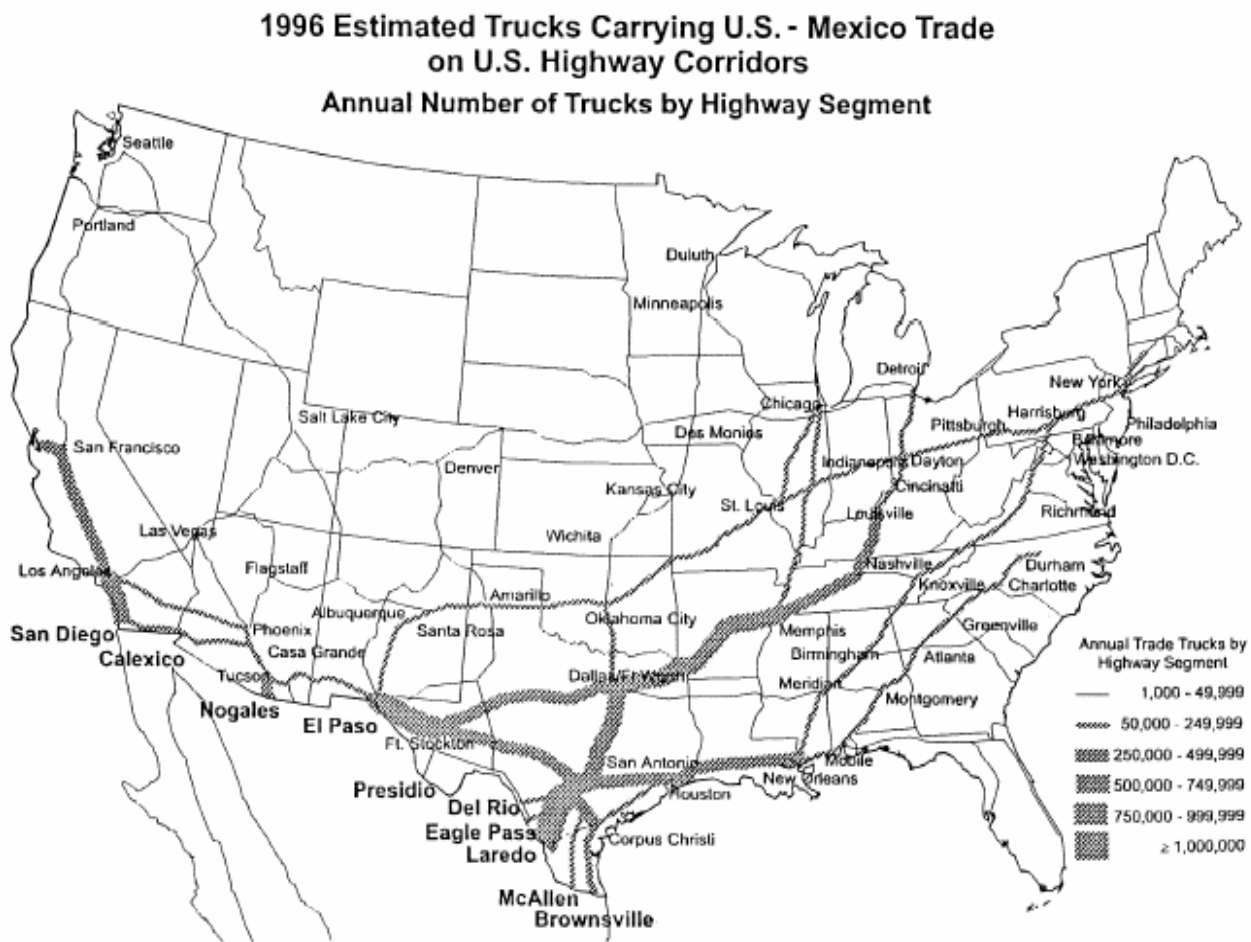


Figure 3. Dominant U.S.-Mexico Highway Trade Corridors.

Over 70 percent of the U.S.-Mexico trade (by value) transported by truck entered the US at a Texas border port of entry in 2001. Since over 50% of this trade flows through the state it results in well-defined transportation corridors in Texas. The location of these corridors is determined largely by the geographical locations of population, manufacturing, and the interstate highways connecting to the main border ports.

John McCray was the first to develop an approach identifying these regional corridors, termed “rivers of trade” (73), and [Figure 2](#) gives the estimated truck corridors carrying U.S.-Mexican trade. Updates to this work have largely confirmed the composition of the NAFTA transportation corridors in the state (74,75).

Clearly, the information collected at federal and state levels at the border should be part of an ITS system. This information is beneficial to a range of entities in the U.S., both at the border and within the state. At the border level, the beneficiaries include brokers, cities, and traffic planners who could develop a greater understanding of the truck flows through the jurisdiction. As the commodities move along the corridor the beneficiaries include the shippers, the transportation companies moving the product, and the ultimate customer who is able to adjust production and marketing schedules to fit the transportation flows along the corridors.

When ITS technologies are being evaluated for economic feasibility, their costs are compared to the benefits that arise from implementation. Typically these cost-benefit calculations are highly site specific and involve only those most directly involved, notably the entity undertaking the investment and the transportation users impacted by the new technology. Evaluation of a unified intelligent transportation system (ITS) suggests something more complex and requires examination of the systemic impact of individual investments in technology and the synergies of those impacted within the transportation system. Border technological evaluations almost been non-systemic, that is they are confined within the physical limits of the port and are rarely, if ever, bi-national in scope. This is clearly limiting, given the growth in logistics, the globalization in trade, and the length of the supply chain in which commodities are shipped, all of which suggests that a broader approach should be adopted.

In general, investments at the border are treated wholly within the confines of federal and state facilities where the technologies are to be located. In order for it to be financially feasible, a unified ITS corridor evaluation requires an economic treatment that recognizes the system rather than an individual technical component located at a specific site.

Benefits of a Unified NAFTA ITS Strategy

As the benefits of a unified strategy are considered with NAFTA transportation corridors in Texas in mind, two groups can be identified. This case study therefore addresses these two groups, first what may be generally known (for example at the TxDOT commission level) and the second group which may be less obvious and not known. While those intimately connected with the feasibility and implementation of state ITS programs know their value in great detail, it is important to recognize that those persons making decisions about ITS deployment may be unaware of many of the benefits related to its implementation. Details of both groups are now identified.

What Is Known:

1. ITS helps make the NAFTA corridors special and maintains a high level of service to users through information sharing (traffic, accidents, and weather).
2. Connectivity between MPO-based ITS projects like TransGuide creates a single system of operating data for the corridor that can be used for real-time decision making and longer-term TxDOT planning decisions (like maintenance).
3. Standardization of ITS lowers system costs through purchasing economies of scale in purchasing.
4. For Mexican trucks crossing into Texas, carrying border data from U.S. Customs and DPS sites along the corridor enhances safety, security, and may expedite their progress across state lines.

What Is Less Obvious:

1. A unified strategy provides ease of use—one pass for all—and the promise of scale economics.
2. Users may access corridor flow information for driver/fleet instructions. They can be charged for this access as long as the benefits exceed the fee structure and may this encourage user (freight) participation in ITS deployment.
3. The unified strategy can link with the emerging current federal corridor ITS initiatives—like CVISN.
4. A unified strategy may impact the sighting of new freight distribution centers on the corridor like Alliance, Fort Worth.
5. A unified freight database will be created over time and can be accessed by TxDOT and Federal authorities in order to improve freight forecasting and transportation planning models, saving TxDOT substantial amounts of money currently spent in data collection and consultant fees.

Funding Sources

No obvious source of funding exists for ITS and NAFTA corridors, although two categories of funding may develop in the future. The First relates to the federal *Borders and Corridors* program which has gone through two iterations. The first, under President Clinton, provided few funds to Texas, while the second, under President Bush, gave \$48 million to Texas for the construction of eight border truck inspection stations. An integrated ITS-NAFTA corridor system might be a strong candidate for funding at the next allocation, given that NAFTA trucking benefits a wide range of trucking companies based in many states.

The second relates to opportunities for credentialing trucks entering the U.S. from Mexico, whether domiciled in either country. The USDOT is attempting to strengthen its ITS programs and make them tie in to improved security as well as safety. This activity would do both but might require TxDOT to undertake some lobbying in Washington, D.C. As the program for securing incoming international freight takes shape over the next five years, it is likely that

HSA requirements on shippers will permit a credentialing system to be implemented without additional information being collected. Safety inspections of all types on all trucks that crossed U.S. land borders and are stopped as they travel across the various state highway corridors to regional markets would then be made more efficient through the ability to identify when and where trucks entered the U.S., their safety status and what commodity category they were carrying.

Trans-Texas Corridor and the Use of Intelligent Transportation Systems

In 2002, Governor Perry announced the Trans-Texas Corridor (TTC) as his vision for the future of transportation in Texas. The proposal involved a 4000-mile multimodal network highway, rail-freight, high-speed passenger rail, and space for utilities. The stated benefits of the system centered on (a) relieving the congestion on the current highway system, (b) providing safer, faster, and more sustainable transportation alternatives to meet 21st Century passenger and freight demands and (c) reducing air pollution through the use of higher performance transportation systems. The Texas Department of Transportation (TxDOT) was given the responsibility of developing the initial concept and after an approximate three-month period involving several internal groups, a report summarizing its findings was released. [Figure 4](#) illustrates the results. (76).

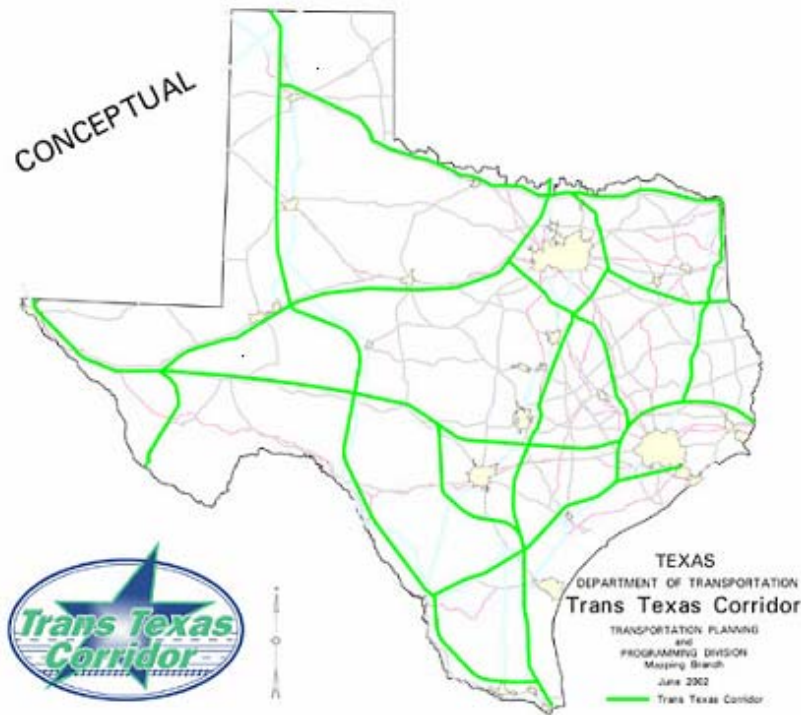


Figure 4. Conceptual Illustration of Tran-Texas Corridors

Four corridors were identified as priority segments of the TTC. These comprised corridors paralleled to I-35, I-37, and the proposed I-69 from Dennison to the Rio Grande Valley, the proposed I-69 from Texarkana to Houston and then Laredo, I-45 from Dallas/Fort Worth to Houston, and I-10 from El Paso to Orange. Critical to the success of the TTC was the appeal to private entities to form public-private partnerships in order to build the system in various stages. In 2001, the 77th Legislature provided several new financial tools to help meet Texas transportation needs. Some that might provide funding for the TTC might include exclusive developmental agreements, toll equities, Regional Mobility Authorities, the Texas Mobility Fund and provisions from the Federal Transportation Infrastructure Legislature related to high-speed rail.

More recently, efforts have focused on attempting to begin the process of moving the TTC towards the award of the first contracts and the building of initial segments. First there have been substantial developments within TxDOT to address the TTC project. In August 2002, a Trans-Texas office was formed to oversee the developments of the TTC. Efforts to strengthen

and market Regional Mobility Authorities also began at that time. Work also continued to market and accept proposals for the initial priority TTC segments and to reach out to the public and stakeholders to explain in greater detail the concept of the TTC and the potential benefits to the state. A research project was let on issues related to right-of-way acquisition for corridor segments (77). In the most recent 78th legislative sessions, important changes were made which empowered TxDOT to promote the TTC. The range of these can be found in the legislation (78) and also on the state DOTs website (79).

With regard to the TTC, it must be recognized that the concept remains visionary without a clear understanding of how it will function and produce actual transportation investments. At the moment, the largest rail companies are not particularly interested in the proposal, and the initial requirement for ROW acquisition is also proving problematic. Clearly if the TTC is to succeed it will do so by moving in stages, perhaps first concentrating on individual modes across key origin destinations and lanes. These are likely to be elements of the overall structure recommended in the initial TxDOT summary report.

The first beneficiary will be highways, and it is likely that TTC segments will hold land available in some form for rail and utilities. One of the forms that highway design might take is to offer a separate truck facility where trucks are allowed to operate at higher than current state size and weight laws. As an example, the trucking industry is currently standardized on 5-axle, 80,000 lb, 53-foot semi-trailer rigs. An obvious financial incentive would be to allow truckers on the segregated truck lanes to operate double 53-foot trailers pulled by a single tractor. This option will offer substantial savings to the shippers and reduce emissions on a per ton basis.

These larger vehicles, sometimes termed Longer Combination Vehicles (LCVs) have been promoted by truckers for well over a decade. They are permitted in certain Western states but not within Texas. One negative aspect of the LCVs related to safety. Those arguing against their operation cite the dangers from mixing light automobile traffic with heavy vehicles. However, segregating the vehicles on the TTC should remove this issue. Concerns over safety will remain, but ITS in its various forms has a valuable role to play. ITS will make the TTC different from the current Interstate highway system. Drivers will be informed more efficiently

from a variety of sources, including what we could term conventional ITS infrastructure. As innovation within ITS continues we should see this reflected on the ITS offered on TTC segments to maintain high levels of service, which justify the tolls placed by the highway operators.

The critical question to be answered in this project is that of funding sources. With regard to the TTC, the research team feels that funding is simply not an issue. The ITS system placed on the TTC would be paid wholly by the companies building and operating the facilities. There is one important issue that needs to be recognized by the Texas ITS staff and that relates to the compatibility between the ITS systems selected for TTC and (a) the segments of the TTC and equally as important (b) the cities which are impacted by the TTC. As a simple example, any ITS system chosen on a TTC segment from Laredo to San Antonio would need to be compatible with the current ITS systems installed in both cities so that information on the whole trip may be shared with drivers. At this stage of the work, we therefore recommend that the ITS group within TxDOT develop appropriate protocols that will enable the chosen TTC system to link with the city ITS systems along the TTC alignments.

HOMELAND SECURITY/EVACUATIONS

The tragic events of September 11, 2001, have made several things clear about America's surface transportation system. First, despite devastating attacks, the national surface transportation system was not seriously disrupted for an extended period of time. Second, the characteristics of the transportation system that we strive for – to be open, accessible, free-flowing and convenient – can leave us vulnerable to deliberate disruptions. Third, and most important, existing ITS capabilities served in both the response to and the recovery from the terrorist acts, many of which were in support of other agencies involved in public safety and relief efforts. Finally, ITS has wide applicability in future efforts to anticipate, deter, and respond to terrorist acts and other disasters.

The same ITS technologies in use today to manage traffic flows and mitigate congestion can be adapted to make the infrastructure and the traveler more secure. Some of these

technologies include smart cards, biometrics identifiers, automatic vehicle location, map databases, video, motion, and infrared detection and surveillance, vehicle classification sensors, weigh-in-motion technology, and geo-location and routing technologies to track the movement and behavior of vehicles, particularly commercial and transit vehicles. Technologies exist to identify vehicle contents, particularly hazardous substances, explosives, and drugs, without opening the vehicle. Technology is available to match a specific commercial vehicle with a specific operator and a specific cargo and to notify authorities and prevent or halt travel in case of a mismatch. Simply doing better surveillance has deterrence value. Furthermore, if an attack does occur, many of the sensor, communication, and analysis technologies used today to better manage travel and transportation can be adapted to assess damage and facilitate recovery, evacuate, and quarantine.

Today, ITS traffic management systems nationwide are linked with public safety agencies, such as police, fire, and rescue. Many ITS traffic operations centers are already integrated with public safety agencies to provide coordination for responding to incidents on our roads. In the event of a disaster, ITS systems can provide an interoperable communications link between public safety community and traffic operations centers, facilitating coordinated disaster response.

Current technologies include vehicle probe data, advanced signal systems, signal priority and preemption systems, moveable lane barriers, dynamic message signs, incident detection systems, mayday systems, and public safety response systems. Traffic management centers, fleet dispatch centers, and telematics services perform portions of this function today. Communications devices available to truck and transit drivers and operators may also be employed to report suspicious activity. At the same time, the ITS industry must diligently continue to expand and refine ITS capabilities, interact constructively with other fields (e.g., aerial surveillance), and continue to provide new tools for building relationships among stakeholders and providing them with the tools they need to operate effectively.

Altogether, ITS can help provide a transportation system that is more secure, better able to respond to crises of any kind, and well-equipped to aid and support the many agencies, both

within and outside the transportation arena, involved in all aspects of security (Table 4). While most of the homeland security-related funding to date has been directed toward airports and first responders (the latter being primarily for equipment and training), funds are also now being dispersed to the water ports for deploying new technology that will enhance security. It is anticipated that more special funding and/or grants will eventually be available for the traditional highway infrastructure as well, some of which will likely be directed toward ITS technologies. A good tool and source of information on this topic is the ITS America website, which can be accessed at <http://www.itsa.org/homeland.html> .

The noted link has regular updates of ITS homeland security-related items, grant announcements, etc. Monitoring of this site (and others) and the preparation of proposals for ITS deployments targeted at addressing homeland security needs would be a good course of action for TxDOT. Proposals directed at “multiple uses” of ITS technology, such as deployments in areas and/or along corridors that experience recurrent congestion or major non-recurring demands on the roadway network (e.g., the I-37 or I-45 corridors during hurricane evacuations) would likely be attractive deployment projects to USDOT.

Table 4. ITS Capabilities for Homeland Security.

Preparedness	<ul style="list-style-type: none"> • Data and tools for analyzing the transportation system, identifying vulnerabilities and to plan in advance for contingencies by conducting “what-if” analyses under various scenarios. • Tools and technology to facilitate communication and coordination among transportation agencies and between transportation agencies and other stakeholders including response agencies and the general public. • Basis and framework for training and testing for emergency situations.
Prevention	<ul style="list-style-type: none"> • Sensors and analysis capabilities to detect and head off threats along roads and rails, at transportation centers (depots and operations/management centers), and for other portions of the infrastructure (bridges, tunnels). • Capabilities to guard against misuse of commercial vehicles and halt deviating vehicles. • Analogous capabilities for transit and rail, including continuous surveillance of the road/rail infrastructure against tampering or misuse.
Protection	<ul style="list-style-type: none"> • Tools and technology for on-site detection and response to potential threats to facilities and systems. • Tools and technology for hardening and coordinating transportation-related communications and information systems. • Tools and technology for establishing and activating alternate routes in times of emergency for vital personnel and materials, and escape/evacuation routes. • Tools and technology to increase the ability of other agencies to undertake protection activities.
Response	<ul style="list-style-type: none"> • An architectural framework and technologies to maintain communications and facilitate coordination among responding agencies. • Tools and technology for determining and disseminating accurate, up-to-date information about the state of the transportation system both to responders and to the general public. • The ability to provide information about the status and location of vehicles carrying hazardous materials in the vicinity of a crisis scene. • Tools and technology for rerouting traffic when the system is impaired or under attack.
Recovery	<ul style="list-style-type: none"> • Tools and technology to create a flexible, reconfigurable transportation system to meet emergency needs. • Enhanced ability to execute plans for alternative modes/alternative routes in emergency situations. • Tools and technology to make maximum use of available capacity through load balancing.

CHAPTER 6: CONCLUSIONS AND KEY ACTION ITEMS

The current state of affairs for ITS deployment in Texas is precarious. On the heels of decreased federal funding support for major urban deployments and large-scale model deployments (from which Texas has benefited greatly in recent years) comes a new transportation project funding process for the State of Texas. While this new process is streamlined and more straightforward in certain respects, the net near-term impact on ITS deployment in Texas will likely be detrimental, as the new process consolidates ITS into categories against which it must compete with other more traditional transportation improvements associated with construction and maintenance activities.

A review of practices in other states with regard to how ITS is funded revealed that several other states – namely California, Colorado, Florida, Michigan and Washington – provide special funding categories (and funds) and/or otherwise emphasize the importance of ITS deployment, operations and maintenance. It is for these reasons that key action item number one is for TxDOT to give serious consideration to modifying the new funding process so as to more clearly prioritize the continued deployment and maintenance of ITS in Texas and build upon the many successes in recent years. It is believed that such an approach will lead to a more successful and consistent ITS Program in Texas.

Aside from the issue of the formal state project funding process, the research team identified numerous opportunities for Texas to enhance ITS deployment and optimize the use of any associated funds that can be attained. The near-term opportunities that appear to show the most promise and should be considered as possible action items include:

1. Collaborate with Florida (and Michigan) regarding ITS software development and other ITS deployment activities associated with the large-scale Florida model deployment occurring at present;

2. Convert DalTrans Software to “open-source” status to facilitate more widespread use, low-cost additional improvements to the software, and consistency for ITS deployments/operations around Texas;
3. Capitalize on opportunities for tax credits and other benefits associated with deployment of energy-efficient ITS equipment;
4. Pursue partnering opportunities associated with new toll road construction that will entail “co-deployment” of ITS in areas where the existing roadway infrastructure and new toll facilities interchange to mutually benefit safety and operations on both roadway systems; and
5. Aggressively pursue federal funds that should be available via USDOT’s new nine (9) ITS initiative focal areas, the federal emphasis on improving safety, and rural ITS deployment.

Additional opportunities that were identified and placed in the category of long-term strategies included:

1. Leasing and related financing options;
2. Deployment strategies and/or partnering projects that would leverage the NAFTA corridor/international trade development activities in Texas; and
3. Proposals and/or approaches of ITS deployment that would address the issue of homeland security – particularly in combination with other regional issues (such as hurricane evacuation) so as to capture multiple benefits from the deployment.

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<http://www.capitol.state.tx.us/statutes/statutes.html>.

49. Which is defined under this statute to include appliances, equipment, facilities and furnishings, or an interest in personal property, whether movable or fixed, considered by the governing body of the governmental agency to be necessary, useful or appropriate to one or more purposes of the governmental agency.

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APPENDIX A

New TxDOT Funding Categories and Descriptions


MAINTAIN IT

CATEGORIES NUMBER AND NAME - DOCUMENT	PROGRAMMING AUTHORITY	USUAL FUNDING	ALLOCATION PROG (Yes/No) RESPONSIBLE ENTITY	RANKING INDEX OR ALLOCATION FORMULA	BRIEF SUMMARY, RESTRICTIONS, ETC
HIGHWAY CONSTRUCTION PROGRAMS					
1 Preventive Maintenance and Rehabilitation SPP	Commission allocation by formula. Allocation program to districts Projects selected by Districts.	Federal 90% State 10% Or Federal 80% State 20% Or 100% State	Yes, Districts	This category was created by consolidating old Categories 2, 3C, 4F, 7, 8A, 10A, 10B, & 14 from the 2002 UTP. The old formulas will continue to be used and the funding amounts consolidated until a new formula can be developed. The old formulas can be found in Exhibit A of the 2002 UTP at: http://www.dot.state.tx.us/moneymatters/moneymatters.htm?pg=utp	Preventive maintenance and rehabilitation of the existing State Highway System. The rehabilitation funds may be used for rehabilitation of the Interstate Highway System main lanes, frontage roads, structures, rehabilitation of signs, pavement markings, striping, etc. The Transportation Planning and Programming Division may approve the use of rehabilitation funds for the construction of interchanges and HOV lanes on the Interstate Highway System. Rehabilitation funds may not be used for the construction of new SOV lanes.
6 Structures Replacement and Rehabilitation SPP	Commission approval. Project-specific Selected statewide based on Texas Eligible Bridge Selection System (TEBSS) and Evaluated statewide by cost- benefit	Federal 80% State 20% Federal 80% State 10% Local 10% Or 100% State	No Commission	Texas Eligible Bridge Selection System (TEBSS) and Vehicle & train traffic, accident rates, vertical clearance, roadway characteristics	Replacement or rehabilitation of eligible bridges on and off the state highway system (functionally obsolete or structurally deficient). Replacement of existing highway-railroad grade crossings, and the rehabilitation or replacement of deficient railroad underpasses on the state highway system. Specific locations evaluated by cost-benefits derived index (benefits such as improved traffic flow, accident/fatality reduction. These funds may be used for preventive maintenance activities on bridges- requires commission approval.

BUILD IT

CATEGORIES NUMBER AND NAME - DOCUMENT	PROGRAMMING AUTHORITY	USUAL FUNDING	ALLOCATION PROG (Yes/No) RESPONSIBLE ENTITY	RANKING INDEX OR ALLOCATION FORMULA	BRIEF SUMMARY, RESTRICTIONS, ETC
HIGHWAY CONSTRUCTION PROGRAMS					
2 Metropolitan Area (TMA) Corridor Projects	Commission approval. Project-specific Corridors selected statewide based on criteria to be determined. Projects scheduled by consensus of districts	Federal 80% State 20% Or 100% State	No Commission	As determined by the commission after considering recommendations of the category work group comprised of TxDOT and its transportation partners. See http://txdotutp.tamu.edu for more information.	Mobility and added capacity projects on major state highway system corridors which serve the mobility needs of the Transportation Management Areas (TMA)- Metropolitan Planning Organizations (MPO) .
3 Urban Area (non-TMA) Corridor Projects SMP	Commission approval. Project-specific Corridors selected statewide based on criteria to be determined. Projects scheduled by consensus of districts	Federal 80% State 20% Or 100% State	No Commission	As determined by the commission after considering recommendations of the category work group comprised of TxDOT and its transportation partners. See http://txdotutp.tamu.edu for more information.	Mobility and added capacity projects on major state highway system corridors which serve the mobility needs of the Urban Areas (non-TMA) MPOs.
4 Statewide Connectivity Corridor Projects SMP	Commission approval. Project-specific Corridors selected statewide based on criteria to be determined. Projects scheduled by consensus of districts	Federal 80% State 20% Or 100% State	No Commission	As determined by the commission after considering recommendations of the category work group comprised of TxDOT and its transportation partners. See http://txdotutp.tamu.edu for more information.	Mobility and added capacity projects on major state highway system corridors serving the mobility needs of statewide connectivity between urban areas and corridors serving mobility needs throughout the state.
5 Congestion Mitigation and Air Quality Improvement SMP	Commission allocation. Allocation based on percent of population in non-attainment Areas. Allocation program to districts. Projects selected by MPO in consultation with TxDOT and Texas Commission on Environmental Quality .	Federal 80% State 20% Or Federal 80% Local 20%	Yes, Districts	Non-attainment area population weighted by air quality severity	Addresses attainment of national ambient air quality standard in the non-attainment areas (currently Dallas-Fort Worth, Houston, Beaumont and El Paso). Funds cannot be used to add capacity for single occupancy vehicles.
7 STP Metropolitan Mobility/ Rehabilitation SMP	Commission allocation. Allocation based on population Allocation program to districts Projects selected by MPO in consultation with TxDOT.	Federal 80% State 20% Or Federal 80% Local 20% Or 100% State	Yes, Districts	Population (2000 Census)	Transportation needs within metropolitan area boundaries with populations of 200,000 or greater. Projects selected by MPOs

BUILD IT

CATEGORIES NUMBER AND NAME - DOCUMENT	PROGRAMMING AUTHORITY	USUAL FUNDING	ALLOCATION PROG (Yes/No) RESPONSIBLE ENTITY	RANKING INDEX OR ALLOCATION FORMULA	BRIEF SUMMARY, RESTRICTIONS, ETC
8 STP Safety - Federal Hazard Elimination Program SMP	Commission allocation. Statewide allocation program Selected statewide by federally mandated safety indices.	Federal 90% State 10% Or 100% State	Yes, Traffic Operations Division	Safety Improvement Index (SII)	Safety related projects - on and off state highway system. Projects are evaluated using three years of accident data, and ranked by Safety Improvement Index.
8 STP Safety - Federal Railroad Signal Safety Program SMP	Commission allocation. Statewide allocation program Selected statewide from prioritized listing.	Federal 90% State 10% Or 100% State	Yes, Traffic Operations Division	Railroad Crossing Index	Installation of automatic railroad warning devices at hazardous railroad crossings on and off state highway system, selected from statewide inventory list which is prioritized by index (# of trains per day, train speed, ADT, type of existing warning device, train-involved accidents within prior five years, etc.
9 STP- Transportation Enhancements SMP	Commission selection and approval. Project-Specific approved by separate Minute Order. Recommended by local governmental entities. Committee review. Selected by commission as outlined in 43 TAC §11.204(c).	Federal 80% State 20% or Federal 80% Local 20%	No	Committee Recommendation	Projects above and beyond what normally is expected for transportation enhancements - twelve general activities as outlined in TEA-21. Projects recommended by local government entities, reviewed and recommended by committee, selected by Texas Transportation Commission.
10 Miscellaneous - State Park Roads SMP	Commission allocation Statewide allocation program Projects selected by Texas Parks and Wildlife Department ( TPWD).	State 100%	Yes, Transportation Planning & Programming Division	None, Selected by TP&WD	Construction and rehabilitation of roadways within or adjacent to state parks, fish hatcheries, etc. subject to Memorandum of Agreement between TxDOT and TPWD. Locations selected and prioritized by TPWD.

BUILD IT

CATEGORIES NUMBER AND NAME - DOCUMENT	PROGRAMMING AUTHORITY	USUAL FUNDING	ALLOCATION PROG (Yes/No) RESPONSIBLE ENTITY	RANKING INDEX OR ALLOCATION FORMULA	BRIEF SUMMARY, RESTRICTIONS, ETC
10 Miscellaneous - Railroad Grade Crossing Replanking Program SMP	Commission allocation. Statewide allocation program Selection based on conditions of riding surface.	State 100%	Yes, Traffic Operations Division	Condition of crossing's riding surface and cost per vehicle using crossing	Replacement of rough railroad crossing surfaces on the state highway system (approximately 140 installations per year statewide). Project selection based on conditions of the riding surface (highway, railroad and drainage) and cost per vehicle using the crossing.
10 Miscellaneous - Railroad Signal Maintenance Program SMP	Commission allocation. Statewide allocation program Contributions to maintain Signals.	State 100%	Yes, Traffic Operations Division	Number of crossings and type of automatic devices present at each.	Contributions to each railroad company based on number of state highway system crossings and type of automatic devices present at each crossing.
10 Miscellaneous - Construction Landscape Programs SMP	Commission allocation by formula. Allocation program to districts Projects selected by districts.	State 100%	Yes, Districts	Varies between programs.	New landscape development projects such as typical right-of-way landscape development, rest area/picnic area landscape development, erosion control and environmental mitigation activities on the state highway system.
10 Miscellaneous (Federal) SMP	<u>Commission approval to Participate.</u> Federal allocations.	Federal 100% Or Federal 80% State 20%	No	None Not Applicable	Federal programs such as Forest Highways, Indian Reservation Highways, Federal Lands Highways, and Ferry Boat Discretionary.

BUILD IT

CATEGORIES NUMBER AND NAME - DOCUMENT	PROGRAMMING AUTHORITY	USUAL FUNDING	ALLOCATION PROG (Yes/No) RESPONSIBLE ENTITY	RANKING INDEX OR ALLOCATION FORMULA	BRIEF SUMMARY, RESTRICTIONS, ETC
<p>11 District Discretionary</p> <p>SMP</p>	<p>Commission allocation by formula. Allocation program to districts Projects selected by districts. Rider 41 to TxDOT's apportionments, minimum \$2.5 million allocation to each TxDOT district.</p>	<p>Federal 80% State 20%, Or Federal 80% Local 20% or State 100%</p>	<p>Yes, Districts</p>	<p>This category was created by consolidating old Categories 4D, 4E, & 11 from the 2002 UTP. The old formulas will continue to be used and the funding amounts consolidated until a new formula can be developed. The old formulas can be found in Exhibit A of the 2002 UTP at</p> <p>http://www.dot.state.tx.us/moneymatters/moneymatters.htm?pg=utp</p>	<p>Miscellaneous projects on the state highway system selected at the district's discretion. A portion of these funds may be used off the state highway system.</p>
<p>12 Strategic Priority SMP</p>	<p>Commission selection. Project-specific</p>	<p>Federal 80% State 20% or State 100%</p>	<p>No</p>	<p>None, Selected by Texas Transportation Commission</p>	<p>Commission selected projects which promote economic development, provide system continuity with adjoining states and Mexico, increase efficiency on military deployment routes, or address other strategic needs as determined by the commission.</p>

APPENDIX B

Survey of TxDOT District Staff

**Survey of TxDOT Personnel Regarding
Intelligent Transportation System (ITS)
Deployment & Funding Needs
May 2004**

The following survey is being used to obtain information in support of a TxDOT-funded research project entitled "Alternative Funding Solutions for ITS Deployment." Responses to this survey will be used to help the research team better focus on your funding needs related to ITS deployment.

The data you provide will be kept strictly confidential, and only total survey statistics will be used. A self-addressed stamped envelope is included for your convenient return of this survey. If you would prefer to complete this survey on-line, please visit <http://san-antonio.tamu.edu/4451/survey> . Please feel free to share this survey with other colleagues you think may have interest in this topic and/or providing their input. Thank you in advance for your time and feedback!

General background information (collected for general statistical purposes only):

1. Your District: _____
2. Your number of years of "transportation" experience: _____
3. Your number of years of experience working with ITS applications: _____
4. How would you rate your working knowledge of ITS technologies and applications (please circle one)?

1	2	3	4	5
Very limited	Fairly limited	Fair	Pretty good	Excellent

5. Please describe the nature of your ITS experience _____

6. What do you believe are significant potential benefits of ITS in your District? (check all that apply)

- Improve safety
- Increase system capacity/efficiency on a recurring basis
- Collect data/information for future decision-making
- Provide real-time data to help operating agencies improve incident management
- Provide better traveler information to the public to choose better routes, modes, etc.
- Other (please specify): _____
- I do not have enough working knowledge of ITS to answer this question

7. Please read the following statements and place a check mark by any that you agree with:

- It is hard to find funding for ITS projects.
- Better information about the costs of ITS is needed in our District.
- Better information about the benefits of ITS is needed in our District.
- Most other local and regional agency staff members do not know much about ITS.
- Our District needs information on ITS benefits that is less biased than what we have seen in the past.
- Our District needs information on ITS benefits that is less technical than what we have seen in the past .

8. Please rate the current importance of the following ITS applications or technology to the transportation system in your District:

ITS Technology	Relative Importance				
	1 Not Important	2 Limited Importance	3 Fairly Important	4 Very Important	5 Critical
Cameras/Closed-Circuit TV for incident management					
Cameras/Closed-Circuit TV for vehicle detection					
Dynamic Message Signs					
Speed Detectors					
Traveler Info. Systems					
Weather Info. Systems					
Communications by phone lines					
Communications by fiber					
Wireless communications					
Other (please specify):					

Recent ITS Deployment(s)

9. Please list any ITS deployment(s) you are aware of in your District within the past five (5) years, and if possible, the source of funding and the year that the project was let:

10. Was acquiring funding for this/these deployment(s) difficult?

No Yes, somewhat Yes, very difficult

11. With regard to funding ITS projects in your region over the last five (5) years, please indicate (in the table below) the source of the funds and your related experience and/or knowledge about obtaining those funds. (Please check all that apply)

Source of Funds	Experience With and/or Awareness of Funding Options				Comments
	Difficult to obtain funds	Easy to obtain funds	Not aware of this funding option	Aware of this option but have not pursued it	
Federal funds					
Local and/or private matching funds					
TxDOT Commission-granted funds					
District maintenance funds					
District construction funds					
Other					

Future ITS Deployment(s)

12. What do you feel are the biggest challenges for you to finding funds for ITS deployment/projects? (please be as specific as possible)

13. Would “Fact Sheets”, like the sample one attached for Traffic Management Centers, be helpful in your pursuit of ITS funding? Yes No

14. If you answered “yes” to the previous question, what types of information would you like to see on a “fact sheet” like this? (please check all that would be important to you)

- Benefits
- Case studies and/or range of potential applications
- Communication link options/requirements
- Costs
- Links to related reference material(s)
- Examples of application in Texas
- Other _____

15. Please list any specific ITS technologies, systems or types of ITS applications for which you would like to see such “fact sheets” put together:

16. Is there any other general information that you would like to share regarding ITS deployment and/or funding?

If you should have any questions or wish to discuss this topic further with the research team, please feel free to contact Russell Henk (Texas Transportation Institute) at (210) 979-9411 or by e-mail at r-henk@tamu.edu . To access helpful ITS-related links and documents and/or to find out more about this research project, you can visit the project website at: <http://san-antonio.tamu.edu/4451/> .

APPENDIX C

“Fact Sheet” for Traffic Management Centers

Transportation Management Centers - Fact Sheet

“The Traffic or Transportation Management Center (TMC) is the hub of a transportation management system, where information about the transportation network is collected and combined with other operational and control data to manage the transportation network and to produce traveler information. It is the focal point for communicating transportation-related information to the media and the motoring public, a place where agencies can coordinate their responses to transportation situations and conditions.



The TMC links various elements of Intelligent Transportation Systems such as variable message signs, closed circuit video equipment, and roadside count stations, enabling decision makers to identify and react to an incident in a timely manner based on real-time data.”¹

The TMC is itself not a technology but rather a place for managing all other components of a transportation management system. In one sense, it is a building, housing all the computers, monitors, and communications equipment. In another sense, it is the various personnel from different agencies who operate in the TMC. The two pictures on this page show the NYC DOT/NYPD Traffic Management Center. The photograph to the right shows the center's manager Mr. Mohammed Talas of NYC DOT standing with NYPD Deputy Inspector Patrick J. McCarthy, the Commanding Officer of the NYPD TMC in front of the Manhattan Signal Board which tracks the function of 2,000 of the 6,600 computerized signals controlled from the room.



¹ Partnership for Advanced Highways (PATH) website.
www.path.berkeley.edu/~leap/TTM/Traffic_Control/tmc.html

(There are over 11,000 signals throughout the five boroughs of NYC.) (Photos for this summary, courtesy of Lt. Joseph H. Wolff, NYPD Traffic Control Division)

Benefits

“TMCs can help reduce incident response times, lower incident rates (mainly secondary incidents), disseminate traveler information and hence reduce congestion and enhance safety. To date there is little data quantifying the exact benefits resulting from TMCs. One study conducted by MnDOT reported decrease in accident rates by 25 percent, 20-minute reduction in response time, 35% increase in average speeds (34 mph to 46 mph) during rush hours and 22% increase in capacity of freeways, after the implementation of their TMC.”¹

The PATH website lists the following benefits:

- Faster incident response and reduction in incident rates.
- By broadcasting traveler information and coordinating their activities with the State Patrol, etc., TMCs have been successful in reducing congestion in freeways and arterials.
- Increases traffic safety by effective incident response and clearance techniques, by providing traveler information regarding incidents it minimizes the likelihood of secondary incidents.
- Enhanced communication in all aspects of transportation management (planning, design, implementation, operation, and maintenance).
- Monetary savings by sharing responsibilities between fewer staff, achieved by co-location of participating agencies at the center.
- Agencies working closely together in a TMC typically produce a more consistent, unified response to a situation, increasing the overall effectiveness of the transportation resources.

Applications to Date – Examples

The TMC concept has been implemented at various scales and levels of government. The Borough of Queens (New York City) TMC monitors 6,000 computerized signal lights, 58 traffic video surveillance cameras, and 7 variable message signs.² The Central Valley TMC in California monitors 2030 miles of highway in a huge area covering Madera, Fresno, Tulare, Kings, and Kern Counties, including Yosemite National Park.³ TMCs also operate at the citywide scale in large cities such as Seattle, Minneapolis/St Paul, and San Diego, countywide in Bay County, Florida and Montgomery County, Maryland, and region-wide such as the Research Triangle of North Carolina (to provide a few examples). Rhode Island DOT has a TMC for the entire state.

² Borough of Queens Traffic Management Center website:
www.ci.nyc.ny.us/html/nypd/html/transportation/traffic.html

³ Caltrans District 6 Central Valley Transportation Management Center website:
www.dot.ca.gov/dist6/tmc/tmcrese.htm

Limitations

Implementing a TMC entails considerable cost. Some costs include conception, design and implementation of the TMC and the capital costs associated with the facility. The Houston TranStar is located in an \$11.5 million, 52,000 sq. ft. building. In addition, there are substantial operational costs. For example, the yearly operation budget for the Seattle TMC is in the range of \$1.4 million, and that for San Antonio ranges from \$700,000 to \$1 million.¹⁷ Not surprisingly, an entity touching disparate governmental agencies as well as various areas of the private sector is subject to daunting organizational challenges. Roles must be clear and communication and coordination is vital. Of course, this is easier said than done. The TMC might be seen as a way of optimizing efficiency by the engineering community, but the law enforcement community might see it as using funds that could put an extra patrol car on the road. Further, there are challenges in managing a complex technological environment.

