The e-STIP:

Using Technology to Support the STIP

Final Report — September 2015

Publication No. FHWA-HEP-16-002

U.S. Department of Transportaiton
Federal Highway Administration
1200 New Jersey Ave., SE
Washington, DC 20590

Notice

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document.

The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers' names appear in this report only because they are considered essential to the objective of the document.

Quality Assurance Statement

The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and

Contents

Glossary

Administrative Modification (or Modification)
Revision to a project that includes minor changes related to the following: project or project phase costs, funding source, and project or project phase initiation dates (23 CFR 450.104).

Amendment
Revision to a project that involves the addition or deletion of a project, or a significant change including major change in project cost, project or project phase initiation dates, or a major change in design concept or design scope. An amendment requires public review and comment, and updated demonstration of fiscal constraint (23 CFR 450.104).

Baseline Project
Ongoing projects included in previous iterations of an approved STIP, which have committed funding and public support. Baseline projects are imported into the e-STIP, under the assumption that the project is still viable (i.e. passes screening for fatal flaws such as lawsuit, lost funding, or loss of community support).

Basic e-STIP
The most basic level of an e-STIP, in which a database of projects is made available over the Internet to stakeholders. Functions may include search, automated updates, and report generation. Basic e-STIPs serve as platforms for one-way communication originating from the state DOT.

Collaborative e-STIP
An intermediate level e-STIP, in which the database of projects serves as a platform for automation of business processes and allows for two-way communication between the state DOT and others involved in the process (sponsoring agencies, etc.). Features may include electronic submission from MPOs, electronic approvals, and demonstration of fiscal constraint. Visualization, GIS, and public input functions may also be included, because they facilitate two-way communication with the public.

Database-driven Static STIP
An approach to managing the STIP using a database system instead of paper or word processing. The database generates a STIP document that appears very similar to a paper-based STIP. A basic e-STIP database is only used by DOT staff, and is not made available to stakeholders of the public.

Eligible project
Either a baseline project or a new project that has passed screening for fatal flaws and is included on the list of projects that will be evaluated for inclusion in the STIP using approved project selection criteria.

e-STIP Change Management Plan
A plan that describes the actions required to support the timely and cost-effective development and deployment of an e-STIP. This change management plan includes elements for managing process and technology changes; the internal and external staff and partner involvement necessary to create buy-in and user competency; and identification of the financial and staff resources that will be required.

Illustrative Project
Proposed project that does not have any or adequate funding assigned to it, but is in the queue to receive funding in the future and is shown for informational purposes.

Obligated Project
Project that the federal government has identified federal funding and is approved for reimbursement. The obligated amount is the federal share, so it may not reflect the final project cost.

Paper-based Static STIP
STIP that is published as a list of projects. Although it may actually be assembled using a paper filing system or a word processor, projects must be manually added, deleted, and modified.

Priority Project
Project that has been evaluated and selected using the approved project selection criteria. Priority projects are assembled into a preliminary STIP that can be screened for compliance with state and federal regulations and requirements.

Sponsoring Agency
Entity eligible to submit a project for federal transportation funding, including but not limited to local or state agencies.

Technology-enhanced e-STIP
Advanced level e-STIP includes the two-way communication features found in a Collaborative e-STIP, but also uses the system to generate information useful to others outside of the programming process, including components of the DOT (finance, asset management, bridge engineering, etc.). It can also include information that supports performance measurement and future cycles of performance-based long range planning.

Introduction

The State Transportation Improvement Program (STIP) is the primary product of the "programming process," one of the core business processes at state departments of transportation (DOTs). The STIP summarizes the decisions made during programming when projects to move forward are selected; each selected project is matched with an available revenue source; and an implementation schedule is established. Programming sounds straightforward but, in fact, is one of the most complex processes for the DOT. In any given year, a DOT could be managing hundreds, or in the case of larger states even thousands, of individual projects. The available resources include multiple federal, state, local, and even private funding sources, each with its own set of restrictions and requirements. At any point in time, for a wide variety of reasons, a project schedule may accelerate or it may slip, affecting not only the timeframe for completion of the project but also the balance of funds available for other projects. The programming process can be highly scientific, employing revenue models and quantitative project selection criteria. It can also be policy-driven and occasionally highly political. It is frequently a blend of scientific, policy analysis, and political evaluation techniques.

A 4-year STIP is the federally mandated short-term planning document that captures the results of the programming process. Every state must have a STIP that meets federal requirements, but most states go beyond the federal requirements and use the STIP as a transparent and fiscally constrained record of their priorities for implementing improvements to the multi-modal transportation system. One of the primary federal requirements is that the STIP must include the projects selected by the metropolitan planning organizations (MPOs) within the state. The MPO's programming decisions are documented in the local Transportation Improvement Program (TIP). TIPs are approved by the Governor and then incorporated into the state DOT STIP, which is ultimately approved by USDOT. Collectively, this results in a STIP that reflects the agreed to and complete list of transportation projects to be implemented across the state over the timeframe of the STIP, generally four years.

The STIP is not a static document. The foundation of the STIP is the interface between the DOT's financial and project management processes. As resources or schedules for any individual project have to be adjusted, the STIP must be modified to reflect the more accurate estimate of time or money required.

For many states, the publicly available STIP document may a large spreadsheet where individual projects are sorted by regions and MPOs within the state. The row for each project includes a project description, estimated total project cost, the amount of federal funds that will be used in each year and the agencies that will carry out the project. For every state, a significant amount of data must be accurately maintained to support this spreadsheet. For many states, this data is collected and maintained through a paper process, demonstrating that the STIP is not static. The foundation of the STIP is the interface between the DOT's financial and project management process. As resources or schedules for any individual projects have to be adjusted, the STIP must be modified to reflect the more accurate and current estimate of time or money required. A

paper process or even a spreadsheet tool requires significant time and staff resources to keep the STIP up to date.

Advances in web technology and improved database usability have spurred creation of electronic tools to support the creation and management of the STIP. This trend has accelerated in the past decade as web technology, data management tools and geographic information system (GIS) capabilities have become more sophisticated, less expensive, and integrated. Therefore, many states have or are considering creating e-STIPs, technology systems that automate significant portions of the STIP process, as a way to save both time and money in creating and managing the STIP process.

Purpose and Audiences for the Guide

The purpose of this guide is to introduce the electronic STIP (e-STIP) as an opportunity to assist state DOTs in managing the development and management of their STIPs. Based on a survey of state DOTs and experiences of current managers involved with the STIP process the guide summarizes the benefits of moving to an e-STIP and discusses e-STIP functionality that will allow state DOTs to maximize the benefits of turning to automation of this complex process. The Guide also includes an e-STIP prototype to help STIP managers envision what an e-STIP might do for their organizations as well as next steps to help develop a DOT action plan for moving forward. Throughout this guide we have cited examples from the 36 states that responded to our 2012 e-STIP survey and the detailed interviews we conducted with the six DOTs that are most advanced in their implementation.

The primary audience for the e-STIP Guide is DOT managers responsible for the development and management of the STIP. However, the Introduction and Overview of the e-STIP have been written to provide executives of the DOT with a quick summary of what the STIP is, its importance to the DOT, and the benefits of supporting this core business process with a robust electronic tool as a support to the STIP Managers who need to make the case for implementing an e-STIP for their DOT.

The business case for implementing an e-STIP is compelling. The programming process is data intensive, federally regulated, highly visible to external partners and the public, and intricately tied to both project and financial management of the DOT. New federal requirements for Performance Based Planning and Programming (PBPP) are placing additional pressure on the accuracy and transparency of the STIP. Under these requirements, projects selected during programming are the glue that ties the required planning goals and targets to the outcomes that are identified in a performance based plan. Creating and managing the STIP will become even more complex as DOTs will be required to explain in the STIP how selected projects will help advance the performance goals established during long range planning. STIPs have the potential to be a powerful source of data to support both the technical analysis and the policy decisions

that will be required to support PBPP, but technology is the only way this information can be tapped efficiently and effectively.

Overview of e-STIP

An e-STIP is an electronic submission, processing, and approval software tool that supports the development and management of the STIP. e-STIP assists the state DOT in collaboratively working with its federal partners, MPOs, and project sponsors. Minimum capabilities include generation of the STIP, generation of the list of obligated projects, electronic processing of amendments and modifications, and real-time status updates of each STIP action item. More advanced e-STIPs are capable of generating reports and information that support the STIP process. The e-STIP is used to automate or streamline functions of the programming process and the creation and management of the STIP. e-STIP technology can generate or assist with publication of the STIP by making the document searchable by internet users as a public involvement tool.

Based on a survey of state DOTs conducted in 2012, many states are using automation to support their programming process but only a handful have advanced to an e-STIP that leverages technology to fully support development and management of the STIP. Provided the flexibility of the STIP format, no national standard exists for e-STIP, so basic functionality of the e-STIP systems can be varied to meet the needs of individual agencies. A full e-STIP system can provide a variety of useful information that a static STIP cannot.

Based on interviews, e-STIPs in place today have a wide range of functionality. The survey indicated that states with the most basic e-STIP allow users to view the database, search, and generate reports. A limited number of staff have permission to update or modify records in the database. However, a more robust e-STIP includes functionality which allows the DOT to collaborate with the agencies that are their partners in creating and managing the STIP, primarily MPOs, FTA and FHWA. In a collaborative e-STIP, the system automates the primary aspects of the STIP business process and facilitates two-way communication among partners and with the public. The primary features of a fully collaborative e-STIP include electronic submission of project requests as well as STIP amendments and modifications from all project sponsors, including at a minimum, MPOs and internal DOT organizational units. It includes functionality that permits the electronic submittal of public comments on individual projects or the STIP overall. It identifies and links project information such as the NEPA or supporting feasibility

Prior to adopting an e-STIP, Florida DOT received widely varying TIP formats from the state's 26 MPOs and having to reformat the documents for consistency was a cumbersome process and time-consuming. FDOT finds that using an e-STIP helps to keep TIPs and the STIP aligned.

studies. It also supports electronic approval of the STIP by MPOs, the state DOT, and federal agencies. Finally, it can be used to test fiscal constraint and promotes the use of visualization and GIS to enhance project information.

A few states responding to the survey have systems approaching this collaborative model so that e-STIP automates their programming process for MPOs and the state DOT, providing a single, cohesive process for creating, approving, and amending the STIP. In this case, the MPO partners are granted access to make changes to selected data elements in their project records. Required approvals between the state DOT and the MPO are handled within the coordinated system eliminating the need for paper or email communication outside of the system.

The benefits, features and functionality, and prototype described in this guide are based on the concept of a highly collaborative e-STIP.

According to PennDOT, using a paper-based system is strenuous and costly, and there is the potential of losing data when papers are misplaced. NYSDOT reported saving thousands of hours of administrative time and many reams of paper. One of TxDOT's primary reasons for developing an e-STIP was to reduce the time needed for project reviews by weeks, and in some cases months.

Benefits of an e-STIP

The 2012 survey of state DOTs with e-STIPs highlighted many examples of the benefits of implementing an e-STIP.

Reduced administrative burden and increased accuracy – The STIP process requires the collection and manipulation a large amount of data about individual projects submitted by a significant number of internal and external project sponsors. An e-STIP promotes process standardization, data consistency, quality assurance and control, and reporting, and provides a repository for retaining a historic record showing all the changes made to individual projects. All of these improve operational efficiency. Depending on the features, an e-STIP can also significantly reduce the time required to approve both the initial STIP and any modifications and amendments. For example, in Pennsylvania the use of an e-STIP reduced the amendment process turn-around time from 2 to 4 weeks to a little as 5 minutes.

Improved access to project related data – Underlying an e-STIP is a comprehensive database of information about current and future projects. An e-STIP provides access to this data to support multiple decision-making processes by the DOT and individual project sponsors. For example, an e-STIP can provide the ability to search STIP data through filters or keywords; uploading documents, images, or videos to produce more descriptive project records; and adding spatial data or geographic coordinates**.** Texas DOT indicated that a major impetus for

the creation of TxDOT's e-STIP was the ability to filter for certain types of individual projects easily. These searches were simply not possible before, as it would require sorting through PDF files for thousands of projects.

Increased collaboration and transparency – E-STIPs can facilitate collaboration with key partners in the development of the STIP including project sponsors, federal agencies and the public. A robust e-STIP supports electronic submittal of project requests and amendments from sponsoring agencies. For example, in Pennsylvania, FHWA staff can approve projects even when on travel, which was a common cause of delay with a paper-based system.

Access to STIP information strengthens a DOT's relationships with project sponsors, stakeholders, and the public, by offering a level of transparency about current and upcoming projects and how public funds are being spent. PennDOT and NJDOT both indicated that visualization and search functions are particularly helpful to the public for accessing and interpreting STIP information. This transparency bolsters a DOT's integrity and helps to build trust in its working relationships with stakeholders involved in the programming process. Access to this information equips the public to be knowledgeable and better engaged in transportation decision making. Colorado DOT uses its e-STIP to increase transparency and enhance public engagement. The e-STIP database generates a Daily Summary STIP Report that is posted online to provide up-to-date funding information to the public. Also, the e-STIP database populates an online Project Locator map that provides geographic visualization of each project in the e-STIP. Project corridors are highlighted on the map; clicking on a corridor provides project information, as well as a link to the Daily Summary STIP Report for more details. The Project Locator also enables the public to submit comments about projects in the STIP.

Using Technology to Support the STIP

Basic Elements of an e-STIP

The collaborative e-STIP represents an intermediate level that uses the project database to automate business processes and support two-way communication between the state DOT and other project sponsors. The basic functionality should support seven elements:

A. **Generation of the Eligible Projects List**
B. **Creation of the e-STIP**
C. **Electronic Processing of Modifications**
D. **Electronic Processing of Amendments**
E. **Generation of the List of Obligated Projects**
F. **Financial Reporting**
G. **Performance Reporting**

Figure 1 shows the relationship among these elements of an e-STIP functionality. The e-STIP itself (element B) begins with a list of projects (A), but is frequently updated through modifications (C) and amendments (D). At various points, the e-STIP system can generate current information like the List of Obligated Projects (E), Financial Reports (F), or Performance Reports (G).

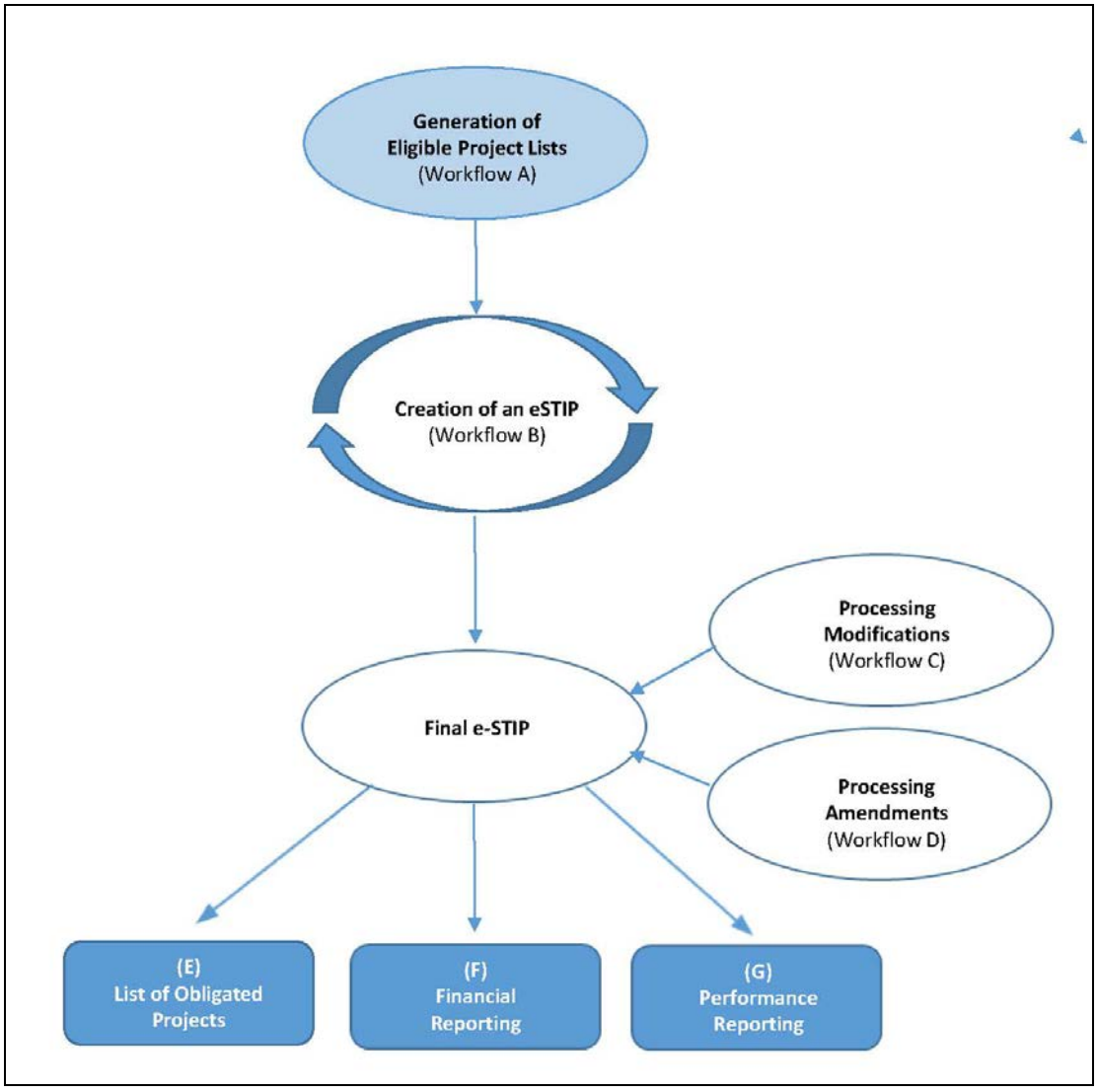


Figure 1. E-STIP Elements

These elements fall into two categories: (1) those that represent a core work flow within the e-STIP (elements A–D); and (2) those that are implemented by creating a robust reporting

capability (elements E–G). The information below describes each of these. Appendix A includes information that is more detailed, and high-level workflow maps for each element of the e-STIP.

Generation of the Eligible Projects List

In the STIP process, projects can be submitted by a wide range of project sponsors both internal and external to the DOT. An e-STIP allows these project sponsors to submit the projects electronically, automates the validation of eligibility against identified screening criteria, and generates the list of projects that are eligible for further consideration for inclusion in the fiscally constrained STIP. About 70% of the DOTs that responded to the e-STIP survey indicated that their system allows electronic TIP submittal from MPOs, and 92% indicated that they have the capability to import and export a variety of file formats into the e-STIP. To import and format the TIP, data is often the initial e-STIP functionality that the DOTs investigate and implement.

Creation of the e-STIP

Creating the STIP is the most complex part of the programming process. The STIP is built as individual projects are tested against project evaluation criteria, matched to available funding sources, prioritized, and assigned to an appropriate year within the timeframe of the STIP. The survey results indicated that 69% the states with an e-STIP use it to create their draft and final STIP documents. The actual evaluation of projects against project selection criteria is not functionality included in the e-STIP. The DOT and MPOs have a variety of processes and criteria to select projects, often tied to different funding categories or jurisdictions. However, an e-STIP should be capable of validating that individual projects selected meet funding category eligibility requirements and any scheduling requirements. A robust e-STIP should also include functionality to build and balance the STIP, receive public comments related to the draft, and administratively approve the document at the MPO, state, and federal levels.

Building and balancing the STIP is a complex process where an e-STIP is particularly useful. Key to this is ensuring that three federal financial requirements are met (1) the overall STIP is fiscally constrained; (2) each year of the STIP is fiscally constrained; and (3) the amount of funds available in each individual funding category is not exceeded. Many states have additional state defined requirements, for example regional equity, that also need to be validated. Testing and balancing combinations of projects to meet all three of these can involve many iterations, and an e-STIP is invaluable in the calculation and recalculation required. Over 90% of the states that responded to the e-STIP survey indicated that they use the e-STIP to document and demonstrate fiscal constraint.

The public has the opportunity to review and comment on the draft STIP. About 40% of the states responding to the survey indicated that they use the e-STIP to receive public comments on the STIP. In addition, the STIP serves as the public record of the projects the DOT is implementing at any given point in time so an e-STIP can be invaluable in providing the public access to information about when projects will start or be completed within their communities. An e-STIP should include functionality that makes basic project information easily accessible to

Staff in PennDOT's district offices have the ability to update e-STIP project records which helps to ensure data accuracy. In New York, MPOs have access to NYSDOT's e-STIP and enter information into the system. In New Jersey, MPOs initiate STIP amendments through NJDOT's e-STIP.

the public. It should include a flexible search function and preferably support GIS mapping. The survey indicated that 54% of the states with e-STIPs have GIS mapping and 38% have some visualization capability within their systems.

There are also administrative efficiencies if the e-STIP includes an electronic approval process for the multiple approval steps that are required for the MPO, state DOT, FTA and FHWA. Of the states responding to the survey, 62% indicated that they have an electronic DOT approval process as a part of the e-STIP, with 46% responding that federal approvals can be completed electronically.

Electronic Processing of Modifications and Amendments

An approved STIP is not a static document. As projects are planned and designed, both schedules and costs can change and these changes require adjustments in the STIP to ensure that the overall program of projects remains current and fiscally constrained. STIP modifications and amendments are the processes of making official changes to the STIP. Modifications are smaller and more informal than amendments and, therefore, have fewer requirements for review and approval. The e-STIP functionality for the two is very similar with electronic submittal of the request, validation against any requirements, ensuring fiscal constraint is maintained and approval of the request. Ninety-two percent (92%) of the states with e-STIPs have functionality to support electronic submittal of modifications and amendments. Those that have electronic approval functionality use it to support these processes.

In Colorado, planners at each of the five DOT regions enter new projects or amendments directly into the e-STIP; the SAP database adjusts the e-STIP almost daily to reflect any new or revised project records, Once the project data has been entered or amended, the software transitions to a stage in which new information can be added, as well as reviewed and edited by others as necessary. The software places these projects in the pre-approval stage until documentation is provided and the public review process has been completed; after this step, the project or amendment is either approved or removed from consideration.

Generation of the List of Obligated Projects

Federally funded projects included in the STIP cannot begin until USDOT (FHWA and FTA) "obligates" the federal funds. This element of the STIP process includes the request from the DOT for federal approval to access the federal funds allocated to an individual project as shown in

the approved STIP and the FHWA/FTA corresponding approval of that request. A complex accounting process of "managing obligation authority" is also in place to ensure that total federal funding approved in any year does not exceed a ceiling that Congress has established. The survey responses indicate that 46% of states that have e-STIPs use the system to track obligated projects and manage their overall obligation authority.

Financial and Performance Reporting

An e-STIP should be supported by a robust database of information about both approved and obligated projects. To access this data any e-STIP must include a well-designed database and a flexible reporting system that supports not only standard reports but also allows user-defined special reports. Standard reports generally include data related to project description and identification number, phase information, funding years and dollar value by year and project location. Financial reporting may include a wide range of reports such as information about the various types of program funds supporting an individual project, or summary reports of dollars obligated, spent, and remaining in total or by funding category. Nearly 40% of the state DOTs responding to the e-STIP survey indicated that they could produce financial reports through the system. Project delivery status is the most common type of performance reporting with 54% of the e-STIP DOTs indicating that they use the e-STIP to provide these reports to organizations. In addition, 38% of these DOTs can generate reports with the associated project performance measurement information, and 23% indicate that their e-STIP includes information that links individual projects to long-range plan goals and objectives.

The e-STIP reporting system also should include functionality that allows a user to define filters to use for reporting. Standard filters identified by the DOTs using an e-STIP include the ability to identify a geographic region (e.g. MPOs or DOT districts) and program or asset type (e.g. pavement, bridge, safety).

Over time, the e-STIP database contains not only information about the current STIP, but also a wealth of information for prior projects that have been funded or even proposed, as well as illustrative projects that are identified for the future but have not yet secured funding. If this database is properly organized and maintained, the data can be very

Colorado's fiscal constraint reports get sent to FHWA showing each region, its projects, and their budgets (including how much of the budget has been spent to date). Updates to the STIP are published daily on CDOT's website as a daily summary for the public; there is also a detailed STIP option available and access to interactive maps.

valuable to a DOT for both managing the current program of projects and developing future versions of the STIP.

The e-STIP and Performance Based Planning and Programming

With new federal requirements for Performance Based Planning and Programming (PBPP), the projects selected during programming are the key that links planning goals and targets to the outcomes that are identified in a performance based plan. Creating and managing the STIP will become even more complex, as DOTs will be required to include a discussion of how selected projects will meet the performance goals. STIPs have the potential to be a powerful source of data to support both the technical analysis and the policy decisions that will be required, but technology is the only way this information can be tapped efficiently and effectively. e-STIP tools are an important step toward the next generation of performance based STIPs. Appendix B provides additional information on linking performance based planning to performance based programming.

The e-STIP Prototype

To help advance the state-of-the practice and encourage state DOTs to invest in e-STIP development this guide includes a prototype of an e-STIP that includes the features and functionality that will achieve the benefits of a collaborative e-STIP. This prototype consists of static Web pages that show both the public and administrative user interface for the e-STIP. It also demonstrates the "look and feel" for key e-STIP work flows, including creating, modifying and amending, and approving the STIP. Appendix C describes the features and functionality of the prototype e-STIP and provides information about the elements within the prototype where individual state DOTs have the flexibility to adapt the design.

State DOT staff can use the prototype to engage with senior managers to help show what an e-STIP is and how it can help the DOT manage the STIP process more efficiently and effectively. The Features and Functionality document can be used to begin discussions with technology staff or consultants on the requirements for the foundation of an e-STIP that can be tailored to meet the state's specific system needs.

e-STIP Implementation: Next Steps

State DOTs that are considering implementing an e-STIP need to use a thoughtful, risk-based project management approach. This includes developing an implementation plan that evolves over time and risk based management of costs and schedules so the system is delivered on time and within budget. This e-STIP Guide is intended to help anyone considering an e-STIP implementation to develop a state specific recommendation for implementing an e-STIP. The information in prior sections can serve as the starting point for identifying the business case and goals for an e-STIP, as well as the basic workflows and potential features and functionality of the system. This information needs to be tailored to the specific issues and context of the agency in order to achieve the specific outcomes the state DOT needs.

Developing the e-STIP Implementation Plan

The e-STIP Implementation Plan is the document that will guide the conversion to an e-STIP from early consideration of the rationale through the development and deployment of the final system. This plan should include:

Essential Steps

- e-STIP business case tailored for key or specific audiences;
- Specific goals to be achieved with the conversion;
- Description of the work flows in the STIP with identification of those to be automated by the e-STIP, those that will remain outside e-STIP functionality and the interface requirements (inputs and outputs) between the two;
- Description of the features and functionality of the e-STIP;
- Description of the underlying data and database requirement to support the e-STIP;
- Training plan to support deployment of the e-STIP;
- Change management plan to support deployment of the e-STIP; and
- Schedule with associated resources (staff time and funding) needed to implement the plan.

The e-STIP implementation plan is not a static document. It will begin as a preliminary scoping document that will help the champion for the e-STIP conversion, most likely the DOT manager responsible for STIP development, summarize the business case and goals for a conversion, the desired features and functionality, and a very preliminary estimate of resources and time required. This preliminary version of the plan can be used to brief senior leaders who need to support and champion the plan and allocate resources to move forward with an e-STIP implementation. As the implementation moves forward, this very preliminary plan is enhanced and refined with additional detail about both system requirements and support needed for a successful implementation.

Key Roles

The plan should also identify individuals to fill key roles for overseeing the e-STIP development and implementation. These roles include:

- e-STIP champion — A member of the senior leadership team who will advocate for the commitment of the organization to an e-STIP and the allocation of resources needed to implement an e-STIP. This individual serves as the primary contact with the Executive Leadership Team throughout the e-STIP implementation.
- Business partner lead — The most likely individual to serve as the business partner lead is the manager of the STIP development process. This individual serves as the project manager for the implementation and leads the team of business experts or process owners. The business partner lead should be knowledgeable in all aspects of the STIP development and

management as well as have an understanding of the roles and responsibilities of internal and external partners and stakeholders in the current STIP process.

- Technology partner lead — This individual has technology systems development experience and should bring an understanding of the existing technology environment at the DOT as well as any technology policies, standards or requirements that govern technology systems development by state agencies. This individual will lead the team of programmers, developers and database experts that will be designing the e-STIP technical program and creating or enhancing the database to support it.
- Business experts team — The DOT should form an advisory team of individuals who are involved in various aspects of the STIP business process within the DOT and at key partner agencies including the MPOs, FTA and the FHWA. This team will help prepare the Implementation Plan and will participate in key aspects of its implementation including for example:
  - Identification of opportunities, issues or challenges in the current STIP development process;
  - Goals for the e-STIP;
  - Documenting and improving the current STIP business process;
  - System requirements;
  - Usability and functionality testing; and
  - Communication with staff and leaders in their organization to support implementation and acceptance of the e-STIP.

Exactly when and how the technology partner lead is identified will vary from state to state based on the state's technology structure and requirements. Advice from states involved in the development of this guide is that identification of a technology partner should occur as early as possible. The technology requirements and structure within the state can strongly influence what the e-STIP can or cannot do. For example, some states will not permit electronic approval processes or have security or firewall requirements that will make sharing system functionality with MPOs difficult. In many situations, overcoming technology requirement barriers is possible, but understanding the challenges sooner will ensure that the implementation plan addresses these issues before they became a problem that may affect the schedule or the overall implementation.

The information below summarizes each section of the Implementation Plan. Appendix D is an implementation-planning checklist.

Creating a Business Case and Goals

Converting to an e-STIP is a considerable technology investment for any state DOT and requires the support from a wide range of internal and external stakeholders. At a minimum, these

include the senior leaders of the DOT, managers of key DOT program areas, senior leaders and staff at the MPOs, and FTA and FHWA staff involved in STIP processes. The manager responsible for the development and management of the STIP is the most knowledgeable about the rationale for an e-STIP and should lead or be heavily involved in preparing and presenting the business case.

An e-STIP business case builds support for the conversion by summarizing the benefits of moving to an e-STIP. The Introduction to this guide includes a discussion of the benefits of an e-STIP that represents the starting point for preparing a state specific business case. This information needs to be tailored to the specific agency and state context. To do this, it may be helpful to ask a number of staff and stakeholders questions such as: What problems, issues, or "pain" do we currently have in the STIP process? Are parts of it taking too long? Where are the bottlenecks? Do we have data integrity issues? Do our customers and partners know where to find information, and when they see it can they understand it? What is the State's Administrative Modification vs. TIP Amendment criteria? Answers to these and other questions will provide a foundation for the tailored business case for an individual state.

The business case needs to convince each key audience to support the development of an e-STIP. Although the core rationale for the business case (for example administrative efficiency, better access to data, transparency) might be the same across all internal and external stakeholders, the business case will need to be tailored to emphasize the efficiencies and benefits that are most compelling for each individual group. A good question to use when tailoring the business case is "What's in it for them?"—essentially what are the most significant benefits of an e-STIP to the specific group?

Those hearing the business case will want to know what they will be required to do. Particularly, for any individual or group that will be asked to invest significant resources, the STIP manager or staff needs to be prepared to provide at least a preliminary estimate of the costs and staff time required, as well as the timeframe anticipated to complete the conversion. This starts with the senior leaders of the DOT who need to consider both the benefits and general costs before they commit to moving forward with an e-STIP. In addition to the costs associated with technology development, resources will need to be allocated to non-technology tasks such as analyzing and improving the existing STIP process and training staff to use the new system.

Goals for the development of the e-STIP system capture the key outcomes that the state wants to accomplish from the conversion to an automated system. These goals should be outcome oriented. They should include quantitative goals where baseline information is readily available. Some example goals are:

- Reduce time to process STIP amendments and modifications by 50%;
- Reduce the time to create the initial STIP by 50%; or

- Improve communication and transparency of the STIP with the public as measured by a reduction in the number of telephone inquiries related to the STIP.

One primary purpose of the goals is to help define the scope of the system development. As users begin to see the power of an e-STIP, there will be many ideas for additional features and functionality. Goals can be used to help screen and evaluate these ideas to help control cost and maintain the schedule for the development of the e-STIP.

Identifying the e-STIP Work Flows

Before beginning any technology development, the DOT needs to ensure that it has clear documentation of the existing STIP development process; identify improvements that will increase the overall efficiency or effectiveness of this process; and consider whether the current organizational structure and placement for the STIP development team is the most effective to support an improved or redesigned STIP development process. The goal of this review is to confirm that the underlying STIP process and organizational implementation are sound, so any automation does not simply automate poor business practices.

While this seems obvious, the STIP process is complex and the execution of the process is shared among a number of DOT offices and with external partners such as the MPOs. The DOT should convene a team with representatives from all the groups that have responsibly for a portion of the STIP process. The purpose of this team will be to create a current process map if one does not already exist, and to look at streamlining and improving the existing process. A technology partner may have business analysts that are trained to document and review existing processes as the foundation for a technology conversion. Some DOTs also have staff who have been trained in process improvement techniques.

Once the underlying STIP development process is documented and improved, the team should identify the specific portions of the process that will benefit from automation. This guide provides generic workflows for the most common functionality incorporated into the collaborative e-STIPs identified through the survey. These workflows and associated documentation are provided in Appendix A.

Three generally accepted organizational structure models are used to support a collaborative e-STIP: centralized, decentralized, and hybrid.

A **centralized organizational structure** maintains a central department or division that is responsible for all e-STIP services. In this type of structure, the STIP has its own dedicated department or it is a significant component of a larger part of the organization such as Planning or Finance.

A **decentralized organizational structure** divides STIP and e-STIP responsibilities throughout various departments and/or organizations. Decentralized organizational structures may still have a STIP Division that coordinates among the various areas but decision-making associated with the STIP is spread throughout the organization.

A **hybrid organizational structure** provides the benefits of both organizational structures. With this approach, e-STIP administrative tasks can be handled centrally, while depending on needs and available staff at individual departments and stakeholder organizations to provide data inputs, as with a decentralized approach. The hybrid approach allows STIP department data policies and metadata standards to be created and prescribed by the DOT in cooperation with the stakeholder organizations. For more detailed information about each structure, see Appendix E.

Identifying e-STIP Features and Functionality

The information and insights gained from the development of the Implementation Plan, including the business case, the goals, and the issues and challenges associated with the current STIP process, are all inputs into identifying the primary features and functionality for an individual state's e-STIP. The Using Technology to Support the STIP section of this guide summarizes the features and functionality that are most common to existing DOT collaborative e-STIPs, and Appendix C: The Prototype Features and Functionality provides a high-level narrative description of the elements that were incorporated into the prototype design. This information should provide a significant foundation for determining an e-STIP that will meet the state DOT's needs.

Identifying Data and Database Requirements

Those involved in STIP development need to work with their technology partners to complete this portion of the Implementation Plan. The STIP staff identifies the existing and new data and the data sources needed to support the STIP process, including data collection methods if new data is needed. The technology partners will evaluate the structure of the existing database or databases to determine if they need to rework or supplement the database to support the expanded capabilities of an e-STIP. Jointly, the business process and technology staff will review existing data definitions and quality assurance protocols to ensure that these are clearly and sufficiently documented to support the collaborative database necessary for an e-STIP.

Every current STIP process has an existing database or information that documents the projects included in the current STIP. For states where the MPO TIP process is not integrated with the DOT STIP process, multiple databases will have to be connected or combined to support a collaborative e-STIP. These databases are used to update the current STIP (or TIP) and serve as the foundation for creating new or revised STIP versions, as needed. These databases include current project records for every approved project in the STIP, but may also have archived past projects and illustrative projects information that are not included in the currently approved, fiscally constrained STIP. Connecting these databases and keeping this data up-to-date, and leveraging the wealth of information they contain (or could contain) is one of the most compelling reasons a state DOT should implement an e-STIP.

The STIP database not only supports the STIP development, it also contains project information that is important to the general public, stakeholders, and partners. The collaborative e-STIP

provides controlled access to some portion of the database for public information purposes. This external visibility and accessibility of the STIP information increases the need for accuracy and management of the data.

Most of the data to populate an e-STIP should be available. However, this data is drawn from a wide variety of sources both within the DOT and externally. To gain access and to create consistent formats, or interoperability, is a significant impediment to an e-STIP, especially among the disparate data sources. But one of the significant benefits of an e-STIP tool is to create standardized formats and partner agreements on data maintenance to leverage existing data for multiple purposes across multiple agencies. In order to build a system, key information and procedures will need to be standardized and adopted with appropriate authority.

Training Plan

As the technology development gets underway, the business partner lead should begin preparing an e-STIP training plan. The training plan should consider training needs across the full spectrum of users both internal and external to the DOT. Initial training content should include a basic introduction to the e-STIP purpose and an overview of its features and functionality. It should provide opportunities for hands-on practice using the tool, and interaction with the trainer and developers to answer questions, and identify and resolve potential problems. This training does not need to be face-to-face classroom training. A variety of formats can be used for implementing the new system applications.

Figure 2. Examples of Training Formats

In Colorado, workers who are identified as future users are given a one-day class on the e-STIP system, followed up by hands-on experience and question and answer opportunities. In Florida, each District has a MPO liaison that works with and guides the MPOs on the use of new products and the e-STIP processes.

Change Management Plan

A fully implemented e-STIP requires significant commitment by the state DOT. However, an e-STIP can solve problems, create opportunities, and improve business results. As with the implementation of any large-scale technology project, a variety of factors will directly affect the overall success of the e-STIP program. Aside from the obvious factors, such as the different hardware/software platforms available and the potential selection of vendors, the DOT must thoughtfully identify and manage the organizational and "people" changes that can and will influence the success of the e-STIP.

e-STIP users generally fall into three categories: Power Users, Analysts, and Viewers. Depending on the user groups, their action with e-STIP may vary from consistent daily use to a more sporadic or irregular use.

- **Power Users** – Power Users are generally daily e-STIP users. They create and manage the data and are skilled in using relational database, GIS software and visualization tools to create, edit, and maintain the e-STIP.
- **Analysts** – Analysts leverage e-STIP information to conduct analysis, improve decision-making capacity, or display data related to information available in the e-STIP into an approachable format. Analysts are skilled at using the search, filter and report generation features of the e-STIP to sort and display information needed for decision-making.
- **Viewers** – Viewers use the e-STIP to view project information through a tabular and/or map interface. The viewer may be looking for information related to an individual project, but data and maps can also be retrieved using pre-defined filters to display information about multiple or a category of projects.

It is important that the e-STIP implementation addresses each user group's individual data and application criteria and requirements. The DOT management and the MPO partners must see the e-STIP implementation as an improvement over the way their employees currently conduct business, as well as a means to improve efficiencies and customer service. Managers must stay well-informed on these different types of users' requirements so they may target system development, overall communication, and training to each group's specific needs.

A change management plan summarizes the organizational supports and actions required to implement an e-STIP. For those state DOTs interested in the orderly implementation of a collaborative e-STIP, these organizational supports include the following:

- The business case and goals that identify the value of the e-STIP to the organization;

- A formal announcement, or policy statement that demonstrates the commitment of senior leadership to implementation of an e-STIP;
- Commitment of resources to develop and implement the e-STIP, including the up-front development costs and the long term staffing and administrative support required for successful integration of the e-STIP into the STIP business process;
- A formal Implementation Plan, which outlines the scope and guides the system development;
- Technical cooperation and oversight to prepare a system development plan and oversee its implementation;
- Staff or structure to resolve internal and partnership policy, management or resource issues; and
- Management to oversee the day-to-day implementation of the Implementation Plan.

Re-engineering workflows and automation often affects the way the DOT conducts its daily business. In this instance, an e-STIP may require a change in the way in which individual work tasks are currently performed. For any major changes, buy-in from DOT and stakeholder employees is imperative. Agency staff must see the benefits of e-STIP implementation. Some examples of how to provide this context are:

- Communicate with employees throughout the progress, keeping them up-to-date and soliciting their input on key issues that will impact their day-to-day work.
- Involve a broader cross-section of employees in the documentation of the current work flow, particularly if no formal documented STIP workflow is in place.
- Show employees how the e-STIP will improve their work processes, data dissemination, or equivalent function.
- Identify the existing personnel within each user group who are willing to be “first adopters”; provide these core stakeholders the appropriate training and then have them demonstrate the most applicable features to their peers.
- Solicit input from the core stakeholders on all major system design and implementation issues throughout the implementation process, and show how their input is welcomed and influences the design of the system as development is underway.

Challenges to e-STIP Implementation

To fulfill the DOT’s established objectives to develop and deploy the e-STIP, there are challenges that DOT will have to address and mitigate. This section summarizes the common challenges to successful e-STIP deployment, and identifies associated risk mitigation strategies related to the four areas: process, people, technology and resources. The risk mitigation strategies are obtained from the resources reviewed, project interviews and team experience.

Process Challenges

Efficient and effective business processes are the foundation for an e-STIP. Often agencies neglect to examine the fundamental business process before beginning the implementation of an e-STIP.

Documenting the STIP business process as a foundation for the e-STIP

A key component of developing and e-STIP system is documenting and improving the underlying business process. Failure to accurately capture the process workflows can lead to such problems as, not meeting the overall federal requirements or capturing quality data. This challenge poses a high level of risk, especially with the extensive time and resources required to develop an e-STIP. Failure of the system to meet the DOT's fundamental needs will impede the transition to an e-STIP.

Strategies for addressing this challenge include:

- Articulate the vision, objectives, and intended outcomes for the e-STIP system upfront to guide the development of the system.
- Document the business rules and workflows at the beginning of the process to ensure that the system meets the DOT's needs.
- If needed, take whatever time is needed to redesign the underlying STIP business process to create the most efficient and effective business foundation for the e-STIP.

Coordinating and standardizing STIP and TIP business processes

One of the primary benefits of implementing an e-STIP is to reduce or eliminate paper flows and duplication of effort as adopted MPO TIPs are integrated into the STIP. The ideal is to standardize the process flows and data definitions among all of the partners so that consistency between the DOT and the MPOs is achieved. With consistent standards in place, the e-STIP can automate the project request, amendment, modification and approval processes so that MPOs can input and manage their project records within the system. Standardization can be difficult and will require negotiation among the multiple MPOs and the state DOT. Having so many parties involved in the STIP development process presents risks associated with differences between internal and external decision-making, and the technical partnerships required to design and implement the change.

If this collaboration cannot be achieved, the inefficiencies and potential errors associated with multiple data entry requirements will continue. The primary strategies to mitigate this risk are:

- Involve MPOs in the documentation of work flows and any STIP process improvements.

- Involve MPOs in STIP process improvements undertaken that support the e-STIP implementation, and include the DOT in any TIP process improvements undertaken by the MPOs.
- Encourage sponsoring agencies (particularly MPOs) to modify their business processes to take full advantage of the system's capabilities (e.g., using the system to review and approve project records instead of printing out the information for external review).
- Formally document roles and responsibilities for the various players in the TIP and STIP development process.

Developing an e-STIP that supports the federal STIP

One of the important reasons to implement an e-STIP is to fulfill federal requirements associated with the programming process. Not meeting requirements for fiscal constraint and STIP modifications and amendments significantly dilutes the value of an e-STIP system. Revising the system to meet regulatory requirements post-roll-out will involve additional personnel and funding resources. Strategies for addressing this challenge include:

- Establish consensus upfront with FTA, FHWA and MPOs on the rules for STIP modifications and amendments to guide the development of e-STIP capabilities for processing revisions.
- Build a standardized system of checks and balances into the e-STIP to validate fiscal constraint.
- Create a system that evaluates and flags changes or revisions that do not comply with federal or state regulations.

Working with state's Office of Information Technology

An e-STIP system, particularly a collaborative e-STIP model, does not exist in isolation and must be flexible and compatible with existing DOT or overall state technology standards and infrastructure. All DOTs have an internal technology department or, in some cases, a separate state agency, that is responsible for technology infrastructure and policy. This office generally oversees development of new systems to ensure that new systems meet the established technology standards and system security requirements. Working with this office is critical to the successful implementation and long-term maintenance of an e-STIP, even more so for a collaborative e-STIP that requires external access to the system. Strategies for addressing this challenge include:

- Talk with the DOT or state's equivalent Office of Information Technology as early as possible to ensure that there is a clear understanding of the state's established requirements and standards before embarking on an e-STIP implementation.
- Work closely with the OIT throughout the lifecycle of the e-STIP development to ensure that it meets IT standards and security requirements. If using a consultant, facilitate a good

working relationship between the contractors and the OIT, by identifying the essential contact persons.

Ensuring data quality

Project data quality presents a moderate level of risk to successful use of an e-STIP. Inconsistent or incomplete data impacts the overall process efficiencies gained by using an e-STIP. Strategies for addressing this challenge include:

- Provide clear format instructions or help menus for inputting project information into the e-STIP, and clearly define data fields used in the system (e.g., endpoints, location, or drop-down menus).
- Lock certain fields for modification once reviewed by the DOT or build in a mechanism for approving revisions to existing data in the system.

People Challenges

The success of an e-STIP system is intrinsically linked to the system's individual users. Challenges associated with the users include preparing people for the new system, communicating the rationale for the new system or the system change, and addressing their fear and reluctance to the e-STIP transition.

Identifying staff with appropriate technical and subject matter expertise

Both technical and subject matter expertise are essential in the implementation of an e-STIP. Whether working in-house or with a contractor, the e-STIP project team should be knowledgeable in several areas: transportation planning process; federal and state programming requirements; database management; geographic information systems; financial management; document management; database analysis; and application development. When the team has the combination of technology and subject area expertise, it will be able to design and create an e-STIP that leverages technology to efficiently and effectively improve the STIP process. Not involving the right expertise may require e-STIP modification once it is rolled out, because the system may not achieve the e-STIP implementation goals. The primary strategy for addressing this challenge is:

- Assemble a multi-discipline project team of staff and/or consultants that contribute a breadth of knowledge to the project.

Managing staff turnover

Turnover of primary internal or external staff participating in the development of the e-STIP can pose a significant risk to the implementation. It can stall the implementation and waste time and money if work tasks and decisions on technology choices need to be revisited. Strategies for managing this challenge include:

- Document the consensus and decisions made during the e-STIP process. This preserves the institutional knowledge about the creation of the system, allows future staff to have a fuller understanding of the system, and promotes business continuity.
- Use good change management practices to build support for the e-STIP at both the staff and management levels, so that changes in staff will not derail the implementation or impede development or continued operation of the system. These change management practices are described within this section of this guide and include, for example, establishing a business case for an e-STIP that helps staff and management understand "what's in it for me?"; asking staff for ideas to improve the efficiency of the existing STIP process; and involving potential e-STIP users in the identification of priority features and functionality and beta testing of the system.

Managing resistance to change

Creating and deploying an e-STIP involves change. Depending on the scope and schedule for implementation, the system change will range from relatively small to transformational. The extent of the resistance from both internal staff and external partners to this change is a significant risk to smooth implementation of the e-STIP. Managing resistance to change is critical to maintaining business during and after the transition to an e-STIP. Strategies for addressing this challenge include:

- Prepare a change management plan so that proactive and coordinated efforts to address resistance to change are employed.
- Market the advantages of using an e-STIP, tailoring the business case to the different types of users.
- Establish an open, honest, and two-way communication network with affected internal and external staff to reveal issues so they can be addressed quickly.
- Cultivate champions for the project, especially among DOT and MPO leadership to both drive and build organizational support for the e-STIP.
- Create buy-in from external partners by involving them throughout the entire e-STIP development and deployment process.
- Strive to create a good "first impression" with a smooth e-STIP launch. Invest in beta testing and de-bugging to prevent the system from having any major issues when users first begin to work with the e-STIP. Consider a pilot test roll-out to a subset of users (e.g. one DOT district or MPO) before the deployment to all project sponsors.

Technology Challenges

Implementing a new technology holds great potential to support business processes, but it also requires a secure environment that allows systems to be accessed appropriately by staff at all participating agencies.

Managing system security

A secure e-STIP system is critical for preserving the integrity of STIP data. A compromised system presents a high level of risk to the DOT's ability to protect its system and to effectively perform its business process. Strategies for addressing this challenge include:

- Involve system security specialists from the DOT or the state agency that oversees technology in the e-STIP development to ensure that the system has adequate safeguards (such as system firewalls) and meets the state's security standards.
- Conduct regular and frequent system back-ups to have near current archived data sets in the event of a system or hardware failure.
- Conduct periodic tests to see if there are system weaknesses that an outside hacker may exploit.
- Require login credentials, with stringent password protection, to prevent unauthorized access to the secure portion of the database.
- Use a role-based system that limits access to the e-STIP system based on the user role (administrator, data editor, data user, etc.).

Accommodating user constraints

A collaborative e-STIP offers significant efficiencies through the interface with MPO TIP processes and databases. However, one challenge may be limitations of MPO staff or technology resources. Often smaller MPOs are technology constrained to using word processing, spreadsheets, PDF writer, or standard database packages such as Access due to varying levels of staffing and resources. This challenge presents a moderate level of risk related to system usability. Strategies for addressing this challenge include:

- Develop the e-STIP to accommodate the lowest common denominator among all organizational partners (federal, state, regional, local, etc.), so that users with even the most basic capability level can successfully utilize the e-STIP system.
- Build an agile, flexible e-STIP system that can accept every possible data format used by partner agencies. Allow multiple options for entering project information to better accommodate interfacing systems, which may include a blank record in the system, upload from a word processing, spreadsheet or PDF template, or a batch upload through database synchronization. Consider potential technology improvements such as cloud based functionality.

Resources

Implementation of e-STIP requires not only an initial allocation of time and money, but also an ongoing commitment of resources for maintaining the system. Ensuring a commitment to build and support deployment of useable components of the system is essential before embarking on a full scale e-STIP implementation.

As development is underway, future users will often identify “bell and whistle” enhancements to the system. Managing the scope carefully is critical. Establishing specific criteria to screen, evaluate, and prioritize the requested add-ons (“include now” or “future enhancement”) might be helpful.

Delivering a useable e-STIP

Successfully developing and implementing an e-STIP is no small feat, and requires adeptly managing multiple project partners and tasks. Failure to deliver useful elements of the e-STIP presents a high level of risk. Failing to see the project to completion results in sunk time and resources, and could potentially disrupt the business process. Strategies for addressing this challenge include:

- Set realistic expectations from the beginning and build support across a core group of users, managers, and senior executives ensuring that support for the implementation is not dependent on one or two individuals.
- Start with a basic system that meets the fundamental needs of the business process, and build modules to add enhancements to the e-STIP over time.
- Create a risk management plan that not only anticipates risks but also identifies “early warning” signals and proactive mitigation strategies. Include contingency funding in the initial implementation budget estimates.

Managing on-going operations and maintenance of the e-STIP

Even once an e-STIP system is released, it may experience technical issues that affect the users' ability to operate the system. Failure to allocate adequate resources for ongoing maintenance to the system poses a high level of risk to the overall functioning of the e-STIP. Strategies for addressing this challenge include:

- Conduct a life-cycle analysis and plan for system operations and maintenance early in the development process and secure a commitment of DOT resources to meet these needs.
- Create a post-deployment plan that identifies who will maintain or update the e-STIP system, and ensure that issues can be addressed promptly and adequately by in-house developers or consultants.

Appendix A: Work Flow Maps

In the tables below, optional steps are shown in *italics*. Each workflow has an "outflow" step, where projects that fail to meet business rule tests are documented. The outflow step is shown with a "#" symbol.

Work Flow A: Generation of Eligible Projects List

The core workflow begins with the identification of those projects eligible for funding within the STIP in a list to form the basic core content of an e-STIP. This step is common to all STIP formats and is therefore present in some format in every State DOT. Although the basic functionality is the same across formats, the e-STIP makes this more formal in preparation for an automated entry system. The business rules identified in the workflow table must be documented along with the list of projects. State DOT practices and processes are clearly defined for partners and stakeholders to support an awareness of deadlines and requirements as well as the results of project screening. The e-STIP basic element allows a combination of electronic and paper formats based on the availability of supporting data and technology.

WORK FLOW A: Generation of Eligible Projects List

Process Purpose: To create a qualified list of projects that meet Federal and State eligibility requirements to be considered for inclusion in the e-STIP. Primary sub-processes: • Advance projects that are not fully implemented (including those that are active and not yet initiated) into a baseline STIP • Screen baseline projects for fatal flaws and eliminate projects based on this criteria • Call for new projects from sponsoring agencies (within the DOT, other State agencies, local governments, MPOs, and tribal governments[1]) • Federal eligibility screening • State eligibility screening
Baseline e-STIP functionality: • Submittal from internal and external sponsoring agencies • Screening for Federal eligibility • Screening for State eligibility

[1] Projects on tribal lands that use federal funds can appear in either the STIP or the Bureau of Indian Affairs Tribal Transportation Program TIP.

Work Flow: See Diagram A in Appendix A	***Required business rules:***
A-1: Identify data required to screen, evaluate and program projects	• Define project information required to screen, evaluate and program project for the STIP • Define program categories that will reserve funding for project pools • Validate Federal eligibility requirements • *Define State eligibility requirements* • Define allocation of benefits/contribution to performance outcomes • Define requirements and deadlines for submittal
A-2: Conduct fatal flaw screening of baseline projects	• Define fatal flaw criteria • Define criteria or process for allocation of benefits/contribution to performance outcomes for all remaining baseline projects
A-3: Issue call for projects	
A-4: Submit projects	
A-5: Does this project meet State eligibility standards?	
A-6: Does this project meet Federal eligibility standards?	
A-#: Discard projects or re-evaluate and re-scope	
A-7: Compile list of eligible projects	

Work Flow B: Creation of the e-STIP

The second element in the basic process makes the transition from current common practice to the necessary foundation for the e-STIP. The baseline functionality in this element formally

integrates associated processes, such as fiscal constraint; the e-STIP documents this step and any supporting information. For smaller states, determining fiscal constraint may occur within the e-STIP, however, for larger states with more complex funding this may not be possible. States that use additional automated processes for budgeting purposes may use this step as an additional advantage by incorporating those elements, as well. Review and approval by state and federal partners, as well as public input, are documented business rules in the e-STIP. Technical processes and practices that support this element are summarized below:

WORK FLOW B: Creation of the e-STIP

Process Purpose: To create an approved e-STIP. Primary sub-processes: • Create preliminary e-STIP • Create draft e-STIP • Approve draft e-STIP • Approve final e-STIP
Baseline e-STIP functionality: • Assigning projects to funding source • Test fiscal constraint • Test performance outcomes • Create draft e-STIP • *Execute internal state DOT approvals* • Create final e-STIP • Execute FHWA/FTA approvals

Work Flow: See Diagram B in Appendix A	***Required business rules***
B-1: Import priority projects	
B-2: Assign projects to funding category and year	

Work Flow: See Diagram B in Appendix A	*Required business rules*
B-#: Remove fatally flawed projects from list	
B-3: Create draft e-STIP	
B-4: Test fiscal constraint	Define fiscal constraint criteria
B-5: Test for State requirements	Define State requirements
B-6: Test for performance targets	Define performance targets
B-7: Does the e-STIP pass all tests?	Repeat B-4 through B-6 until draft e-STIP meets requirements
B-8: Execute internal State DOT review	
B-9: Solicit public comment	
B-10: Create final e-STIP	
B-11: Complete State approvals	
B-12: Complete Federal approvals	

Work Flow C: Electronic Processing of Modifications

Minor changes in projects that do not impact fiscal constraint and do not significantly change the project description or termini may require an update of the STIP. Proposed changes must be submitted, screened and approved to be incorporated. In the e-STIP this is a formal process with documented screening criteria. The steps and approvals are documented and create an electronic record of the activities. Associated practices and processes to modify the STIP are summarized below:

WORK FLOW C: Electronic Processing of Modifications

Process Purpose: To receive, screen and accept minor changes to projects included in the approved e-STIP.

Primary sub-processes:

- Submit modifications
- Validate modifications
- Modify e-STIP

Baseline e-STIP functionality:

- Submittal from internal and external sponsoring agencies
- Screening against modification criteria

Work Flow: See Diagram C in Appendix A	***Required business rules***
C-1: Submit modification request	Define information required to screen project modifications
C-2: Does this pass modification screening?	Agree on the size and scope of the project needed to qualify as a modification[2], per the agreement between the DOT and FHWA Office Define modification screening criteria
C-#: Discard projects or re-evaluate and re-scope	
C-3: Modify e-STIP	
C-4: Notify FHWA and sponsoring agency of modification approval	

Work Flow D: Electronic Processing of Amendments

When changes exceed the modification eligibility requirement a STIP amendment is required. This element represents a formal STIP amendment process. Required approvals for STIP amendment along with the required screening for fiscal constraint are included in this step. Changes to anticipated performance outcomes as a result of the proposed change are also identified and reviewed. In general, any impacts on the approved STIP are identified, evaluated and executed in this step.

[2]A modification is a revision to a project that includes minor changes related to the following: project or project phase costs, funding sources of previously-included projects, and project or project phase initiation dates (23 CFR 450.104).

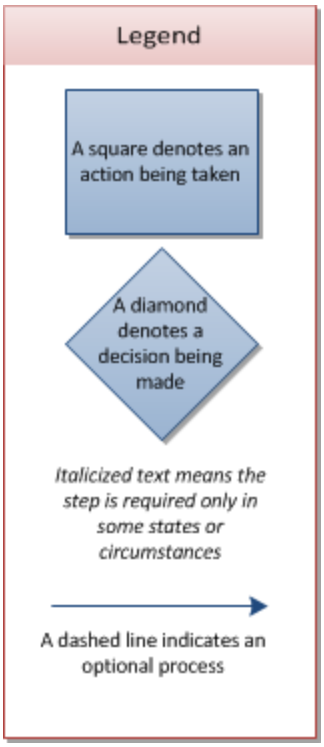
WORK FLOW D: Electronic Processing of Amendments

Process Purpose: To receive, evaluate and approve significant changes to projects included in the approved e-STIP. Primary sub-processes: • Submit amendment • Evaluate impacts on approved e-STIP • Execute approvals
Baseline e-STIP functionality: • Screen for fiscal constraint impact • Screen for performance outcomes impact • *Execute State approval process* • Execute Federal approval process

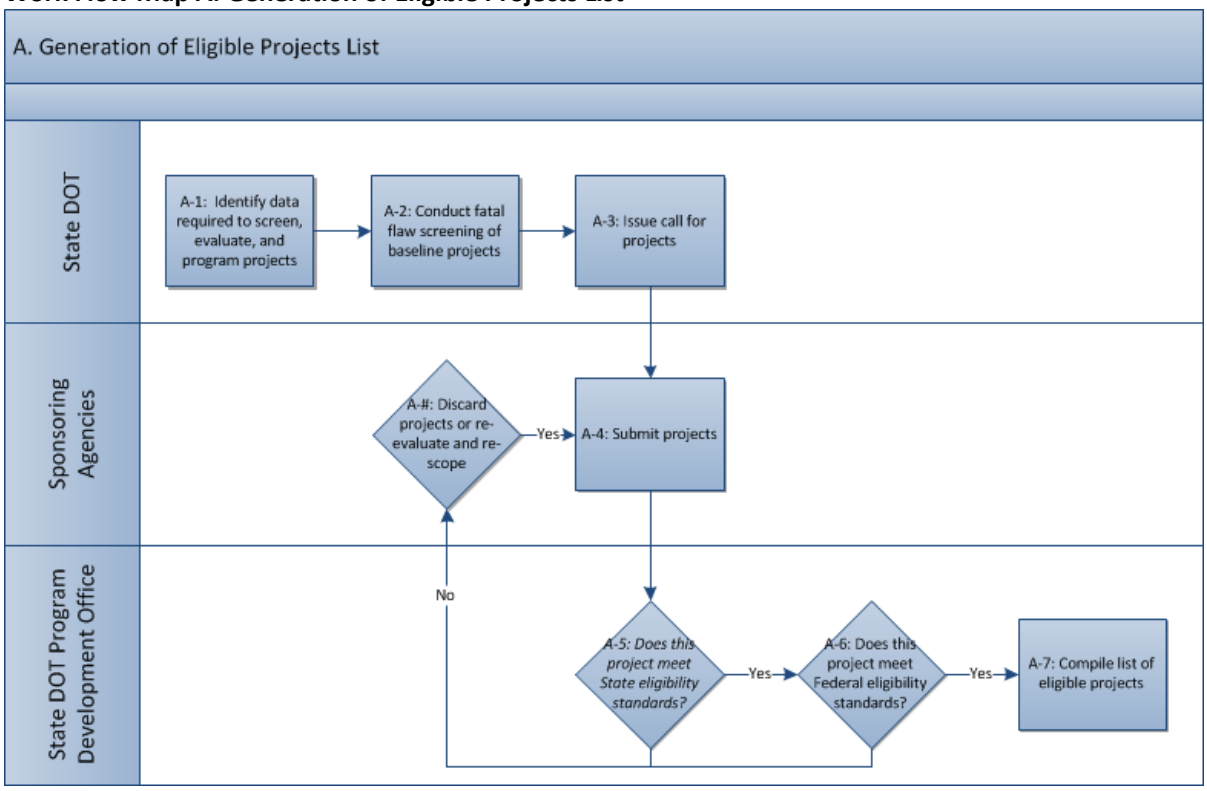
Work Flow: See Diagram D in Appendix A	***Required business rules***
D-1: Submit amendment request	Agree on the size and complexity of a project to qualify as an amendment[3] Define information required to support testing for amendments
D-2: Test fiscal constraint	
D-3: Test for State requirements	
D-4: Test performance outcome impact	
D-5: Does the e-STIP pass all tests?	

[3] An amendment is a revision to a project that involves the addition or deletion of a project, or a significant change including: major change in project cost, project or project phase initiation dates, or a major change in design concept or design scope. An amendment requires public review and comment, and updated demonstration of fiscal constraint (23 CFR 450.104).

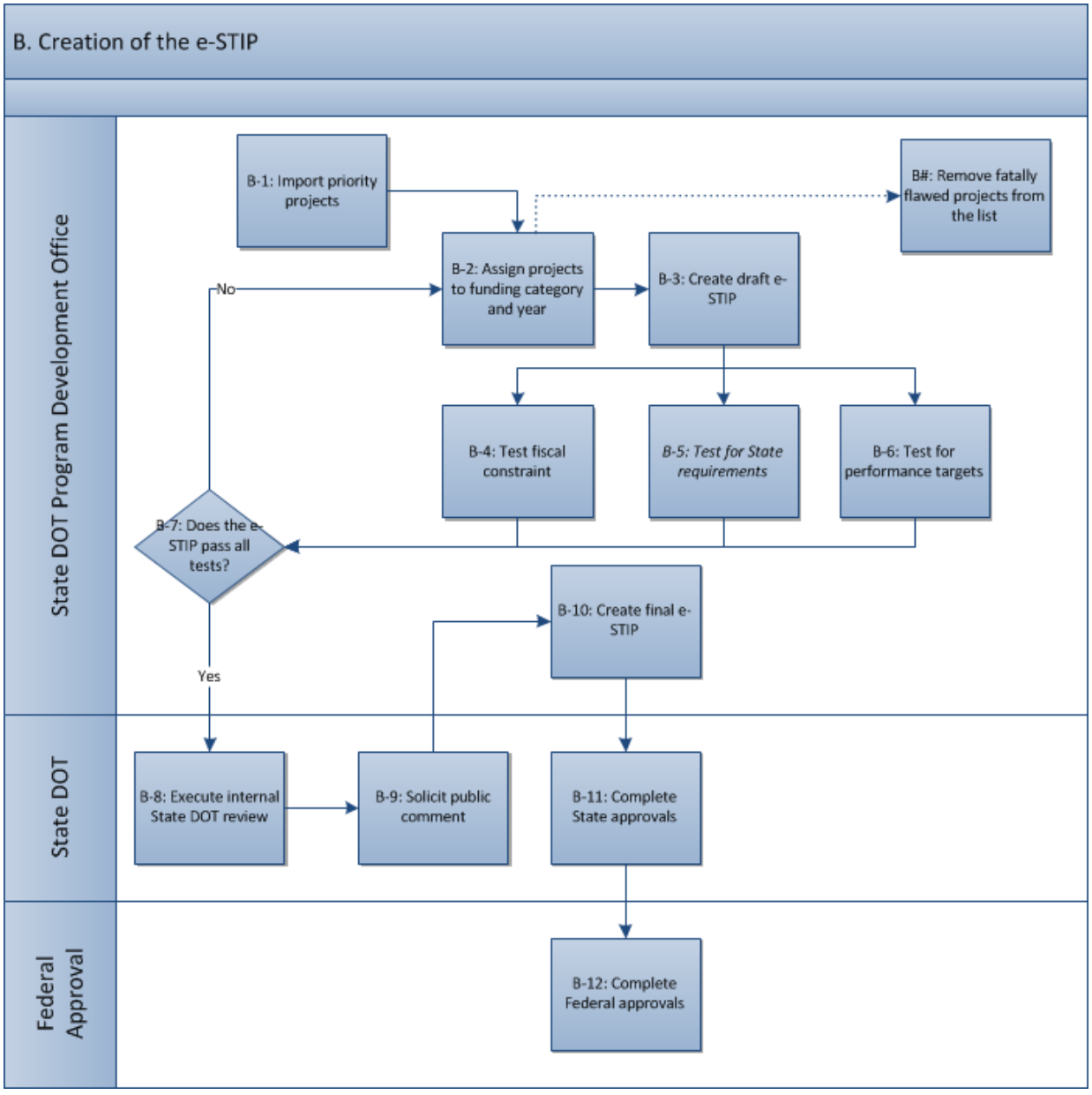
D-#: Discard projects or re-evaluate and re-scope	
D-6: Execute internal State DOT review	
D-7: Solicit public comment	
D-8: Execute Federal approval process	
D-9: Notify sponsoring agency of amendment approval.	



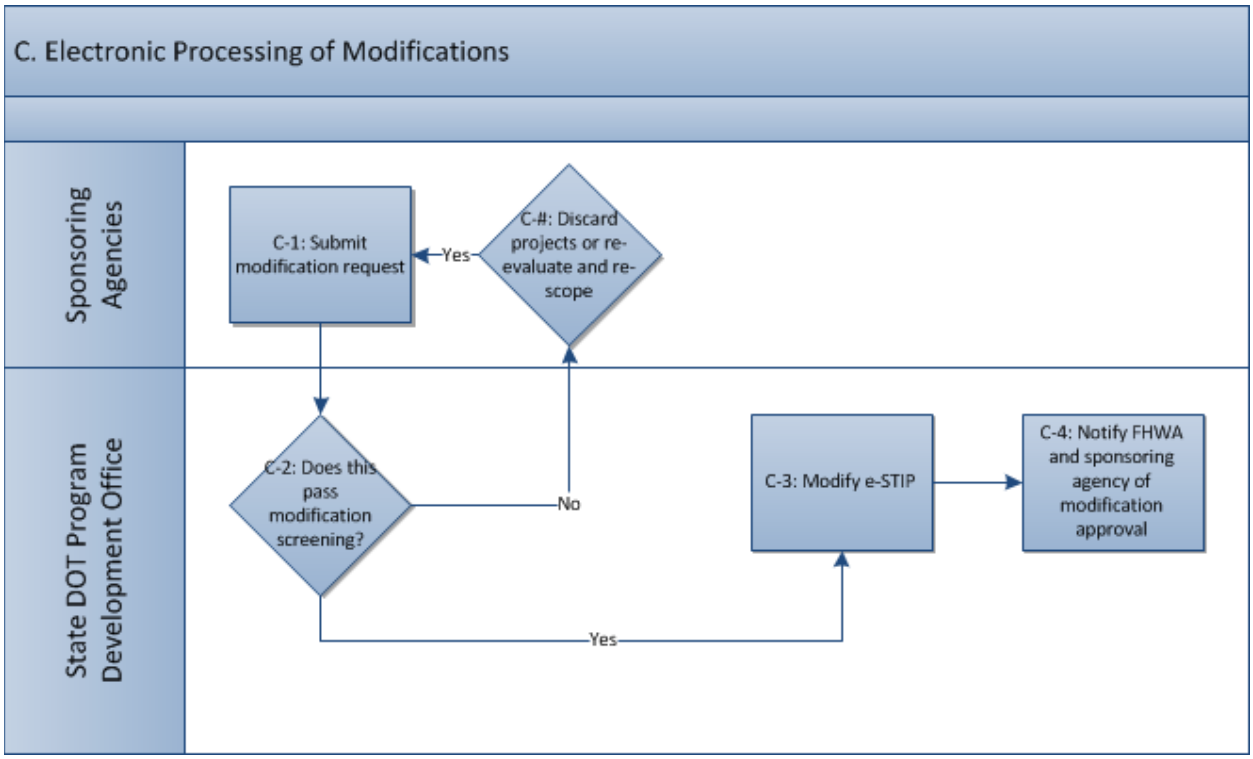
Work Flow Map A. Generation of Eligible Projects List



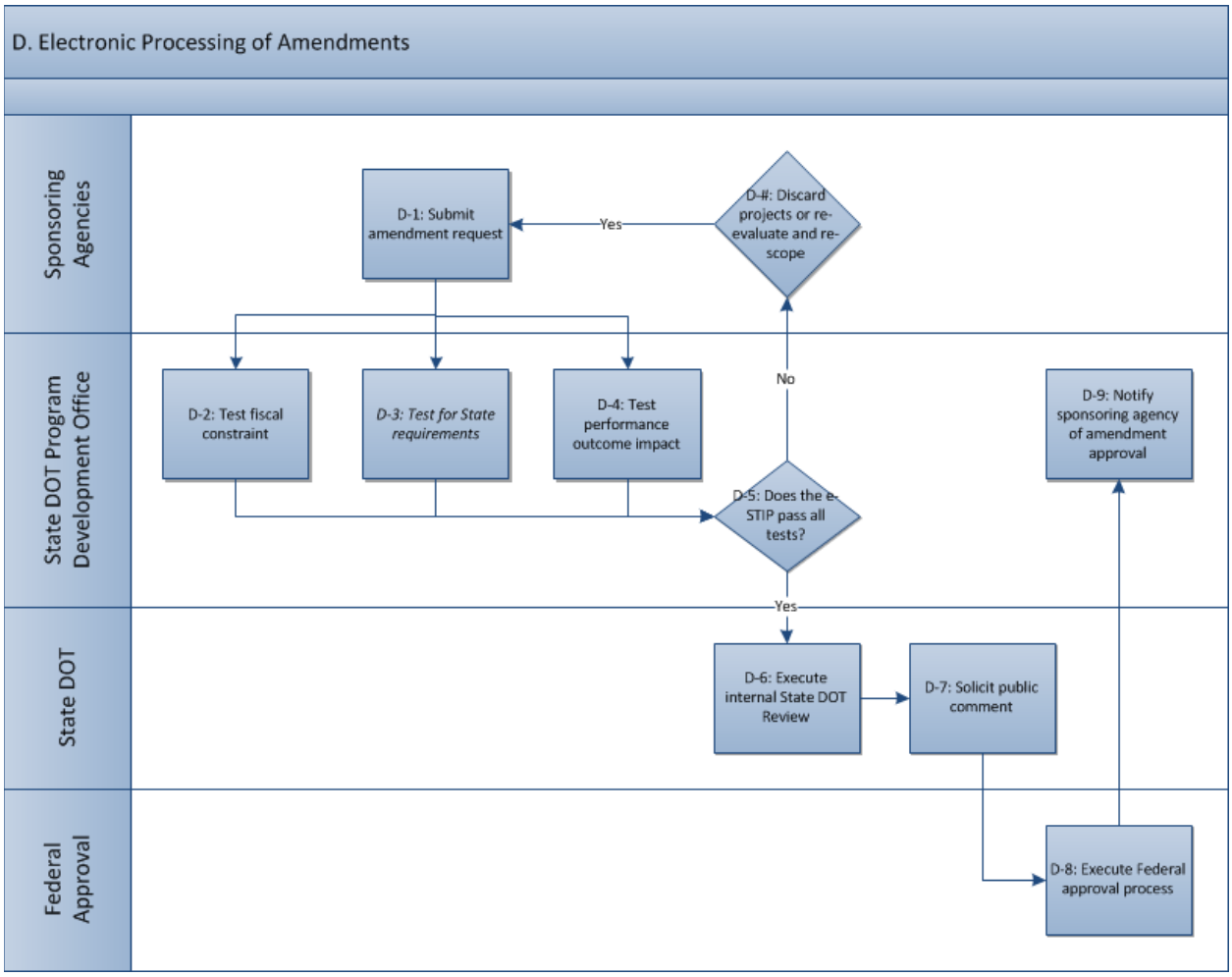
Work Flow Map B. Creation of the e-STIP



Work Flow Map C. Electronic Processing of Modifications



Work Flow Map D. Electronic Processing of Amendments



Appendix B: e-STIP AND PERFORMANCE BASED PLANNING AND PROGRAMMING

Introduction

State departments of transportation (DOTs) have existing long-range planning and short-term programming processes. Under federal regulations, DOTs have flexibility in the form and content of their long-range plans, and they have been innovative in identifying planning processes and documents that fit their unique decision-making context. FHWA's **Model Long-Range Transportation Plans: A Guide for Incorporating Performance-Based Planning**[4] captures the diversity of DOT plans, including examples of policy documents, investment strategies, strategic corridor identification, project-specific plans and combinations of these. State DOTs also have long-standing processes for creating and managing the State Transportation Improvement Program (STIP). USDOT regulations have mandated a fiscally constrained STIP as a requirement for receiving federal transportation funds for more than 25 years.

Certainly many DOTs recognize that linking plans and programs is a best practice, but only a few DOTs have explicitly tied these together. MAP-21's performance-based planning and programming (PBPP) requirements change this. Long-range plans must now identify not only goals but also targets to track the progress toward meeting those goals. STIPs must include a description of the anticipated effect of the overall STIP on the approved goals and targets. Ultimately, the DOT will be required to report the extent to which projects and services implemented affect the goals and targets identified in the DOTs and in any metropolitan planning organization (MPO) long-range plans within the state.

Connecting these two processes can be met with significant challenges. Tying long-range plans and the STIP together requires an examination, and potentially an entire redesign, of two of the oldest and most entrenched DOT decision-making processes—allocating resources to types of transportation improvements (e.g., maintenance, preservation, expansion) and project selection. No industry standards or best practices for these two processes are available. Typically, the decisions are informed by a combination of technical analysis and policy (potentially even political) considerations. In some states, legislation or negotiated memoranda of understanding determine how funding is allocated to programs, geographic regions or partners. The DOT decision makers involved in allocating funds and selecting projects might not be involved directly in either state long-range planning or STIP development. In some states, final decision-making authority for priorities regarding improvement to significant portions of the transportation system does not rest with the DOT, but rather with the MPOs.

Given these challenges and the lack of regulatory pressure, DOTs fine-tune but rarely overhaul the processes that link long-range planning and programming. Before the PBPP requirements were established, transportation professionals had little need to request research or gather case studies on how resource allocation (also called investment strategy) and project selection decisions are made across DOTs. With MAP-21 requirements, transportation agencies will need to review and adjust their existing investment strategies and project selection processes to

[4] http://www.fhwa.dot.gov/planning/performance_based_planning/mlrtp_guidebook/

ensure that the intent of the goals is reflected in the projects funded in the STIP. This paper provides some insights into how DOTs and MPOs are currently executing and coordinating these two processes and how they may consider changes to these processes in response to the PBPP requirements.

Although in practice investment strategies and project selection are part of either long-range planning or programming, for this paper, these two processes are discussed as separate elements of the critical linkage between a PBPP plan goals and targets and the development of a performance-based STIP.

This technical memorandum is organized into four major sections:

- The first provides a brief overview of performance-based planning requirements as context. A more complete description of performance-based planning is found in FHWA's **Performance Based Planning and Programming Guidebook**.[5]
- The brief overview of performance-based planning is followed by a more in-depth discussion of the critical role an investment strategy and project selection have in ensuring that plans and the STIP are linked. The narrative and examples for this section are drawn from an FHWA-convened focus group in which the participants discussed both past practices in establishing the agency's investment strategy and selecting projects and potential changes their agency is considering in light of PBPP. Six agencies, three state DOTs and three MPOs, participated. In addition, representatives from FTA and FHWA's Planning, Performance Management and Resource Center offices attended. Each state and MPO had completed or almost completed a long-range plan that included performance based goals and targets. All six agencies were considering the potential impacts of the MAP-21 PBPP requirements on their current programming processes.
- The third section of the paper provides insights into the changes needed to transition to a performance-based STIP.
- The final section provides information related to using an e-STIP to support a performance-based STIP.

Overview of Performance-Based Planning

Both DOTs and MPOs are required to adopt a long-range plan. For the MPOs, the development of this metropolitan transportation plan (MTP) begins with identifying and adopting goals for the transportation system based on the needs and aspirations of the region. These goals are used to guide the adoption of a desired future system that addresses deficiencies, while supporting or providing the mobility and access that growth, change, or both require. The current regional transportation system most often requires improvements to develop this desired future, and

[5] http://www.fhwa.dot.gov/planning/performance_based_planning/pbpp_guidebook/

these improvements are represented as individual project concepts that are identified within the adopted plan.

Prior to MAP-21, the federal requirements for state long-range planning allowed states to determine both the process and the type of plan to adopt. In current practice, most states have a long-range planning process in which multiple related plans are developed to reflect the state's diverse multimodal transportation system needs. These are generally linked through policy alignment and often include modal-specific or corridor-specific plans that analyze and identify improvements similar to the regional MTPs. Some states choose to identify priorities by focusing on levels of investment needed to address deficiencies without including project- or corridor-specific decisions in the adopted plan. In this case, the state long-range plan establishes the investment strategy for the state by allocating anticipated revenue to categories that reflect different transportation system needs (e.g., expanding, modernizing or maintaining transportation assets and services).

MAP-21 identified new requirements related to state long-range planning to support a PBPP approach and performance reporting. Every state must establish performance measures and targets. At a minimum, the state is required to demonstrate progress toward achievement of national performance goals. MAP-21 encourages states to track performance more broadly, to measure "progress toward attainment of critical outcomes for the State."

For both states and MPOs, performance-based planning introduces a specific requirement to develop objectives and measures that enable comparison between the goal-oriented outcomes of the long-range plan and the actual performance of the transportation system, once projects and services are implemented. Although MAP-21 implies that goals and targets will be set to show improvement in system performance, this will not always be the case. Analyses could show that stabilizing the system conditions or even reducing the rate of decline for some assets might be the better outcome the state can achieve with the limited resources. Whatever the circumstances, the projects selected represent the actions needed to influence system performance and to meet goals. This requirement creates a true planning "cycle" through the identification and adaptation of planning goals over time, based on actual performance as compared to expected performance.

Successful PBPP implementation requires stronger coordination and collaboration in establishing regional, state and national goals, performance measures and targets. MAP-21 requirements for reporting actual outcomes against national goals establish a more specific relationship among national, state and regional goals through the setting of targets that are the collective responsibility of the state DOT and the MPOs in metropolitan areas and the state DOT in non-metropolitan (rural) areas. It also requires planning and programming coordination between the state and the MPOs to "ensure consistency to the maximum extent practicable."

Linking Plans and Programs: Investment Strategy and Project Selection

The PBPP requirements put investment strategy and project prioritization front and center as the critical link between performance-based plans and performance-based STIPs. Unlike long-range planning and the development of STIPs and transportation improvement programs (TIPs), federal regulations do not address how these processes should operate. Every state and MPO has its own "way of doing business," and these processes have been evolving over the past 20 years.

Investment Strategy

The investment strategy is the result of political and policy decisions that allocate available revenues from all sources (federal, state, local, private) to various transportation system improvements. An investment strategy establishes the share of funding that will be available to major types of investments or geographic regions to fund projects. The categories of investment included in the strategy vary across states and MPOs, but always reflect the outcomes the policy makers want to achieve from the available transportation funding. For example, in recent years, many DOTs have established "Preservation First" as their highest priority need. This investment strategy prioritizes preservation and maintenance of current infrastructure over adding new capacity. Other common examples of types of investment that can be part of an investment strategy include adding new road capacity, preservation and maintenance of the existing highway system, multimodal improvements (transit, rail, bicycle and pedestrian), safety, economic development and congestion mitigation.

Investment strategies also can have a geographic or agency component set by policy, memorandum of understanding or law. For example, Michigan's Act 51 legislation establishes a funding formula that divides available transportation revenue among Michigan DOT, county road commissions and local governments. These agencies have the authority to allocate their portion of the revenue to their agency's investment or project priorities.

For MPOs, the investment strategy is embedded in the long-range planning process as policy makers consider the trade-offs between various scenarios for the future transportation system. When and how the DOT investment strategy is set is even less consistent. In some states, particularly those with investment or corridor-based long-range plans, the investment strategy is defined through the long-range plan. For others it could be set through agency policy or even federal and state legislation based on the funding allocations (sometimes referred to as "funding pots") that are established by law.

Prior to MAP-21, federal funding was divided into more than 40 separate programs, commonly called "pots of money," with limited ability to move funding between programs. For many states, particularly those that also had category-specific state funding, the pot of money available was both the primary driver and constraint on selecting projects for the STIP. These legislative requirements essentially predefined the DOT investment strategy. MAP-21 provides states with

significantly more flexibility in determining how to use federal funding. Rather than defining individual pots of money, MAP-21 reduced the number of federal funding programs, replacing them with national goals that define the federal interest in the transportation system. As a result, DOTs have much greater flexibility in deciding how to invest their federal funds across types of improvements to the transportation system to achieve the performance goals.

All the states and MPOs that participated in the FHWA focus group indicated that they have moved or are in the process of transitioning from selecting projects against various pots of money to a more scenario-based investment strategy that considers tradeoffs in system performance based on varying funding allocated across the state-defined investment categories. In this approach, project selection is based on needs. The responsibility of matching the selected project to an eligible funding source is more administrative and generally assigned to the staff that manage federal and state funding and federal obligation authority.

The states and MPOs that participated in the focus group provided a diverse set of outcomes that are included in their investment strategy. For the MPOs, the desired outcomes are defined by their long-range plan goals. Scenario testing within the MPO planning process provides the opportunity for the decision makers to consider the tradeoffs among the various goals, and the adopted plan reflects their investment strategy over the period of the plan, generally 25–30 years. These MPOs indicated that, because the long-range plan and investment tradeoff analysis are both embedded in the MTP process, the goals, targets and investment decisions should and need to be aligned. The MPO Policy Board is the decision maker across all these processes, which significantly reduces the risk of failing to align these key decisions.

Examples of DOT and MPO Investment Strategy Categories

- System preservation
- Modernization
- Expansion
- Non-road modes
- Safety
- Economic prosperity
- Geographic equity
- Major widening
- Minor widening
- Supportive of land use plans
- Supportive of livability and health goals
- Local accessibility
- Regional mobility

The states participating in the focus group are at various stages in their PBPP implementation, but consistent with MAP-21 all have moved or are moving toward setting goals and targets that define performance outcomes. Both Texas and Wyoming are using current condition and performance data to analyze current and project future performance of the system. Wyoming uses its goals to determine its investment strategy and then attempts to optimize how money is assigned to best meet the priorities. The Texas DOT has developed a data-driven, scenario-testing tool that can be used to analyze the impact on 20-year system condition and performance under different investment strategies.

For the state DOTs participating in the focus group, the final decision on the investment strategy is made by an executive leadership team of the DOT. This decision-making process predates the PBPP requirements; and although the executives have considered the state long-range plan and

goals, the linkage is not a strong and well-established part of this executive-level decision-making process. The extent to which MPO plans are considered when the DOT is setting the resource allocation for the state was unclear from this group. When the MPO plan reflects needs and priorities of the DOT, it is more likely to influence state resource allocation decisions to that region. For example, the Tennessee DOT was actively involved in the development of the most recent metropolitan transportation plan of the Chattanooga-Hamilton County Regional Planning Agency, the MPO for the region. As a result, "system preservation" is one of the three primary investment categories included in the plan. Scenario testing evaluated the impact to system preservation, as revenue was allocated under the different MTP scenarios.

The focus group identified several key challenges when trying to align an investment strategy to goals and targets included in a state or MPO plan. These included consistency of MPO and state DOT goals and targets, state and MPO buy-in, and education of decision makers.

Consistency of MPO and State DOT Goals and Targets

In many states, a significant portion of the transportation system needs is within the metropolitan areas where MPOs are responsible for long-range planning and the TIP programming. Before MAP-21, coordinating plans and programs was a process requirement, with states and MPOs afforded significant leeway in determining how the "coordination" would be defined and implemented within each MPO. With PBPP, there are potential consequences if a state cannot demonstrate the link between goals and targets and the performance of the system. Under these circumstances, states and MPOs must engage in meaningful discussions and negotiations to ensure that their goals, targets and subsequent investment strategy for the metropolitan area are complementary so that the projects and services implemented support and advance improvements in federal, state and MPO goals and targets. In Utah, the state DOT and the MPOs have addressed this challenge by working together to align their long-range plan goals and outcomes.

State and MPO Buy-In

A related risk is the challenge of relationship building and information sharing needed for the DOT and MPOs to reach consensus on complementary goals, targets and investment strategies. Given that the past relationship between the DOT and the MPO has been more hands off and even adversarial in some cases, getting buy-in for complementary goals and investment strategies will be a significant challenge.

The early participation of Tennessee DOT in the development of the MPO MTP is one approach for

Texas Outreach to Inform Resource Allocation Decisions

The Texas DOT has developed a data-driven, scenario-testing tool that can be used in real time to analyze the impact on 20-year system condition and performance under different investment strategies. The DOT has used this tool in workshops designed to help the MPOs, regional planning agencies and key stakeholders understand the trade-offs Texas DOT faces when allocating limited resources to extensive needs across the state.

overcoming this barrier. Active participation in the planning process enables each agency to educate and provide supporting data on its highest needs. Scenario testing of alternative investment strategies within the planning process provides the information needed to inform tradeoff analysis and the policy discussions related to goals, targets and the investment strategy.

Texas DOT used a different approach. They conducted workshops across the state at which MPOs, rural planning organizations and key stakeholders could provide inputs into the DOT scenario-testing tool and see the results during the workshops. This hands-on information sharing gave the participants a new perspective on the impact of shifting funding among categories of investment and the challenges Texas DOT faces in meeting all the transportation needs in the state. This transparent and hands-on experience established a common understanding of current resources and needs across the state for all the planning partners.

Education of Decision Makers

Focus group participants also indicated that educating the policy makers that make or influence the decisions about goals, targets, investment strategies and project selection is a significant challenge. Senior executives and policy boards at DOTs and MPOs are both influencers and decision makers in these processes. In some states, approval or adoption of the state long-range plan or STIP involves the Governor or the Legislature. These participants rarely understand how the full process works. They are engaged at key points to make a discrete set of decisions.

Under PBPP, these key decision makers need to understand their roles in linking goals and targets to investment strategy and project selection decisions. Given the time and attention constraints of these policy makers, planning directors and technical staff will need to develop a communication strategy that tailors the information to the needs of the specific audience and their role in decision-making. This communication strategy will need to provide concise a picture of what is changing and why it is being changed, the impact the changes have on their specific decision-making responsibilities and the information that will be provided to support their decision-making.

Project Selection

Once the agency has an approved investment strategy, project selection begins. The project selection process has two components: identifying the project selection criteria and evaluating proposed projects against the criteria to establish a priority list of projects to be included in the STIP. To ensure that plans and the STIP are linked, both the project selection criteria and us of the criteria to rank potential projects must be informed by the goals and targets established in the long-range plan.

Project selection criteria are the foundation for the project selection process. These criteria define the data and information that will be used to evaluate, compare and rank various proposed projects. Project selection criteria can be quantitative, qualitative or a combination of

the two. Transportation agencies use a variety of methodologies to support project selection. Some current techniques are

- Scoring or other quantitative approaches that use multiple attributes applied across many projects;
- Optimization approaches within individual program areas (such as bridge and pavement management systems) that identify sets of investments to minimize lifecycle costs;
- Using economic analysis tools to consider the outcomes from implementing a group of related projects; and
- Corridor approaches that develop preferred investment strategies for major corridors and then prioritize projects across those corridors.

> Oregon DOT has explored using economic analysis approaches that account for multiple factors; for example, benefit/cost analysis and "least cost planning". These criteria are used to rank project alternatives, either within individual project categories or across a set of categories.

Discussions with policy makers influence all of these quantitative approaches; and generally, adjustments are made to reflect more qualitative factors, as projects are ranked. Two examples of qualitative factors are equity and using transportation investment to support implementation of non-transportation goals. One of the investment strategy priorities of the Chattanooga MPO is livability and health. This MPO uses public engagement to identify a cluster of projects that fits this investment category.

Based on the experience of the participants in the FHWA focus group, who determines the project selection criteria and what metrics will be used vary widely. Three factors that influence how project selection is conducted at state DOTs were identified during the discussion: (1) centralized or decentralized decision making, (2) the program type (e.g., bridge and pavement vs. major reconstruction or expansion), and (3) resource availability. Even within an individual DOT, the process for establishing project selection criteria for different programs or areas of the department varies by these factors.

In some states, decisions are highly centralized. A technical team, sometimes in conjunction with policy-level decision makers, determines the project selection criteria that will be used to evaluate projects. The project nomination or call for projects will be issued from a single point or office within the DOT. This formal call for projects might include only documentation for the technical evaluation criteria. The implementation feasibility and political considerations supplementing the technical information are available when projects are ranked and selected by central-area decision makers.

When decision making is decentralized, individual program areas (e.g., bridge, pavement, bicycle and pedestrian) or geographic regions (e.g., DOT districts, individual MPOs) establish their own project selection criteria. For example, in Texas, individual MPOs establish the project selection criteria and have their own call for projects. The Texas DOT district engineer works directly with the MPO during project selection to represent Texas DOT interests. Texas DOT accepts MPO-selected projects unless the project represents an egregious violation of the Texas DOT plan.

Based on the information shared by the focus group participants, DOTs generally have a mix of centralized and decentralized elements in establishing their project selection criteria and ranking projects. More technically driven program areas, such as pavement preservation or bridge repair, will be decentralized and defer to the program area staff while "heavy ticket" projects are centralized. Another example, local road improvements or multimodal projects such as bicycle and pedestrian or transit capital, might be decentralized to regional, local or transit agencies, while selecting projects to improve state or interstate roads remains with the DOT.

Finally, the focus group participants indicated that when financial resources are extremely tight, project selection criteria and project selection is highly centralized with decisions made at the policy level, generally by the MPO board or a team of senior executives within the DOT.

The focus group identified four challenges to PBPP implementation associated with the project selection criteria and process: (1) data, methodology and tracking system availability; (2) different decision makers; (3) lack of communication and transparency; and (4) set-asides.

Data, methodology and tracking system availability

PBPP is a data-driven process. It requires high quality multimodal data about current condition and needs, a methodology that projects future performance based on the timeframe of the long-range plan, and tracking systems that accurately record actual improvement once projects and services are implemented. Focus group members pointed out that the vision for PBPP cannot be achieved without the data, methodologies and systems for all modes of transportation. Most DOTs and MPOs have some of what they need, but few if any have all the components. Identifying resources to improve these core data elements of PBPP is a significant challenge for DOTs and MPOs.

Different decision makers

Another challenge identified by the focus group participants is the potential for new or different set of decision makers as DOTs move from planning to resource allocation and project selection. Ranking and evaluating potential projects might be done by DOT staff who have not been involved or are even aware of MPO or state long-range plans. If this is the case, there is a significant risk that the projects selected for the STIP will not reflect the goals and targets set in the performance-based plan. DOT and MPO planners need to know who will be selecting projects and then smooth the transition between plans and project selection by educating these decision-makers in the critical role project selection has in linking the plans and programs.

Lack of communication and transparency

Several participants indicated that a lack of communication may occur on how and which certain project selection criteria are used and why. In the case of the more technical programs, the lack of communication is likely about methodologies or analyses that are contained within management systems. For large investments, the decision about project selection criteria is made at the policy level, and limited information is shared about these factors, when considered during the technical analysis, trade-off considerations or policy decision-making. In either case, the primary mitigation strategy is to educate everyone involved about the intent of PBPP and the potential consequences of the goals and targets disconnecting, projects selected and the outcomes achieved once projects are implemented.

Set-asides

Participants also mentioned a challenge associated with politically motivated set-aside funding. In this example, funds are directed by law to specific projects or types of projects that are not consistent with goals and outcomes identified in a performance-based plan. DOTs and MPO can avoid this challenge by acknowledging and accommodating legislative constraints when setting goals and targets for the long-range plan. Educating and providing key legislative leaders with information about the PBPP requirements and the state's ability to affect national goals can also help.

Summary Conclusions

During the focus group discussions, three themes emerged. To link planning and programming across investment strategy and project selection processes, state DOTs and MPOs need:

- **Collaboration –** Investment strategies and project selection criteria are key decisions that link long-range plans to STIPs. Aligning these decisions, along with long-range planning goals, outcomes and targets, is the foundation for implementing PBPP. DOTs and MPOs need not achieve consensus on these key planning decisions, but they do need to collaborate to ensure that plans, investment strategies and selected projects are complementary.

- **Transparency –** The MAP-21 PBPP requirements are intended to increase transparency and accountability in decisions related to transportation investments. In the past, decisions about resource allocation and project selection have often been questioned because partners and stakeholders did not have a clear understanding of how decisions were being made or who was making them. Implementing transparent decision-making processes should be a high priority in any PBPP implementation.

- **Education and Communication –** When implemented as intended, PBPP will help officials at all levels demonstrate that public funds are achieving outcomes that are

consistent with federal, state and regional goals. To achieve such consistency, everyone involved in making decisions about plans, resource allocation and projects will need to understand why this is important and how their "piece of the action" fits. Planning directors at DOTs and MPOs need to be proactive in implementing inclusive communication and training strategies designed to help policy makers and technical staff understand their roles in PBPP.

The Performance-Based STIP

Although this paper has discussed project selection as a separate element, in fact, selection is part of programming, the process that results in developing the list of projects for the STIP. As discussed in this paper, a performance-based plan with complementary DOT and MPO goals and targets and aligned investment strategies and consistent project selection criteria are the underpinning for the STIP. This section discusses the steps needed to transition to a performance based STIP.

Programming is the allocation of funding to specific projects. Under a performance-based framework, the STIP can serve as an information-rich report that communicates the specifics of project investments, the associated funding sources and how they contribute to performance improvements in the transportation system.

Development of the STIP is a well-established and familiar business process within a state DOT. The staff that support this activity have created procedures, process steps and supporting analytical tools to ensure efficiency and accuracy in the process. The specific steps in STIP development, however, differ significantly from state to state. This section provides a more general description of how a PBPP approach can be embedded into STIP development.

The introduction of performance measures adds a new layer of complexity to STIP development. MAP-21 stipulates that the STIP "Will include, to the maximum extent practicable, a discussion of the projected effect of the STIP toward achieving the performance targets established in the long-range plan, linking investment priorities to those performance targets."[6] The STIP represents the agency's current investment priorities through project funding allocation and the anticipated improvements in performance based on the projects selected.

The following information represents a systematic consideration of how a performance-based STIP is developed, followed by the ways in which an e-STIP will facilitate this process.

Establishing the Baseline STIP

The first step in developing a performance-based STIP is completed outside of the actual STIP process. Each state DOT determines the number of years to include in the STIP while meeting the federal requirement for a 4-year period. The current federally approved portion of the STIP

[6] http://www.fhwa.dot.gov/map21/factsheets/snmp.cfm

represents the baseline to begin a performance-based process and contains those projects that are active and eligible for funding. The information available in the current STIP is important for considering how existing projects contribute to current planning goals and the national goals.

Validation/reprioritization of current projects. The transition to a performance-based STIP requires an evaluation of currently funded projects. Although all projects need to be connected to goals and measures, some projects will continue to move forward in their implementation regardless of the contribution to the goals and measures. Agency decision makers determine which currently programmed projects will be included in the STIP during the transition to a performance-based approach, which could be based on many technical or policy-driven factors. The new or revised selection criteria must be considered in this decision. This reconsideration of currently funded projects provides an opportunity to reprioritize the way in which funding is allocated to advance the agency's goals and measures. With the introduction of the national goals, this step is more critical because active projects must be assigned to goals that were not in place previously. Questions that agencies will need to consider are:

- Which projects meet the new or revised selection criteria?
- Which projects no longer support the goals and objectives?
- What data are available to support current projects in performance measurement?
- Which projects should be carried forward from the previous STIP cycle?

As data and information needs are considered, an opportunity is presented to remove projects that do not adequately address the new goals and performance measures. Most likely, these projects have not started yet. Some projects, however, will have advanced in project development to the point where stopping is unreasonable. The support that these projects provide to the new goals and targets might be questionable but the purpose is validated in project development with regard to a supported need. This review can enable agencies to identify funding available for reallocation based on answers to the following questions:

- Do projects that have been in included in the prior STIP but not yet let for construction support the new goals?
- Do they meet any of the project selection criteria?
- Do these projects have a purpose that is justified beyond meeting the goals or contributing to system performance?
- Should any projects be removed from further consideration?

Allocate benefits/contribution to performance outcomes. This step evaluates each project carried forward into the new STIP with respect to that project's contribution to the goals and performance targets. Also necessary is preparing for the fiscal constraint determination by initial

sorting of projects into the appropriate funding categories. In addition to eligibility requirements for the various federal funding programs, individual states will have state-specific project eligibility requirements. Validating that projects are eligible for the assigned funding source is part of prioritization.

The Call for Projects: Identifying New Projects for the STIP

The call for new projects communicates the agency's project selection criteria to a wide range of potential project sponsors. Project sponsors will need this information to provide strong justification for their projects and to understand any post-implementation requirements for monitoring and reporting.

Allocate benefits/contribution to performance outcomes. Typically, project sponsors initially assess projects against the selection criteria and rank projects within the agency's project list. In a PBPP approach, this assessment includes assigning the anticipated contribution of each proposed project to the adopted performance outcomes and targets. In some cases, assigning the contribution to a group of projects intended to achieve similar outcomes might be possible. In any case, MAP-21 requires DOTs to include in the STIP a discussion of the STIP's impact on achieving progress toward the adopted performance targets. This connection between individual or grouped projects is an essential part of fulfilling the intent of MAP-21.

State DOTs will need to coordinate with their MPOs to assign benefits or contribution to performance outcomes to ensure alignment among the agencies responsible for TIP and STIP development. Some questions to support this coordination are:

- Do any of the selected projects support the national goals?
- What approaches to performance monitoring have been identified?
- How will regional contributions to the performance targets be quantified and contribute to state-level performance targets?

Ultimately, however, the state DOTs must consider all projects with respect to the established federal and state requirements (including those governing the incorporation of TIPs into the STIP). Assignments can be adjusted by the state DOT as existing and proposed projects are combined to address funding requirements, fiscal constraint and other criteria throughout the process of developing the STIP so that all federal and state requirements are met. The anticipated contribution to achieving performance targets is another requirement that must be considered as the draft STIP is assembled.

Prioritize all approved projects. Project prioritization within the STIP, conducted by state DOT staff, occurs after project submittals are complete. Project prioritization combines existing projects (baseline) with proposed projects (new) to compile a performance-based STIP with sufficient detail about project intent, schedule and allocation of financial resources to evaluate

progress toward goals and targets. The amount of data involved is considerable, and technology can greatly facilitate the collection and analysis required. Building the STIP is an iterative step that can take time to adjust across all the complex criteria and requirements.

Validate process for performance monitoring. Performance is measured against the targets, not the selection criteria. Monitoring of implemented projects is necessary to illustrate progress toward the national, state and regional goals. Each previous step has considered available methods and approaches to monitoring performance for both baseline and new projects. When STIP prioritization is completed, the ability to monitor performance across the transportation system must be established. Monitoring approaches to individual projects can be used collectively or the state DOT might establish overarching methods to measure performance at a system-wide level. The monitoring step is essential in a performance-based STIP to report against targets and to adjust project selection in the next STIP update.

Create the Draft and Final STIP

The draft STIP represents the full list of proposed and currently funded projects balanced to meet fiscal constraint and other state or federal criteria. For a PBPP-based STIP, this point is where the agency can evaluate whether the STIP shows progress toward achieving the adopted targets. This version of the STIP, required for public review and comment, will have undergone agency analysis and validation. Before release for comment, the agency will consider:

- Have individual projects been assigned to appropriate funding sources?
- Have state and federal requirements been met across funding categories?
- Does the STIP pass initial fiscal constraint testing?
- Which projects or groups of projects support individual performance targets?
- Have desired performance outcomes been supported and tested adequately?
- What internal approvals or reviews of the draft STIP are required prior to release for public comment?

Public comment on the draft STIP is a critical step and a commitment of significant time and resources by the state DOT. Collecting comments, considering changes, adjusting project entry data and revalidating fiscal constraint are standard requirements to move from a draft STIP to a final version. Using a PBPP approach, the anticipated progress toward targets will need to be reevaluated if significant changes are made to the draft STIP. The need to manage the complexity of building, testing and managing a state's STIP is a significant reason why DOTs have implemented e-STIPs. Automation can improve the efficiency and accuracy of both STIP development and ongoing management.

System Performance and Feedback

STIP projects are proposed and funded based on the best cost estimates possible of expected transportation system improvements. The actual performance measurement of those improvements may not occur until implementation, and STIP project implementation occurs over several years—potentially several STIP cycles.

The final step of a performance-based planning and programming cycle will involve comparing actual performance data to the performance measures and targets adopted in the Statewide Long-Range Plan and the Metropolitan Transportation Plan. The STIP process, however, does not create the data needed to assess actual performance. The role of the STIP is to collect and organize the routine data that is considered within the *selection and funding of projects* to contribute to performance reporting. The STIP data elements can be organized from the outset to inform more readily anticipated performance against individual measures and targets.

Many systems in the state DOT collect data on infrastructure condition and system performance. Some examples of common systems are asset management, bridge repair and replacement, management systems for highway performance, crash and safety data, and agency financial reporting data. Many DOTs have developed sophisticated technology to support tracking and management of the transportation system. These individual systems, however, have been implemented over time and generally were not designed to connect with one another for data sharing and analysis. When these systems are not integrated to report a complete picture of improvements, much of the valuable and supportive data could be lost.

DOTs and MPOs will have to consider the challenges of moving to a performance based STIP. Some of these include tagging of project benefits to specific goals and targets, validation of project selection criteria, and time constraints.

Tagging of project benefits to specific goals and targets

Typically, sponsors justify a proposed project with an expansive discussion of what the project will bring to the transportation system and the community. In the past, pressure to measure whether an implemented project actually resulted in those benefits did not exist. PBPP changes that paradigm. Project sponsors will need to tag project benefits to the applicable goals and targets and provide some analysis or methodology for assessing the projected benefit. DOTs will need to provide directions and procedures to project sponsors on the acceptable parameters for linking a proposed project to a goal, as well as the level of justification that will be needed to validate that linkage.

Validation of project selection criteria

The validation that project selection criteria actually screen and select projects consistent with measures and targets established during planning is a significant challenge. Such validation could be difficult in the first performance-based cycle. Additionally, some technical and policy choices

about which projects to bring forward from the current STIP into the first PBPP STIP might be difficult. Related to this challenge is the MAP-21 requirement that the STIP include a section describing how the overall program of projects included in the STIP will influence goals and targets, specifically those related to the national goals. This description will need to be based on some supportive information. Although guidance will be provided by FHWA, each DOT will need to evaluate the availability of data and analytic capability to meet this requirement.

Time constraints

The development, approval and adoption of the STIP are time-bound for the agency to remain eligible for federal funds. Planning and implementation of the transition to a performance-based STIP must be carefully coordinated and can require running parallel STIP processes during the transition to ensure that required timeframes are met. Additional resources and staff time will be required. Finding and committing these additional resources can be a significant challenge for many DOTs and MPOs.

Opportunities to Support PBPP with an e-STIP

Performance-based planning offers many opportunities that are also improvements to the development of the STIP including:

- Support of an educated and informed public;
- Coordination and collaboration between participating communities and agencies;
- Improved data gathering, data sharing and analysis across agency partners; and
- Increased efficiency in capturing and reporting data in meeting targets.

The performance-based STIP requires the state DOT to establish the specific contributions a project is expected to make toward improved system performance in advance of project implementation. To be able to monitor and report performance outcomes, each project selected must be "tagged" with its contribution to the goals and targets established during the planning process. The e-STIP database can be the foundation for a PPBP-compatible programming approach, as the database is the repository for this critical information.

To support a performance-based planning process most effectively, an e-STIP must go beyond basic functionality to be both collaborative and technology enhanced. A collaborative e-STIP supports the sharing of information needed between the state DOT and MPOs for setting and monitoring targets within the national goal areas. A technology-enhanced e-STIP is needed for data from the STIP and MPO TIPs to be combined with data generally available from other electronic tracking and reporting systems within the agency. The technology associated with an e-STIP further enhances the DOT's analysis and reporting capabilities against performance targets by allowing projects that are not directly comparable to be combined for analysis. The e-

STIP introduces another advantage by capturing the relevant data on project entry and by developing algorithms to make the comparisons.

Inform Public Understanding of Performance Requirements

The ability to facilitate two-way communication between a DOT and external parties has the potential to greatly enhance the public's understanding of how the new requirements affect the traditional programming process. PBPP is new to the public and important stakeholders, which presents a communication challenge for the state DOT to contain expectations and educate this external audience. A technology-enhanced e-STIP also can be an effective engagement tool during the performance-based planning process to communicate appropriately the requirements and commitments that lead the development of the STIP.

Collaboration with Partner Agencies

As discussed in Technical Memorandum 3 (Benefits and Challenges to Implementing an e-STIP), a collaborative e-STIP increases the efficiency and accuracy of e-STIP data collection as project sponsors enter specific project information directly into the e-STIP database. This direct entry not only reduces data entry error but also enables the state DOT to select which fields are most appropriate for project sponsors to enter and which should be adjusted specifically by the DOT.

Map-21 requires DOTs and MPOs to cooperate in setting targets and holds both accountable for achieving those targets within the metropolitan area. The process of building the STIP is complex and requires multiple iterations; this is magnified by PBPP as states and MPOs attempt to find the combination of projects that will meet their individual goals, while demonstrating progress toward achieving targets. Some improvements that an e-STIP offers are:

- An e-STIP can be designed to validate that the "decision rules" related to the cooperative agreements are being followed as projects are entered and grouped in the system.
- The e-STIP can group and accumulate projects intended to support the same measure across program categories to enable initial testing of how well the draft STIP is demonstrating progress toward agreed-to targets.
- With more efficient communication, creating a close to "real-time communication mechanism" might be possible to support the multiple iterations needed to optimize performance, while meeting all other federal and state requirements.

Improved Transportation Investment and Cost Estimates

All types of e-STIPs capture project cost data during the STIP development process, and this information can be used to support future cycles of long-range planning. In a PBPP approach, however, this information has a more crucial role. The intent of the MAP-21 tracking and reporting requirements is to encourage continuous improvement in the selection, funding and implementation of projects to achieve maximum benefit from the money spent. With information about both the cost and the anticipated benefits, the e-STIP database can provide important clues that can be used to improve project selection criteria, STIP cost estimating and STIP development or project implementation, or both.

Tracking Consistency of Selected Projects with MTP Investments
Southeast Michigan Council of Governments (SEMCOG) identifies preferred funding levels for each major program that are consistent with goals and objectives of the LRTP, and tracks how well projects selected for programming compare to these pre-determined levels.

Business Process and Administrative Efficiencies

Implementation of any e-STIP should prompt the agency to examine critically the underlying STIP process to confirm that the foundation is sound and efficient before investing in technology development. This process evaluation step, however, is particularly important when the e-STIP is supporting the transition to a PBPP process. Before technology development begins, the redesign of the STIP process to incorporate the elements of PBPP should be completed. In considering this process redesign, the DOT should consider changes to the process that at a minimum address PPBP related elements of

- Increased cooperation with MPOs and other partners throughout the STIP development and implementation;
- Validation that project selection criteria reflect performance-based outcomes;
- Establishing methods and analyses to capture the anticipated project contribution to goals and targets during the call for projects;
- Tracking and monitoring changes in anticipated benefits during implementation; and
- Establishing process and technology interfaces necessary to monitor and report progress toward targets as required by MAP-21.

The technology interface issue is particularly important when considering the implementation of a PBPP e-STIP. One of the greatest benefits of the e-STIP can be to incorporate the functionality and the algorithms needed to fulfill the tracking and reporting requirements of MAP-21. Although it will not have necessary information on actual performance, the e-STIP database does have crucial information about costs and anticipated benefits expected from projects and programs and might be a logical system to bring data from a variety of projects, financial and asset management systems together to compare expected and actual performance. These analyses of department-wide data can provide a better understanding of the connection between levels of investment and actual system performance outcomes, allowing DOTs to produce more accurate estimates of expected performance levels based on a specific investment level. This information is useful for identifying trends, determining baseline levels, and setting and adjusting targets.

Connecting Projects to System Performance Goals

The Maryland Department of Transportation is integrating the Maryland Transportation Plan (MTP) with the Consolidated Transportation Plan (CTP), and the annual Attainment Report to assess progress toward the goals and objectives identified in the MTP and identify which long-term goals each project supports.

Challenges to Creating a PBPP e-STIP

Technical Memo #3 provides information on the benefits and challenge associated with any e-STIP implementation. This section focuses on additional technology related challenges associated with creating an e-STIP that supports a PBPP STIP.

A critical success factor for an e-STIP implementation is ensuring that the underlying STIP process has been evaluated, and redesigned if needed, to reflect a consistent, efficient and effective execution of the STIP development and management processes. This becomes significantly more challenging when the e-STIP is supporting a PBPP STIP since there are major process inputs, sub-processes, or outputs that will need to be created for the first time.

A second challenge is creating the “case for change” that will help DOTs embrace the idea of an e-STIP as an asset in the transition to a PBPP approach. Of the State DOTs interviewed as part of Task 2, five were asked whether the e-STIP serves as a tool for performance-based planning and programming process. The responses were mixed. In three states (Pennsylvania, Colorado, and Texas DOTs), the e-STIP is either currently linked with the long range transportation planning process or there is interest in using the system as a tool for performance measurement. Colorado DOT’s e-STIP project records already “tag” individual projects to long range planning objectives.

However, two states had not yet or did not intend to use their e-STIPs for this purpose. New Jersey DOT, while not currently using its e-STIP for performance measurement, has considered

the possibility. On the other hand, Florida DOT does not intend for the e-STIP to be a performance measurement tool, stating that other tools are better suited.

There also may be a significant challenge in translating the "decision rules" for assigning benefits or contribution to targets by individual projects or even programs of projects into technology supported analyses and algorithms. The ability to automate this methodology could prove difficult.

A DOT will need to decide whether or not to link the e-STIP to external partner and other DOT electronic systems. Creating an e-STIP that is linked with external agency partners technology will facilitate the two-way exchange of information between the DOT and external actors. While this enables a more transparent and inclusive STIP development process, there are significant challenges that must be considered:

- Responding to more comments, questions and feedback from the public as a result of a more robust and accessible public involvement process through the e-STIP website;
- Managing external system users (project sponsors, MPOs, FHWA, FTA,) pertaining to issues of access, security, training and staff availability; and
- Coordinating the activities of external system users (data input schedules, deadline, etc.) and the interface with other systems (technological compatibility, etc.).

If the e-STIP is intended to support tracking and reporting of performance as projects and programs are implemented, then it must be able to draw data from other DOT financial and asset management systems. Depending on the technology environment, this could be difficult to do. On the other hand, if this functionality is not a part of the e-STIP, monitoring and tracking to meet MAP-21 requirements will be resource and time intensive as the supporting information is scattered across the agency in various formats from hard copy to technology-supported databases.

The use of a technology-enhanced PBPP e-STIP – with its higher degree of complexity – can exacerbate any of the internal agency challenges above. However, this type of e-STIP presents additional advantages over a collaborative e-STIP model, even though the increased complexity may make implementation more challenging. Applying the same strategies needed to deploy a less advanced system will equip State DOTs for successful implementation. These strategies include:

- Making the case for an e-STIP to potential users and DOT executives;
- Involving both stakeholder and system developer early in the project planning process;
- Offering training and technical support for users; and

- Committing adequate resources to the development and ongoing system maintenance improvement.

Conclusion

A performance based planning and programming approach is a significant shift in the DOTs and MPOs planning and programming processes. It will require DOTs and MPOs to examine both the technical supports, and the decision-making roles and responsibilities. An e-STIP can be a valuable tool to help support the development of a PBPP STIP. It can embed the decision rules to validate which goals a funded project is supporting, and provide a resource that can enhance accountability and partner collaboration. While an e-STIP can be designed to be the tool for supporting PBPP reporting of the outcomes achieved, this is a more complex technology implementation that requires the DOT to invest in integrating the e-STIP with current management and financial systems internally and potentially externally.

Finally, this paper has identified some, but certainly not all, of the changes that will be required as DOTs transition to performance based STIPs, and has discussed some of the most evident challenges these agencies will need to overcome. There are surely unknown challenges and unanswered questions that will emerge as agencies at all levels, federal, state and regional, continue to implement PBPP. The industry will need to continue to share experiences and insights through, for example, focus groups, peer exchanges and web networks. Technical assistance and research will be needed to explore more difficult challenges or technical issues. Finally, everyone should expect that it will take two or more cycles of the long range plan and STIP for agencies to complete the transition to PBPP.

Appendix C: Prototype Features and Functionality

Introduction

This document is a companion to the e-STIP prototype. The purpose is to describe the features and functionality of the prototype e-STIP as well as to identify the areas where individual State DOTs have the flexibility to adapt the design. This prototype is based on a collaborative e-STIP model which enables two-way communication between agencies and with the public, as well as electronic processing of STIP-related actions. The extent of collaboration is based on permissions granted by the State DOT. A collaborative e-STIP includes, for example, functionality for an electronic call for projects, electronic approvals by the state, MPOs and FHWA, and demonstration of fiscal constraint. Visualization, GIS, and public input functions also can be features of a collaborative e-STIP because they facilitate two-way communication with the public.

A collaborative e-STIP can support many, but not all, aspects of a performance based planning and programming (PBPP) approach. A fully PBPP e-STIP requires a technology-enabled e-STIP which creates interfaces with other DOT management and financial systems to allow the flow of data seamlessly within the organization. These interfaces are so specific to individual agencies, that a prototype beyond the collaborative version is not useful.

This prototype demonstrates the major elements of an e-STIP. These include:

1. Primary features of an e-STIP,
2. Functionality that supports common workflow processes, and
3. Interface design and usability, including navigation cues.

The prototype provides a blueprint for agency staff to use as they work with their IT partners to design the implementation of an electronic system to manage the STIP. The features and functionality included in this prototype are based on input from State DOT STIP development staff and represent basic elements that any State DOT might include in their e-STIP design. There are many areas that can be customized to fit the individual State needs. Each State has a different process for managing how they assemble and communicate this information to their partners, the general public and within their own organization. With this tool, State DOTs will be able to track different metadata based on specific State requirements for their STIP tracking.

Prototype Features

Home Page

The home page is the landing area for all users of the site, and it should provide an introduction to the purpose of the STIP, in addition to helping users explore the information available within the e-STIP. The basic features available on this page are*:*

1. **Introduction**
2. **Search**
3. **Project List**
4. **Sign In**

Each of these features are illustrated in Figure 3 and described in the following sections.

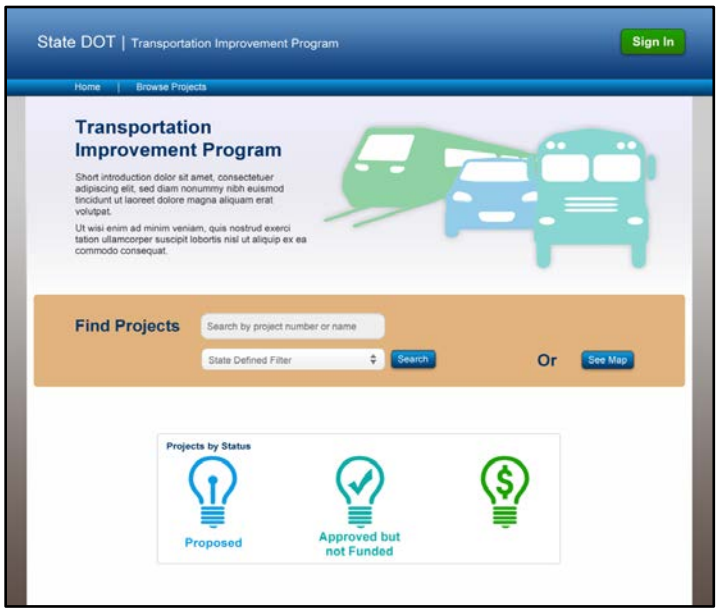


Figure 3. Prototype Home Page Screen

Introduction

The prototype Home Page is generic without introductory text because individual e-STIPs will include graphics and introduction text that will be State defined. This content serves to explain the purpose and use of the website and offers guidance to users. The Home Page is externally facing, so the introductory content is targeted to the general public.

Search

Search offers a quick way for users to immediately find the most relevant information available within the e-STIP. The prototype illustrates three search options that may be used individually or together. The first search option is a "full text string search" that users can use to match any terms across multiple sets of metadata. The State will define the scope of this search based on the metadata they chose to collect and define.

In addition to the full text search, there is the option to select a value from a predefined dropdown. An example of this is "Select a County", where the values would be all the Counties for a specific State. Clicking search would filter out only the projects that impacted the County selected. This is also a State-defined option.

The final search option is a map view which allows the user to select areas or projects of within a defined geographic area. The map view is often a standard feature of existing e-STIP functionality, and helps users orient to their location. The map will display information identified by the DOT as relevant, and can be linked to a more detailed page if the DOT chooses.

Search actions will lead users to the public-facing Browse Project page where their search criteria will be returned.

NOTE: *The prototype does not contain active search functionality, and a search technology has not been specified or prescribed.*

Project List

The prototype illustrates a quick link structure that will efficiently allow users to sort projects by their status. The terminology selected for a public-facing list is "Proposed", "Approved but not Funded", and "Funded". This refers to the standard FHWA terminology of "Proposed", "Approved but not Obligated" and "Obligated", respectively – which are used within the industry, but are not commonly understood by the public. The Admin facing pages in the prototype include the standard terms to illustrate that the content and interface on the public and administrative pages can be different. Specific terminology can be altered by the DOT to match descriptions most commonly used.

Clicking any of these links will lead users to the public-facing Browse Projects screen where the list of projects that comply with the Status they selected will be returned.

Sign In

The sign in function is the one feature on the Home Page that is only for internal agency and partner use. The public will not be able to use this feature since access will be granted by permission and credentials. The State DOT will establish rules and procedures for administrative access. Signing in will give a user the ability to see the Admin Browse Project page and, based on the level of permission, grant the ability to access the detailed functionality for project entry and revisions. In order to view the pages in the prototype related to the access restricted functions, specifically Add/Edit Projects and STIP Approvals, the user must click on the "Sign In" button.

Browse Projects

The Browse Projects pages (Public and Admin) are the primary tool for finding the projects that are most relevant to users. The prototype (Figure 4) shows a left hand bar that contains a standard set of filters based on metadata that the State collects. There are an established set of filters to use as an example, but states are encouraged to modify this area to fit their common search requirements and specific set of data. Selecting a value from any of the dropdowns will automatically return the relevant results on the page.

Administrative Browse Projects

The Admin Browse Projects screen is meant for the agency users of the system. Generally this level of user will be considered a "power user" with a more in-depth understanding of projects, terms, and functions. States can be more liberal with the amount of metadata used and displayed in this area of the site, which should be driven by the use cases defined by agency staff and external agency partner users (e.g. MPOs, RPOs, FHWA).

This page contains search functionality similar to the search box available on the Home Page. As stated previously, the agency will define the scope of this search based on the metadata chosen. The prototype illustrates only the full text search option on this page. Search results will display as an update to this page.

Admin users have the ability to define their sort parameters. By default the projects will be sorted by Project ID/Title, since that is the first piece of metadata the users see for each project record. States are encouraged to define the sorting options of this page based on metadata deemed most relevant.

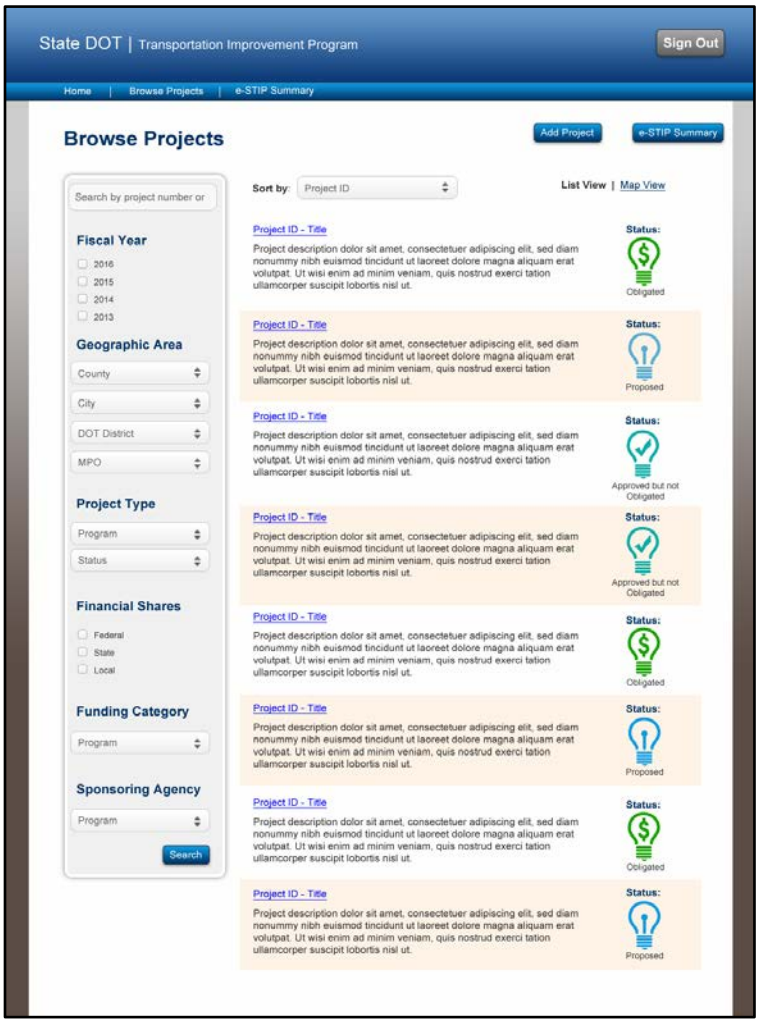


Figure 4. Admin Browse Projects Screen

Each Project record will have a Project ID/Title that is linked to the Project Detail screen. There will be the description text listed underneath the Project ID/Title to provide context for the users. Status on the Admin pages in the prototype are "obligated", "approved but not obligated", and "proposed". Additional metadata fields can be added to the project records in the results based on what is important to the State DOT.

Other features that are specific to the Admin Browse Projects page are the ability to add a new Project, edit existing projects, and link to an e-STIP summary report. The Add Project feature

provides a new page for detailed input. The e-STIP Summary page is similar to an existing STIP format with a full list of projects in a defined layout that is printable.

Public Facing Browse Projects

The Public Facing Browse Projects screen allows the general public and stakeholders to view the STIP in detail without access to detailed underlying information. This page is very similar to the Administrative page without the ability to add or edit projects. Agencies should consider the most common search requirements the general public user needs when determining filtering options on the left hand side of the page. The prototype page shown in Figure 5 limits the filters to fiscal year, geographic area, and project type.

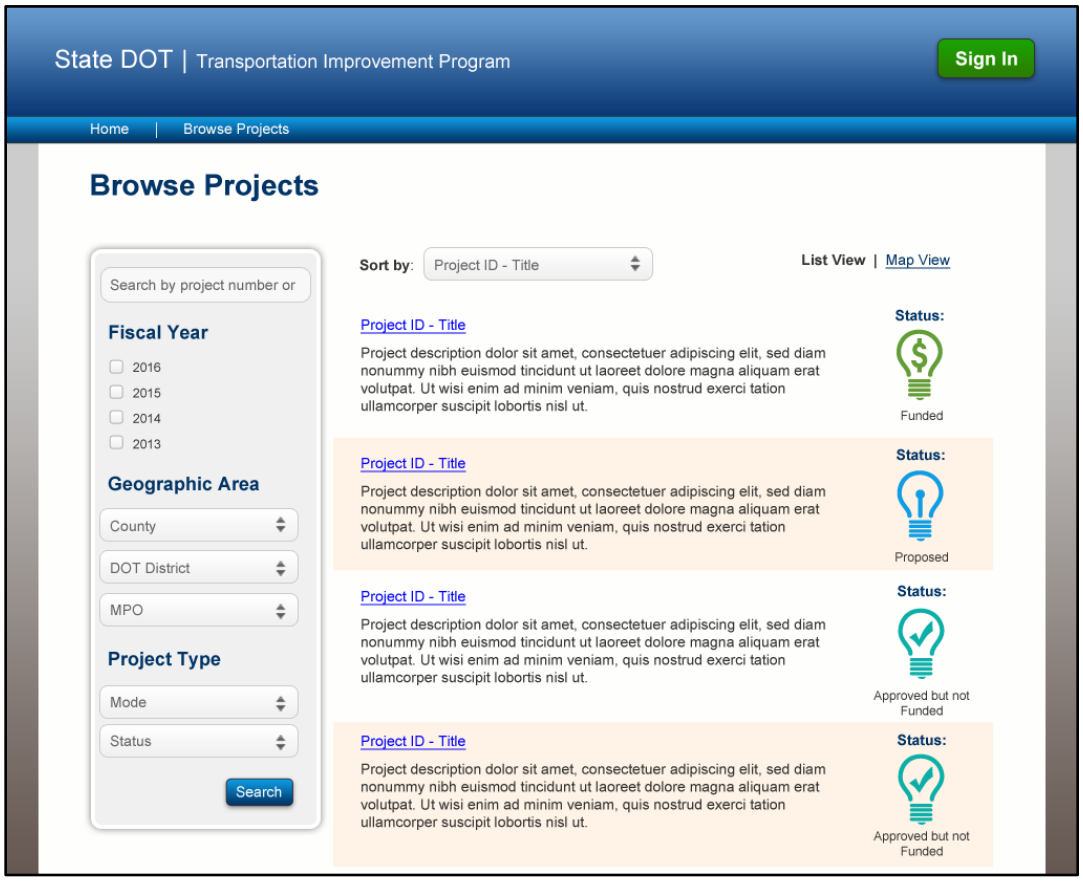


Figure 5. Public Facing Browse Projects Screen

Project Detail Page

The Project Detail page can be accessed by clicking the "Project ID/Title" from either the Public or Admin Browse Projects screen. The purpose of this page is to communicate the details of a specific project to the end user.

This represents the most customizable page for State DOTs because each agency places a different value on the metadata that they track. The information that is displayed on the prototype Project Detail page was defined by research across a small subset of states to determine the most commonly used metadata. States are encouraged to add any additional information that they track to create an e-STIP that is a comprehensive resource for their state.

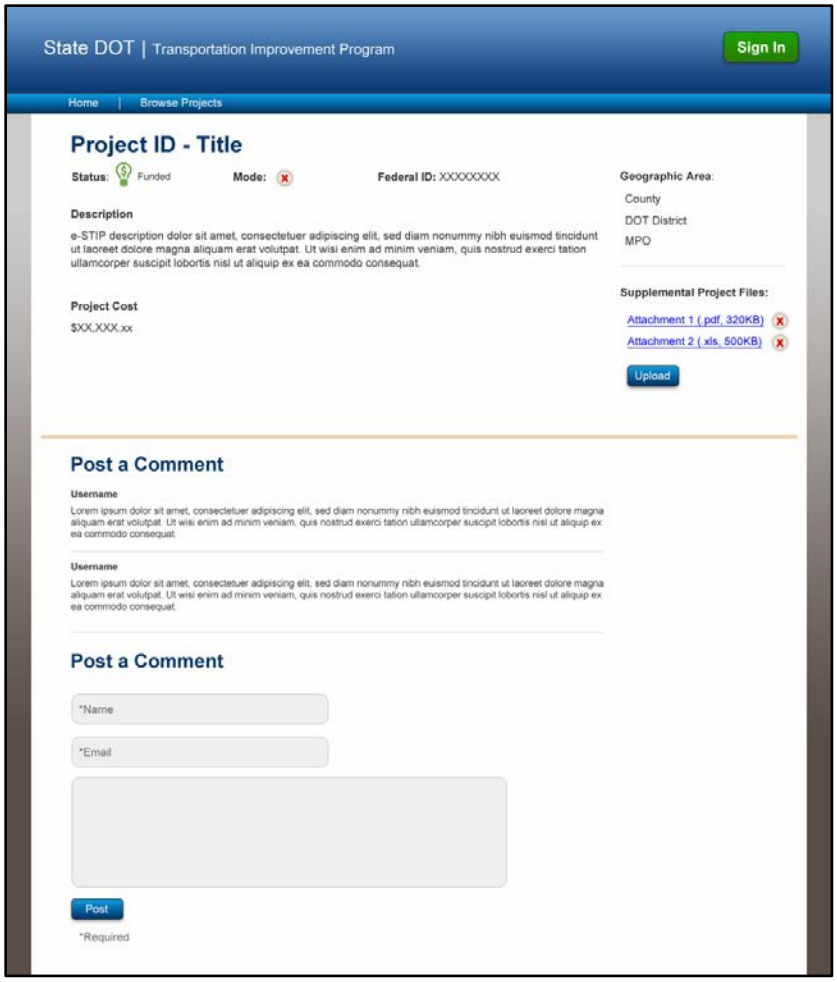


Figure 6. Public Facing Project Detail Screen

Public Facing Project Detail Page

The Public Facing Project Detail page will appear as a static text display, since the general public will have no ability to edit project specific information. Included on this page is a much smaller subset of metadata meant for public consumption. States may proactively determine what information they include on this page, while maintaining the simple format to avoid confusing the user.

The public will also be able to enter comments about individual projects. This may assist in collecting comments during STIP public comment periods or it may act as an ongoing "temperature check" of public concerns or issues. Note that this is not intended to replace any system or process that the agency currently uses to capture feedback. This feature is an enhancement or may serve as the basis to integrate existing systems.

Administrative Project Detail Page

The Admin Project Detail page will appear as an editable page, since the Admin users will have the ability to add or edit the project metadata. The user must "Sign In" in order to view the Add/Edit page. The system can include multiple levels of authorization allowing users from various agencies or parts of the DOT ability to edit some fields without having full edit access. The full set of metadata for projects should be displayed on this page.

This page is setup to have maximum flexibility for States to tailor to their specific data needs. We have included some of the basic metadata that is generally associated with projects, but States will have as much room as needed to add additional fields that are local requirements. These can be free text, dropdowns, or any other type of data that the States would want. States will also have the ability to determine which of these fields are visible to the public.

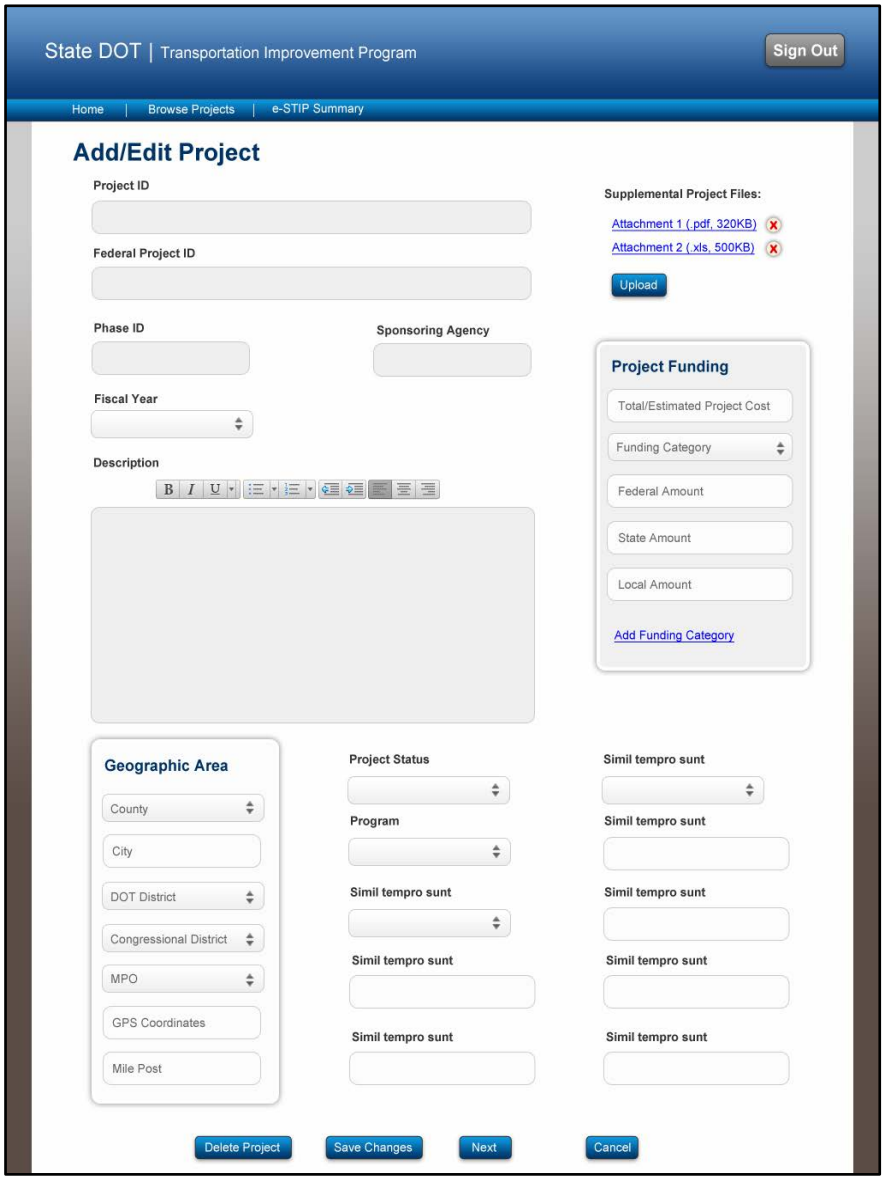


Figure 7. Admin Facing Project Detail Screen

STIP Approvals Page

The ability to automate the multiple levels of approvals needed for a STIP is one of the benefits of implementing an e-STIP. However, the approval process is one of the most highly individualized among the states. In order to proceed to any Approvals process, the reviewers must verify that the STIP meets the fiscal constraint requirement. The prototype illustrates the ability to enter comments associated with approval or rejection of fiscal constraint. The user must "Sign In" in order to view the STIP Approvals Page

Approval options exist for three levels of approval (State DOT, FTA, and FHWA). Approval steps will likely include multiple reviews and approvals from staff and mid-level managers prior to reaching the department's executive leadership and beyond. The administrative authorization functionality should be used to ensure that only the specific individual authorized to approve has access to approve or reject. Each level of approval should have access to a comment box to ask questions and/or provide a rationale for rejection.

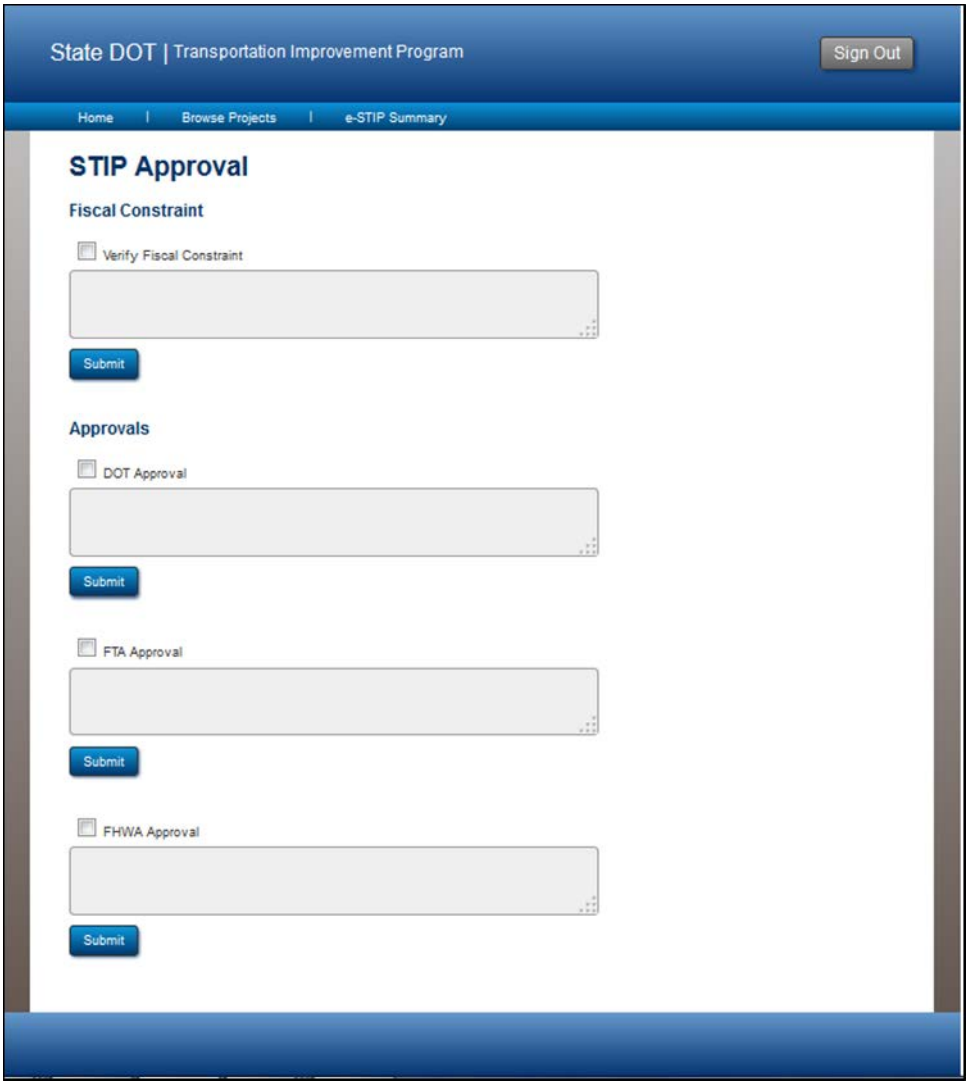


Figure 8. STIP Approval Screen

Appendix D: Implementation Planning Checklist

	Implementation Step	Considerations	Guidebook Reference
Creating a Business Case and Goals			
☐	Assemble project team to oversee the e-STIP development and implementation	Key roles include e-STIP champion, business partner lead, technology partner lead, and team of business experts; clarify roles and responsibilities.	Developing e-STIP Implementation Plan
☐	Develop business case to build support for e-STIP conversion	Identify the benefits of moving to an e-STIP; tailor information needs to specific state and agency contexts.	Benefits of an e-STIP
☐	Identify goals for the development of the e-STIP	Goals should align with key outcomes for the conversion to an automated system; identify how e-STIP can support performance-based planning and programing.	Benefits of an e-STIP
Develop Plan for e-STIP Implementation and Deployment			
☐	Develop a scoping document and schedule	Include business case and goals for conversion, key players, desired features and functionality, staffing and resource allocations, and basic estimate of resources and time required.	e-STIP Implementation: Next Steps
☐	Develop a post-deployment plan to address ongoing system maintenance needs	Allocate adequate resources for ongoing maintenance	Challenges to e-STIP Implementation

Document STIP Work Flows			
☐	Document the current STIP development process	Map out work flows for the entire STIP business process and current organizational structure	Identifying e-STIP Work Flows
☐	Identify process improvements to the STIP development	Determine what would improve the overall efficiency and effectiveness of the process	Identifying e-STIP Work Flows
Identify e-STIP Features and Functionality			
☐	Determine which elements of the STIP development process should be automated in the e-STIP	Consider available staff and financial resources to help determine the extent of automation	Using Technology to Support the STIP
☐	Identify specific features and functionality	Determine whether desired features and functionality are compatible with OIT technology specifications	Using Technology to Support the STIP
Identify Data and Database Requirements			
☐	Identify data needed to support the STIP process	Identify existing data sources, and data collection methods (if new data is needed).	Identify Data and Database Requirements
☐	Develop formats and partner agreements for data maintenance	Standardize information and procedures to improve data quality	Identify Data and Database Requirements
☐	Evaluate existing database(s) needed to support the e-STIP	Determine need to rework or supplement database(s) to support the collaborative e-STIP system; determine if e-STIP meets OIT requirements for external interfacing	Identify Data and Database Requirements

Training Plan			
☐	Develop e-STIP training plan	Training should address full spectrum of users (internal and external to the DOT); should include hands-on practice.	Training Plan
Create Change Management Plan			
☐	Develop change management plan that summarized the organizational supports needed to implement an e-STIP.	Evaluate change management needs related to the various e-STIP user groups (i.e., Power Users, Analysts, and Viewers).	Change Management Plan
☐	Receive buy-in from DOT and stakeholder employees.	Clearly communicate the benefits of e-STIP implementation and changes to their work that will occur once the e-STIP system is deployed.	Change Management Plan

Appendix E: Organizational Structure Models

Organizational Structure Models

Essential to the success of an e-STIP implementation effort will be how the system fits within the overall make-up of the organization. There are three generally accepted organizational structure models used to implement a Collaborative e-STIP: centralized, decentralized and hybrid.

A centralized organizational structure maintains a central department or division that is responsible for all e-STIP services. In this type of structure the e-STIP would often have its own dedicated department or it is a component of an Information Technology department. The e-STIP department or division would employ a staff consisting of management, analysts, technicians, and programmers. These individuals are tasked with facilitating and maintaining all the organization's hardware, software, application development, planning, and training. Data are created and maintained by this group, or outsourced to contractors. All other participants are characterized as end-users, with only the capability to view, query, and analyze spatial and non-spatial data (see Figure 3).

Figure 3. Centralized Organizational Structure

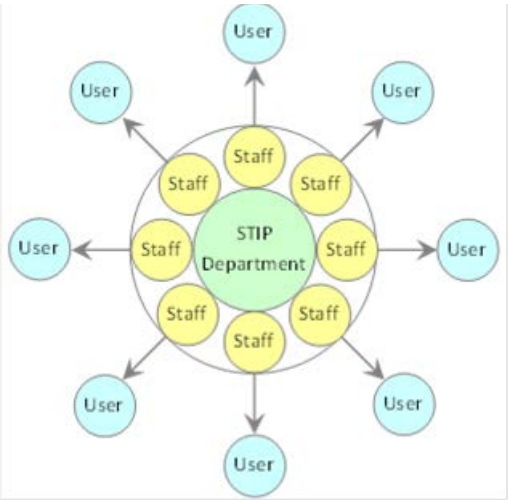
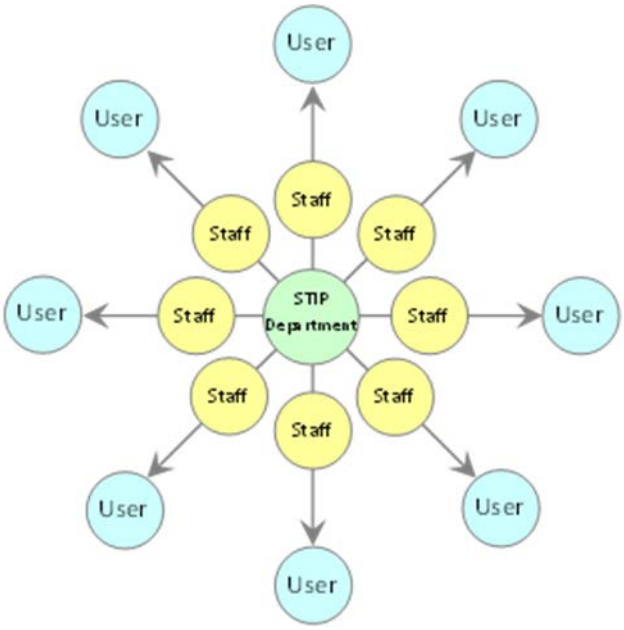


Figure 4. Decentralized Organizational Structure



A decentralized organizational structure divides STIP responsibilities throughout various departments and/or organizations. Decentralized organizational structures may still have a STIP Division that operates independently or under the jurisdiction of another department. This approach divides system and data maintenance between the STIP Division and departmental and/or organization end-users. During their course of daily business, users update an enterprise database. All users share responsibility for maintaining the data, and users within each department and/or organization maintain specific data

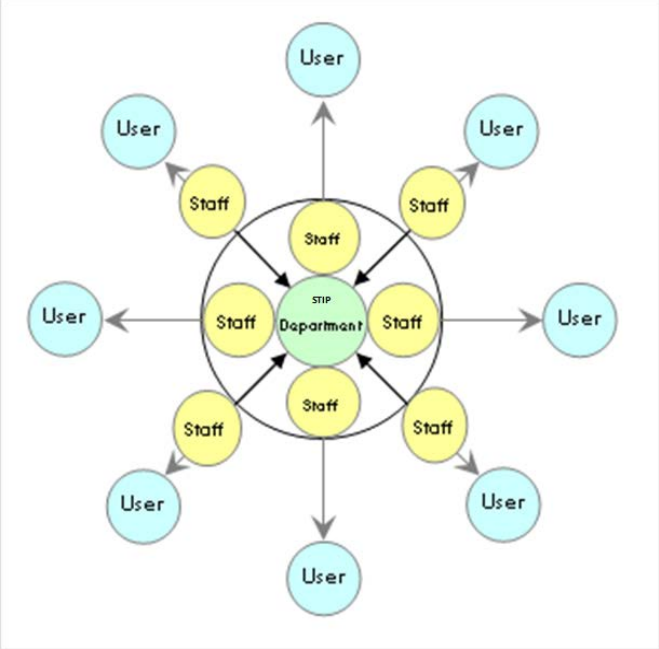
according to their jurisdictions, disciplines, and specialties (see Figure 4).

This type of organizational structure enables the STIP Division to focus on hardware and software maintenance, data exchange and distribution, application/data design and development, user training and support, community extension, and technology innovation, instead of devoting time to the creation and maintenance of data.

It is most likely that state DOTs would support a hybrid organizational structure, based on centralized and decentralized organizational structures. This type of structure provides the benefits of both organizational structures in scenarios where full implementation of either organizational structure cannot be readily attained.

With this approach, e-STIP administrative tasks can be handled centrally, depending on needs and available staff at individual departments and stakeholder organizations to provide data inputs from a decentralized approach. The hybrid approach allows STIP department data policies and metadata standards to be created and proscribed by the DOT in cooperation with the stakeholder organizations (see Figure 5).

Figure 5. Hybrid Organizational Structure



How the e-STIP fits within the organization is essential to the success of this hybrid approach. It is important to note that having some measure of a centralized e-STIP application is a crucial factor with regard to e-STIP success. The STIP Division should continue to be utilized to direct the overall e-STIP implementation efforts of the organization. Instead of conducting all daily data development tasks for various departments or stakeholder organizations, they should work with these organizations to establish standards for data sharing, integration, and dissemination. The STIP Division should provide technical expertise, training, and direction for the e-STIP in cooperation with IT staff, as necessary.

T able 1. Overview of Three Variations of e-STIP Organizational Structure

	Centralized e-STIP Organizational Structure	Decentralized e-STIP Organizational Structure	Hybrid e-STIP Organizational Structure
Basic Structure	Dedicated DOT STIP department/division handles all e-STIP services.	e-STIP services performed by various DOT departments/divisions and external organizations (e.g. sponsoring agencies).	Dedicated DOT STIP department/division handles e-STIP system administration. DOT and external organizations are involved in data creation and maintenance.
Roles and Responsibilities	Dedicated DOT department/division facilitates and maintains all hardware, software, e-STIP system development, planning and training. All other stakeholders are end-users with capabilities limited to viewing, querying and analyzing data.	Various DOT departments/divisions may handle system management, allowing the STIP Division to focus on hardware and software maintenance, data exchange and distribution, application/data design and development, user training, and technical support and innovation. All users help enter and maintain data.	Dedicated DOT department/division directs overall e-STIP system management, and provides technical expertise and training. Data input and maintenance tasks are delegated to other departments/divisions and external organizations.
Data Management	DOT department/division creates and maintains all data (or outsources to contractors).	Specific data management responsibilities are assigned to the various users based on their jurisdictions, disciplines and specialties.	Data management protocol and metadata standards are created and proscribed by the DOT in cooperation with the stakeholder organizations.
e-STIP Access	Only DOT department/division holds administrative access to the e-STIP system.	All users have at least some administrative permission in the e-STIP system.	All users have at least some administrative permission in the e-STIP system.

Organizational structure and staffing are inherently interrelated. STIP staff allocations must be determined before specific job requirements and responsibilities can be agreed upon. In order to ensure the successful implementation and operation of the e-STIP implementation process, an adequate level of appropriately trained staff must be dedicated to the STIP