# APPLICATION FOR PARTICIPATION IN THE FY01 ITS INTEGRATION COMPONENT of the ITS DEPLOYMENT PROGRAM

## PROJECT DESCRIPTION

**Project Identification Number and Name:** 37.C - College Station

**Project Location:** College Station, Texas

**FY01 Congressionally Designated Funding Amount:** $ 1,428,506


| | | |
|---|---|---|
| **Submitted by (Agency):** | Texas Transportation Institute, and the Texas Department of Transportation | |
| **(Date):** | March 15, 2002 | |
| **Project Contact (Name):** | Kevin Balke | Kirk Barnes |
| **(Organization):** | Texas Transportation Institute | Texas Department of Transportation |
| **(Address):** | 3135 TAMU College Station, Texas 77843 | 1300 N. Texas Avenue Bryan, Texas 77803 |
| **(Phone):** | (979) 845-9899 | (979) 778-9756 |
| **(Fax):** | (979) 845-9873 | Fax: (979) 778-9703 |
| **(e-mail):** | k-balke@tamu.edu | kbarnes@dot.state.tx.us |

## TABLE OF CONTENTS

## EXECUTIVE SUMMARY

Special events are primary generators of traffic congestion in the Bryan/College Station area. Most of the major special event traffic is concentrated within a 1-mile radius of one another. During some events, such as major football games on campus, traffic on the transportation network increases by 15-20 percent. This project focuses on expanding and integrating the transportation management infrastructure to permit the operating agencies (i.e., the Texas Department of Transportation, the City of College Station, and the City of Bryan) to better operate the transportation system during these special events.

There are four primary components of this project:

- Develop a Regional ITS Architecture and ITS Deployment Plan for the Bryan/College Station area
- Upgrade and integrate the portions of the transportation communications network of the City of Bryan, the City of College Station and the TransLink® Laboratory
- Integrate traffic signal information and video on several important special event travel routes in the Bryan/College Station area
- Enhance the traffic management and information dissemination capabilities for special events through the installation of two dynamic messages signs on routes leading into the Bryan/College Station area and integrate their operations into the TransLink Laboratory

Agencies participating in the regional ITS architecture include the following:

- The City of College Station
- The City of Bryan
- TxDOT
- Brazos County
- College Station Urban Transportation Study Steering Committee (MPO in the Bryan District)
- Brazos Transit
- Texas A&M University Parking, Traffic, and Transportation Services (PTTS)
- The Texas Transportation Institute (TTI)

This project also involves upgrading and integrating portions of the transportation communications network and traffic signal control infrastructure of the City of Bryan, the City of College Station, and TxDOT so that each agency can share traffic, signal timing, and video information along some of the primary special event traffic routes in the Bryan/College Station area. To accomplish this, TTI and TxDOT plan to upgrade a portion of an existing twisted pair communication system in the City of Bryan with fiber optic infrastructure and tie this upgraded communication network with the City of College Stations fiber network. Traffic signal control hardware will be upgraded at eleven intersections in the City of Bryan. Tying the two communication networks and upgrading the signal control equipment will permit the City of Bryan, TxDOT, and the City of College Station to share traffic, signal timing, and video information that can be used to manage, in real-time, special event traffic in the Bryan/College Station area.

This information will be integrated into the operations of the TransLink Laboratory. In the Laboratory, representatives of the different operating agencies will be able to monitor traffic information, determine appropriate strategies, and implement changes to the traffic signal systems on the network. Because the communications infrastructure is shared by the various operating agencies, agencies will be able to respond to developing traffic situations in real-time and potentially mitigate the situations before they become critical. To disseminate information to motorists entering the Bryan/College Station area, two dynamic message signs will be installed and integrated into the operations of the TransLink Research Laboratory.

The agencies participating in this project include the following:

- The Texas Transportation Institute (Lead Agency)
- The Texas Department of Transportation
- The City of College Station
- The City of Bryan

The costs for completing the primary elements of this project are as follows:

| **Project Component** | **Component Costs** |
|---|---|
| Regional ITS Architecture | $209,000 |
| Integration of Communication Infrastructure | $1,067,212 |
| Integration of Traffic Signal Systems | $904,000 |
| Information Management and Archiving | $446,800 |
| Project Evaluation | $230,000 |
| **Total** | **$2,857,012** |

This project is expected to start September 2002 and be complete in September 2005. The following shows major milestones and expected completions dates:

- Define requirements by October 2002
- Identify equipment requirements by April 2003
- Final regional architecture and deployment plan by April 2004
- Procure equipment by December 2004
- Install equipment by December 2004
- Proof of concept testing by February 2005
- Full implementation by April 2005
- Evaluation of the integration project by June 2005
- Final Report by August 2005

# PROJECT PROPOSAL

# TECHNICAL APPROACH

## 1. Background

The Bryan/College Station area is the home of Texas A&M University (TAMU). With an annual enrollment of over 44,000 students, the Texas A&M University is the largest trip generator in the Bryan/College Station Area. Given that the university is centrally located in the State of Texas, approximately equidistant from three of the 10 largest cities in the United States (Houston, Dallas and San Antonio) and the state capital (Austin), TAMU attracts students (and their parents), and visitors, from all over the state and the world.

Located on the South side of the campus are the major sporting and cultural facilities. The major venue in this is Texas A&M's Kyle Field, the home of the Aggie football team. In 1999, TAMU completed a $32.9 million expansion of the north end zone, which raised the capacity of Kyle Field to 82,600, making it the largest football stadium in the state of Texas. Since the completion of the expansion, the average attendance at Kyle Field is over 78,000. The TAMU Board of Regents recently approved funding to further expand Kyle Field and could potentially add 12,000 more seats to the stadium.

The south side of campus is also the home of other sporting and cultural venues. Reed Arena, located across the railroad tracks from Kyle Field provides a high-class 12,500-seat arena for the entertainment, education and business needs of Texas A&M University as well as for the Bryan and College Station communities. The TAMU baseball facility at Texas A&M University, C.E. "Pat" Olsen Field, is located across from Kyle Field, near the corner of George Bush Drive and Wellborn Road. With a seating capacity of 7,053 in the permanent stands, the Aggies have averaged approximately 4,000 fans each game. The TAMU track, soccer, and softball programs have stadiums located in the south side of campus as well.

Also located close by is the George Bush Presidential Library. The Library is the home of artifacts, films, photographs, and documents relating to the political career of George Herbert Walker Bush. Last year, over 125,000 visitors from all over the world toured the George Bush Presidential Library.

Needless to say, with all these major traffic generators in such close proximity to one another (all within approximately one mile radius), getting traffic to and from these venues is a major task for TAMU, TxDOT, the City of College Station, and the City of Bryan. Figure 1 shows the major routes for traffic getting to and leaving these major venues. Currently, TxDOT is responsible for operating all the major roadways leading into the Bryan/College Station area, including SH 6, SH 21, SH 47, SH 30, FM 2818, and FM 2154. TxDOT is also responsible for operating the traffic signals at all the major diamond interchanges with SH 6, including Briarcrest Drive (FM 1179), University Drive (FM 60), and Harvey Road (SH 30). The City of College Station is responsible for operating (within its City limits) University Drive/Raymond Stotzer Boulevard (FM 60), part of Texas Avenue (SH 6 Business), George Bush Drive, and Wellborn Road (FM 2154); while the City of Bryan is responsible for operating part of Texas Avenue (SH 6 Business), Villa Maria/Briarcrest Dr (FM 1179), and FM 2818 (on the north side of the area). On football weekends, traffic on the major roadways leading to and from these facilities increases by over 15 – 20 %.

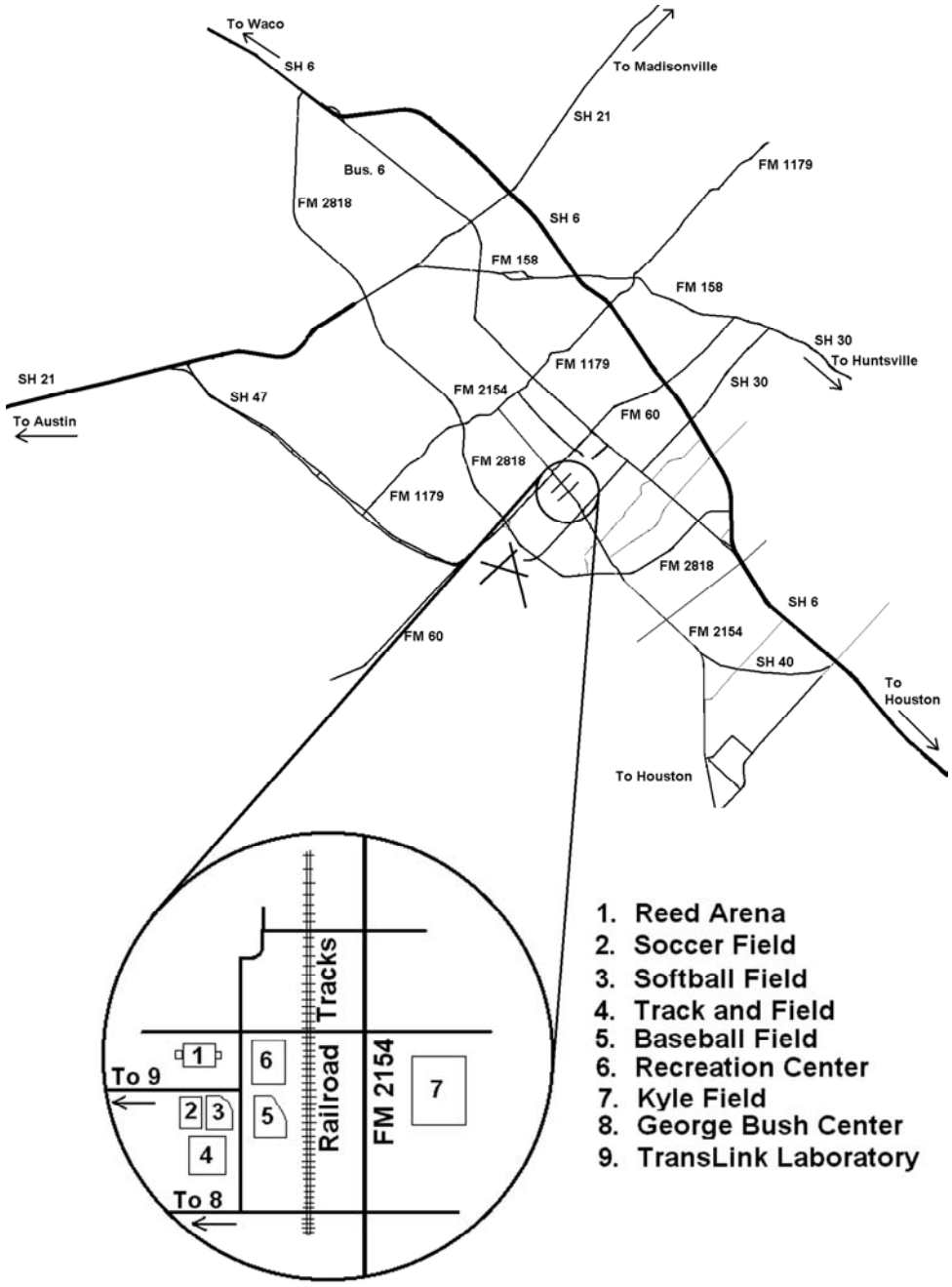


**Figure 1. Major routes for traffic to the major venues on University Campus**

To complicate matters, a Union Pacific Rail line runs through the heart of these traffic generators. This rail line carries approximately 20-25 trains a day, arriving randomly throughout the day. Rail traffic often travels through the corridor as roadway traffic is either trying to get to or leave these major facilities.

TxDOT, the City of College Station, the City of Bryan, and TAMU have coordinated the management of traffic for these major venues for years. Representatives from all these agencies meet regularly to discuss strategies for managing traffic for major events and traffic control plans are implemented for these events; however, these plans are static and rely upon police officers in the field to make changes to the traffic control, often in isolation. Currently, the City of College Station uses a different type of traffic signal controller than the City of Bryan. The City of Bryan's traffic signal system is not integrated with the City of College Station's system, which is not integrated with the TxDOT diamond interchange signals. There is no method of detecting and communicating traffic changes among the agencies. Motorists coming into the area from Houston and Austin are not aware of alternate routes or traffic conditions that may affect their route choices. In short, while the traffic management for these special events is *coordinated*, it is NOT *integrated*. Systems do not talk to one another and this limits the ability of the agencies to respond, in a dynamic manner, to changing traffic conditions.

This project begins the process of working towards integrated operations for managing traffic for special events in the Bryan/College Station area. The project begins constructing a communications network that will allow traffic data, signal timing information, train information, and video to be shared between the City of College Station, the City of Bryan, and TxDOT, through the TransLink Research Center. Information about video, signal timing data, and traffic data will be brought back to the TransLink Laboratory. During special events, agencies can use the TransLink Laboratory to monitor traffic conditions and change signal timings, in real-time from the laboratory floor. A data archiving system will be developed and housed in the TransLink Laboratory that will allow traffic and response information to be collected and archived for use in developing real-time traffic management strategies. This project also will provide the City of Bryan, the City of College Station, and TxDOT the ability to integrate their traffic signal systems along the major special event travel routes, and yet maintain each agency's autonomy over their respective system. This project also looks to expand the agencies ability to manage travelers' arrival and departure routes to these special events through motorist information systems.

## 2. Project Description

This project will be used to perform the following five major integration related tasks:

- Development of a Regional ITS Architecture and ITS Deployment Plan
- Upgrade and Integration of Agencies' Communications Network
- Integration of Traffic Signal Information
- Integration of Information Management and Archiving Systems
- Project Evaluation

The work to be performed in each of these major tasks is described next:

Development of a Regional ITS Architecture and ITS Deployment Plan

One of the first objectives of this project will be to develop a Regional ITS Architecture for the Bryan/College Station area. TxDOT's Traffic Operations Division in Austin will contract with a vendor to develop this architecture for the Bryan/College Station area. This architecture will examine the current and proposed communications and traffic management systems in Bryan/College Station area and map out a plan for ensuring that further expansion of the transportation management systems conform to the National ITS Architecture. The plan will also highlight the communications and traffic management standards that will be used by all the agencies in the Bryan/College Station area in the further expansion of their traffic management systems. The following local agencies that will be asked to participate in the development of the Regional ITS Architecture are:

- The City of College Station
- The City of Bryan
- TxDOT
- Brazos County
- College Station Urban Transportation Study Steering Committee (MPO in the Bryan District)
- Brazos Transit
- Texas A&M University Parking, Traffic, and Transportation Services (PTTS)
- The Texas Transportation Institute (TTI)

Other agencies from surrounding areas that affect traffic operations in the Bryan/College Area may also be asked to participate in the development of this plan.

Upgrade and Integration of Agencies' Communications Network

Figure 2 illustrates the existing and proposed fiber communications infrastructure in the Bryan/College Station area. Over the past few years, the City of College Station has embarked on a rather aggressive program to install fiber optic cable throughout the city. Part of this fiber has been dedicated for traffic management purposes. The City of College Station currently has fiber optic cable running along Wellborn Road (FM 2154), University Drive (FM 60), and the west side of SH 6 Bypass. This fiber is used to provide communications to the City-operated traffic signals in the corridor from the City of College Station Traffic Management offices.

The City of Bryan has an existing twisted-pair communications system that is used to provide interconnection for the traffic signals along Briarcrest/Villa Maria (FM 1179) from Wellborn Road (FM 2154) to just short of the SH 6 Bypass.

The first College Station earmark (CSIP I) is integrating existing optical fiber that is shared between the Texas A&M University and the City of College Station. This fiber serves as the communications medium for the Gigabit Ethernet network that permits the City of College Station and TTI, through the TransLink Research Laboratory, to share traffic signal, video, and train information in the Wellborn corridor (FM 1179). Part of the new project (CSIP II) will be used to expand the Gigabit Ethernet network into other areas of the City of College Station and into the City of Bryan, which will permit these cities' transportation agencies and the TxDOT/Bryan District to share traffic, signal timing, and video data. To achieve this, TxDOT is proposing to upgrade the existing twisted pair cabling along Briarcrest/Villa Maria with fiber optic cable as well as to install new fiber optic cable

along the west side of the frontage road as illustrated in Figure 2. This upgraded communication backbone will then be tied into the existing City of College Station fiber backbone at the intersection of SH 6 Bypass and University Drive (FM 60). Once this connection is complete, traffic, signal timing, and video data can be attained from the intersections in both Bryan and in College Station and displayed in the TransLink Laboratory.

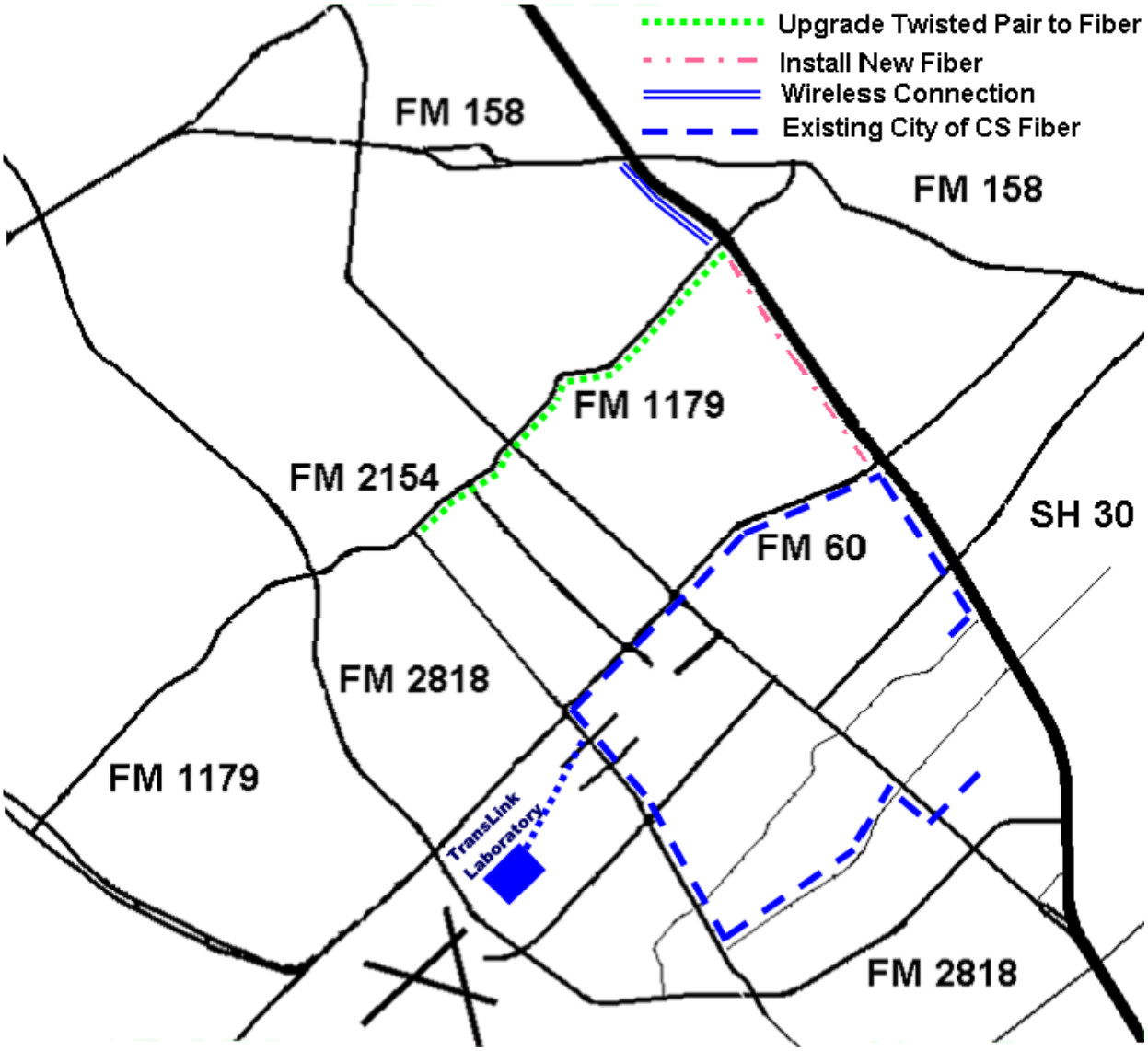


**Figure 2. Existing communication infrastructure and proposed communication infrastructure upgrade**

As previously stated, CSIP II will integrate the traffic control equipment and the video streams along the freeway corridor from FM 1179 in the north to SH 30 in the south with an extension of the Gigabit Ethernet network developed in CSIP II. However, the fiber communications for this network are not available to the TxDOT office. It is planned to provide TxDOT personnel access to the network over a DSL or an ISDN line. The speed of such a communication link is sufficient to provide control of all the intersections under TxDOT's control and also allow for streaming video to be seen from the cameras in the field.

TxDOT will be responsible for the upgrade to fiber optic communications on Briarcrest/Villa Maria to create the backbone for the Gigabit Ethernet network. This includes all preliminary engineering and the PS&E, and the job will be let through the District. Through an interagency contract, TTI will then configure the fiber, which includes specifying, purchasing, installing and testing the communications equipment, and integrating the independent communications systems of multiple agencies.

Integration of Traffic Signal Information

The City of College Station uses a closed-loop system to manage their traffic signals. The City of Bryan also operates many of their traffic signals using a closed-loop system; however, they use a different signal controller than the City of College Station. TxDOT Bryan District uses the same signal controllers as the City of College Station, but their signals are not integrated with either the City of College Station or the City of Bryan. Another objective of this project is to integrate these traffic signal systems whereby each of the operating agencies can use information about traffic conditions from different parts of the transportation network to better operate their signals locally. By integrating the signals, the traffic signal operators of the Cities of Bryan and College Station will be able to monitor and modify any signal operations along the main arterial corridors that pass through both the cities. By virtue of their integration into the system, the agencies will also be able to monitor the train movements and traffic signal operations along the Wellborn Road corridor. Integrated operations will be essential to better handle the special event traffic entering and leaving the Bryan/College Station area.

To achieve this integration, this project proposes to replace the existing incompatible equipment at 11 intersections along Briarcrest/Villa Maria (FM 1179) from SH 308 (South College Ave.) in the west to Freedom Boulevard adjacent to the interchange of SH 6 in the east. This needs to be done in order to integrate with the existing signal control equipment at the diamond interchange of FM 1179 and SH 6. These intersections will then be integrated on the CSIP II network. The City of Bryan will be responsible for installing the controllers and rewiring the cabinets.

Technicians from the city of Bryan and College Station will assist in upgrading some of the signal equipment. They will be assigned full time to accomplish the project tasks for the duration of the task. The cities will keep a record of the personnel hours spent on their assigned tasks and provide them to TxDOT for billing purposes.

In addition, equipment will be installed at four diamond interchanges operated by TxDOT (SH 6 and FM 158, FM 1179, FM 60, and SH 30) that will allow traffic, signal timing, and video data to be brought back to the TransLink Laboratory. At three of the interchanges (SH 6 and FM 1179, FM 60, and SH 30), integration will be achieved by tying the diamond controllers into the fiber optic communications system. Most of these intersections already have or will have video detection

installed. Video detection for a diamond interchange utilizes six cameras and can be viewed in a quad format over two streams of video. It is also anticipated that a surveillance camera will be installed at each interchange to obtain supplemental data about freeway and interchange operations. This supplemental data will enhance TxDOT's capability to monitor and modify the interchange operations.

The interchange of FM 1179 and SH 6, immediately north of the interchange of FM 60 and SH 6 currently has video detection. The intersection adjacent to the interchange (Freedom Boulevard) has loop detection. This detection will have to be upgraded to video detection to improve the arterial and interchange operations. The video from Freedom Boulevard will be available in a single video stream in a quad format. The video streams from this area and the signal control equipment will be integrated into the CSIP II network using the fiber that was deployed to integrate the City of Bryan with the City of College Station.

Integration of the last diamond interchange (FM 158 and SH 6 Bypass) will be achieved through a wireless connection. This interchange, which is just north of the intersection of the Briarcrest (FM 1179) interchange is beginning to carry more traffic and recently underwent a bridge widening. This interchange is also one of the major interchanges that services downtown Bryan. Since there is no video detection at this interchange, a radio communication link is adequate to allow traffic and signal timing data to be integrated into the system.

TxDOT will be responsible for the upgrade to newer signal control equipment and video detection and surveillance systems. This includes all preliminary engineering and the PS&E, and letting under the same contract with the above task of Upgrade and Integration of Agencies' Communications Network. Through the interagency contract, TTI will: lead the effort to integrate the traffic signal equipment and the closed loop system along FM 1179 into the Gigabit Ethernet network; upgrade the signal operation strategies to respond to special events; evaluate applicable NTCIP standards and incorporate them into the field devices and communications network as appropriate; and be responsible for integrating the video streams from the video detection units and surveillance cameras, which includes the management of hierarchical camera control and video stream configuration among multiple agencies. TTI will also purchase some video detection and surveillance equipment and signal control cabinets to accommodate the new systems.

Integration of Information Management and Archiving Systems

Once the communication systems have been linked, traffic, signal timing, and video data will be transmitted to the TransLink Laboratory. As a result of the equipment upgrades made as part of this project, a total of 18 new video feeds, and 18 intersection data feeds will be added to the TransLink Laboratory. These new feeds with be added to the 10 video streams and 5 intersection data feeds that are being installed as part of CSIP I. In the TransLink Laboratory, these video streams can be displayed on the video wall. During special events, the operating agencies can come to the TransLink Laboratory, monitor traffic flow on the equipped routes, and adjust signal timings directly from the laboratory. As the communications network continues to grow, video and intersection data can be made available through the TransLink Laboratory.

CSIP I took the approach of providing some of the video streams available from the Wellborn Corridor to the traveling public over the Internet. In CSIP II, TTI would extend the video coverage available to the general public to provide regional traveler information. As part of CSIP II, the data

and information available from the larger regional capabilities would be provided via the public Internet so that drivers within the area would have the ability to look at historical travel patterns along the covered routes. This necessitates data archiving components to CSIP II. While the exact concept of information is not currently known, it is anticipated that traffic signal information from the region can be utilized to convey meaningful traveler information in an easy to understand graphical format. The data archiving activities will support not only the development of how to present this information, but also address the storage and analysis capabilities required to generate this information.

In addition to traffic data, the data archiving function will include data on the rail movements through the Wellborn corridor as well as weather information. In addition to a storage mechanism, the data archival system will also provide retrieval and aggregation functions to serve the various needs of the agencies and the region. Functionality will also be present to manage the data archival system, with provisions for off-line storage, system backup, and providing data feeds to other information sources, where necessary.

From a high-level perspective, the CSIP data archiving operation supports multiple objectives. Data stored at a very low-level will support the needs of system operators, to examine the traffic signal plans along the roadways to achieve better coordination, especially in the light of integrated operations between the City of Bryan, the City of College Station, and TxDOT. As data is 'aged' within the system, some degree of aggregation takes place. This information at the higher level of aggregation will provide insight into the traffic patterns throughout the region. It is anticipated that the level of aggregation will be variable, to best suit the task at hand. In addition to the operating agencies above, agencies such as the B/CS MPO and PTTS routinely utilize this type of information to improve the accuracy of their long-term planning. Aggregated information can also be valuable to the traveling public, by allowing for comparisons of historical and current travel data. Providing this information helps keep motorists informed of any changes in the roadway environment and promotes better regional mobility.

Also as part of this project, two DMS message signs will be installed – one on SH 6 to the south of College Station, and one on SH 21 on the west side of Bryan. These signs will be used to provide traffic and routing information to motorist entering the Bryan/College Station areas for special events from Houston and Austin, respectively. These signs will also be integrated into the operations of the TransLink Laboratory. Using real-time information about traffic conditions on the major traffic routes into the area, TxDOT and the cities can broadcast traffic and routing information to motorists from the TransLink Laboratory.

TxDOT will install the two DMS systems through a District letting contract that will be separate from the above tasks (although may be in conjunction with another TxDOT project). As in the above tasks, TxDOT will perform all preliminary engineering and the PS&E. Through the interagency contract, TTI will design, specify, install and test the communications equipment, and integrate the DMS with the CSIP network. TTI will incorporate all the field devices into the ATMS management system by upgrading the video reception and projections facilities and designing and writing software for archiving all the data being collected from various sources in the project. TTI will provide data to the participating agencies and appropriate information to the public in the College Station area via a website.

Project Evaluation

Through the interagency contract, TTI will perform and submit a Local Evaluation Report documenting the lessons learned in meeting project goals and objectives. More details about the evaluation are described in Section 8.

## 3. Rural Projects

This project does not have any rural components.

## 4. Infrastructure Components to Be Integrated

A. Traffic Signal Control
   1. *City of Bryan Closed-Loop System*
   2. *TxDOT Diamond Interchange Control Systems*
   3. *City of College Station Traffic Signal System*

B. Freeway Management
   None

C. Transit Management
   None

D. Incident Management
   1. *TxDOT DMS Control*

E. Electronic Fare Payment
   None

F. Electronic Toll Collection
   None

G. Highway-Rail Intersection Control
   1. *City of Bryan intersections near rail road crossings*
   2. *City of College Station intersections near rail road crossings*

H. Emergency Services Management
   None

I. Paratransit and Demand-Responsive Transit
   None

J. Regional Multi-Modal Traveler Information Services
   1. *TTI's TransLink Research Laboratory*

K. Other ITS Systems
   1. *TAMU/City of College Station/City of Bryan/TxDOT Special Event Management Team*

Using the identifying letters and numbers above, indicate those infrastructure components that will be integrated

| | | |
|---|---|---|
| A1 | with | A2 |
| A2 | with | A3 |
| A1 | with | A3 |
| A1, A2, A3 | with | J1 |
| D1 | with | J1 |
| G1, G2 | with | J1 |
| J1 | with | K1 |

**Note:** This project is designed to allow traffic demand data, video, and signal timing information to be shared between the City of Bryan, City of College Station, and TxDOT Bryan District, through the TransLink Laboratory, for the purposes of managing traffic operations during special events (such as football games, sporting events, concerts, graduation, etc.) on the TAMU campus.

## 5. Integration Approach

Section 2 of this proposal identifies five major areas of integration across multiple agencies. The key to achieving the interoperability goals of the project is the ability to share the project related information seamlessly, both data and video. The information needs to be shared between the project partners of TTI, the City of College Station, the City of Bryan, and TxDOT.

CSIP I pioneered the deployment of a Gigabit Ethernet network based communications system for data and video transfer between the partners in the project. Gigabit Ethernet is a standard protocol that has been in use for several years. It offers several advantages over other high-bandwidth solutions and costs significantly less. In CSIP II, this network will be extended to other areas of the College Station region beyond the CSIP I project area of the Wellborn corridor. Wherever feasible, the fiber infrastructure will be utilized to provide the high-bandwidth solution.

The continuation of the Gigabit Ethernet network will start at a junction point at the intersection of University Drive and Wellborn Road. While the fiber path for the phase I deployments flows to the south, the fiber path for the phase II integrations flows to the east. The information streams will merge at this point and flow west to TTI.

A second junction point will occur at the TTI detector testbed site located near the interchange of University Drive and on SH 6. CSIP II project locations are both north and south of this central point and provide a logical split point for the fiber routing. Both of these junctions will be accomplished using standard Gigabit Ethernet network components developed for fiber aggregation.

Continuing north from the interchange of SH 6 and University Drive, the Gigabit Ethernet network will turn west at the interchange of SH 6 and FM 1179. This affords the opportunity to integrate both the interchange itself as part of the freeway operations corridor and provides a logical junction point for the integration of arterial traffic signal operations along FM 1179 heading west to FM 2154. All of this will be accomplished using fiber-based communications and extending the core technology deployed in CSIP I to leverage the investment.

Due to the physical distances of some project locations from the core fiber-based communications network, additional technologies will be employed to accomplish the integration goals. As an example, fiber based communication to the TxDOT offices does not currently exist and will not be implemented as part of this project due to cost. However, a phone line or other type of industry standard communications methodology such as DSL (Digital Subscriber Line) will be deployed to enable TxDOT to receive data and video from the regional network. In addition, project equipment such as the DMS (Dynamic Message Signs) will be integrated using wireless communications equipment. The access point into the core regional network will likely be at either the intersection of Harvey Road (SH 30) and University Drive (FM 60) or at TTI.

With the equipment being deployed at multiple locations amongst several different operating agencies, a core question of integration focuses on the capability of equipment control. CSIP I is developing and will implement a standards-based hierarchical control methodology to avoid conflicts on equipment usage. In CSIP II, this conflict control mechanism will be expanded to cover

the additional equipment. The potential for control conflict is perhaps most obvious when examining the video feeds that will be available on the project.

While CSIP I featured 10 streams of video in addition to the traffic signal control and rail monitoring data, CSIP II adds 18 new video streams to the regional network, as summarized below:

FM 1179 area:

1. Interchange control (Fixed B&W) - 2
2. Adjacent Intersection (Fixed B&W) - 1
3. Interchange surveillance (PTZ color) - 1

FM 60 area:

1. Interchange control (Fixed B&W) - 2
2. Adjacent Intersection (Fixed B&W) - 1
3. Interchange surveillance (PTZ color) - 1
4. TTI's test bed (Fixed & PTZ color) - 2

SH 30 area:

1. Interchange control (Fixed B&W) - 2
2. Adjacent Intersection (Fixed B&W) - 1
3. Interchange surveillance (PTZ color) - 1

FM 1179 and FM 2154

1. Rail surveillance (PTZ color) - 2

FM 60 and Bus. 6

1. Intersection surveillance (PTZ color) - 2

As with CSIP I, the video streams will be placed into the Gigabit Ethernet network using IP (Internet Protocol) based video encoders. The use of common networking methodologies such as video multicasting will likely be employed to reduce the overall video equipment costs for the project. Video multicasting allows one camera location to simultaneously supply a video stream to multiple end-points. CSIP I is providing valuable experience in this regard, which will be directly applicable to the larger regional network deployed for CSIP II.

In addition to the concepts of network communication, control capabilities and cost saving measures such as video multicasting, CSIP II will continue to utilize and enhance the security considerations designed into CSIP I. While the network design itself provides a level of security, numerous industry standard security issues are being considered in CSIP I and will carry over to CSIP II.

In conclusion, the integration approach of CSIP II is to build upon the success of CSIP I by extending the core network, integrating additional points with standard communication technologies, and deploying solutions for device control, video sharing and security. This provides a comprehensive framework for the creation of an interoperable system between the project partners.

With this ability to share information seamlessly, the project also stands poised to provide tremendous benefit to the traveling public. While the most obvious benefit will come from coordinated control for the corridors in the project and a higher quality of travel service, the public will also benefit from the use of information sharing technologies such as traffic information, websites, camera snapshots, and incident alerts.

## 6. Architecture

This project agrees to follow the Architecture approach included in Section 3.2 of the Guidance. This project meets the criteria indicated with an "X" below:

X A. A regional ITS architecture exists or is being developed.
In the discussion section below, the project proposal identifies the region, the organization (with contact) responsible for developing or maintaining the regional ITS architecture, the parts of the regional ITS architecture that will be reflected in the project design and implementation, and any updates to the regional ITS architecture that are necessary to reflect the specifics of the proposed project.

___ B. A regional ITS architecture does not exist (and is not currently under development) and the project is to receive more than $300K in funding (after takedowns) from this program in FY01.
In the discussion section below, the project description explicitly states that (1) a project level ITS architecture will be developed, using a systems engineering analysis, and the project will be designed in accordance with the project level ITS architecture and (2) the development of a regional ITS architecture will be initiated, using a systems engineering analysis, within a year of obligation of funds. Also in the discussion section, the project description identifies the region to be included in the regional ITS architecture, the agencies/systems to be included in the project level ITS architecture, the agencies to be (initially) included in the regional ITS architecture, and the funding source(s) and schedule for both the project level and regional ITS architecture development.

___ C. A regional ITS architecture does not exist (and is not currently under development) and the project is to receive less than $300K in funding (after takedowns) from this program in FY01.

In the discussion section below, the project description explicitly states that a project level ITS architecture will be developed, using a systems engineering analysis, and the project will be designed in accordance with the project level ITS architecture. Also in the discussion section below, the project description identifies the agencies/systems to be included in the project level ITS architecture, as well as the funding source(s) and schedule for this development.

Discussion

As part of this project, TxDOT will contract with a vendor to prepare a Regional ITS Architecture and ITS Deployment Plan for the Bryan/College Station Region that includes the transportation agencies operating primarily in Brazos County. Those agencies include, but are not limited to, the following:

- The City of College Station
- The City of Bryan
- TxDOT
- Brazos County
- College Station Urban Transportation Study Steering Committee (MPO in the Bryan District)
- Brazos Transit
- Texas A&M University Parking, Traffic, and Transportation Services (PTTS)
- The Texas Transportation Institute (TTI)

TxDOT will be responsible for maintaining the regional ITS architecture after it has been developed. Kirk Barnes, TxDOT/Bryan District Traffic Engineer, will be the primary contact for ongoing operations and maintenance.

## 7. ITS Standards and Standards Testing

This project agrees to follow the ITS Standards and Standards Testing approach included in Section 3.3 of this Guidance.

This project agrees to cooperate with the analysis of the project as a potential test site for the US DOT sponsored ITS Standards Testing Program.

This project agrees to serve as an ITS standards testing site if selected to participate in the testing program.

ITS Standards Contact (Name): Curtis Herrick
(Organization): c/o Texas Transportation Institute
(Address): 3135 TAMU
College Station, TX. 77843-3135
(Phone): (561) 781-1685
(Fax): (800) 380-5294
(e-mail): gcherrick@earthlink.net

In the discussion section below, the project proposal identifies the ITS Standards that will be considered in the project design; if an applicable listed standard will not be considered, the project provides justification as to why the standard will not be considered; and describes the process that will be used to ensure that the considered standards will be incorporated in the project design.

Discussion:

1. The Following ITS Standards Will Be Considered In the Project Design.
   - Common Incident Management Sets
   - J2353 – Data Dictionary for ATIS
   - J2354 – Message Set for ATIS
   - Message Set for External TMC Communication
   - NTCIP Center-to-Center – DATEX-ASN (Parts 1 and 2)
   - NTCIP Object Definitions for CCTV Camera Control
   - NTCIP Internet (TCP/IP and UDP/IP) Transport Profile
   - NTCIP File Transfer Protocol Application Profile
   - NTCIP Trivial File Transfer Protocol Application Profile
   - NTCIP Object Definitions for Dynamic Message Signs
   - NTCIP Object Definitions for Environmental Sensor Systems
   - NTCIP Point to Multi-Point Protocol using RS-232 Subnetwork Profile
   - Traffic Management Data Dictionary

2. Justification for Not Considering the Following ITS Standard.
   None

3. Process to Ensure Considered Standards Will Be Incorporated in the Project Design.

Over the past several years, the ITS industry has developed a set of standards to increase the interoperability of equipment and information in ITS deployments. The benefits of such standards are clear, as they reduce the overall complexity of systems, provide for more cost-effective equipment solutions, and reduce the customization necessary for effective information exchange between all user groups.

In general, standards govern how components of the system should work within a general framework. In the concept of ITS, that framework is the national ITS architecture. Each particular standard addresses a defined need and provides the rules for both how to communicate and what to communicate.

Within this project, there exists a clear need to communicate effectively and efficiently between multiple agencies, using various pieces of equipment, along different types of communications infrastructure. Wherever possible and practical, this project will strive to implement the appropriate standards to achieve the objectives of the project. This will be accomplished at a number of timeframes throughout the life of the project.

Prior to purchasing equipment, the available standards will be used to develop specifications for the equipment to be purchased and deployed. As part of this project, a wide range of equipment will be purchased and deployed. Prior to each purchasing opportunity, the family of ITS standards will be reviewed to determine applicability to the individual pieces of equipment. In many cases, multiple standards will apply. It is also recognized that standards outside of the ITS family should also be employed to provide the interoperability necessary for successful integration. As an example, some additional standards outside of the ITS family would be those governing communications using Gigabit Ethernet in a TCP/IP environment. Specification of equipment that adheres to these additional standards simply serves to increase the interoperability of equipment and devices within the project.

As equipment is deployed, standards-based communications to integrate each component will be used. In many cases, these standards will cover not only the protocols of how communications should take place over various medium, but also the vocabulary of what should be communicated. The use of standards in this aspect ensures consistent communication between disparate devices as they will ‘talk’ the same language.

As integration progresses, the applicable standards at all levels of information exchange will be used to ensure that information and data from the project can be retrieved, examined, stored, analyzed, and presented in a manner consistent with other ITS deployments. This serves to increase the community of knowledge for all ITS deployments and ensures long-term operations capability and viability for the systems deployed in this project.

## 8. Evaluation of Benefits

This project agrees to participate in Evaluation of Benefits as described under Section 3.4 of the Guidance.

If this project is selected for independent evaluations, the project will cooperate with the independent evaluators and participate in evaluation planning and progress review meetings to ensure a mutually acceptable, successful implementation of the independent evaluation.

This project agrees to collect, document, and annually report cost accounting data.

Evaluation Contact (Name): Kevin Balke
(Organization): Texas Transportation Institute
(Address): 3135 TAMU
College Station, TX 77843-3135
(Phone): (979) 845-9899
(Fax): (979) 845-9873
(e-mail): k-balke@tamu.edu

This project agrees to perform a local evaluation funded from Project resources and submit a Local Evaluation Report documenting the lessons learned in meeting project goals and objectives. The Local Evaluation Report will address the following issues identified with an "X" (identify at least two):

___ Evaluate the institutional issues associated with achieving cooperation among public sector agencies, and document how they were overcome.

__X__ Provide a brief lessons learned report on the technical and institutional issues encountered in integrating ITS components.

___ Provide an evaluation report on the lessons learned in employing innovative financing or procurement and/or public-private partnering techniques.

__X__ Produce a lessons learned report on the experiences, challenges and approaches used in achieving consistency with the National ITS Architecture and/or implementation of ITS standards.

___ Produce a case study on the planning process used to achieve integration into an approved plan and program developed under an area-wide (statewide and/or metropolitan) planning process which also complies with applicable state air quality implementation plans.

__X__ Provide the appropriate metropolitan planning process with data generated by ITS technologies and services, and provide a report on plans or intentions for archiving the data and using it.

In the discussion section below, the project proposal identifies the steps that will be taken to meet the evaluation requirements.

Discussion

A Local Evaluation Report documenting the lessons learned in meeting the goals and objectives of the project will be submitted. As part of these lessons learned, TTI will collect, document, and report annually the costs associated with this project. TTI will develop spreadsheets that will capture the costs of all equipment and integration efforts expended in this project. TTI will also incorporate into a website all lessons learned associated with the project. Examples of the type of information that will be included in the website are as follows:

- Papers discussing applicability of standards to project goals and objectives
- Information concerning the implementation and status of the regional architecture
- Papers summarizing product evaluations
- Papers documenting trials and solutions encountered in implementing standards and specifications, as well as integrating the systems
- Procedures and specifications for testing equipment for compliance to standards
- Access to historical and real-time data collected through the integration of the signal systems

## SCHEDULE

**9. Start Date:**

September 2002

**10. Expected Completion Date:**

September 2005

**11. Milestones and Expected Completion Date:**

- Define requirements by October 2002
- Identify equipment requirements by April 2003
- Final regional architecture and deployment plan by April 2004
- Procure equipment by December 2004
- Install equipment by December 2004
- Proof of concept testing by February 2005
- Full implementation by April 2005
- Evaluation of the integration project by June 2005
- Final Report by August 2005

## FINANCIAL PLAN

### 12. Non-Federally Derived Funding Sources

Congressionally Designated Amount: $1,428,506

Amount Used for Integration Activities: $2,005,212 (70% of total project cost)

Amount Used for Rural Infrastructure Deployment: $ 0

20% Minimum Match Amount: $1,428,506 (50%)

A minimum 20% of the total cost of the project must be from non-Federally derived funding sources, as statutorily required, and must consist of either cash, substantial equipment or facilities contributions that are wholly utilized as an integral part of the project, or personnel services dedicated full-time to the proposed integrated deployment for a substantial period, as long as such personnel are not otherwise supported with Federal funds.

| **Identify non-Federal funding Source** | **Identify Type of Funds** (cash, equipment or facilities, or full-personnel services) | **Identify Major Activities Supported with these Funds:**<br>(1) Integration activities;<br>(2) Rural Infrastructure Deployment; or<br>(3) Infrastructure Deployment Supporting Integration | **Specify Amount of Funding ($)** |
|---|---|---|---|
| TxDOT | Cash | (1) Regional architecture<br>(1) Communication infrastructure (fiber)<br>(3) Upgrade signal control equipment for integration<br>Video detection equipment<br>Video surveillance cameras<br>DMS signs<br>(1) Evaluation<br>**Subtotal = $1,010,506** | $104,500<br>$305,506<br>$231,500<br>$108,000<br>$6,000<br>$140,000<br>$115,000 |
| TTI | Cash | (1) Video interface equipment (encoders, decoders)<br>(1) Communication infrastructure (routers, switches)<br>Upgrade signal control equipment cabinets<br>Video detection equipment<br>Video surveillance cameras<br>Upgrade equipment for video sharing, data archiving<br>**Subtotal = $400,000** | $107,100<br>$121,000<br>$11,500<br>$24,500<br>$52,500<br>$83,400 |
| City of College Station | Personnel services | (3) Signal technician | **$7,000** |
| City of Bryan | personnel services | (3) Signal technician | **$11,000** |
| **Total** | | | **$1,428,506** |

**Note: Personnel identified for 20% Match will have the following responsibilities:** The cities of Bryan and College Station will each dedicate a signal technician to install the video interface equipment and integrate it with the network.

## 13. Other Funding Sources

Remaining 30% Match Amount: There are no other Federally-supported projects directly associated with this proposal; the full 50% match is represented in Section 12.

A maximum of 30% of the total cost of the Project may come from a variety of funding sources and may include the value of Federally-supported projects directly associated with the proposed integration project.

| **Identify Funding Source** | **Identify Type of Funds** (cash, equipment or facilities, or personnel services) | **Identify Major: (1) Integration Activities, (2) Rural Infrastructure Deployment, or (3) Infrastructure Deployment Supporting Integration Supported with These Funds** | **Specify Amount of Funding** ($) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Note: Personnel identified for 30% Match will have the following responsibilities:**

## PARTICIPATING AGENCIES AND ORGANIZATIONS

### 14. Project Participants and Roles and Responsibilities

| | |
|---|---|
| **Lead Agency** | Texas Transportation Institute |
| **Roles and Responsibilities** | Overall project management.<br>Implementation of integration hardware and software, and operations and maintenance of communication network. |
| **Contact** | Kevin Balke, Ph.D., P.E., TransLink Research Center Director<br>Srinivasa Sunkari, P.E. |
| **Agency Responsible for Long-term O&M** | Texas Department of Transportation |
| **Roles and Responsibilities** | Project and funding oversight.<br>Ongoing operations and maintenance of Regional ITS Architecture.<br>Upgrade of communication network and signal control equipment.<br>Purchase and installation of DMS signs.<br>Operations and maintenance of TxDOT equipment. |
| **Contact** | Kirk Barnes, P.E. |
| **Participating Agency** | City of College Station |
| **Roles and Responsibilities** | Use of facilities, field implementation and general project support.<br>Regional Architecture steering committee member.<br>Operations and maintenance of City of College Station equipment. |
| **Contact** | Mark Smith, Public Works Director |
| **Participating Agency** | City of Bryan |
| **Roles and Responsibilities** | Use of facilities, field implementation and general project support.<br>Regional Architecture steering committee member.<br>Operations and maintenance of City of Bryan equipment. |
| **Contact** | Rick Conner, Public Works Director |

## 14 A. Additional Participants in Regional Architecture

| | |
|---|---|
| **Participating Agency** | College Station Urban Transportation Study Steering Committee (Bryan District MPO) |
| **Roles and Responsibilities** | Regional Architecture steering committee member. |
| **Contact** | Michael Parks, P.E., Director MPO |
| **Agency Responsible for Long-term O&M** | Brazos County |
| **Roles and Responsibilities** | Regional Architecture steering committee member. |
| **Contact** | Al Jones, County Judge |
| **Participating Agency** | Brazos Transit |
| **Roles and Responsibilities** | Regional Architecture steering committee member. |
| **Contact** | John McBeth, General Manager, Margie Lucas, Asst. General Manager |
| **Participating Agency** | Texas A&M University PTTS |
| | |
| **Roles and Responsibilities** | Regional Architecture steering committee member. |
| **Contact** | Robert Bisor III, Interim Director |
| | |