ITS/CVO Technical Project Management for Non-Technical Managers

Participant Guide


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Photo Courtesy of Hunter Engineering Company

Prepared for: U.S. Department of Transportation
Office of Motor Carriers - ITS/CVO

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ITS/CVO Technical Project Management
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Module 1: Welcome 1-1

Module I: Welcome

ITS/CVO Technical Project Management
for
Non-Technical Managers

Module 1: Welcome 1-2

Participant Introductions

- Please Share the Following Information With Your Table:
  - Your Name
  - Your Organization
  - Your Current Involvement With ITS/CVO Projects
  - Your Project Management Experience
  - Your Expectations for This Course

Module 1: Welcome 1-3

So that you can get to know your colleagues, we'd like to go around the room for self-introductions. Please share:

- Your name
- Your organization
- Your current job involvement with ITS/CVO projects
- Your project management experience
- Your expectations for this course.

ITS/CVO Training Program Highlights

- FHWA/OMC Identified the Need for a Technical Training Program To Support the Deployment of ITS Technologies
- Program Requirements Were Identified by Federal, State, and Industry Leaders in ITS/CVO
- A Series of Courses Are Being Designed
  - Introduction to ITS/CVO
  - ITS/CVO Technical Project Management for Non-Technical Managers
  - Understanding ITS/CVO Technology Applications

Module 1: Welcome 1-4

In 1996, the FHWA Office of Motor Carriers (OMC) identified the need to develop a Technical Training Program to support the deployment of Intelligent Transportation System (ITS) technologies for Commercial Vehicle Operations (CVO). The workforce– to include state staff, industry personnel, OMC Field staff, and Federal-aid staff– all needed training and education on these new technologies.

The OMC worked with consultants to develop the ITS/CVO Technical Training Program Work Plan.

Specific activities included:

- Collecting ITS/CVO data
- Interviewing ITS/CVO subject matter experts
- Developing an initial training needs analysis
- Identifying specific tasks required to develop a training strategy
- Establishing a training development timeline.

Based on this information, the OMC designed a series of three technical training courses to support the ITS/CVO initiatives. This course, ITS/CVO Technical Project Management for Non-Technical Managers, evolved from the suggestions made by ITS project managers during the surveys and focus groups.

This ITS/CVO Project Management course has been designed using a combination of lecture, case study, and individual exercises. This format was chosen to blend the best learning methods for optimal learning and retention.

Course Perspective

- Use These Guidelines as We Work Through the Course:
  - Your State Agency Has Approved an ITS/CVO Project with Funding
  - You Have Been Chosen To Manage Detailed Project Planning and Implementation
  - You May Not Have a "High Tech" Engineering or Information Technology Background
  - You Are Interested In Learning More About ITS/CVO Project Management

Module 1: Welcome 1-5

You are working in a state agency that has approved an ITS/CVO project with funding (based on priorities included in the state's ITS/CVO Business Plan), and the program manager has appointed you to be responsible for managing detailed project planning and implementation. You may not have a highly technical background. Finally, you are taking this course to become more aware of ITS/CVO project management issues, lessons learned, and skills for doing your job.

Course Goals

- Identify and Define the Key Issues and Constraints Unique to ITS/CVO Projects
- Understand Some Key Lessons Learned From Other States' Prior ITS/CVO Project Experience
- Apply Some Basic Project Skills to an Illustrative Case Situation

Module 1: Welcome 1-6

The primary purpose of this course is to identify and describe the issues, knowledge, and skills that are applicable to managing technical projects related to ITS/CVO.

There are three participant learning goals for the course:

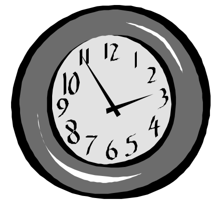
1. Identify and define the key issues and constraints that are unique to ITS/CVO projects.
2. Understand some key lessons learned from other states' prior ITS/CVO project experience (e.g., CVISN prototype and pilot states).
3. Apply some basic project skills to an illustrative case situation indicative of a typical ITS/CVO project, and develop solutions.

You will be provided with lecture materials, a case scenario of a typical ITS/CVO project, and management tools to achieve these goals.

This course will provide a general foundation, or "awareness level" of skills necessary to manage deployment of ITS/CVO. The specific application of the skills may be affected by policies or guidelines of your agency or jurisdiction.

Another aim of this course is to help establish an information sharing network between individuals who are already involved in managing ITS/CVO projects and those who are new to the program. This network will be a valuable resource as you get further involved with ITS/CVO.

Course Agenda



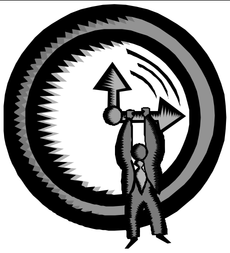
- **Day One**
  - **8:30 - 10:00** **Introduction**
  - **10:15 - 12:00** **ITS/CVO Deployment Context**
  - **1:00 - 2:45** **Implementation Planning of ITS/CVO**
  - **3:00 - 5:00** **Case Study**

- **Day Two**
  - **8:30 - 9:30** **Case Study Wrap-up**
  - **9:45 - 10:30** **Procurement of ITS/CVO Technical Services**
  - **10:45 - 12:15** **Implementing, Monitoring & Measuring Performance**
  - **1:15 - 4:30** **Case Study**
  - **4:30 - 5:00** **Conclusion & Next Steps**

Module 1: Welcome 1-7

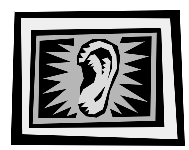
This course is designed to run for two days. Our hours each day are 8:30 am - 5:00 pm. Each day we will have a 15-minute morning break, a 1-hour lunch break, and a 15-minute afternoon break.

The course is designed to include seven hours of instruction per day; however, if we don't stay close to the agenda, it is possible to run late or end early. We will make every effort to achieve the course objectives within the allotted time.



Course Ground Rules

- ❖ Your Learning Is in Your Hands
- ❖ Ask and Answer Questions Candidly
- ❖ Maintain a Spirit of Dialog - Be Open to Others' Point of View
- ❖ If a Question Is Not Applicable at the Time It Is Asked It Will Be Placed in the "Parking Lot" and Answered Later
- ❖ Let the Instructor Know if You are Having Difficulty Seeing or Hearing
- ❖ Start on Time, End on Time



Module 1: Welcome 1-8

To ensure the course progresses smoothly, it is important that we agree on some basic ground rules:

- Your learning is in your hands
- Ask questions and answer them candidly
- Maintain a spirit of dialog - be open to others' point of view
- If a question is not applicable at the time it is asked it will be placed in the "parking lot" and answered later
- Let the instructor know if you are having difficulty seeing or hearing
- Start on time, end on time.

Course Evaluation

- Your Comments Will Remain Anonymous
- Feedback Will Be Used to Improve Future Course Offerings
- Fill Out at the End of Each Module
- We Will Collect at Course Conclusion

Module 1: Welcome 1-9

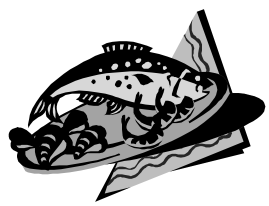
During the course, you will have the opportunity to evaluate the effectiveness of the course by filling out a course evaluation form. All of your comments will be reviewed and used to improve the course.

The first section of the evaluation has room for comment on each module of this class. Feel free to make notes as each module is completed. The second section asks for you to provide your evaluation of the course as a whole. You will also be given time at the end of each day to complete your evaluation.

The evaluation forms will be collected before we leave, at the completion of the course tomorrow.

Housekeeping

- Location of Restrooms
- Location of Telephones
- Break & Lunch Locations
- Smoking Policy
- Emergency Information



Module 1: Welcome 1-10

➢ *Participant Manual*

- The Participant Manual is meant to be an interactive tool to provide you with valuable reference material.
- Your manual contains all of the material we will be discussing in this course.
- Other references, for later use, are also contained in your manuals.
- Take notes as needed.
- The glossary includes a list of acronyms and key definitions.
- The intent is that the guide be used after the class ends, to refresh your memory of the ITS/CVO program.
- You have copies of all overhead slides for your use if you must provide briefings and/or training to others.

➢ *Handouts*

- You will be given some handouts during the course, which are meant to complement the participant manual as a reference tool.
- You should insert the handouts in the manual in the related module.

➢ *Case Studies*

- Two case studies have been developed to help clarify many of the concepts you will learn. During case study work, consider how the information will affect your own jurisdiction and participate fully.

MODULE 2 - INTRODUCTION

Module II: Introduction to ITS/CVO Programs and Project Management

ITS/CVO Technical Project Management for Non-Technical Managers

Module II: Introduction to ITS/CVO 2-1

Module II Learning Objectives

- ITS/CVO Vision, Program Areas, and Deployment Strategy
- Relationship Between Functional Program Areas and ITS/CVO Projects
- Key Features of ITS/CVO Project Management
- Challenges in Managing ITS/CVO Projects

Module II: Introduction to ITS/CVO 2-2

Let's begin by looking at the module's four learning objectives.

Module II Learning Objectives

- ITS/CVO Vision, Program Areas, and Deployment Strategy
- Relationship Between Functional Program Areas and ITS/CVO Projects
- Key Features of ITS/CVO Project Management
- Challenges in Managing ITS/CVO Projects

Module II: Introduction to ITS/CVO 2-3

The first objective involves a review of information from the Introduction to ITS/CVO course. We should be able to cover it fairly quickly. The other objectives involve new information related to ITS/CVO programs, projects, and management. We will need to spend more time on them, so let's get started.

Definitions: ITS & CVO

ITS Technologies
- Information processing
- Communications
- Sensors
- Electronics

ITS/CVO Program Areas
- Safety assurance
- Credentials administration
- Electronic screening
- Carrier operations

Commercial Vehicle Operations
- Safety enforcement
- Administration
- Fleet & vehicle management
- Highway traffic management

Module II: Introduction to ITS/CVO 2-4

This slide summarizes the basic ITS/CVO concepts.

First, ITS involves the application of information, communications, control, and electronics technologies in the transport sector.

Second, Commercial Vehicle Operations (CVO) are concerned with all aspects of the commercial movement of goods and passengers on the North American highway system, including enforcement and safety, credentials administration, fleet and vehicle management, and highway traffic management.

ITS/CVO is at the intersection of both of these concepts– that is, the application of intelligent technologies to commercial vehicle operations. This ITS/CVO intersection is represented by four functional program areas: safety assurance, credentials administration, electronic screening, and carrier operations.

ITS/CVO Vision & Mission

- ITS/CVO Vision Statement:
  - Assisted by Technology, Trucks and Buses Will Move Safely and Freely Throughout North America.
- ITS/CVO Mission Statement:
  - Use Cost-Effective Methods and Technology To Streamline State Regulatory, Enforcement, and Carrier Practices, While Increasing Safety and Productivity for States and Carriers With Benefits and Safety for All.

Photo Courtesy of Hunter Engineering

Module II: Introduction to ITS/CVO 2-5

The core concept in the vision statement is that trucks and buses move safely. The mission focuses on how that vision will be accomplished by using cost-effective methods and technologies to streamline operational practices.

ITS/CVO Benefits

- **Reduces Crashes**
- **Reduces Costs**
- **Improves Efficiency and Competitiveness**
- **Improves Administrative Processes**
- **Increases Safety**
- **Reduces Congestion**

Module II: Introduction to ITS/CVO 2-6

These benefits provide the underlying rationale for the motor carrier industry's plus the state and federal government's attention to ITS/CVO. They can be summed up in the slogan on the U.S. DOT logo, "Safety, Simplicity, Savings."

National ITS/CVO Program Framework

Program Areas

Safety Assurance	Credentials Administration	Electronic Screening	Carrier Operations
• Access to driver, vehicle, and carrier information on inspections and accidents • Automated inspections and reviews • Onboard safety monitoring	• Electronic credentialing • Clearinghouses • Interagency data exchange • Interstate data exchange	• Automated weight and credentials screening • International electronic border clearance	• Fleet and vehicle management • Traveler information systems • Hazardous materials incident response

CVISN Architecture (Technical Infrastructure)

Mainstreaming (Organizational Infrastructure)

Module II: Introduction to ITS/CVO 2-7

As introduced earlier, ITS/CVO has four program areas: Safety Assurance; Credentials Administration; Electronic Screening; and Carrier Operations. Each program area includes a number of focus areas. For example, a key focal area in the "Electronic Screening" program is "International electronic border clearance." These areas provide a consistent reference for the Federal, State, and private industry stakeholders involved in planning and deploying ITS/CVO projects. For example, State ITS/CVO Business Plans use these program areas as an organizing framework.

CVISN: Commercial Vehicle Information Systems and Networks

Program Areas

Safety Assurance	Credentials Administration	Electronic Screening	Carrier Operations
• Access to driver, vehicle, and carrier information on inspections and accidents • Automated inspections and reviews • Onboard safety monitoring	• Electronic credentialing • Clearinghouses • Interagency data exchange • Interstate data exchange	• Automated weight and credentials screening • International electronic border clearance	• Fleet and vehicle management • Traveler information systems • Hazardous materials incident response

CVISN Architecture (Technical Infrastructure)

Mainstreaming (Organizational Infrastructure)

Module II: Introduction to ITS/CVO 2-8

Underlying the ITS/CVO framework (four program areas) is the CVISN architecture, which stands for Commercial Vehicle Information Systems and Networks. CVISN is the collection of state, federal, and private sector information systems and communications networks that support commercial vehicle operations. The CVISN architecture, part of the National ITS Architecture, provides a technical framework which describes how ITS/CVO elements fit together into an overall system.

CVISN: Commercial Vehicle Information Systems and Networks

- Objective
  - Develop Technical Infrastructure To Support Widespread ITS/CVO Deployment
- Expected Benefits
  - More Efficient Data Interchange
  - Ability To Improve Credentials Administration, Safety Assurance, and Enforcement Procedures
  - Reduced Administrative Burden for Regulatory Compliance

Module II: Introduction to ITS/CVO 2-9

CVISN can be better understood by reviewing its objectives and expected benefits. The objective of CVISN is to develop an "open systems" technical infrastructure that allows different ITS/CVO systems to communicate easily and consistently using common principles, data, and standards. This will lead to several benefits as listed here.

Mainstreaming

Program Areas

Safety Assurance	Credentials Administration	Electronic Screening	Carrier Operations
• Access to driver, vehicle, and carrier information on inspections and accidents • Automated inspections and reviews • Onboard safety monitoring	• Electronic credentialing • Clearinghouses • Interagency data exchange • Interstate data exchange	• Automated weight and credentials screening • International electronic border clearance	• Fleet and vehicle management • Traveler information systems • Hazardous materials incident response

CVISN Architecture (Technical Infrastructure)

Mainstreaming (Organizational Infrastructure)

Module II: Introduction to ITS/CVO 2-10

Also underlying the ITS/CVO framework (four program areas) is the Mainstreaming initiative. Mainstreaming involves organizing and managing ITS/CVO deployment and communicating with key stakeholders to gain their participation and support. More simply, it is the institutional glue for planning and deploying ITS/CVO systems.

This happens through multiple activities:

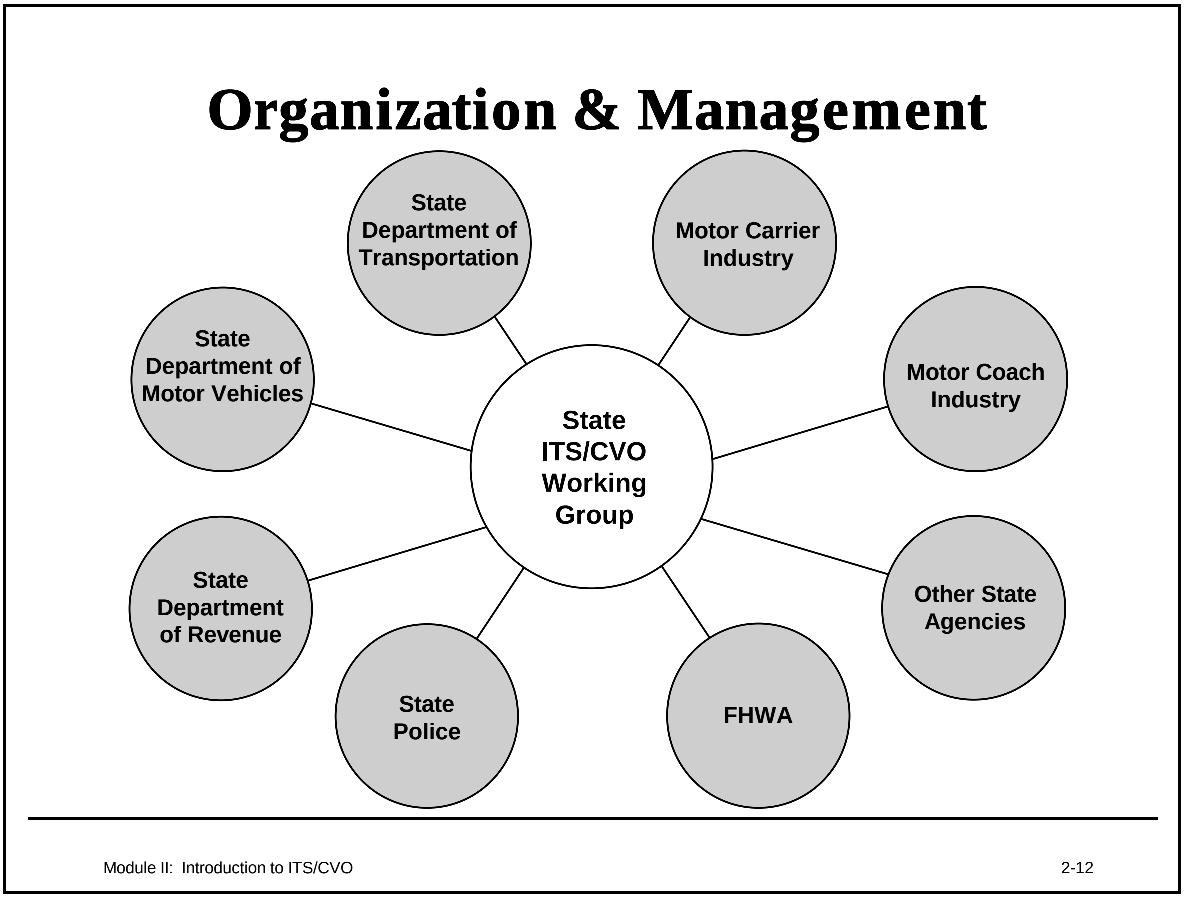
- State ITS/CVO working groups that include all stakeholders, including the motor carrier industry.
- State ITS/CVO business plans and ITS/CVO regional coordination plans. (These will be discussed in Module IV.)
- Multi-state or regional forums facilitated by "regional champions." These champions are dedicated staff to support both the state and regional forums.
- Delivery of awareness level training courses by regional champions and others.

ITS/CVO Mainstreaming Initiative

- **Objective**
  - **Organize and Manage ITS/CVO Deployment**
- **Expected Benefits**
  - **State**
    - **Better Use of Agency Resources; Integration of ITS/CVO Projects into State and Metropolitan Programs**
  - **Regional**
    - **Cost-effective Technology Transfer; Coordination of Regional Transportation and Economic Investments**
  - **National**
    - **Comprehensive and Consistent ITS/CVO Program; Public-Private Partnership for Innovation; Safer and More Efficient Transportation System**

Module II: Introduction to ITS/CVO 2-11

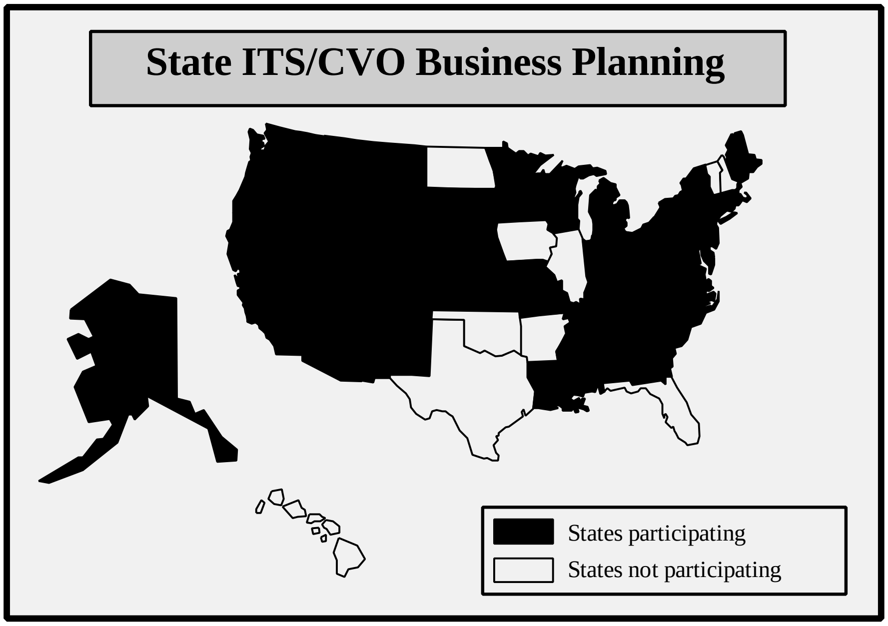
Mainstreaming refers to the FHWA's initiative to bring together CVO stakeholders and manage the ITS/CVO deployment process. As a result, benefits are expected at the state, regional, and national levels.



This diagram displays the most important stakeholders involved in the Mainstreaming initiative. Their roles and relationships will be reviewed in Module III.

The ITS/CVO program is a partnership of government, industry, and academia. The need will always be there to get industry input and involvement in ITS/CVO programs. Many of the state ITS/CVO working groups currently have representation from the motor coach and motor truck industries.

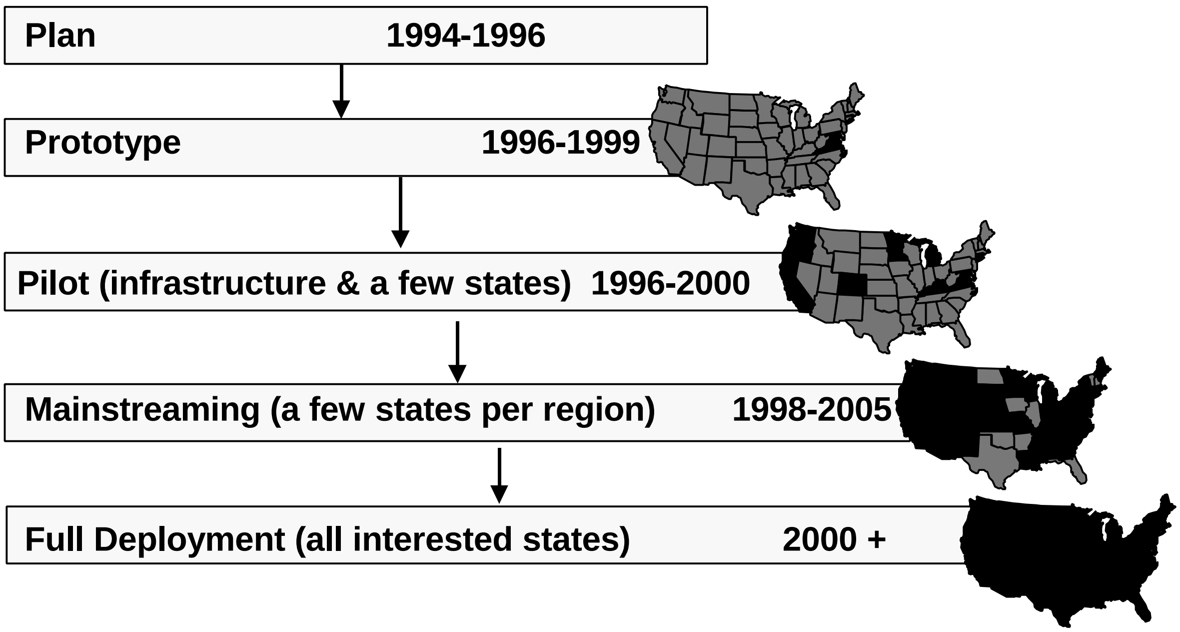
State Working Groups & Regional Consortia



Module II: Introduction to ITS/CVO 2-13

More than 35 states are participating in the ITS/CVO mainstreaming initiative. The state ITS/CVO mainstreaming program will emphasize planning for and deployment of specific ITS/CVO technologies and services, with a particular emphasis on the deployment of the CVISN infrastructure.

Phased Deployment Strategy



Module II: Introduction to ITS/CVO 2-14

The U.S. Government's strategy is to deploy ITS/CVO in phases as represented in this diagram. Planning took place from 1994 to 1996. The product of this planning was an ITS/CVO Program Plan and the CVISN architecture as well as a series of operational tests. The CVISN technologies are being tested in two prototype states (Maryland and Virginia) and seven pilot states in seven regions of the country. Piloting started in 1996 and should be completed before the year 2000. After 2000, the program will expand and move to full deployment.

Module II Learning Objectives

- ITS/CVO Vision, Program Areas, and Deployment Strategy
- Relationship Between Functional Program Areas and ITS/CVO Projects
- Key Features of ITS/CVO Project Management
- Challenges in Managing ITS/CVO Projects

Module II: Introduction to ITS/CVO 2-15

Now let's examine the relationship between ITS/CVO programs and projects.

What Is a Program?

- Program - "A Group of Projects Managed in a Coordinated Way To Obtain Benefits Not Available from Managing Them Individually; Often Include Elements of Ongoing Operations; May Involve a Series of Repetitive or Cyclical Undertakings"

PMI Body of Knowledge

ITS/CVO Program Areas

Safety Assurance	Credentials Administration	Electronic Screening	Carrier Operations

Module II: Introduction to ITS/CVO 2-16

This slide provides a definition of a program from the Project Management Institute (PMI). Note that programs are comprised of different projects.

How Do Projects Link to Programs?

❖ **Project - "A Temporary Endeavor Undertaken To Create a Product or Service; a Project Is Often a Sub-Set of a Program"**

PMI Body of Knowledge

Example ITS/CVO Projects within Program Areas

Safety Assurance Projects

- **Provide ASPEN-Equipped Laptops for Inspections**
- **Evaluate Brake Testing Product XYZ**

Electronic Screening Projects

- **Upgrade Weigh Station ABC To Do Electronic Screening**
- **Develop and Deploy Mobile Electronic Screening System**

Module II: Introduction to ITS/CVO 2-17

Here we see the definition of a project, and the relationship between projects and programs. For example, in the safety assurance program at a state level, you may have several projects including one for providing laptops for inspection and another for evaluating a brake testing product.

A project like this would have several characteristics. First, it would be "temporary" in nature with a start and end time, along with a budget. Second, it would have a specific objective. Finally, the project would relate to an existing product or service in use–some "legacy system." These are characteristics that project managers need to focus on as we will see during the remainder of this course.

Where Do ITS/CVO Projects Come From?

- **Response to State and Industry Needs**
  - **Targeted Problem (e.g., Truck Brakes)**
  - **Need for Process Improvement**
  - **Technology Upgrade/Update Opportunity**
- **"Best Practice" Experience from Other States**
- **National ITS/CVO Priorities**

Module II: Introduction to ITS/CVO 2-18

Within this context of programs and projects, there are three primary sources of projects: high-priority state and industry needs, best practices from other states, and national priorities.

Most projects are identified using an analysis of government and industry needs in a state. For example, concern over high accident rates could lead to an automated vehicle inspection project.

Some projects can be identified from "best practices" experiences of other jurisdictions such as: "State X reduced the amount of time carriers wait to register their vehicles by installing an automated registration system, so why don't we try it?"

Other projects are directly related to the goals and objectives of the national ITS/CVO program. An example of such a program would be an international electronic border clearance project to improve the efficiency of border crossings.

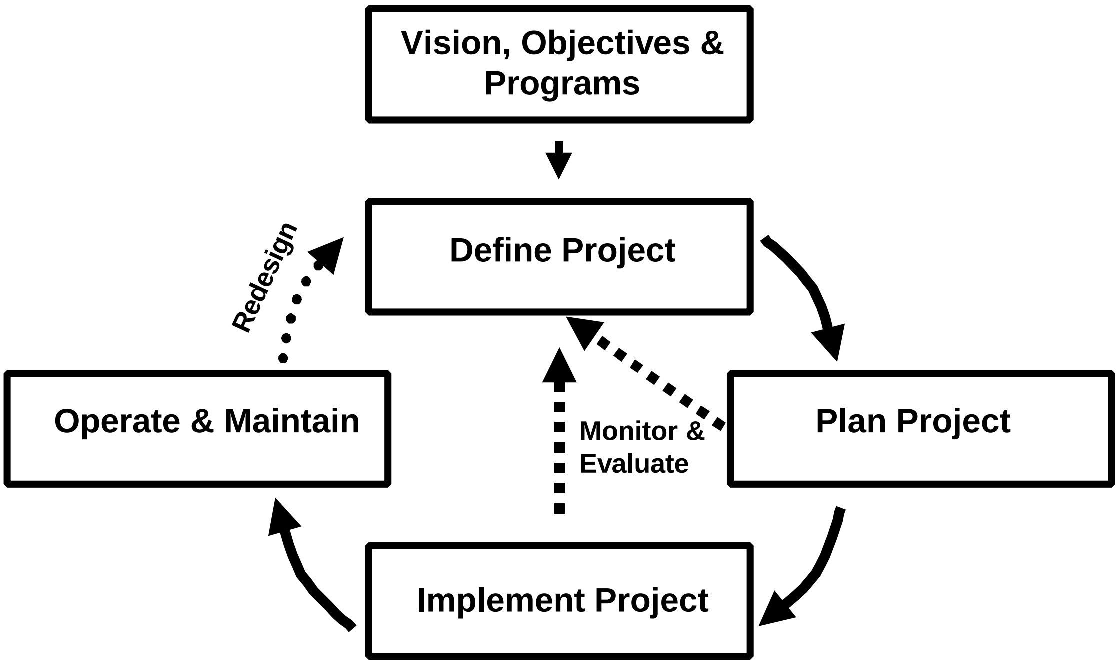
Module II Learning Objectives

- ITS/CVO Vision, Program Areas, & Deployment Strategy
- Relationship Between Functional Program Areas and ITS/CVO Projects
- → Key Features of ITS/CVO Project Management
- Challenges in Managing ITS/CVO Projects

Module II: Introduction to ITS/CVO 2-19

Now we will take a look at the key features of ITS/CVO project management.

Project Management Life Cycle Process

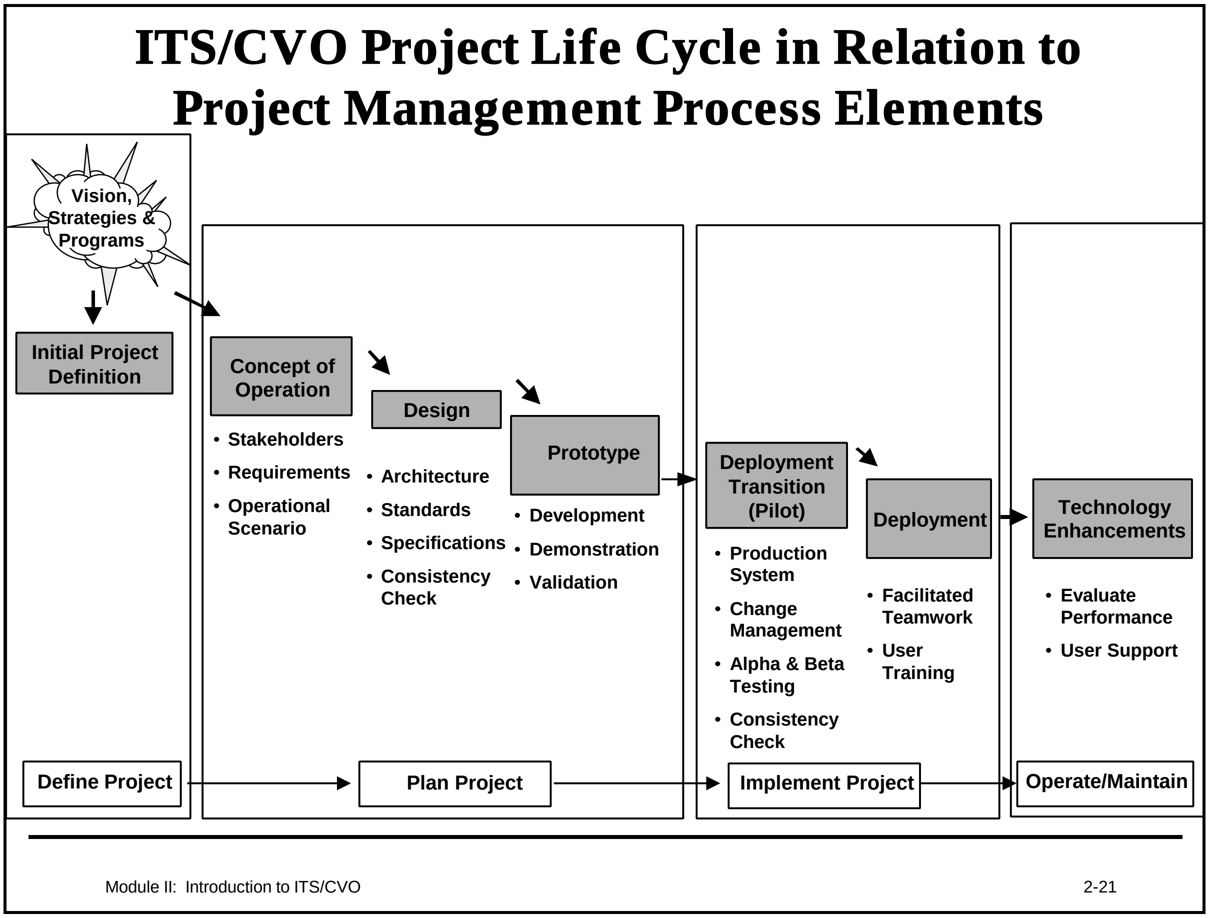


Module II: Introduction to ITS/CVO 2-20

This diagram describes the basic project management life cycle. These life-cycle features hold true for all types of projects, including ITS/CVO projects. Projects cycle through a series of steps– from definition, to planning, to implementation, and to operating and maintenance. This process is iterative involving feedback (through monitoring and evaluation) at every step.

Project definition for ITS/CVO projects typically occurs as part of the business plan development. This process typically produces project concepts with general descriptions.

Project planning produces a more detailed implementation plan with quantifiable objectives and specific work assignments, milestones, and budgets. For example, this process occurred as part of the CVISN Pilot State Workshops.



Now let's see how this basic project life cycle is manifested in the context of an ITS/CVO Project. The ITS/CVO project definition flows from the State ITS/CVO Business Plan. Planning involves developing a clear concept of operations, a design, and prototyping. Implementation includes deployment transition (with pilots) and deployment. During operations and maintenance the system is maintained and enhanced. Throughout time are iterations and cycles of learning. The subprocesses associated with each step will be explained in later course modules. They are also defined in the Glossary.

Overview-Key ITS/CVO Roles & Responsibilities

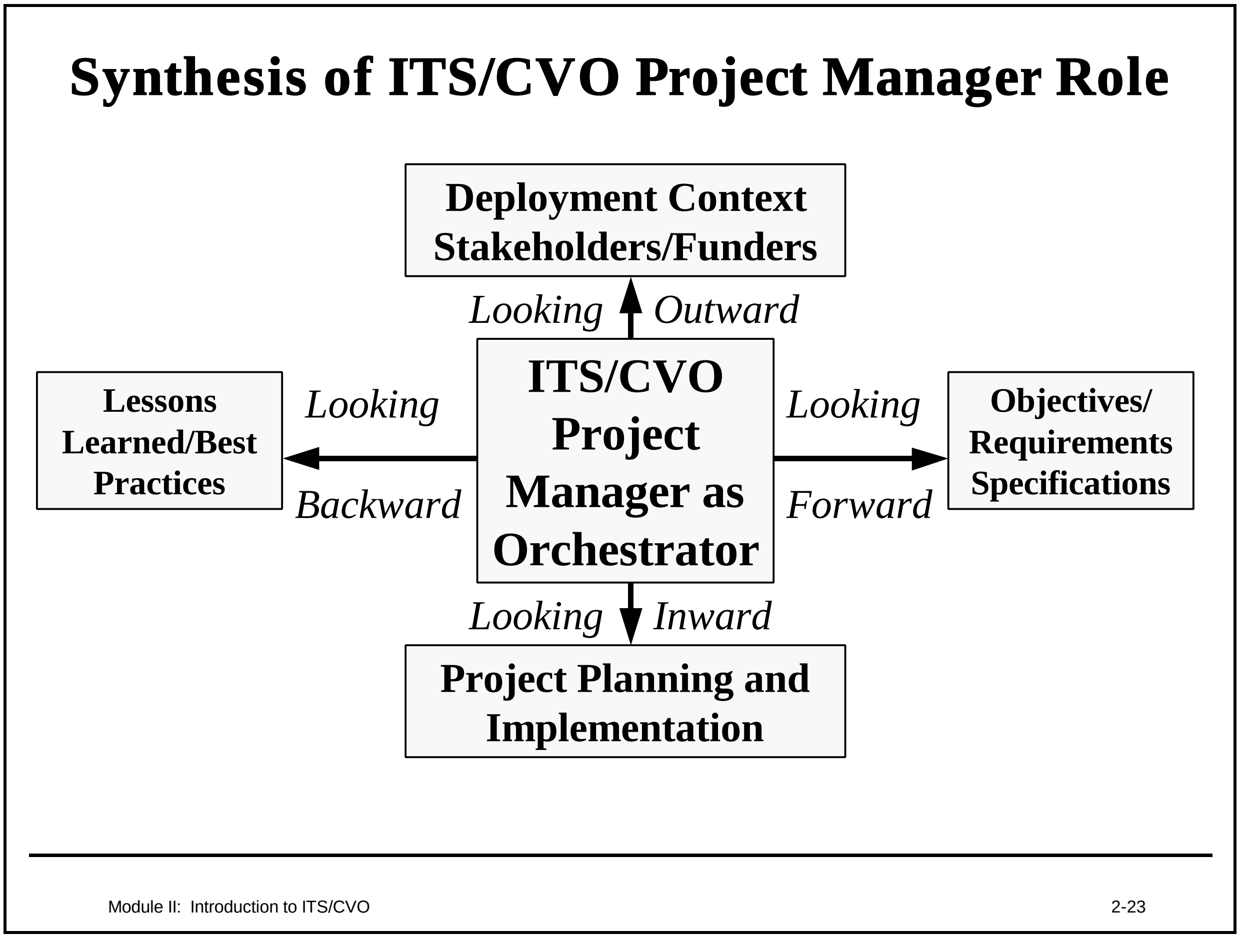
Key Staff	ITS/CVO Deployment Phases: Project Definition and Planning	ITS/CVO Deployment Phases: Project Implementation	ITS/CVO Deployment Phases: Operations & Maintenance
State: 1. Project Manager 2. System Architect 3. Contract Officer	1. Manage Planning Process 2. Document Requirements 3. Support Planning	1. Manage Implementation 2. Ensure System Meets Requirements 3. Do Procurement	1. Manage System Operation & Maintenance 2. Identify Future Enhancements 3. Ensure Maintenance
Federal: 1. ITS Specialists HQ ITS/CVO Staff 2. OMC State Directors and Program Specialists	1. Provide Guidance as Needed 2. Serve as Liaison w/State Offices	1. Be Informed of Implementation 2. Provide Guidance	1. Ensure Architecture Consistency for Interoperability 2. Standards Maintenance
Private (or in-house): 1. Consultant/ Contractor	1. Prepare Technical Specifications	1. Carry Out/ Implement Contracts	1. Provide Technical Assistance * System Repairs * Testing * Monitoring

Module II: Introduction to ITS/CVO 2-22

This diagram brings together the key roles and responsibilities in ITS/CVO project planning and implementation. Particularly important to us are the roles and responsibilities of the Project Manager at the state level. Notice how the roles both differ for various actors and evolve over the project life cycle.

One key implication of these changing roles for the ITS/CVO Project Manager is that the “management role” is very different from one stage of the project cycle to the next. We will be examining these differences more carefully over the next two days.

The System Architect plays a key role in managing all the technical issues for the project manager. In prototype states they found the most successful implementations had both a project manager and a system architect. For future CVISN efforts you will be required to have both a project manager and a system architect.



The ITS/CVO project manager is like a symphony conductor in that he/she entails simultaneous orchestration of many different parts over time. The manager is continuously:

- "Looking forward" to the accomplishment short and longer term objectives;
- "Looking outward" to the deployment context including stakeholders and funders;
- "Looking inward" to the project elements and team members; and
- "Looking backward" to lessons and practices of others.

This course will explore each of these different roles. For example, in the Module III we will focus on the "Looking Outward" dimension. Later modules will cover the other perspectives.

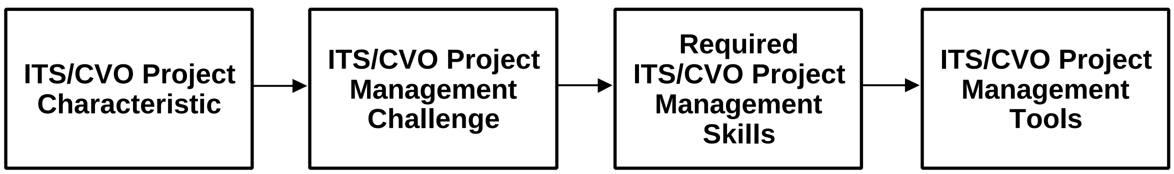
Module II Learning Objectives

- ITS/CVO Vision, Program Areas, & Deployment Strategy
- Relationship Between Functional Program Areas and ITS/CVO Projects
- Key Features of ITS/CVO Project Management
- → Identify Challenges in Managing ITS/CVO Projects

Module II: Introduction to ITS/CVO 2-24

Last, let's examine the challenges presented by ITS/CVO project management.

Framework for Analyzing Management Challenges

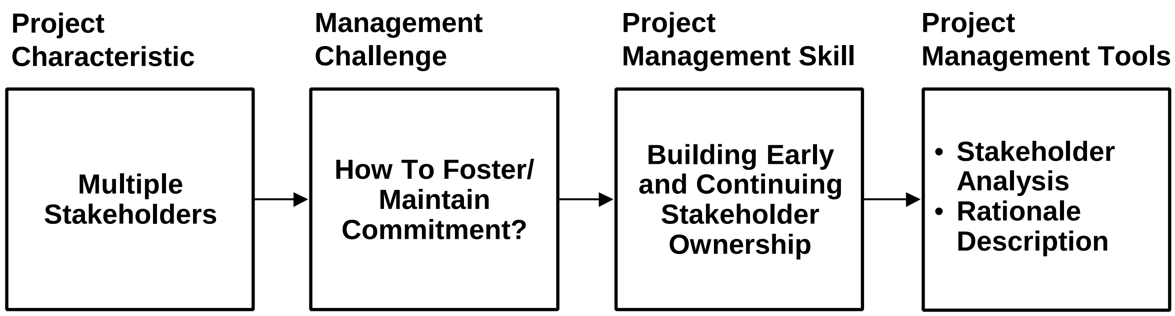


Module II: Introduction to ITS/CVO 2-25

Throughout this course we will analyze these management challenges by understanding their origins, and then define the skills and tools that can help overcome them.

Managers of ITS/CVO projects confront a unique set of management challenges, and that even those of you with traditional infrastructure project management expertise need to have some new concepts and approaches in your toolkit. Let's look more specifically at the management challenges in ITS/CVO projects implied by its unique project characteristics and then move to a consideration of the knowledge and skills that you should have to be a successful project manager. We will follow this logic in every module of the course. That is, we will move from ITS/CVO project characteristic, to management challenge, to management skill for handling that challenge, to project management tool. So, at the end of the course, you will have tools appropriate for the management challenges at each step of the project cycle.

Management Challenges, Skills, and Tools

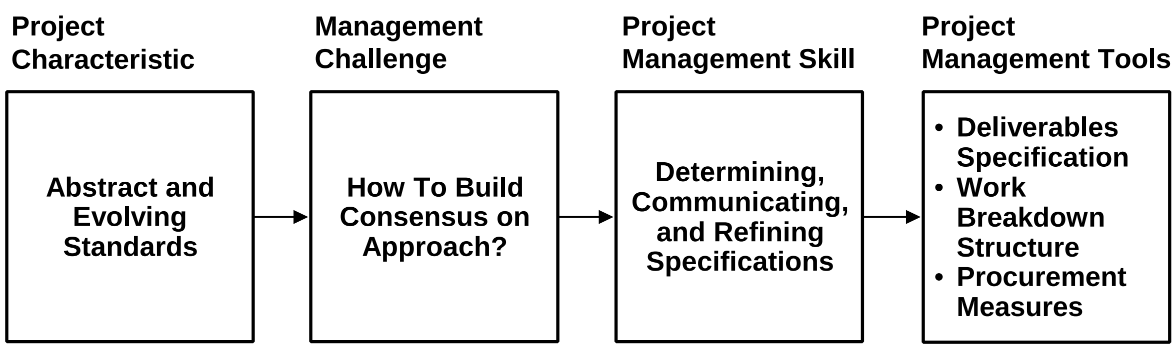


Module II: Introduction to ITS/CVO 2-26

Let's consider five common ITS/CVO project characteristics, the challenges they create, and the skills and tools that help overcome those challenges.

First, ITS/CVO projects typically involve multiple stakeholders in both the public and private sectors. Responsibility for CVO activities is fragmented among five or more agencies in many states, including departments of transportation, revenue, public safety, and motor vehicles; state police; and public utility commissions. Multi-state or regional projects require the involvement of multiple jurisdictions. Similarly, the motor carrier and motor coach industries are diverse. The project manager must be able to develop and maintain the involvement of these multiple stakeholders at all stages of the project. This requires skills of outreach and stakeholder coordination. A variety of tools are available to help build these skills; these will be covered in later modules of the course.

Management Challenges, Skills, and Tools



Module II: Introduction to ITS/CVO 2-27

A second common characteristic of ITS/CVO projects is that they involve user requirements and standards that may be abstract, evolving, or not uniformly accepted. Nevertheless, the project manager must be able to build consensus on the project's operating concept and technical approach and communicate it to the project team and other interested stakeholders. This requires skills in determining, refining, and communicating specifications. Again, several tools are available to assist the project manager.

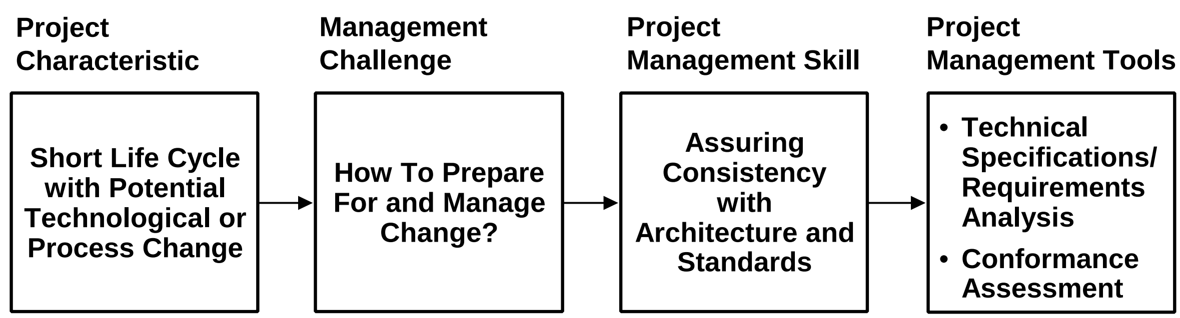
Management Challenges, Skills, and Tools

Project Characteristic	Management Challenge	Project Management Skill	Project Management Tools
Uncertain Schedule, Cost, and Risks	How To Plan for and Manage Uncertainty?	• Developing Adaptable Schedules and Budgets • Anticipating and Mitigating Risks	• Bar Charts • Resource Estimation • Monitoring Plan • Performance Reporting

Module II: Introduction to ITS/CVO 2-28

Because ITS/CVO technologies are new or evolving and relatively few implementations have been completed, data on schedules, costs, and risks are less reliable and more difficult to estimate accurately compared to more traditional transportation projects. Therefore, successful project management requires flexibility, and the project manager must be able to plan for potential risks, develop adaptable schedules and budgets, and monitor performance carefully.

Management Challenges, Skills, and Tools



Module II: Introduction to ITS/CVO 2-29

Many ITS/CVO projects are characterized by a much shorter time period than traditional infrastructure projects. Within that shorter period, however, both technologies and business processes are evolving quickly. The project manager must plan for this change and manage it in a way that avoids potential obsolescence and ensures consistency with appropriate architecture and standards.

Management Challenges, Skills, and Tools

Project Characteristic	Management Challenge	Project Management Skill	Project Management Tools
Dispersed, Cross-cutting Team Structures →	How To Ensure Components and Teams Work Together? →	• Developing Cross-Organization Teams • Encouraging Integration →	• Team Staffing and Building • Systems Integration Testing • Systems Training Plan

Module II: Introduction to ITS/CVO 2-30

Finally, because ITS/CVO projects often involve complex teams and multiple segment components, the project manager must devote attention to ensuring components and teams work together. Key project management skills include developing cross-organizational teams and encouraging integration through testing and training. Again, there are tools available to help the project manager meet these goals, and we will learn about these tools in subsequent modules.

Module II Summary

- ITS/CVO Vision
  - Make Commercial Vehicle Transportation Safer and More Efficient Through Applications of Advanced Intelligent Technologies
- ITS/CVO Projects and Program Areas
  - Safety Assurance, Credentials Administration, Electronic Screening, Carrier Operations
- ITS/CVO Projects Cycle
  - Definition, Planning, Implementation, Operations/ Maintenance
- ITS/CVO Projects Management Challenges
  - Project Managers Must Have Access to an "ITS/CVO Toolkit"

Module II: Introduction to ITS/CVO 2-31

Now let's summarize the module.

MODULE 3 - ITS/CVO DEPLOYMENT CONTEXT

Module III: Deployment Context - Project Stakeholders & Project Funding

ITS/CVO Technical Project Management for Non-Technical Managers

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-1

Now we can start with Module III: ITS/CVO Deployment Context– Project Stakeholders and Project Funding.

Module III Learning Objectives

- Key Stakeholder Groups for ITS/CVO Projects
- Challenges to Stakeholder Involvement
- Stakeholder Analysis Tool
- ITS/CVO Project Funding Issues & Approaches

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-2

There are four learning objectives for this module on the ITS/CVO deployment context. The "deployment context" deals with the "looking outward" dimension of the project manager's role.

The first three objectives deal with a key feature of the ITS/CVO deployment context: stakeholder groups and how to gain their commitment. The final objective deals with ITS/CVO project funding. Funding involves a particular subset of stakeholders so we will use it to illustrate how a project manager interacts with the external project context during planning and implementation.

Module III Learning Objectives

- Key Stakeholder Groups for ITS/CVO Projects
- Challenges to Stakeholder Involvement
- Stakeholder Analysis Tool
- ITS/CVO Project Funding Issues & Approaches

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-3

The first topic concerns the identification of key project stakeholders. This activity should take place at the start of your project planning. Identifying stakeholders has become an important component of project management over the last ten years. Some identification work should have been done as part of your state's ITS/CVO Business Plan. You, as project manager, will need to understand who the stakeholders are and how they are affected– both positively and negatively– by your project.

From the experience with the St. George Port of Entry/ITS project in Utah, the point was made that "We believe the number one lesson learned was to identify the partners (e.g. stakeholders) who would have an interest, and gain positive benefits from, the development of an ITS/CVO program."

Stakeholders Are:

- Institutions, Groups or Individuals Who:
  - Have an Interest in the Short and Long Term Success of the Project
  - Contribute to or Are Affected by Some Part of the Project, as Gainers or Losers
  - Can Influence the Real or Perceived Success of the Project

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-4

Let's begin by defining the term stakeholders. Stakeholders may include institutions, groups, and individuals with an interest or stake in your project. Stakeholders are "at stake" for different reasons. Some groups may see your project as helping them. For example, they may get a new computer and color printer. Others may see the project as a burden. For example, they may think it will create more work and responsibility with no additional pay.

In the ITS/CVO context, one group of stakeholders would be the system users, while another group would be the project funding organizations.

Let's review stakeholder identification in the ITS/CVO context.

ITS/CVO Stakeholder Identification: Why do it?

- ITS/CVO Projects Require Several Types of Stakeholder Involvement:
  - Executive Ownership & Commitment (Throughout Life Cycle)
  - Consensus on Expected Results and Requirements (During Planning & Implementation)
  - Working Together in a Coordinated Manner (During Planning, Implementation, and Operations/Maintenance)
- Before a Manager Can Obtain "Buy-in", It is Necessary to Identify Key Actors & Design Strategies Appropriate for Their Involvement

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-5

Now that we know who stakeholders are, a second question is: why identify them? Here is a summary of what we talked about in Module II on the importance of identifying stakeholders and obtaining their commitment.

Exercise: Grouping Stakeholders for ITS/CVO Projects

	Customers/Users (Multiple Layers)	Sponsor (Financial, Technical, Political)	Project Management (in Project Organization)	Project Team (Involved in Doing Project Work)	Other Interested Parties
Commercial Drivers					
Industry & Trade Associations					
Special Interest Groups					
FHWA					
State Government Agencies					
Politicians					
Private Contractors					
State ITS/CVO Project Manager					
Motor Carriers (motor coach and trucks)					
Local Agencies					
Federal Agencies (e.g. Treasury, Justice)					
State Procurement Office					
Shippers, Receivers & Insurers					
State ITS/CVO Systems Architect					
Other					
Other					

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-6

Take one or two minutes to complete this exercise individually. At the bottom of the table there is also some space for you to enter your own ITS/CVO stakeholders and for you to match them with the groups in the columns.

Module III Learning Objectives

- Key Stakeholder Groups for ITS/CVO Projects
- Challenges to Stakeholder Involvement
- Stakeholder Analysis Tool
- ITS/CVO Project Funding Issues & Approaches

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-7

Now we can move on to the next learning objective. Once we know who our stakeholders are, we can identify challenges to their initial participation and ongoing involvement in ITS/CVO projects, and then develop strategies to overcome these barriers.

Representative Barriers to Stakeholder Involvement in Projects

Type of Stakeholder Barriers	Examples
1. Perception that the Project (or a Part of It) Has Limited or Undefined Benefits	State Official: "My Manual CVO Registration System Is Working FINE, So Why Do I Need an Electronic System?"
2. Perception That the Project (or a Part of It) Costs More Than It is Worth	Public Executive: "I'm Not Convinced that the Cost of Your Proposed Roadside Electronic Screening System Is Worth The Projected Safety Enhancements"

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-8

Experience with project management has documented several general types of perceptions about a project that create barriers to stakeholder involvement. Some representative types of barriers include the following:

- Perception that the project has limited or undefined benefits;
- Perception that the project will provide minimal value for cost;
- Perception that the project is not feasible to do; and
- Perception that the project is counter to what should be done.

Representative Barriers to Stakeholder Involvement in Projects

Type of Stakeholder Barriers	Examples
3. Perception that the Project (or Part of It) Is Not Feasible	Enforcement Officer: "I Don't Believe that the New Electronic System Will Give Me Reliable Data; I Like My 'Paper' System"
4. Perception that the Project (or a Part of It) Is Clearly Against or Counter to the Stakeholder Group's Interest	Motor Carrier Industry: "How Will the Government Use the Data that They Have Collected on Me?"

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-9

Next we will go through the particular response of each type of stakeholder to these barriers.

How the Barriers Impact Stakeholder Behavior

Representative Barrier to Stakeholder Involvement	Executives/ Sponsors	Customers/ Users	Project Manager/ Organization
1. Undefined Benefits	• Will Be Reluctant to Commit to Project	• Will Show Disinterest in the Project	• Will Give Mixed Signals About Why Project is Being Done
2. Minimal Value for Cost	• Will Not Support Budget Increases & Extensions	• Will Argue That the Project is Not Worth It	• Will Try to Reduce Budget & Minimize Costs
3. Low Feasibility	• Will Keep Low Profile Until Project Proves Do-able	• Will Show Skepticism & Reluctance to Participate	• Will Need to Spend More Time Than Expected
4. Counter to What Should Be Done	• Will Openly Oppose the Project	• Will Not Use Project Deliverables	• Will Not Be Able to Gain Cooperation

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-10

The barriers manifest themselves somewhat differently for the several stakeholder groups. For example, as presented in example #4, if the project is perceived to be counter to what should be done, then:

- Executives will openly oppose it;
- Customers will not use the project deliverables; and
- Project team members will not be motivated to work on the project.

Therefore, it is very important for a manager to understand stakeholder perceptions, and to counter the negative impact of these barriers.

Module III Learning Objectives

- Key Stakeholder Groups for ITS/CVO Projects
- Challenges to Stakeholder Involvement
- Stakeholder Analysis Tool
- ITS/CVO Project Funding Issues & Approaches

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-11

Now that we have identified the barriers to stakeholder involvement, we can introduce a management tool for analyzing them.

Stakeholder Involvement Tool: Stakeholder Analysis

- **Purpose:**
  - **Determine What Stakeholder Interests To Take Into Account During a Project and How To Secure Their Commitment**
- **Description:**
  - **Technique that Combines Tools for Assessing Interest of Influential Institutions, Groups, & Individuals, & Identifying Resources They Can Mobilize to Affect Outcomes**
- **When To Use:**
  - **Use During All Phases of the Project Life-Cycle**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-12

Stakeholder Analysis is a tool for determining the ITS/CVO project-related interests of important stakeholders and taking these interests into account in a manner which ensures their commitment.

Let's look at the tool in more detail.

A Stakeholder Analysis Is:

- An Important Management Tool for ITS/CVO Technical Project Managers
- A Technique for Assessing the Interests of:
  - Influential Institutions
  - Groups & Individuals
  - Resources that Can Be Mobilized To Affect Outcomes
- A Method To Assist You in Accounting for These Interests During Project Planning & Implementation by
  - Obtaining "Buy-in"
  - Leveraging the Resources of Others

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-13

This is a definition of stakeholder analysis. We view stakeholder analysis as a management tool for helping you to better understand which groups your project will affect, and how to take these groups into account as you plan and implement your project.

Stakeholder Analysis Questions

- **What Groups & Individuals Have a Readily Identifiable "Stake" or Interest in the ITS/CVO Project?**
- **Is the Stakeholder Group Likely to Support the Project (Based on Some Expected Benefit) or Oppose the Project (Due to Some Expected Burden or Loss)?**
- **What Actions Can Be Taken To Gain or Strengthen the Support of Stakeholders for the Project?**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-14

Now we can talk about how Stakeholder Analysis works. The approach includes three basic questions:

1. What groups and individuals have a readily identifiable "stake" or interest in the ITS/CVO project? (We did an exercise on this earlier in this module).

2. Is the stakeholder group likely to support the project (based on some expected benefit) or oppose the project (due to some expected burden or loss)?

3. What actions can be taken to gain or strengthen the support of stakeholders for the project?

Stakeholder Analysis Matrix

Location:

ITS/CVO Program Area:

Project Name:

Key Stakeholders?	Benefits?	Losses?	Strategies for Stakeholder Cooperation?
Customer/User **1.**			
Sponsor **1.**			
Project Manager **1.**			
Project Organization **1.**			
Other **1.**			

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-15

Here is a matrix format for completing a Stakeholder Analysis for your own projects. You can use this format when you get back to your state and begin managing ITS/CVO projects.

Steps for Stakeholder Analysis

Step 1: Complete Information

Location:
ITS/CVO Program Area:
Project Name:

Step 3: Identify Likely Benefits & Losses for Each Group

Key Stakeholders?	Benefits?	Losses?	Strategies for Stakeholder Cooperation?
Customer/User 1.			
Sponsor 1.			
Project Manager 1.			
Project Organization 1.			
Other 1.			

Step 2: List Key Stake-holder Groups for Your Project

Step 4: Analyze Implications for Project Including Support Strategies

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-16

To complete the matrix you would follow these steps:

1. Complete the project information.
2. Think of all the related stakeholders and list them in the appropriate group, beginning with the stakeholders we identified in our earlier exercise.
3. Think about the benefits and losses associated with the project that would affect each group and list them.
4. Analyze the implications that implementing the project will have on each stakeholder and how it may affect their behavior.

Let's take an ITS/CVO example. In Utah's State St. George Part of Entry ITS project, one key stakeholder group was the motor carriers who would use the new weigh-in-motion scales. They would benefit from the project in terms of saved time in entering Utah. However, some truckers perceived a potential loss of privacy. The implication for the project was to have open and continuous communications of project benefits with the truckers, and to design this activity into the project.

Stakeholder Analysis Illustration

Location: Virginia

ITS/CVO Program Area: Safety Assurance

Project Name: SAFER DATA MAILBOX

Key Stakeholders?	Benefits?	Losses?	Strategies for Stakeholder Cooperation?
1. MCSAP Inspectors	Timely Inspection Data	None	Train on New System
2. MCSAP Agencies	Ability to Target High-Risk Carriers	Loss of Data Control Due to Immediate Transfer	Seek Input from Management on Data Flow
3. Motor Carriers	Fewer Inspections for Safe Carriers	Potential Misuse of Data by States	Develop Joint Agreement on Data Use

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-17

This is an illustration from a project in Virginia, the SAFER Data Mailbox project.

Module III Learning Objectives

- Key Stakeholder Groups for ITS/CVO Projects
- Challenges to Stakeholder Involvement
- Stakeholder Analysis Tool
- → ITS/CVO Project Funding Issues & Approaches

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-18

Our last topic addresses ITS/CVO funding issues and approaches. Project funding or financing entities represent one of the important types of stakeholders in the sponsor group that we discussed a few minutes ago. So, our discussion of this topic will illustrate several of the stakeholder issues and strategies presented earlier in the module, as well as introducing new information on funding.

The Key Questions About Funding

- Project Manager Must Address Many Funding Issues as Part of ITS/CVO Projects
- Core Questions Are:
  1. What Are the Funding Requirements at Each Stage of the ITS/CVO Project Cycle?
  2. What Are the Management Issues Related to Project Funding?
  3. What Strategies Are Available for Dealing With Project Funding?

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-19

There are three key project funding issues that occupy the attention of ITS/CVO project managers:

1. What are the funding requirements at each stage of the ITS/CVO project cycle?

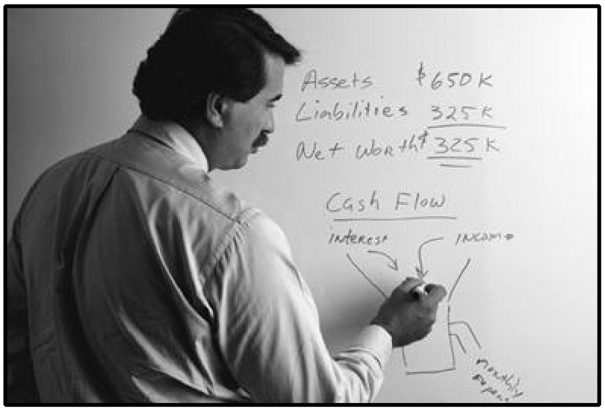
2. What are the management issues related to project funding?

3. What strategies are available for dealing with project funding throughout the life cycle?

At the completion of this session we will be better able to answer each of these questions. Let's discuss each of these in turn.

Question 1:

What Are the Funding Requirements at Each Stage of the ITS/CVO Project Cycle?



Module 3: Deployment Context - Project Stakeholders & Project Funding 3-20

The first question we want to focus on is the funding requirements at each stage of the ITS/CVO project cycle.

Funding During the Project Life Cycle

- **Funding Approach Must Match the Project's Life Cycle**
  - **How Much Funding Is Needed at Every Project Cycle Phase?**
  - **Can Funding Be Obtained as the Project Progresses Through its Life Cycle?**
  - **What Are the Funding Alternatives I Should Consider?**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-21

Funding must be compatible with a project's life cycle. These are some important questions to ask to ensure compatibility. The most basic is "how much funding is needed at every project cycle phase?" When you as a technical manager are assigned a project, you will probably be given a "project budget." But you will need to assess whether the budget is adequate for project success.

Let's focus again on the three phases of the project life cycle with some of the typical ITS/CVO activities carried out in each. Usually, you as a manager will be involved in funding activities at every phase of the project.

- During planning you will be given a funding amount, and will need to develop a detailed budget and documents for implementation.
- During implementation you will need to consider funding requirements for operations and maintenance (O&M), and prepare necessary documents.

The variables to consider that affect funding at each phase are presented in the next slide.

How Do ITS/CVO Project Life Cycle Phases Differ?

- **Type of Work Being Performed (Services, Equipment, Software, O&M, Warranty Support)**
- **Cost To Accomplish the Work**
- **Amount of Time Necessary To Complete the Work**
- **Who Is Involved (What Agencies; What Departments Within the Agencies)**
- **Amount & Kinds of Risk Inherent in the Work**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-22

Here are the project elements that will influence your project funding at each phase. To develop a budget you will need to consider:

- The type of work and how it changes;
- The cost of each type of work;
- The time involved, especially if it extends longer than a normal one-year budgeting cycle;
- Who is involved and whether costs differ by agency; and
- The risks involved that may lead you to increasing the "contingency funding" that you require.

We will have on opportunity to examine these variables and their impact on funding more thoroughly in our case exercise later in the course.

Funding Must Be Compatible With the Project's Life Cycle

- **Amount of Funding (Is There Enough?)**
- **Uses for Funding (Services, Equipment, Software, O&M, Warranties)**
- **Time Period (Single or Multiple Years) over which the Funding Can Be Used**
- **Funding Flexibility (Opportunity To Extend or Expand)**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-23

Taking these factors into consideration, the project manager's task is to ensure that funding is compatible with each project phase along several dimensions:

- Amount;
- Eligible uses of funds;
- Timing; and
- Flexibility.

We will examine each of these topics in more detail in our next section on funding issues.

Systems Often Transition from One Type of Funding to Another as the Project Progresses Through Its Life Cycle

- **Funding Request & Approval Process May Require a Year or More**
- **Delays Due to Funding Process Can Increase System Costs, & Decrease Likelihood of Project Success**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-24

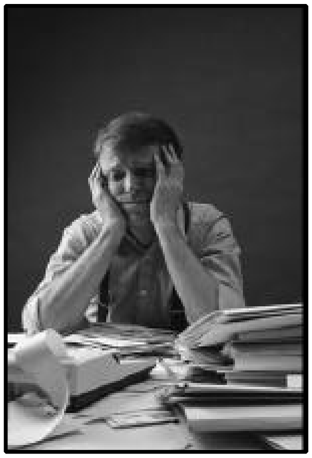
To match funding to a project's phases, it is often necessary to use different types of funding from different sources for the different project phases.

This can present several challenges. First, the funding process may require a long lead time so you need to plan ahead. Second, you need to be sure that delays in obtaining funds do not increase the overall costs of the project. This second point is very important because there are costs associated with delays. The best way to combat these delays is to educate all players and document all decisions.

For example, on a CVISN project in Virginia a delay in funding caused the state to take some individuals off the project and assign them elsewhere. This resulted in a delay of the project completion date.

Question 2:

What are the Management Issues Related to Project Funding?



Module 3: Deployment Context - Project Stakeholders & Project Funding 3-27

Now we can move to the next question. Let's examine in more detail the management issues related to funding.

As introduced earlier, there are four fundamental management issues related to funding. Let's examine some common ITS/CVO issues, along with some guidance on dealing with each issue.

Issue: Is There Adequate Funding in Terms of Full Life-Cycle Costing?

What an ITS/CVO Project Manager Should Look For	What Guidance To Follow
1. Is There Enough Funding for Each Phase of the Project Life Cycle?	• Ask Project Implementers & Contractors for Cost Estimates & Check Against Plans • Discuss Funding Characteristics with Your Supervisor
2. Is the Funding Stable?	• Inquire from "Old Hands"

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-27

The first issue relates to adequate funding for the full project life cycle. This chart shows some of the things that a project manager can look for and also some steps a manager can take to address the issue.

On the first question, remember that ITS/CVO projects have relatively higher planning/piloting and O&M costs than traditional infrastructure projects. So you need to check estimates carefully and make a strong business case for your budget.

On the second question, check the stability of your funding. Will it last? What can replace it? For example, the FHWA ITS/CVO deployment incentive funding program will phase out in a few years. Project managers need to take this into account for all of their ITS/CVO projects.

Issue: In What Ways Can You Use the Funding?

What an ITS/CVO Project Manager Should Look For	What Guidance To Follow
1. What Restrictions or Limitations Come with the Funding (e.g. Procurement Types, Scope of Work Elements)?	• Seek Advice from Financial Personnel • Determine Matching Funds Requirements
2. What Procedures Are Followed To Use the Funding?	• Plan Ahead • Work with Financial Personnel on FAR Compliance

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-28

Our second issue addresses ways in which you can use funding. Here the first question is what restrictions or limitations accompany your project funding. Some funding, for example, may have procurement restrictions or may only be used for capital versus operational expenditures. These are important considerations and you should clarify this issue when you accept management responsibility for a project.

The second question is related. It deals with procedures for using the funds. Our advice is to check with financial personnel on the procedures that must be followed for various types of funding. For example, some funding may require that you follow the FAR (Federal Acquisition Requirements) procedures. Others may require their procedures. Procurement issues are discussed in more detail in Module V.

Issue: Over What Time Period Can the Funding Be Used?

What an ITS/CVO Project Manager Should Look For	What Guidance To Follow
1. Can Left-Over Money from One Project Phase Be Used in the Next?	• Roll Tasks from One Phase into the Next • Use Task Order Contracting
2. When Is Monitoring & Reports Required?	• Include Requirements in Procurement RFPs

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-29

The third issue deals with timing in the use of your project funds. For example, can funds left over during project planning "roll over" to project implementation? Some contracting mechanisms, like basic task order agreements, might provide you more timing flexibility and you need to consider these possibilities.

A second timing question involves financial monitoring and reporting: You can save some reporting effort by building in clear reporting requirements into contracts. For example, let the contractor write some of your reports for you. This will free up time for you to focus on more strategic matters.

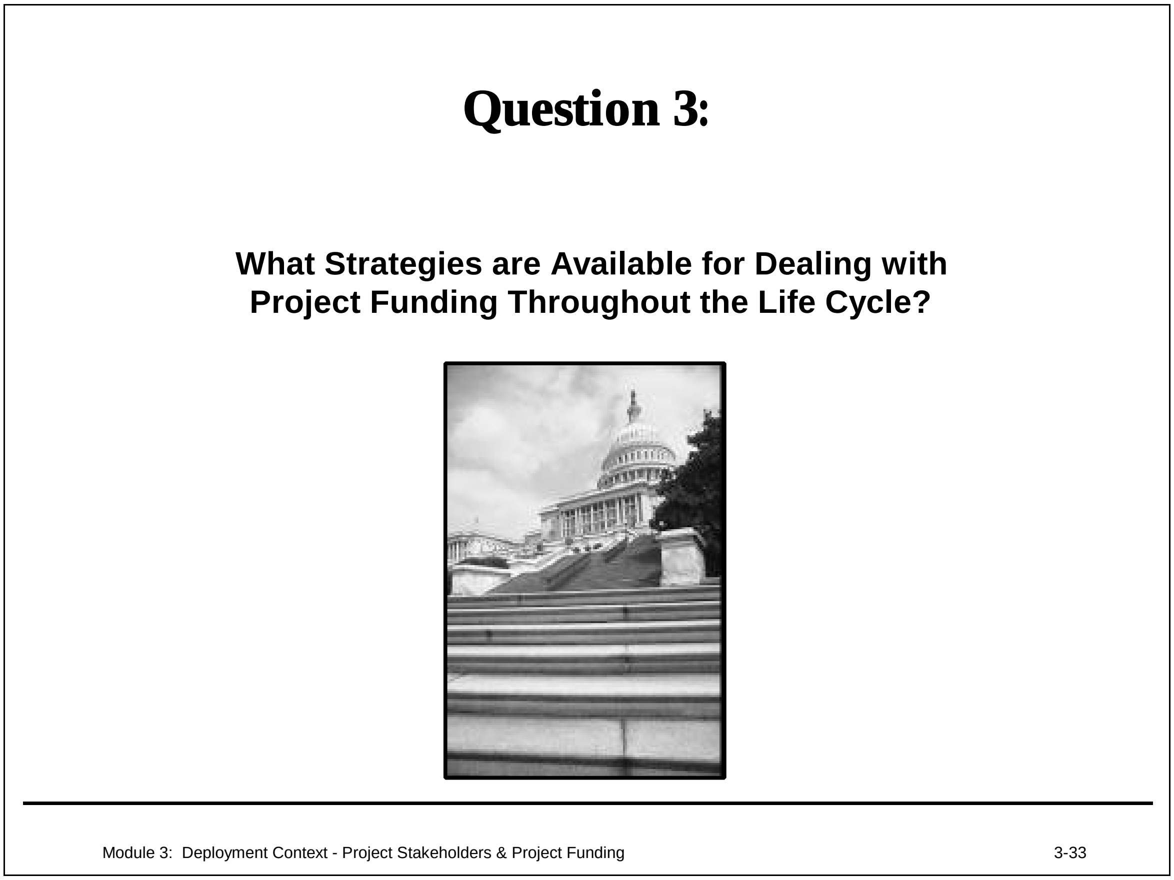
Issue: Are the Funding Levels Flexible?

What an ITS/CVO Project Manager Should Look For	What Guidance To Follow
1. Is Additional Funding Available if Project Costs Grow?	• Phase the Work To Reduce Risk of Overrun • Monitor Carefully • Build in Contingency To Budget
2. Can We Mix Different Types of Funding in The Same Phases?	• MOUs Between Agencies • Work with Financial Office

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-30

Our last issue addresses the question of whether funding is flexible. Here you want to assess the possibility of adding to your funding in case you require additional resources. There are several ways to deal with this issue. One is to build a contingency into your budget. A contingency of 5 to 10 percent is normal. Other ways are to phase the work, and to monitor the financial aspects of the work carefully so as to minimize surprises.

The second question relates to mixing types of funding for your project. If there are multiple agencies involved in a project you may find they are using several different funding sources. These will need to be understood and handled. The use of a memorandum of understanding (MOU) between agencies is one way to do this. You also should work closely with your financial staff.



Finally, let's look at some general management strategies for dealing with ITS/CVO project funding.

Investment in ITS/CVO Is Significant and Growing

- **Estimated Investment in ITS Products & Services Totaled $1.2B from 1991-1997**
- **CVO Spent Approximately $250M for 1991-1997**
  - **Federal/State Governments Spent $210M**
  - **Private Sector Contributed $40M**
- **1997 Federal Total Expenditures for ITS/CVO**
  - **$22.4M for R&D (Safety, Electronic Screening, Carrier Operations)**
  - **$9.5M for CVISN**
  - **$2.4M for Mainstreaming**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-32

The Federal government and private enterprises are increasing their investments in ITS/CVO. This trend is expected to continue.

Federal Government Is a Major Source of ITS/CVO Funding

- Transportation Equity Act of the 21st Century (TEA-21)
  - ITS Deployment Incentive Funding
- Federal-Aid Highway Programs Financed by the Highway Trust Fund (STP, NHS, CMAQ)
- Motor Carrier Safety Assistance Program (MCSAP)
- Innovative Financing (SIB, TIFIA, GARVEE Bonds)

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-33

At the Federal level, there are several primary sources for ITS/CVO funding. These were discussed in the Introduction to ITS/CVO Course so we will not discuss them in detail here.

These acronyms are defined in your glossary and further information on funding strategies can be found on the FHWA ITS/CVO website.

Let's look at an illustration of how funding sources can be used differently at various stages of the project life cycle. Take, for example, the Motor Carrier Safety Assurance Program (MCSAP).

MCSAP Restrictions Provide an Example of How Funding Must Be Matched to the Project

- **MCSAP Provides Assistance for the Enforcement of Federal Rules, Regulations, Standards, & Policies Applicable to CVO Safety**
- **Usually Requires an 80/20 - Federal/State Cost Share**
- **MCSAP Funding Used for Performance-Based Grants To Increase Safety Enforcement at International Border Crossings**
- **Also Used for Adoption of the National Governor's Association Recommendations with Respect to Police Accident Reports for Truck & Bus Accidents**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-34

As we discussed before, it is important that funding match the project. MCSAP restrictions are an example of how important this is. The focus of MCSAP is for implementation of several specific program activities. When using this funding, project managers need to have a full understanding of these limitations. As they say, "There are always strings attached."

State/Local Government Is Another Funding Source for ITS/CVO Projects

- State/Local Funding Sources
  - State DOT
  - State DMV
  - State Police
  - State Department of Revenue
  - Toll Authorities
- State/Local Funding Categories
  - Research & Development
  - Studies & Engineering/Design Services
  - Construction
  - Operations/Maintenance

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-35

State and local governments can also provide funding for ITS/CVO projects. These funds for your project may come from various agencies and be used for different purposes. In some cases, the source of this funding will be cost avoidance as a result of new projects or reengineering. Again, you need to understand these. In addition, you should prepare for the legislative outreach and education that may be required to obtain state funding.

There Are Several Unconventional Ways To Reduce Individual Contributions to the Total Funding Program

- Pooling
  - Multiple Agencies Share Cost of Various Stages
  - Implications Include Time To Achieve Consensus & Delays Due to Holdups in Pool Partner Agencies
- User Fees
- Partnerships
  - Private Sector Participates in Return for Opportunities for Profit-Making
  - Implications Include Time To Negotiate, Reporting Requirements, & Stability of Private Partner Firms

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-36

Besides the different funding sources we have just discussed, there are also some unconventional ways to get funding. We are seeing more of these innovative arrangements being used in many states. Note that each of these sources come with opportunities and implications. With pooling, you can expand the funding available. But there are time and cost implications in doing it. Likewise with partnership agreements.

For example, the I-95 Corridor Coalition states pooled their resources to gain advantages before undertaking CVO projects.

Working With the Private Sector Is One Method To Extend Public Funds

- Public/Private Partnership Implies that Resources Are Pooled & Risks Are Shared
- Partnership Is Not a Conventional Contract
- Private Sector Must Have a Motivation to Participate in the Partnership
  - Typically, the Eventual Profit from Ongoing Sale of Goods/Services or Private Sector Operation of the System Must Be Clearly Defined

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-37

Working with the private sector is an increasingly popular way to extend public funds. Note two things about this source of funding:

First, both resources and risks are shared. Both parties share in success and in failure.

Second, the private sector must be able to see some short or long term gain from participating. If the profit prospects are unclear, the interest in participating will be low.

Private Sector Has Multiple Concerns in ITS/CVO Partnerships

- **Data Privacy and Control**
- **Administrative Reporting Requirements**
- **Migration of Proprietary Systems to Open Standards**
- **Who Benefits vs Who Pays**
- **Incentives To Use Safety Technology**
- **Ability of the Public Sector To Meet Its Obligations**

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-38

Here we list some of the concerns that private sector representatives may voice about investing in ITS/CVO projects.

The private sector enters such partnerships with a great deal of skepticism, so keep that in mind if you are thinking about pursuing this route for funding.

There Are Several Recommended Practices for Working with the Private Sector

- Define Roles & Responsibilities, Administrative Requirements, Risks, and Benefits for Each Partner
- Establish Public/Private, Multi-Agency Steering Committee
- Develop and Agree Upon an Issue Resolution Process and Timeline, with Intensive Communications
- Clarify Ownership and Licensing Status of Deployed Systems

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-39

Experience shows that when working with the private sector following certain guidelines works best. These are some of the most important lessons that we have learned from the early stages of ITS/CVO deployment.

For example, Virginia Technical College received funds from the automotive industry and the government to develop and build ITS components on a tractor trailer. The components were for collision avoidance systems, automatic braking and tracking.

Module III Summary

- Stakeholder Involvement
  - Identify Stakeholders with Positive and Negative Project Impacts
  - Ensure Early and Continuous Involvement of Key Stakeholders
- Funding Approaches
  - Understand and Prepare for Changing Funding Requirements at Each Stage of the Project
  - Explore Federal-Aid, State, and Private Sector Funding Opportunities

Module 3: Deployment Context - Project Stakeholders & Project Funding 3-40

Let's summarize Module III by reviewing the key learning points.

One final point to emphasize is that unexpected delays in software development, hardware problems, etc. can impact funding and budgets. This is especially true in prototype or pilot projects. We need to be prepared to handle these situations and monitor contractor expenditures during these times.

MODULE 4 - IMPLEMENTATION PLANNING

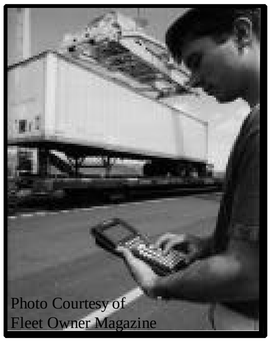


Photo Courtesy of
Fleet Owner Magazine

Module IV: Implementation Planning of ITS/CVO Projects

ITS/CVO Technical Project Management for Non-Technical Managers

Module 4: Implementation Planning of ITS/CVO Projects 4-1

In this age of global interdependence, our learning comes from varied places around the world. In Asia, for example, there is a saying that is appropriate for this module on project planning. The Asians say, "Success is in the opening time," and so it is with a project's success!

Many of the factors contributing to success are determined in the beginning phases– or during project definition or planning. We observed this during the last module where we saw the importance of stakeholder involvement right from the beginning of a project. Now, we need to spend some time learning about how you as project managers can manage the planning phase to enhance the prospects of success for ITS/CVO Projects.

Module IV Learning Objectives

- **Major Steps In the ITS/CVO Project Planning Process**
- **Key ITS/CVO Project Planning Roles and Skills**
- **Basic Project Planning Tools and Techniques**
- **Application of Planning Tools to the Development of an Illustrative ITS/CVO Project Plan**

Module 4: Implementation Planning of ITS/CVO Projects 4-2

Here are the learning objectives for this afternoon's module. The first three deal with the ITS/CVO project planning process at the state level, and with some basic skills and tools that you need for project planning. We recognize that all of you have been "planning" for things all of your life, so our intent here is to augment your current planning skills with those that are necessary for successfully navigating the unique ITS/CVO project challenges introduced this morning in Module II.

We will cover the first three objectives here in the plenary session. This will take about two hours. Then we will introduce a case exercise to provide you with an opportunity to apply some of the ITS/CVO planning tools in an illustrative case situation for the State of Midland. We will provide you with the overview of Midland to use as background information for the case.

Module IV Learning Objectives

- Major Steps In the ITS/CVO Project Planning Process
- Key ITS/CVO Project Planning Roles and Skills
- Basic Project Planning Tools and Techniques
- Application of Planning Tools to the Development of an Illustrative ITS/CVO Project Plan

Module 4: Implementation Planning of ITS/CVO Projects 4-3

Let's begin with the first learning objective– understanding the ITS/CVO project planning process.

ITS/CVO Project Life Cycle: Typical Steps Related to State Level ITS/CVO Project Management

Project Phase	Define Project	Plan Project	Implement Project	Operations & Maintenance
Steps:	1. Assess ITS/ CVO Needs 2. Identify Priority Projects in ITS/CVO Program Areas 3. Develop Initial Concept for the Project	4. Assign Project to Technical Manager for Detailed Planning 5. Develop Detailed Project Plan 6. Obtain Necessary Commitments	7. Procure Services for Implementation 8. Manage Implementation 9. Prepare for Operations and Maintenance Including Upgrades	10. Operate and Maintain Project
Mechanisms:	1, 2 & 3 State ITS/CVO Business Plan	4. Supervisor Assignment Order 5. ITS/CVO Project Plan 6. Approval Procedures	7. Procurement Regulations 8. Implementation Arrangements 9. Operations & Maintenance Plan	10. Operations & Maintenance Arrangements

Module 4: Implementation Planning of ITS/CVO Projects 4-4

This slide summarizes the typical state-level ITS/CVO project cycle steps and mechanisms. As we showed earlier, projects move through a life cycle process of defining a project, planning, implementation, and operations and maintenance. Several steps can be identified for each of these phases. This module focuses primarily on Steps 4 to 6, but it is important for Technical Managers to understand how projects are defined and where they come from, so we'll begin by briefly reviewing Steps 1, 2, and 3.

Where Do ITS/CVO Projects Come From?

- **Response to State and Industry Needs**
  - **Targeted Problem (e.g., Truck Brakes)**
  - **Need For Process Improvement**
  - **Technology Upgrade/Update Opportunity**
- **"Best Practice" Experience from Other States**
- **National ITS/CVO Priorities**

Module 4: Implementation Planning of ITS/CVO Projects 4-5

In Module II, we learned that projects come from one of several sources and provided some examples. In each of these cases, projects are defined in relation to some ITS/CVO need at the state level.

Project Definition Steps

Steps	Mechanisms
1. Assess State ITS/CVO Needs ↗ Problem Areas ↗ Opportunities for Improvement	National & Regional Policies, Priorities, & Funding Incentives State Level Problem Analysis Best Practices Sharing
2. Identify Priority Projects in ITS/CVO Program Areas	National ITS/CVO Program Areas State/Agency Program Focus
3. Development of Initial Concept for the Project Including: ↗ Objectives ↗ Schedule ↗ Stakeholders ↗ Cost ↗ Technical Approach ↗ Issues	ITS/CVO State Business Planning Process

Module 4: Implementation Planning of ITS/CVO Projects 4-6

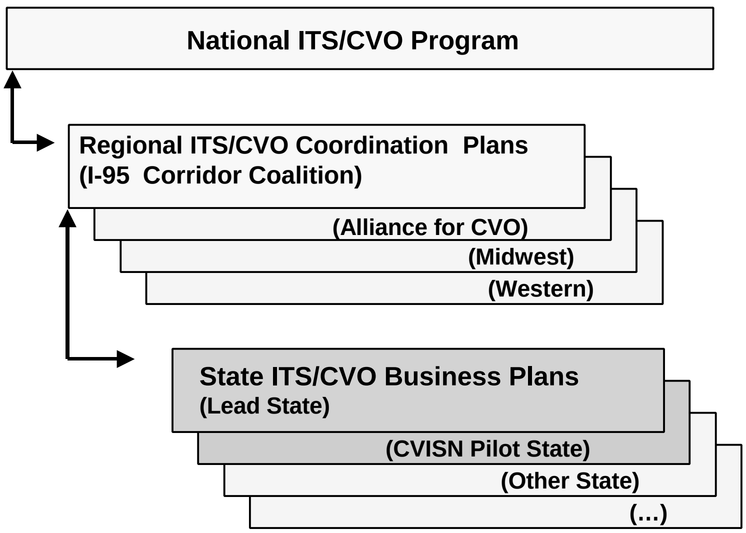
The first step in the definition process is assessing local needs in relation to actual or projected problems and opportunities.

The second step is to use the ITS/CVO national and regional guidance and program areas (as presented in Module II) to identify priority projects, that is, those that:

- Will meet a need; and
- Can be implemented within time and budget constraints.

Finally, an initial project concept is developed as part of the State ITS/CVO Business Plan. Let's examine the state level business planning process in a little more detail before moving to the planning steps, where you as Project Manager get more directly involved.

ITS/CVO Strategic/Business Planning Occurs at Three Levels

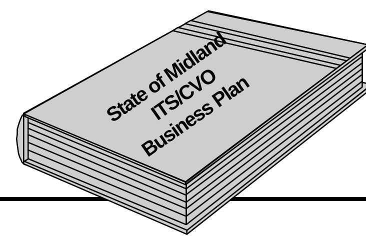


Module 4: Implementation Planning of ITS/CVO Projects 4-7

Focused ITS/CVO planning occurs at three levels: state, regional, and national. Many states have completed business plans and others are in process. All plans are interconnected, building upon the ideas and principles of each other.

Purpose of a State ITS/CVO Business Plan

- Ensure Support for Coordinated ITS/CVO Deployment in a State
- Explain How ITS/CVO Programs Can Best Be Implemented in the State and What Projects Will Be Undertaken as Part of the Programs
- Baseline the State's Current Institutional Arrangements



Module 4: Implementation Planning of ITS/CVO Projects 4-8

There are two aims of a business plan: To ensure stakeholder support (as we discussed in Module III) and to set forth the state's program and project framework (as we outlined in Module II).

Benefits of ITS/CVO Business Plans

- Framework for Identifying Problems and Opportunities Facing State Agencies and Motor Carriers
- Stakeholder Consensus on Changes in CVO and Improved Communication
- Coordinated ITS/CVO Development and Deployment
- Program Summary Useful for Distribution, Including Initial Project Concept Descriptions
- Justification Needed To Obtain ITS/CVO Funding

Module 4: Implementation Planning of ITS/CVO Projects 4-9

There are several benefits of state level planning. Our case exercise will stress the project concept descriptions in the fourth bullet, although all of these benefits are important.

Model ITS/CVO Business Plan Contents

1.0 Introduction

2.0 Overview of the Business Planning Process

3.0 Description of the State
- **3.1 Current State CVO Program**
- **3.2 Economic and Political Characteristics**
- **3.3 Issues and Opportunities**

4.0 Strategic Overview
- **4.1 Mission Statement**
- **4.2 Guiding Principles**
- **4.3 Goals and Objectives**

5.0 Program Summary
- **5.1 Business Plan Structure**
- **5.2 Description of Projects**
- **5.3 Ranking of Projects**

6.0 Organization and Management Approach
- **6.1 Lead Agencies**
- **6.2 Scheduling/Milestones**
- **6.3 Costs, Funding, and Return on Investments**

Module 4: Implementation Planning of ITS/CVO Projects 4-10

In the typical state business plan, project descriptions are found in the Program Summary chapter. Frequently, information on objectives is found in the Strategic Overview description, and information on project organization, stakeholders, scheduling, and funding is found in the Organization and Management Approach.

State Business Plan Project Description Contents

- Objective
- Outcome
- Lead Agency
- Other Participating Agencies
- Key Issues
- Technical Approach
- Products
- Schedule
- Cost/Funding Approach

Here is an example of the types of project information that a state business plan might contain from the program summary chapter. This is information that will be available to you as you begin to plan a project.

Project Planning Steps

Steps	Mechanisms
4. Assign Project to a Project Manager for Detailed Planning	Supervisor Assignment Order
5. Develop Detailed Project Plan Which Incorporates: ↗ Justification (Purpose and Benefits) ↗ Objectives and Requirements ↗ Work Breakdown ↗ Schedule & Responsibilities ↗ Resources Required ↗ Risks To Be Mitigated ↗ Team Organization and Planning	ITS/CVO Project Plan
6. Obtain Necessary Executive & Other Stakeholder Commitments & Approvals	Approval Procedures

Module 4: Implementation Planning of ITS/CVO Projects 4-12

For project planning, the process is initiated through an assignment of responsibility for project management from a state supervisor to a project manager. Then, the project manager has the responsibility to develop a detailed project plan which will stand up to scrutiny of state officials and other stakeholders. The development of the project plan is the process by which you will take a project concept from the business plan to add details, further define the project, and list the steps necessary to complete the plan. This is important because the final planning step includes obtaining necessary approvals.

Module IV Learning Objectives

- Major Steps In the ITS/CVO Project Planning Process
- Key ITS/CVO Project Planning Roles and Skills
- Basic Project Planning Tools and Techniques
- Application of Planning Tools to the Development of an Illustrative ITS/CVO Project Plan

Module 4: Implementation Planning of ITS/CVO Projects 4-13

Now let's look at the project manager's role and needed skills during planning to successfully complete these planning steps– our second learning objective.

ITS/CVO Project Manager's Planning Role

ITS/CVO Management Challenge Which the Role Addresses		ITS/CVO Planning Skills
How To Foster Multiple Stakeholder Commitment?	→	Building Early and Continuous Stakeholder Ownership
How To Build Consensus on Evolving Standards & Communicate Them Effectively?	→	Determining and Communicating Performance Specifications and Work Steps
How To Plan for Uncertainty & Build in Flexibility?	→	Developing Adaptable Schedules & Budgets; Anticipating Risks
How To Prepare for Technological Change & Potential Obsolescence?	→	Understanding Architecture and Standards
How To Ensure Components & Teams Work Together?	→	Developing Cross-Organizational Teams

Module 4: Implementation Planning of ITS/CVO Projects 4-14

The project manager's planning role is to develop a detailed project plan that incorporates key factors needed for ITS/CVO project success. In Module II we set forth the key management challenges in ITS/CVO projects. The project manager's planning skills, to be optimally effective, must relate to each of these challenges.

This encompasses both "looking forward" to results and "looking inward" to planning the work activities.

Module IV Learning Objectives

- Major Steps In the ITS/CVO Project Planning Process
- Key ITS/CVO Project Planning Roles and Skills
- → Basic Project Planning Tools and Techniques
- Application of Planning Tools to the Development of an Illustrative ITS/CVO Project Plan

Module 4: Implementation Planning of ITS/CVO Projects 4-15

Now let's move to the tool and technique level– down to the "how to's." Project management tools come in many different levels of sophistication and detail. In this course we want to introduce you to the basic level tools in their most easy to use format. Those of you who will be managing large and complex ITS/CVO projects will want to supplement your toolkit with more sophisticated applications of these basic tools, especially those dealing with activity scheduling, costing, and risk analysis. There are many project management books, software packages, and training courses available for this purpose.

ITS/CVO Technical Manager Planning "Tools" Related to Skills

ITS/CVO Planning Skills		Basic Project Planning Tools
Building Early and Continuous Stakeholder Ownership	→	Stakeholder Analysis * Rationale Description
Determining and Communicating Performance Specifications & Work Steps	→	Deliverables Specification Work Breakdown Structure (WBS)
Developing Adaptable Schedules & Budgets; Anticipating Risks	→	Bar Charts Resource Estimations Risk Mitigation Plan
Understanding Architecture & Standards	→	Technical Specifications/ Requirements Analysis
Developing Cross-Organizational Teams	→	Team Staffing and Building

* Discussed in Module III

Module 4: Implementation Planning of ITS/CVO Projects 4-16

The ITS/CVO project manager planning "toolkit" should correspond to the required planning skills discussed earlier. These basic tools are used over and over again in planning and are useful to master. They are also the tools that we will be applying in our case exercise following the afternoon break. So let's get started on learning them. Note that we have a head start on one of these tools, stakeholder analysis, having introduced it in a previous module.

A Project Detailed Planning Process Is Necessary To Plan Work & Communicate Among Project Members

1. Provide Project Rationale
2. Define Objectives & Deliverables
3. Create Work Breakdown Structure
4. Define Schedules & Milestones
5. Estimate Resources & Costs
6. Develop Risk Mitigation Plan
7. Define Technical Specifications & Requirements
8. Define Team Organization

Define & Plan

Feedback & Interaction

Module 4: Implementation Planning of ITS/CVO Projects 4-17

This is a SIMPLIFIED view of how the ITS/CVO project planning process should work. Building on the State ITS/CVO Business Plan, you will define and plan the project. As you do this, there is continuous feedback and interaction.

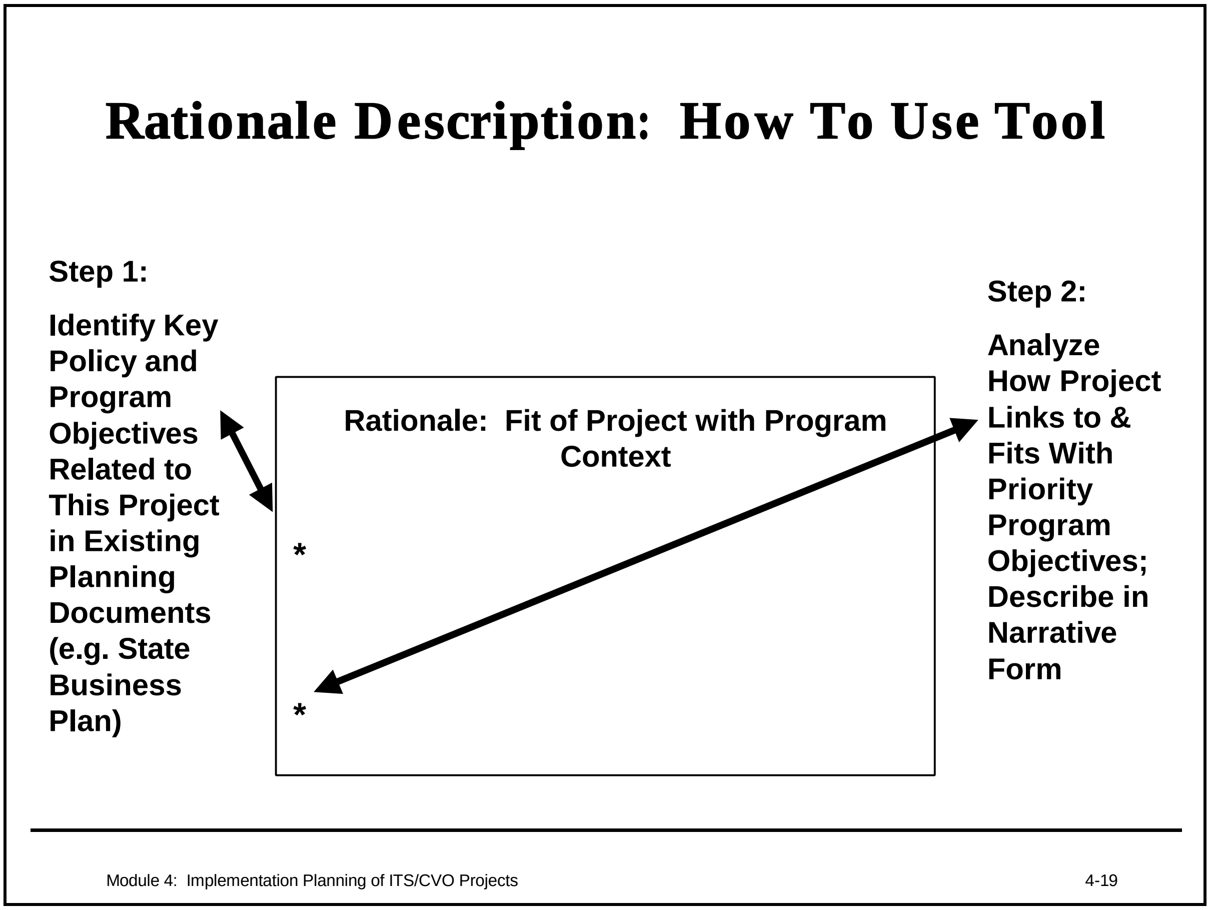
Planning Tool: Rationale Description

- **Purpose:**
  - **Demonstrate the Relevance of a Project to the Program & Policy Context**
- **Description:**
  - **Narrative Explanation of the Fit and Linkage of a Project to the ITS/CVO Program Objectives and Priorities**
- **Related Tools:**
  - **Cause and Effect Analysis**
  - **Objective Trees/Hierarchy of Objectives**

Module 4: Implementation Planning of ITS/CVO Projects 4-18

The first planning tool is for describing the rationale or justification for your project by showing how it fits with the state policy context and business plan priorities.

Note on each of these tool descriptions we are giving you the tool's purpose, its description, and a list of other related tools you might want to use in your planning process. We do not intend to discuss the other tools in this course but want to list them for your future reference.



Here are the steps in using this tool. You will write your answers in narrative format.

Step 1: Identify key policy and program objectives related to this project in existing planning documents.

Step 2: Analyze how the project links to and fits with priority program objectives and describe in narrative form.

Rationale Description: Utah St. George Port of Entry ITS Project

Rationale: Fit of Project With Program Context

- **The Utah State ITS/CVO Business Plan Identifies Improving Commercial Vehicle Port of Entry Efficiency and Safety as a High Priority Objective, Consistent with FHWA Guidelines.**
- **This Port of Entry Project Will Enhance/Contribute to/ Help Accomplish the Automation Objective by Improving Automation of Port of Entry Commercial Vehicle Functions (permits, etc.) in the Utah and Arizona I-15 Corridor.**

Module 4: Implementation Planning of ITS/CVO Projects 4-20

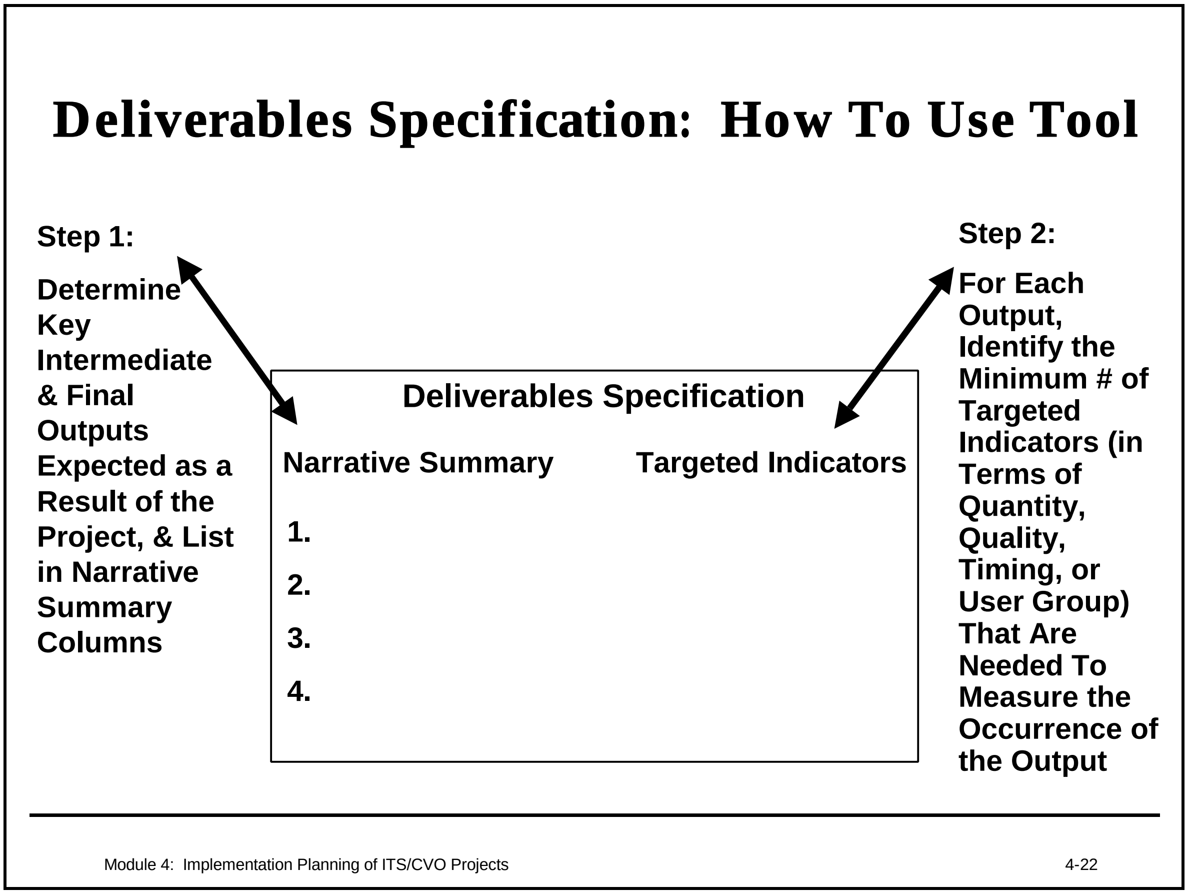
Here is an illustration for Utah's St. George Port of Entry/ITS Project. We will use this example throughout this module.

Planning Tool: Deliverables Specification

- **Purpose:**
  - **State Intended Project Deliverables in Measurable Terms So They Can Be Communicated to Others**
- **Description:**
  - **Narrative Listing of Key Project Deliverables/Outputs Accompanied by One or More Targeted Performance Measures (in Terms of Quantity, Quality, Timing, or User Group) for Each**
- **Related Tools:**
  - **Concept of Operations Document**
  - **Logical Framework Approach**

Module 4: Implementation Planning of ITS/CVO Projects 4-21

The second tool is to determine deliverables specification. This is a very important tool. Its purpose is to state intended project deliverables in measurable terms so they can be communicated to others. This is a basic tool for identifying performance measures around systems requirements and an operations concept. Let's look at how to use it.



The tool format and steps in use are as follows:

Step 1: Determine key intermediate and final outputs expected as a result of the project, and list in narrative summary columns.

Step 2: For each output, identify the minimum number of targeted indicators (in terms of quantity, quality, timing, or user group) that are needed to measure the occurrence of the output. These indicators are also referred to as milestones.

Deliverables Specification: Utah St. George Port of Entry/ITS Project

Deliverables Specification

Narrative Summary	Targeted Indicators
1. New Port of Entry Facility With High Tech Equipment Is Operational	1.1 Weigh-in-Motion Scales Installed by X Date
2. Training Completed	1.2 Microwave Communication System in Use by Y Date
3. Etc.	1.3 Etc.

Module 4: Implementation Planning of ITS/CVO Projects 4-23

Here is an illustration from the same Utah project.

When we return from break we will discuss other planning tools, including Work Breakdown Structure (WBS) and Bar Charts.

Planning Tool:
Work Breakdown Structure (WBS)

- **Purpose:**

  Develop and Reach a Common Understanding of the Project Scope

- **Description:**

  Hierarchical Breakdown of Project Elements Which Defines and Organizes the Total Scope of the Project

- **Related Tools:**

  Scope Statement

  Component/Activity Listing

Module 4: Implementation Planning of ITS/CVO Projects 4-24

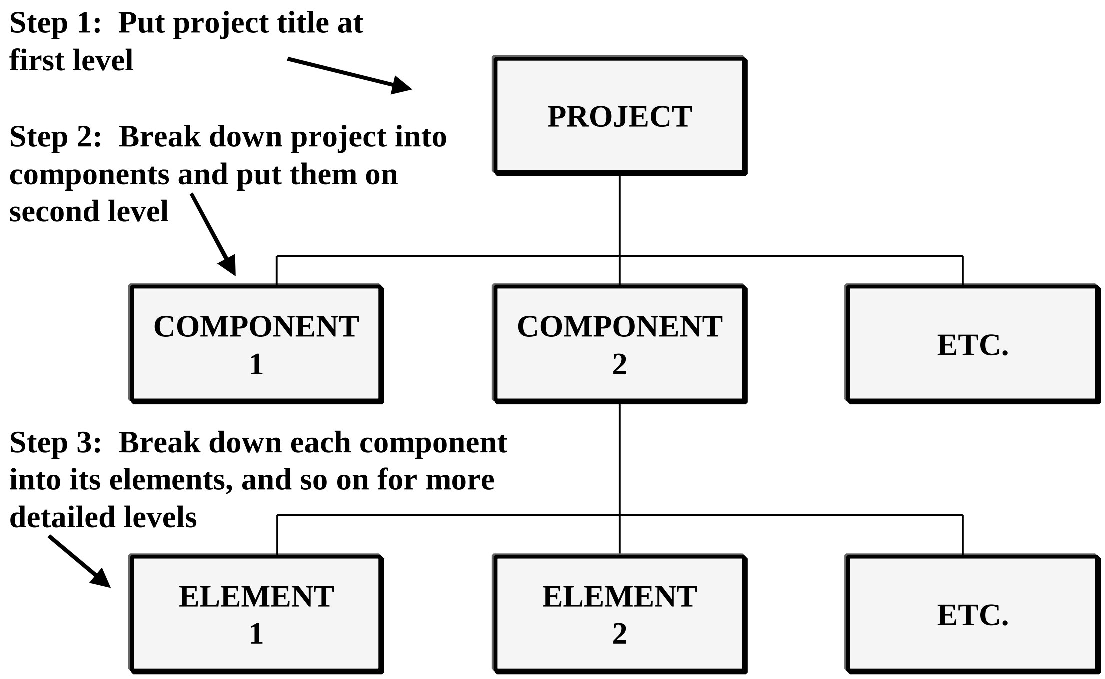
The Work Breakdown Structure (WBS) is at the heart of project planning process. This tool helps to define the scope of the project and to organize the project components and activities. The WBS organizes project elements by hierarchical levels. Each descending level represents an increasingly detailed definition of a project component.

The WBS provides the basis for many other ITS/CVO planning and implementation tools including:

- Activity and task listing;
- Scheduling;
- Responsibility assignment;
- Estimating costs and budgets;
- Risk analysis; and
- Integrating the total project effort.

This is a tool that every ITS/CVO project manager should understand.

WBS: How To Use Tool



Module 4: Implementation Planning of ITS/CVO Projects 4-25

A WBS takes the form of an upside down tree. A complete WBS provides a graphic display of all project elements, and as such provides a common framework for planning and implementation.

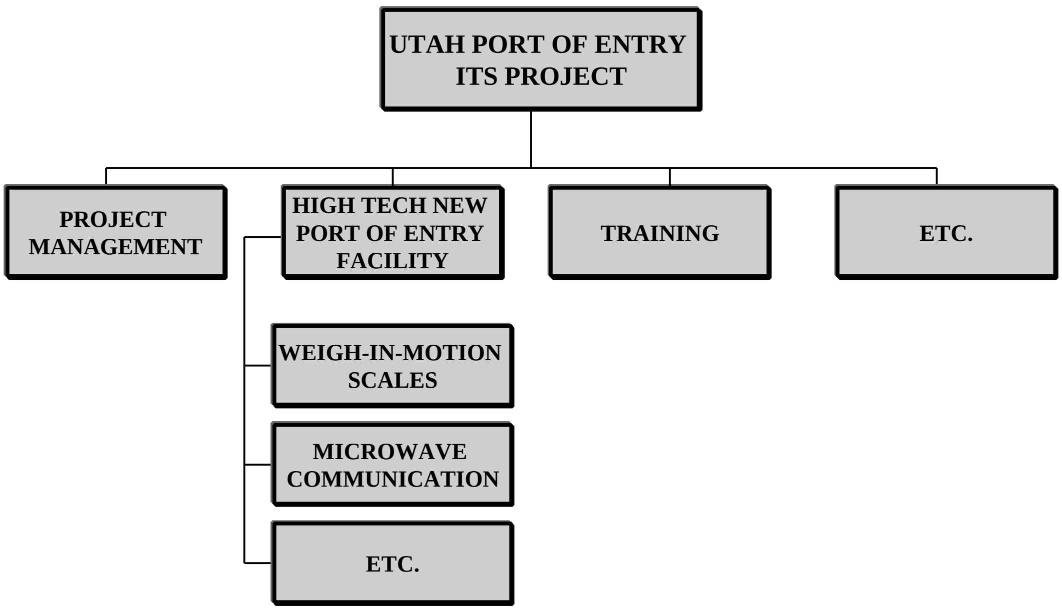
There are 3 steps in preparing a WBS.

Step 1: At the first level, put a box with the project title.

Step 2: At the second level, break down the project into the major components and put them in boxes at the same level.

Step 3: At the third level, break down each component into its elements for scheduling and costing.

Work Breakdown Schedule: Utah St. George Port of Entry ITS Project



Module 4: Implementation Planning of ITS/CVO Projects 4-26

Here is a WBS example from the Utah Port of Entry Project. Note that the components and elements are directly linked to the project deliverables as presented earlier on slide 4-23. Likewise, the weigh-in-motion element can be further broken down into activities, sub-activities, and so on. You will be using WBS in CVISN workshops. All of you will have an opportunity to work with a WBS during the case exercise later in this module.

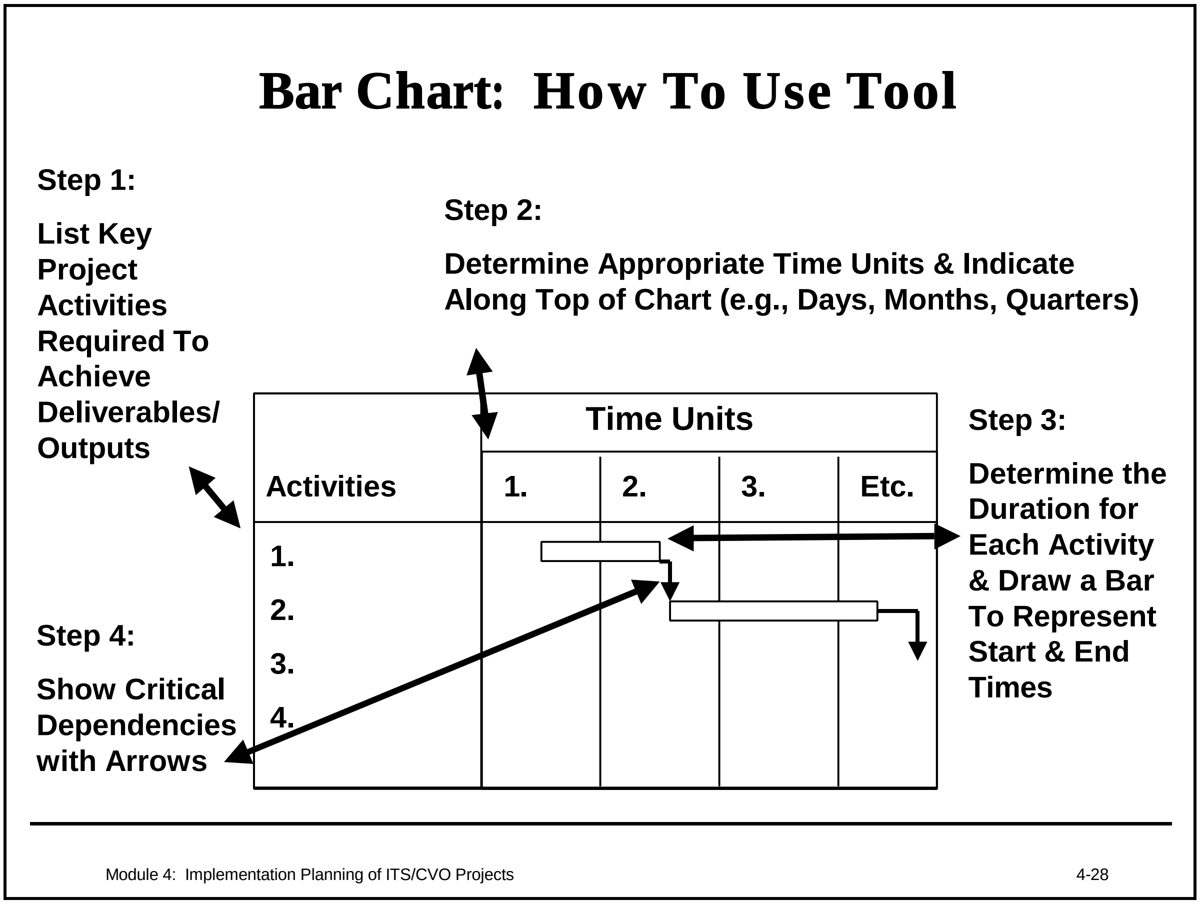
Planning Tool:
Bar Chart*

- **Purpose:**
  - **Determine the Length of Time and Scheduling Flexibility Involved in Implementing a Project**
- **Description:**
  - **Graphical Display of Project Schedule-Related Information**
- **Related Tools:**
  - **Program Evaluation & Review Technique (PERT)**
  - **Critical Path Method (CPM) Diagram**
  - **Organizational Responsibility Charting (ORC)**

*** This Tool Is Also Referred to as a Gantt Chart**

Module 4: Implementation Planning of ITS/CVO Projects 4-27

Building on the WBS is a common tool for scheduling– the Bar Chart. You may have heard of PERT and CPMs. The Bar Chart is a simpler form of these tools. The Bar Chart is useful for displaying the start and end times for your planned activities as well as the dependency relationships between activities.



This is what a Bar Chart looks like and here are the steps in developing the chart.

Step 1: List key project activities required to achieve deliverables/outputs. These activities should come from the WBS.

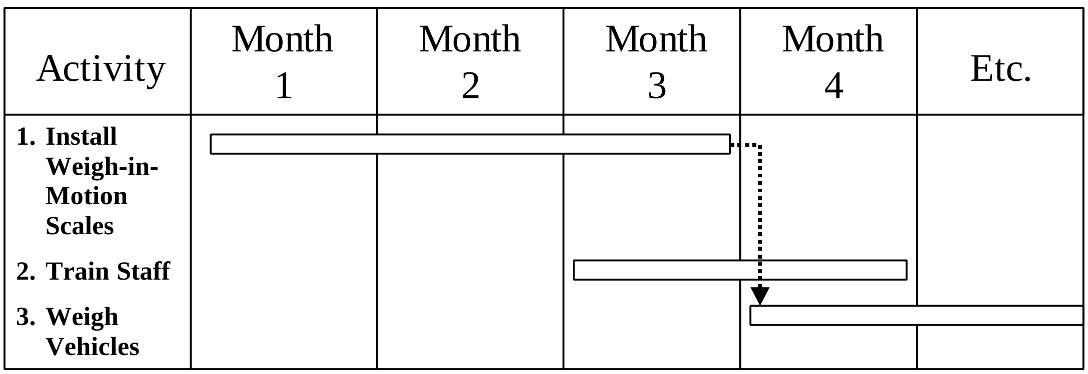
Step 2: Determine appropriate time units for your project and indicate along top of chart (e.g., days, months, etc.).

Step 3: Determine the duration for each activity and draw a bar to represent start and end dates.

Step 4: Draw arrows to show critical interfaces or dependencies from one task to the next.

The Bar Chart helps managers with scheduling or time– one of three major constraints in any project. Another constraint is performance, which we dealt with in the deliverables specification tool earlier. The final element in the “triple constraint” is cost, and managers handle costs with budgets. We will introduce a resource estimate tool below to deal with the cost constraint. But now let’s look at an example of the “Bar Chart.”

Bar Chart:
Utah St. George Port of Entry ITS Project



Module 4: Implementation Planning of ITS/CVO Projects 4-29

Here is a partial bar chart for the Utah Port of Entry Project. Note that Activity 2 can go on at the same time as Activity 1– a current activity. However, as shown by the dependency arrow, Activity 3 cannot begin until Activity 1 is completed.

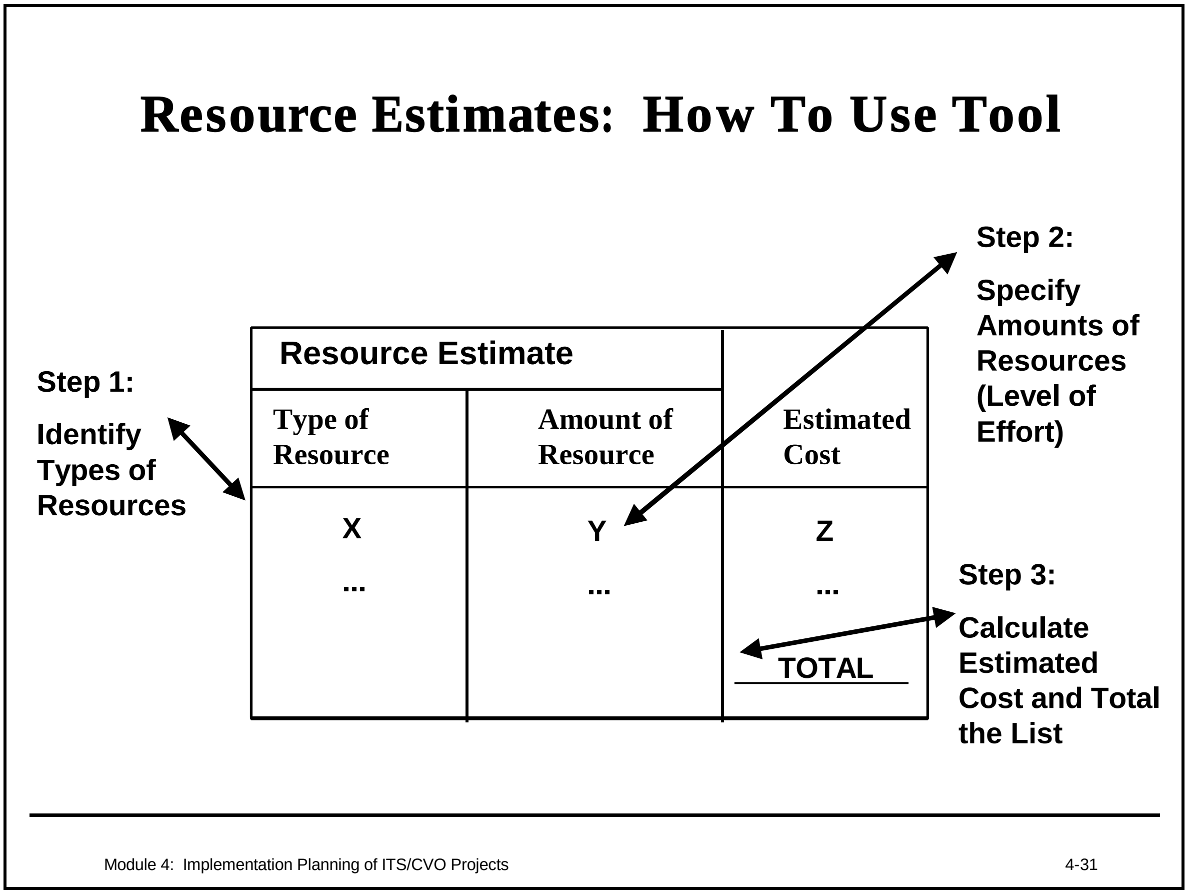
The Bar Chart also can be used to assign responsibilities for activities by specifying stakeholders or project team members involved in each activity.

Planning Tool: Resource Estimates

- Purpose:
  - Assess the Likely Cost of Project Resources or Inputs
- Description:
  - List of Required Level of Resources Needed to Carry Out Project Activities along with Their Estimated Costs
- Related Tools:
  - Process Mapping
  - Budgeted Cost of Work Scheduled (BCWS)
  - Life-Cycle Costing

Module 4: Implementation Planning of ITS/CVO Projects 4-30

Now let's look at resources or inputs, which usually are measured with a budget.



The budget format is usually a spreadsheet. The steps in developing a resource estimate include:

Step 1: Identify types of resources, for example, staff or a computer system. The types of resources are linked to the components, elements, and activities in the WBS and Bar Chart.

Step 2: Then state how many or the amount of a resource needed to complete the project. For example, indicate how many staff or computers you will need.

Step 3: Finally estimate the costs for each resource type, and total the list.

Resource Estimates : Utah St. George Port of Entry/ITS Project

Type of Resource	Number	Costs
1. Project Manager	1	100,000
2. Consultants	1.5	200,000
3. Programmer Analyst	1	75,000
4. Technical Support Specialist	1	75,000
	1st Year Total	$ 450,000

Module 4: Implementation Planning of ITS/CVO Projects 4-32

Let's look at a sample resource estimate for the Utah project. This is not a complete list, rather it is a snapshot to provide you with a frame of reference for using the tool. This list is illustrative. A more complete budget would include all of the budget categories presented in Module III.

Planning Tool: Risk Mitigation

- **Purpose:**
  - **Identify Likely Project Risks & Ways To Reduce Them**
- **Description:**
  - **Narrative Description of Events that Are Both Likely & Will Have a Negative Consequence for the Project, along with Ways To Deal with Them**
- **Related Tools:**
  - **Business Process Reengineering**
  - **Risk Analysis**

Module 4: Implementation Planning of ITS/CVO Projects 4-33

Risk mitigation is an important function in ITS/CVO projects. The risk mitigation tool can help a manager to be prepared for risks by identifying them and building in ways to mitigate their negative impacts.

Risk Mitigation: How To Use Tool

Step 2: Identify Potential impacts Associated With Each Risk

Step 1:

Identify Events that Are Likely to Occur & Will Impact Your Project Negatively

Risks	Impacts	Suggestions For Overcoming Risks
1.		
2.		

Step 3:

For Each Risk, Develop a Strategy for Preventing or Dealing With It

Module 4: Implementation Planning of ITS/CVO Projects 4-34

Here is the tool format.

Step 1: Identify events that are likely to occur and will impact your project negatively.

Step 2: Display the potential impacts associated with the identified risks.

Step 3: Develop a strategy for preventing or dealing with the risk.

Risk Mitigation:
Utah St. George Port of Entry ITS Project

Risks	Impacts	Suggestions
1. Vendor Bids in Response to RFP Exceed the Budgeted Amount	- Delay Project - Force Re-Planning	1.1 Seek FHWA Supplemental Budget 1.2 Phase Project over Longer Time To Spread Out Funding Requirements

Module 4: Implementation Planning of ITS/CVO Projects 4-35

Here is an example of the Risk Mitigation tool applied to the Utah project. This risk actually came to pass. Suggestion 1.2 was followed to reduce the impact.

Planning Tool: Technical Specifications and Requirements

- **Purpose:**
  - **Identify Technical Requirements and Specifications Required for Conformance**
- **Description:**
  - **Listing of Applicable CVISN Standards, Requirements, Timing, and Strategies for Conformance for a Project**
- **Related Tools:**
  - **Work Breakdown Structure**
  - **Business Process Reengineering**

Module 4: Implementation Planning of ITS/CVO Projects 4-36

Once you have identified the deliverables and work breakdown structure, another important task is to determine the technical specifications of the project. Typically, this involves identifying the current processes used for the CVO functions being addressed by the project (e.g., vehicle registration or roadside safety inspections), including hardware, software, information systems, communications systems, and data flows. Based on this baseline of the current process, the project manager would map out the specific requirements associated with the proposed project, including changes in hardware, software, information systems, and communications systems. In particular, the project manager must be aware of applicable architecture and standards to which the project must conform. The CVISN architecture and its subcomponents serve as a blueprint for mapping these data flows and defining these technical standards. Once these specifications are identified, the project manager should determine a schedule and strategy for assuring that the project is conforming with them.

Technical Specifications and Requirements: How To Use Tool

Step 2: For Applicable Standards, Identify Specific Requirements (e.g., DSRC, EDI, etc.)

Step 3: Indicate Planned Dates for Conformance Assessment

Step 4: Describe Strategy for Ensuring Your Project is in Conformance

Step 1: Indicate Which CVISN Standards Are Applicable To Your Project

Applicable CVISN Architecture Component?	Specific Standards Related to Architecture Component?	Dates for Conformance Assessment Process?	Conformance Strategy?
A. Safety Information Exchange Yes ___ No ___			
B. Credentials Administration Yes ___ No ___			
C. Electronic Screening Yes ___ No ___			

Module 4: Implementation Planning of ITS/CVO Projects 4-37

This template illustrates a simple approach to identifying the key technical specifications, as well as the conformance strategy. The key steps are as follows:

Step 1: Indicate which CVISN architecture components are applicable to the project–for example, does the project fall under Safety Information Exchange, Credentials Administration, or Electronic Screening.

Step 2: For the applicable architecture components, identify the specific standards that must be used. For example, standards currently are being developed for Electronic Data Interchange, Dedicated Short-Range Communications, and other key enabling technologies.

Step 3: Indicate the planned dates for assuring conformance with the identified standards.

Step 4: Describe a strategy for ensuring that the project is in conformance with the identified standards.

Technical Specifications and Requirements: Utah St. George Port of Entry ITS Project

Applicable CVISN Architecture Component?	Specific Standards Related to Architecture Component?	Dates for Conformance Assessment Process?	Conformance Strategy?
A. Safety Information Exchange Yes ____ No _X_			
B. Credentials Administration Yes ____ No _X_			
C. Electronic Screening Yes _X_ No ____	DSRC (ASTM Draft 6)	End of Month 2 with Completed Installation of Roadside Readers	Use the FHWA Conformance Assurance Process (Available from JHU/APL Website)

Module 4: Implementation Planning of ITS/CVO Projects 4-38

Here is an example of the Technical Specifications and Requirements tool applied to the Utah project. This project involves electronic screening, and the key applicable standard is for DSRC, which governs the transmission of data between the in-vehicle transponder and the roadside reader. The state plans to test for conformance with the standard once the roadside readers are installed.

Note that the FHWA is developing a Conformance Assurance Process to assist states in verifying that their ITS/CVO deployment activities are in compliance with the CVISN architecture. This is an important requirement for states that wish to use Federal funds to support ITS/CVO deployment.

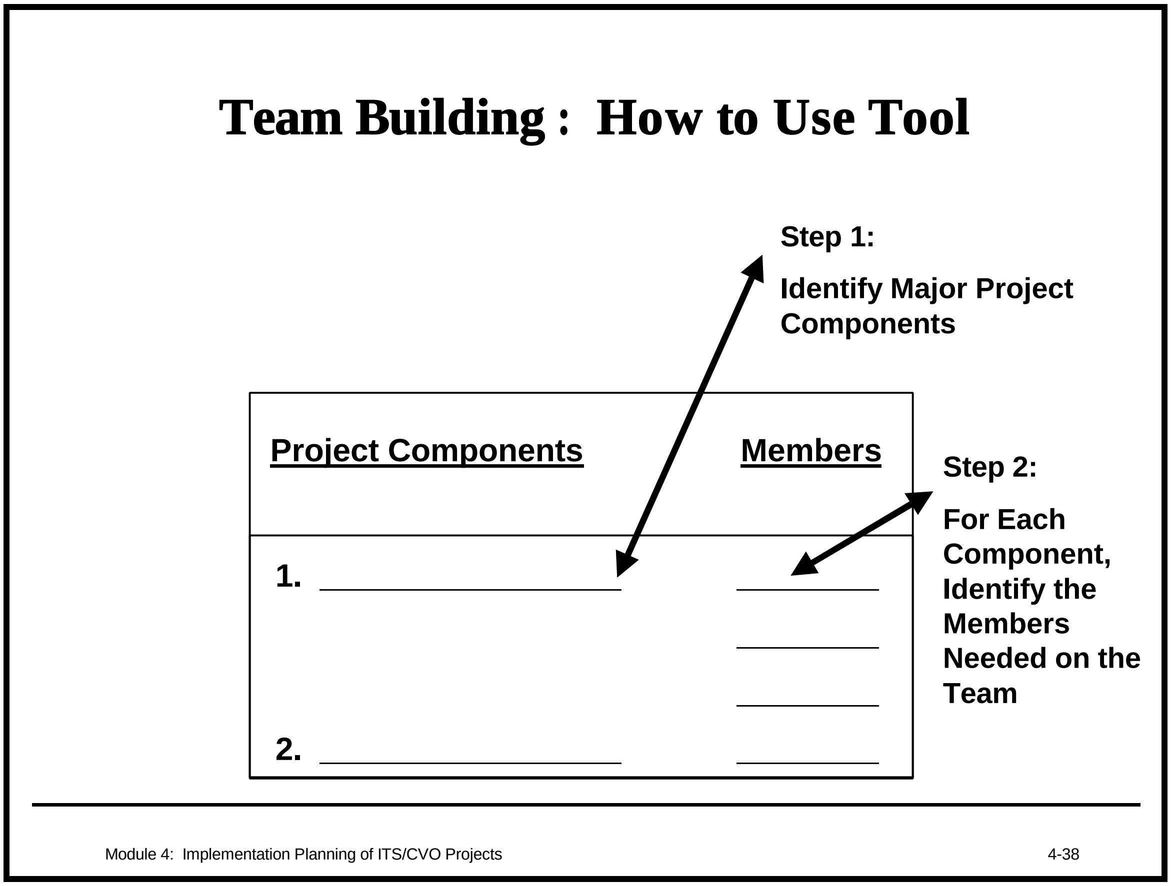
Because this tool requires detailed technical knowledge, we are not going to use it as part of our case study at the end of this module. However, you should be aware of these issues, which will be covered in greater detail in the third training course, “Understanding ITS/CVO Technology Applications.”

Planning Tool: Team Building

- Purpose:
  - To Involve Key Team Members in the Project in Order to Enhance Project Performance
- Description:
  - A Technique by Which Project Stakeholders (Internal & External) Learn to Come Together Around a Project Objective & Perform at a High Level of Productivity
- Related Tools:
  - Quality Assurance Teams
  - Advisory Committee Development

Module 4: Implementation Planning of ITS/CVO Projects 4-37

Finally, we need to discuss Team Building. Team Building includes both identifying people with the right mix of knowledge and abilities and getting their productive involvement. The Team Building tool is useful in identifying team composition at different points in the ITS/CVO project cycle. Team composition will depend upon the activities taking place at any time as displayed in the Bar Chart. For ITS/CVO projects, the project manager and a systems engineer will usually be the core team. Other technical and administrative staff will be included as determined by the work activity.



The steps in using the team building tool are listed here.

Step 1: List major project components from the WBS or Bar Chart.

Step 2: For each component, identify the members needed on the team to complete the task.

ITS/CVO Project Illustration: Utah St. George Port of Entry/ITS Project

Components	Members
1. Project Management	1.1 Project Manager 1.2 Systems Engineer 1.3. Contracts Representative
2. Training	

Module 4: Implementation Planning of ITS/CVO Projects 4-39

For the Utah project, the tool could be applied as shown on the slide.

Three people– the project manager, systems engineer, and contracts representative– make up the core project management team.

Identifying team members is only half of the team building task. The other half is getting their productive involvement. A project manager can facilitate involvement by:

- Having team members agree on the team tasks, including deliverables and time limits;
- Assuring the necessary skills for task performance are available; and
- Providing encouragement and incentives for task accomplishment.

We will have an opportunity to practice these team building skills in our case study exercise sessions.

Module IV Learning Objectives

- **Major Steps In the ITS/CVO Project Planning Process**
- **Key ITS/CVO Project Planning Roles and Skills**
- **Basic Project Planning Tools and Techniques**
- **Application of Planning Tools to the Development of an Illustrative ITS/CVO Project Plan**

Module 4: Implementation Planning of ITS/CVO Projects 4-42

We are now ready to complete the first portion of the case study that will help you apply what you have just learned.

ITS/CVO Technical Manager Case Illustration

ITS/CVO Deployment in the State of Midland

Module 4: Implementation Planning of ITS/CVO Projects 4-43

Now we will begin the case illustration, and work on applying the tools to the development of an actual project plan for an ITS/CVO project. This case study will be interactive and iterative. It is interactive because you will be developing a case in small groups and presenting your results for review and discussion. It is iterative because you will begin the case today and continue it tomorrow. Today we will use the case to deal with the ITS/CVO implementation planning issues. Tomorrow we will return to the same case to deal with implementation management issues. This case is built on the illustrative State of Midland, which was first introduced in the Introduction to ITS/CVO course.

Module IV Summary

- Key Steps in ITS/CVO Project Planning
  - Provide Rationale, Define Deliverables, Create Work Breakdown Structure, Define Schedule, Estimate Resources, Assess Risks, Build Team
- Key Project Manager Planning Skills
  - Building Stakeholder Ownership, Determining Performance Specifications, Creating Schedules and Budgets, Developing System Architecture Standards, Gaining Team Commitment
- Project Planning Tools Provide the Skills a Manager Needs for Project Planning

Module 4: Implementation Planning of ITS/CVO Projects 4-44

Let's summarize Module IV by reviewing the key learning points.

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MODULE 5 - PROCUREMENT

Photo Courtesy of Hicklin Engineering

Module V: Procurement of ITS/CVO Technical Services

ITS/CVO Technical Project Management for Non-Technical Managers

Module V : Procurement of ITS/CVO Technical Services 5-1

For the next 45 minutes we will be dealing with the subject of procurement.

Module V Learning Objectives

- **Procurement Roles of the Project Manager**
- **Government Procurement Options and Requirements**
- **Procurement Process, Including Challenges and Tools**
- **How To Build Flexibility Into the Procurement Process**
- **ITS/CVO Lessons Learned From Initial Deployments**

Module V : Procurement of ITS/CVO Technical Services 5-2

There are five learning objectives for this module.

The information provided in this module is very general and introductory in nature. Those of you with ITS/CVO project procurement responsibilities will want to learn more following this course. We will provide you with some pointers on how to continue your procurement learning during the module.

Module V Learning Objectives

- **Procurement Roles of the Project Manager**
- **Government Procurement Options and Requirements**
- **Procurement Process, Including Challenges and Tools**
- **How To Build Flexibility Into the Procurement Process**
- **ITS/CVO Lessons Learned From Initial Deployments**

Module V : Procurement of ITS/CVO Technical Services 5-3

Our first learning objective focuses on the ITS/CVO project manager's procurement role and responsibilities.

Project Manager Procurement Roles and Responsibilities

Roles	Responsibilities: Direction	Responsibilities: Oversight
Technical	• DefineScope of Work • Direct Contractor Technical Activities	• AssessContractor Compliance with Specifications
Programmatic	• Develop and Implement Contractor Tasks • Develop Schedule	• Monitor Contract Deliverables • Track and Maintain Schedule
Administrative	• Direct Contractor Activities within Contract Scope	• Approve Invoices • Coordinate with Contracting Office and Other Agencies

Module V : Procurement of ITS/CVO Technical Services 5-4

The project manager has three types of procurement roles: technical, programmatic, and administrative. The technical role deals with the definition, delivery, and assessment of the end product or service. The programmatic role deals with the mechanics of defining and executing project tasks. The administrative role consists of general housekeeping and contract maintenance.

For each of these roles, there are two kinds of responsibilities: procurement direction and procurement oversight. The direction responsibilities include planning for the procurement, such as developing the contractor scope of work, and directing contractor activities during implementation. The oversight responsibilities include assessing consistency with system architecture and standards, monitoring, and signing off on invoices and work completion.

Importantly, the project manager will want to work closely with the contracting office in carrying out all of these roles and responsibilities.

Module V Learning Objectives

- Procurement Roles of the Project Manager
- ➡ Government Procurement Options and Requirements
- Procurement Process, Including Challenges and Tools
- How To Build Flexibility Into the Procurement Process
- ITS/CVO Lessons Learned From Initial Deployments

Module V : Procurement of ITS/CVO Technical Services 5-5

Now we will continue with our next topic, procurement options.

What Are The Major Contract Types?

Contract Types	Primary Use	Characteristics	Regulation
Traditional Construction	Infrastructure Capital Improvements	• Typical competitive - lowest responsive bid • Requires detailed specifications	Title 23 CFR Part 635
Engineering and Design Service	Professional Architecture & Engineering Services	• Qualification-based selection followed by competitive negotiation selection • Experience and reputation	Title 23 CFR Part 172
Non-Engineering Non-Architectural	Real Property, Services, Goods, Research	• Typically competitive-lowest responsive bid • Have been used for ITS field operational tests	Title 49CFR Part 18
Innovative Contracting	Complex Projects Employing Advanced Technologies	• Lowest life-cycle cost • Specifications usually cannot be well defined at outset	FHWA SEP-14

Module V : Procurement of ITS/CVO Technical Services 5-6

Let's begin by briefly reviewing the major types of contracts that state transportation agencies are using. Most infrastructure improvement projects use "traditional construction" contracts. These are typically competitive and require detailed specifications. Complex projects employing advanced technologies, such as ITS/CVO, may require more innovative contract arrangements. Let's examine in more detail the procurement options for innovative contracting.

What Are The Procurement Options?

Procurement Approaches	Primary Use	Pros	Cons
Design-Bid-Build	Typical Construction Approach	Competition, familiar process, no justification needed	Less flexible, not well-suited to high tech projects
Design-Build	Projects Employing Advanced Technologies	Flexibility, expedience, consistency	Requires detailed specs, contractually challenging
Integrator/ System Manage System	Projects Employing Advanced Technologies	Flexibility, control, design optimization, expedience	May be more costly, unfamiliar process, risk for errors
Public/Private Partnerships	Projects Employing Advanced Technologies	Flexibility, shared resources and risk	No contractual commitments, limited control

Module V : Procurement of ITS/CVO Technical Services 5-7

In contrast to the traditional procurement approach for infrastructure construction projects referred to as "Design-Bid-Build," there are three basic procurement options for advanced technology projects such as ITS/CVO. These procurement options are discussed in detail in the FHWA document, "Federal-Aid ITS Procurement Regulations and Contracting Options," which is being handed out.

First, "Design-Build" is a contracting method in which a single entity provides design services and constructs the project all under one contract. This contrasts with the typical construction "Design-Bid-Build" contracting method in which a transportation agency utilizes the services of an engineering consulting firm (or in-house staff) to design a project (design step), invites contractors to submit bids (bid step), and subsequently constructs the project using th4e services of a contractor (build step). That technique utilized two independent but sequential contracts– engineering and design services, and construction.

Second, "System Integrator" is a contracting method in which all project design and integration functions are performed by a systems manager/integrator, typically a professional consultant, and all construction activities are performed by various contractors under the agency's direct management and control.

Finally, "Public-Private Partnerships" is a method that uses a Memorandum of Agreement (MOA) between the government and a private firm to design and build a system. This method provides a high degree of flexibility and shared risk. Each of these options are explained with illustrations in the handout. In this procurement method, the agency and the contractor agree to share costs of system development and implementation. The contractor may agree to this arrangement because they envision the ability to develop a long-term revenue stream. Documents governing partnerships have been generally less formal, resulting in terms that can be difficult to enforce.

Module V Learning Objectives

- Procurement Roles of the Project Manager
- Government Procurement Options and Requirements
- Procurement Process, Including Challenges and Tools
- How To Build Flexibility Into the Procurement Process
- ITS/CVO Lessons Learned From Initial Deployments

Module V : Procurement of ITS/CVO Technical Services 5-8

The third topic focuses on the definition of the procurement process. We will briefly discuss the basic steps of procurement management as outlined by the Project Management Institute, then move to an explanation of these steps in the ITS/CVO context.

This chart displays the 6 basic steps in a typical procurement process. Consistent with the project life cycle, procurement begins with planning and proceeds through implementation and closeout.

Now, let's look at each of these steps in more detail in relation to ITS/CVO projects.

The Typical Procurement Process

1. Procurement Planning
2. Solicitation
3. Proposal Evaluation and Selection
4. Contract Negotiation and Award
5. Contract Administration
6. Contract Close-out

Module V : Procurement of ITS/CVO Technical Services 5-9

This chart displays the 6 basic steps in a typical procurement process. Consistent with the project life cycle, procurement begins with planning and proceeds through implementation and closeout.

Now, let's look at each of these steps in more detail in relation to ITS/CVO projects.

Procurement Planning

PM RESPONSIBILITIES	→	• Development of Procurement Management Plan and SOW • Technical Direction for Procurement Type Selection and Procurement Schedule • Interagency Coordination
POTENTIAL RISKS	→	• Selection of Procurement Method Incompatible with Project Requirements • SOW Requirements Inconsistent with Budgetary and/or Scheduling Constraints
USEFUL TOOLS AND TECHNIQUES	→	• Consult with Previous Implementors • Work with Contract Office

Module V : Procurement of ITS/CVO Technical Services 5-10

Planning addresses the questions of whether or not to procure, who to involve, and how, what, and when to procure.

Procurement planning results in a scope of work (SOW)– like we developed in our Midland exercise yesterday– and a procurement plan (including the type of procurement that will be used).

At this stage the ITS/CVO project manager provides technical direction in close cooperation with the contract office, and with other public agencies involved in the project.

Because the planning process requires the ability to accurately predict things such as project cost, duration, and technical requirements, it is always challenging. The contractual obligations that will result lend extra importance to this step.

An accurate SOW is critical. It must focus as much on what you want to accomplish as on how you want it done. In other words, you will want to decide whether you're procuring hardware and software, or information services. One option you may want to consider is having the contractor own and operate the system, and provide you with the data it generates.

This is where the experience of previous implementers can be invaluable. The FHWA is an excellent source of information regarding these points of contact.

Solicitation

PM RESPONSIBILITIES →	• Coordination of Identification of Selection Criteria • Technical Input and Review of RFP
POTENTIAL RISKS →	• Omission of Qualified Bidders May Lead to Legal and/or Financial Repercussions • Inappropriate Selection Methodology Can Lead to Sub-Optimal Selection
USEFUL TOOLS AND TECHNIQUES →	• Cooperate with Contract Office Staff

Module V : Procurement of ITS/CVO Technical Services 5-11

The next procurement step is solicitation. Take a minute to read the activities and Project Manager responsibilities.

Perhaps the best way to ensure the optimal selection of a contractor is the development and use of selection criteria and a scoring methodology that focus on the performance specifications from the SOW.

Proposal Evaluation and Selection

PM RESPONSIBILITIES	→	• **Coordination of Technical Input to Evaluation**
POTENTIAL RISKS	→	• **Improper Scoring Criteria Can Lead to Sub-Optimal Selection** • **Lack of ITS/CVO Knowledge Can Lead to Misinterpretation of Contractor Proposal** • **Contract Appeals**
USEFUL TOOLS AND TECHNIQUES	→	• **Use Orals Selection Process**

Module V : Procurement of ITS/CVO Technical Services 5-12

The proposal evaluation and contractor selection step involves receipt and evaluation of proposals and awarding of the contract.

There are standard procedures to be followed here, and your contract office can assist with this.

Once again, accurate selection criteria are critically important during this phase of the procurement. One way in which risk can be reduced is through an oral presentation process. This process allows the procuring agency the option to ask proposers to answer questions regarding the proposed system or service. This approach can serve to mitigate a number of the unknowns by the nature of its interactive exchange.

Contract Negotiation and Award

PM RESPONSIBILITIES →	• Technical Input and Oversight of Negotiation
POTENTIAL RISKS →	• Partnership MOA Negotiation Might Get Drawn Out • Agency and Contractor Contracts Personnel Unfamiliar with New Approaches May Be Hesitant
USEFUL TOOLS AND TECHNIQUES →	• Use Performance-Based Measures • Consider Negotiating for IV&V Agreement for Verification of Adequacy of Deliverables • Use MOA from Other Successful Implementations

Module V : Procurement of ITS/CVO Technical Services 5-13

The next step in the procurement process involves negotiating and awarding the contract, or signing the MOA.

The project manager provides technical direction and oversight throughout this step. These duties are critical since the project manager will be responsible for ensuring compliance with the technical terms of the resulting contract.

Because many ITS/CVO implementations require a combination of hardware and software systems that can be difficult to quantify, the identification of meaningful contractor performance assessment measures can be difficult. An agency that negotiates performance-based measures is more likely to end up with systems and services that meet its need. An example of a performance based measure might be the completion of a set number of system transactions, with a minimum reliability threshold. One possible mechanism is the use of an independent verification and validation (IV & V), where the agency can bring in an independent third-party evaluator to perform the assessment. Whatever measures are chosen, they must be negotiated at this time. This is also the point where MOAs are negotiated. If using a non-traditional procurement method, agencies should allow extra time in the project schedule for this phase. Finally, agencies should consider negotiating for any services related to long-term operations and maintenance of the end system.

Contract Administration

PM RESPONSIBILITIES →	• **Technical Direction of Contractor Activities** • **Management and Approval of Contract Deliverables** • **Invoice Review and Approval**
POTENTIAL RISKS →	• **Vaguely Defined Partnership MOA Puts Agency at Risk** • **Software Development Often Takes Longer To Complete than Originally Anticipated**
USEFUL TOOLS AND TECHNIQUES →	• **Consider IV&V Agreement as Means to Assess Compliance With MOA**

Module V : Procurement of ITS/CVO Technical Services 5-14

The next step is contract administration. The project manager's activities during this step are to monitor contractor performance and provide overall direction, support, and approval.

There are at least three areas of significant concern when it comes to contract administration. The first is the manifestation of difficulties in directing contractor work when using innovative contracting, particularly when specific, binding agreements don't exist. The second stems from the reluctance of private sector users to commit to participate. Since participation is usually voluntary, aggressive recruitment of users is often necessary. Finally, history has shown us that software development often takes significantly longer than originally anticipated.

Contract Close-Out

PM RESPONSIBILITIES →	• Technical Input to Final Contractor Performance Review • Approval for Payment of Final Invoice
POTENTIAL PITFALLS →	• Omission of One or More Contractual Requirements
USEFUL TOOLS AND TECHNIQUES →	• Follow Sound Administrative Practices During Earlier Procurement Phases

Module V : Procurement of ITS/CVO Technical Services 5-15

Contract close-out involves administrative closure, verification of work, and update of records. Some contracts require specific procedures and actions for close-out. This is the last step in the procurement process.

Provided the proper control and monitoring mechanisms were used during the previous phase, contract closeout should be fairly straightforward. Two key issues to verify are that the contractor has met all obligations, and that there are no outstanding contractual issues or open invoices. These are primarily housekeeping issues that will likely be directed, at least in part, by your contracts representative.

Module V Learning Objectives

- Procurement Roles of the Project Manager
- Government Procurement Options and Requirements
- Procurement Process, Including Challenges and Tools
- How To Build Flexibility Into the Procurement Process
- ITS/CVO Lessons Learned From Initial Deployments

Module V : Procurement of ITS/CVO Technical Services 5-16

Our next topic is building flexibility into the procurement process. This topic is important since flexibility is required to overcome many of the challenges and pitfalls that project managers confront during procurement.

Building Flexibility into Procurement

- Public-Private Partnering
  - Can Use Contract, MOA, or Franchise Agreement
  - Develops Evolving Informal Arrangements
  - Requires Intensive Management
- Performance-Based Contracting Criteria
  - Hold Contractors Accountable for Results
  - Encourage Innovation by Contractor

Module V : Procurement of ITS/CVO Technical Services 5-17

Here are two methods that can be used to build some flexibility into the procurement process.

The first method is public-private partnering. Partnering allows you to learn as you go since the MOA is an informal arrangement. However, as we indicated earlier, the downside is lack of control and the management intensive nature of these agreements.

The use of performance-based contracting criteria can also provide flexibility. By holding contractors responsible for results, contractors have flexibility to innovate around their technical approach and specific activities.

Since ITS/CVO is an evolving area, many ideas on flexible approaches will come from procurement professionals at the state and Federal level on ITS/CVO programs and projects. Networking and sharing best practices with these individuals is a great way to learn.

Module V Learning Objectives

- ❖ Procurement Roles of the Project Manager
- ❖ Government Procurement Options and Requirements
- ❖ Procurement Process, Including Challenges and Tools
- ❖ How To Build Flexibility Into the Procurement Process
- ➔ ❖ ITS/CVO Lessons Learned From Initial Deployments

Module V : Procurement of ITS/CVO Technical Services 5-18

Our last topic covers some emerging lessons about ITS/CVO project procurement.

Lessons Learned for Procurement

- Address Unique ITS/CVO Characteristics
  - Contractor/Provider Base Is Still Limited
  - Experienced Implementors Are Valuable Information Sources
  - Input From Carriers Is Critical to Project Success
- Pay Attention to Public-Private Partnerships
  - Many Agencies and Contractors Are Unfamiliar
  - Managing Contractor Activities Can Be Challenging
  - Well-Written Agreement Is Critical

Module V : Procurement of ITS/CVO Technical Services 5-19

The lessons are organized into several major categories.

First, remember that ITS/CVO complements, but is very different from traditional infrastructure construction projects. There is some good experience out there, but the contractor/provider base is still limited so you should learn as you go by contacting others with experience. In addition, make sure you are communicating with carriers at every step of the process. Second, with respect to public-private partnerships, remember this is a new approach and that many states, and state contracting officials, are inexperienced with it. There are challenges and risks, but also some key benefits such as flexibility, so proceed carefully. The most important thing you can do is to have a well-written MOA.

Lessons Learned for Procurement (continued)

- Structure Scope of Work Appropriately
  - Performance-Based RFPs Leave Room for Innovation, but May Lead to Unexpected Results
  - Detailed Activity-Based RFPs Limit Innovation, but Results Are More Predictable
- Address Evolving Requirements
  - If Requirements Are Evolving or Not Well Understood, Allow for Adequate Funding and Time for Evaluation and Decision-making Processes

Module V : Procurement of ITS/CVO Technical Services 5-20

If you want to encourage flexibility and innovation, then you should consider a performance-based contract. However, you should be aware that these may lead to unexpected results compared with detailed activity-based RFPs.

Also, if system requirements are not very well understood or are evolving, then build in extra time and resources for contract evaluation and work performance.

Module V Summary

- **Each ITS/CVO Procurement Is Unique – Focus on the End Results to Be Most Effective**

Module V : Procurement of ITS/CVO Technical Services 5-21

As a general rule, look at the unique features of every system– especially the performance equivalents as outlined in the scope of work– and adopt your procurement approach to fit the need of that system.

MODULE 6 - IMPLEMENTING, MONITORING, & MEASURING

Module VI: Implementation Monitoring and Measuring Performance

ITS/CVO Technical Project Management for Non-Technical Managers

Module 6: Implementation Monitoring and Measuring Performance 6-1

In this module, we will examine ITS/CVO project implementation. As explained yesterday, project implementation begins when an executive decision is taken to carry out the "project plan." Procurement, as presented in Module V, takes place at the beginning of implementation. In this module, the focus will be on the ITS/CVO project manager's role related to the day-to-day implementation, monitoring, measuring performance, and reporting. In many cases, these represent tools for managing change as a project evolves.

Module VI Learning Objectives

- Major Steps in the ITS/CVO Project Implementation Process
- Key ITS/CVO Project Manager Roles and Skills During Implementation
- ITS/CVO Project Implementation Tools and Techniques
- Application of Implementation Tools to the Management of an Illustrative ITS/CVO Project

Module 6: Implementation Monitoring and Measuring Performance 6-2

This module has four learning objectives. The first three will be done here in the large group. The fourth objective will be accomplished by returning to the Midland case study exercise, and interacting in small groups around an implementation problem.

We plan on covering the first three objectives rather quickly with few illustrations so we can spend most of our time on the case study. The case study will provide you with an opportunity to grapple with several ITS/CVO implementation issues.

Module VI Learning Objectives

- Major Steps in the ITS/CVO Project Implementation Process
- Key ITS/CVO Project Manager Roles and Skills During Implementation
- ITS/CVO Project Implementation Tools and Techniques
- Application of Implementation Tools to the Management of an Illustrative ITS/CVO Project

Module 6: Implementation Monitoring and Measuring Performance 6-3

Let's move to the first objective, and discuss the major steps in the ITS/CVO project implementation process.

Project Implementation Steps
(Step 8: Manage Implementation)

Steps	Mechanisms
Deployment Mobilization	❖ Team Selection and Building ❖ Final Procurement Arrangements ❖ Monitoring and Reporting Plan ❖ Kickoff Meeting
Deployment Transitions (Pilots)	❖ Pilot Plan ❖ Testing ❖ Architecture Consistency Checks
Deployment	❖ Systems Integration ❖ Interagency Coordination ❖ User Training ❖ Preparation for Operations & Maintenance

Module 6: Implementation Monitoring and Measuring Performance 6-4

This slide highlights the ITS/CVO project implementation steps and mechanisms.

Managing implementation includes three activities:

1. **Deployment mobilization.** After implementation approvals are obtained, the project manager will want to fine tune the deployment plan so it can be used for handling day-to-day activities. If not already available, this will include identification of and assignment of responsibilities to the project team (as discussed in Module IV), final preparation of procurement documents, and development of a monitoring and reporting plan for measuring performance status and communicating progress.

   Implementation Team kick-off or start-up meetings provide an opportunity for combining the mobilization and team building functions.

2. **Deployment transitions.** If the ITS/CVO project includes a pilot activity prior to full deployment, then the project manager will need to manage this process. The pilot will normally involve a combination of internal and consultant staff whose activities will need to be coordinated and monitored. Alpha and Beta testing will need to be completed along with checks for architecture and standards consistency.

3. **Deployment.** The ITS/CVO project manager is responsible for system deployment. This will require assuring teamwork across multiple agencies and consultants along with a heavy dose of user training. The manager will need to balance tradeoffs of performance and quality with the constraints of time and cost as we discussed earlier.

Finally, throughout implementation, the project manager needs to keep one eye on preparations for operations and maintenance. A "Concept of Operations" describing "what work will be done and who will be doing it" after the system is deployed was developed in an early project planning phase, and should have been further specified as the project plan evolves. During implementation, the project manager will need to keep the "Concept of Operations" clearly in view to ensure that the necessary arrangements for full system operations and maintenance are in place at the time the project is completed. This includes the following considerations:

- Operations coordination and conflict resolution;
- Operations shift-change procedures;
- Continuous configuration checking and evaluation;
- Fault detection and reporting; and
- Operations upgrade readiness.

Module VI Learning Objectives

- Major Steps In the ITS/CVO Project Implementation Process
- Key ITS/CVO Project Manager Roles and Skills During Implementation
- ITS/CVO Project Implementation Tools and Techniques
- Application of Implementation Tools to the Management of an Illustrative ITS/CVO Project

Module 6: Implementation Monitoring and Measuring Performance 6-5

Now let's turn our attention to the second objective, the ITS/CVO project manager's implementation role and accompanying skills.

ITS/CVO Project Manager's Implementation Role

Management Challenges in ITS/CVO Projects		ITS/CVO Implementation Skills
How To Maintain Multiple Stakeholder Commitment?	→	Ensuring Stakeholder Outreach and Participation
How To Ensure Specifications Meet Evolving Priorities and Standards?	→	Refining Operations Concept and Communicating Priorities
How To Measure Performance and Address Risks?	→	Monitoring and Reporting on Corrective Actions
How To Manage Technological Change & Potential Obsolescence?	→	Checking for Configuration Consistency and Readiness
How To Facilitate Integration of Components & Teams?	→	Encouraging Integration Through Testing, Systems Training

Module 6: Implementation Monitoring and Measuring Performance 6-6

To fully understand the ITS/CVO project manager's role during implementation, we also need to review the management challenges that will be salient based on the key implementation steps. Returning to the general list of management challenges, from Module II, we can now review elements of the manager's roles and required skills during implementation.

Module VI Learning Objectives

- Major Steps In the ITS/CVO Project Implementation Process
- Key ITS/CVO Project Manager Roles and Skills During Implementation
- ➡ ITS/CVO Project Implementation Tools and Techniques
- Application of Implementation Tools to the Management of an Illustrative ITS/CVO Project

Module 6: Implementation Monitoring and Measuring Performance 6-7

Based on an understanding of ITS/CVO project implementation steps and project manager's roles and skills, let's move to our third objective of understanding project implementation tools and techniques.

This segment of the module will be handled like we did in Module IV – by providing you with a list of several key tools along with a brief description of each. Then you will have an opportunity to apply several of them in the case exercise that follows.

ITS/CVO Project Manager "Implementation Tools"

ITS/CVO Implementation Elements		Basic Project Implementation Tools
Ensuring Stakeholder Outreach and Participation	→	Stakeholder Analysis
Refining Operations Concept and Communicating Priorities	→	Deliverables Specification Work Breakdown Structure (WBS) Procurement Measures
Monitoring and Reporting on Corrective Actions	→	Monitoring Plan Performance Reporting
Checking for Configuration Consistency and Readiness	→	Conformance Assessment
Encouraging Integration Through Testing, Systems Training	→	Systems Integration Testing Systems Training Plan

Module 6: Implementation Monitoring and Measuring Performance 6-8

The ITS/CVO project manager "implementation toolkit" should correspond to the required implementation skills discussed earlier. The basic tools you see here in the right column are used over and over again in project implementation and are useful to master.

Let's get started on describing each tool. Note that several implementation tools were also used during planning:

- Stakeholder Analysis and Benefits Reporting were discussed in Module 3.
- Deliverables Specification and Work Breakdown Structure were discussed in Module 4.
- Procurement Measures were discussed in Module 5.

We will not describe them again here, but the fact that some tools re-emerge during implementation should highlight the point that ITS/CVO projects are dynamic and iterative in nature, not static and linear. You can expect to use most of the project management tools over and over at different stages of the life cycle.

This module will focus on five new tools not covered in previous sections.

Implementation Tool: Monitoring Plan

- **Purpose:**
  - **Ensure that Project Performance Is Tracked and Measured in an Efficient & Timely Manner**
- **Description:**
  - **Matrix Which Indicates When and by Whom Key Project Performance Indicators/Milestones (Physical and Financial) Should be Measured, Assessed, Controlled, and Reported**
- **Related Tools:**
  - **Deliverables Specification/Operations Concept**
  - **Bar Chart**
  - **Control Chart**
  - **Status Reports**

Module 6: Implementation Monitoring and Measuring Performance 6-9

Early in implementation, project managers should draft or refine a project monitoring plan. This plan allows the manager to track and measure project progress, and control for changes in performance (or scope), schedule, and cost in an efficient and timely manner.

The monitoring plan should build on the deliverables specification and related planning/procurement documents. The plan should also specify when monitoring should be carried out and by whom. For example, the CVISN project in Virginia used monitoring plans to identify action items for group members. A good monitoring plan also indicates the source of monitoring data (e.g., finance department project expenditure database).

Finally, a good monitoring plan should give priority to important results and milestones – and not try to monitor on an activity by activity basis.

Monitoring Plan: How To Use Tool

Step 1: Fill in Planned Results for Monitoring from Deliverables Specification or WBS

Step 2: Indicate Date and Team Member Who Will Monitor

Step 3: Provide Source of Monitoring Data

Performance Milestones or Key Elements To be Monitored	When To Monitor (monthly, etc.)	Who Should Monitor	Source of Data for Monitoring
1.			
2.			
3. Etc.			

Module 6: Implementation Monitoring and Measuring Performance 6-10

This slide shows how to use a simple monitoring plan matrix.

In Step 1, you write down planned performance measures that need to be tracked. This information will be drawn from planning documents. In Step 2, determine when progress should be monitored and by whom. For example, the system engineer may be charged with monitoring the technical elements of the project… .while the contracts officer is given responsibility for procurement matters.

Finally, as in Step 3, specify where the data for monitoring will be found.

Monitoring Plan
Utah Port of Entry ITS Project

Performance Milestones or Key Elements To be Monitored	When To Monitor (monthly, etc.)	Who Should Monitor	Source of Data for Monitoring
1. Weigh-in-Motion Scales	Monthly	Project Manager	Contractor
2. Microwave Communications	Monthly	Systems Architect	Contractor
3. Training	Monthly	Project Manager	Contractor

Module 6: Implementation Monitoring and Measuring Performance 6-11

Here is a monitoring plan example from the Utah port of entry project. Note that the milestones are linked to those presented on the deliverables specification.

Implementation Tool: Performance Reporting

- **Purpose:**
  - **Provide Stakeholders with Information on How Resources Are Being Used To Achieve Project Objectives**
- **Description:**
  - **Collection & Dissemination of Performance Information Including Status (Where Project Now Stands), Progress (Accomplishments and Recommendations), and Forecasting (Predictions of Future Progress).**
  - **Performance Reports Can Take Various Forms Including Bar Charts, Histograms, and Tables**
- **Related Tools:**
  - **Monitoring Plan**
  - **Change Requests**

Module 6: Implementation Monitoring and Measuring Performance 6-12

The output of monitoring is a performance report. Performance reporting is used to communicate planned versus actual status along with suggested corrective recommendations if necessary.

Analysis of project performance in preparing a report often identifies a change in project scope that either presents a threat to the project's schedule or budget. For example, a deliverable may not meet quality specifications and may delay the project. Or a new technological advance may allow the project to finish ahead of schedule, thus saving time and dollars. These changes in scope are common during implementation and are referred to as "scope creep."

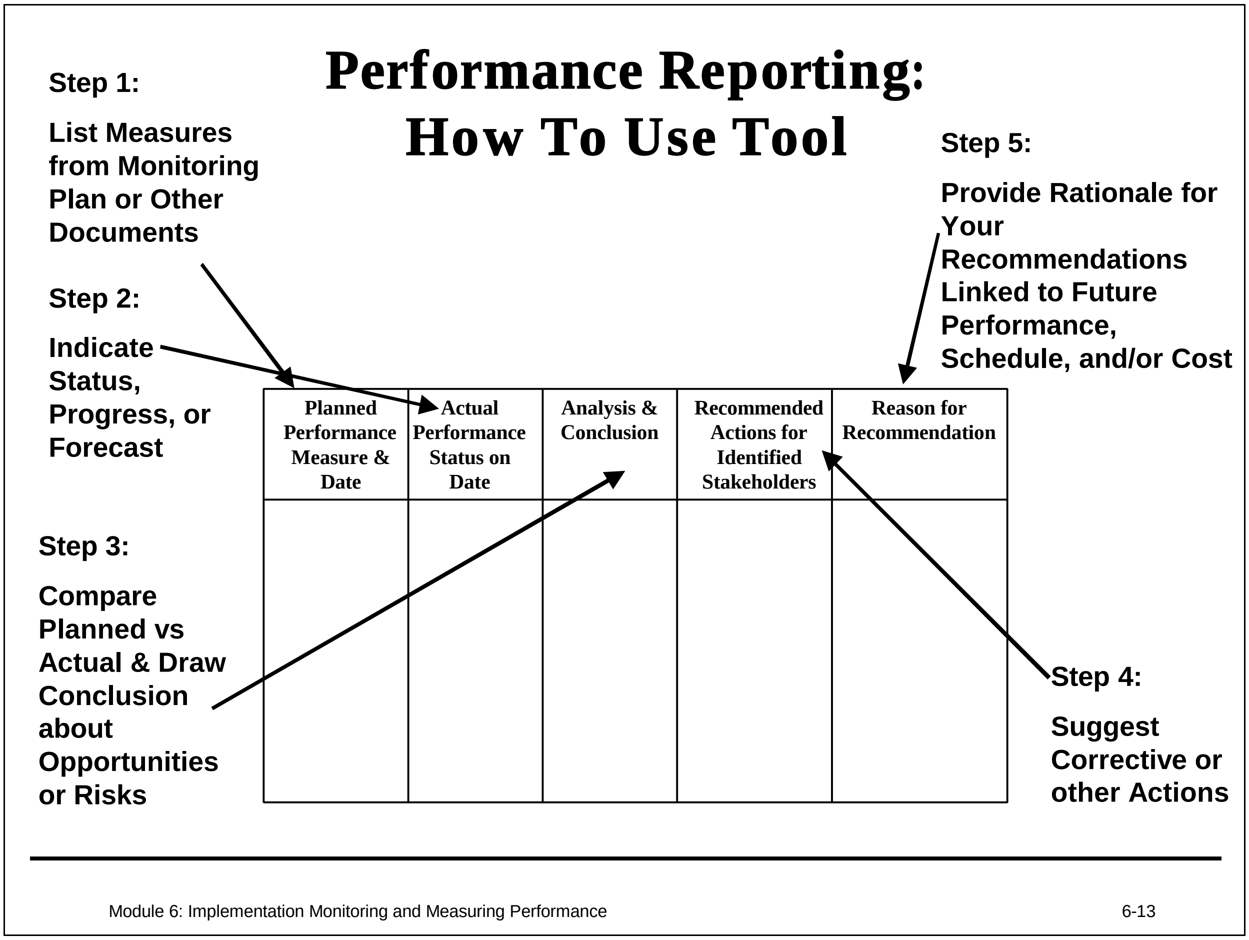
The PMI suggests several best practices for managing "scope creep."

- A clear requirements specification, along with good reference documents, can minimize scope creep.

- Clarifications and modifications should be encouraged early in implementation since changes become progressively more costly over time.

- One simple way to control “scope creep” is to formally ask this question each month: “Have any changes been requested (by executives, the contractor, the team, others) and agreed to?”

If any significant changes are agreed to, they should be justified and reported. The project manager should not just ask the question about changes, but also do the analysis needed to approve or deny changes. For example, if an executive or client wants a performance change, the project manager should ask them if they feel the change warrants either giving something else up or increasing time and budget. It should also be noted that some of the changes are out of the project manager's control, especially where other government agencies are involved. Performance reporting provides the means for justifying and reporting on project stakes.



Here are five steps in completing a performance report. The steps take you through comparison of actual against planned status (Steps 1 & 2), to an analysis (Step 3), to action recommendations for one or more stakeholders (Step 4), to a statement of rationale (Step 5).

These reports are useful for documenting progress and problems and for getting support from stakeholders as changes occur.

Performance Reporting
Utah Port of Entry ITS Project, Month 4

Planned Performance Measure & Date	Actual Performance Status on Date	Analysis & Conclusion	Recommended Actions for Identified Stakeholders	Reason for Recommendation
Install WIM Scales (Month 3)	Completed in Month 4	Delay Due to Bad Weather	Consider Time and Cost Implications of Delay for Other Project Items	Project Elements Are Frequently Interdependent
Train Staff (Month 4)	In Progress	Delay Due to Late Installation of WIM	Extend Training Schedule by 1 Month	Project Completion Requires Training

Module 6: Implementation Monitoring and Measuring Performance 6-14

Here is an example of the types of issues that may be addressed as part of the performance report. These are not actual events that occurred as part of the Utah project, but rather illustrations of the use of this tool.

Implementation Tool: Conformance Assessment

- **Purpose:**
  - **Allow Project Manager To Determine if Specific Systems Configuration is Consistent with Relevant Architecture & Standards**
- **Description:**
  - **Narrative Matrix Description Which Allows a Comparison of a Configured System with Relevant Standards To Eliminate Inconsistencies**
- **Related Tools:**
  - **Deliverables Specification**
  - **Monitoring Plan**
  - **Change Requests**

Conformance assessment focuses on ITS/CVO system configuration including: device and software version; documentation; etc. The purpose is to assure that the ITS/CVO project is consistent with national architecture and standards. As ITS/CVO architecture and standards are evolving, assessments should occur periodically during implementation. The project manager must be aware if any of the standards have changed since the project plan was created or the last conformance check occurred.

The systems engineer working with the project should be able to assist the project manager with these assessments. Let's look more closely at how to use this tool.

Conformance Assessment: How to Use Tool

Step 2:

Check System Configuration and Indicate Actual Status

Step 3:

Identify Important Consistencies and Inconsistencies that Will Affect System Performance, Schedule, and/or Cost

Standard Specification with Date	System Configuration Status	Analysis of In-consistency	Recommended Change Requests

Step 1:

Indicate Standard Specification from Terms of Reference or Other Documents with Date

Step 4:

If Required, Indicate Change Request at Appropriate Level of Detail

Module 6: Implementation Monitoring and Measuring Performance 6-16

The steps in completing the conformance assessment are similar to those in performance reporting, but focus specifically on architecture and standards conformance.

This special level of attention is warranted in ITS/CVO deployment projects as the national ITS and CVO architecture are evolving quickly. The project manager may want to assemble a Conformance Assessment Team (COAT) to evaluate architectural conformance at various points in the ITS/CVO project life cycle. This team would follow steps 1 to 4, relying on project documents (e.g., memoranda of agreement, operational concept documents, system design descriptions, architecture specifications, etc.) to complete their assessment and indicate change requests. An option is to work through an independent validation and verification (IV&V) contract. The procurement officer can assist with these mechanisms.

Conformance Assessment
Utah Port of Entry ITS Project

Standard Specification with Date	System Configuration Status	Analysis of Inconsistency	Recommended Change Requests
ASTM DSRC Version 6	Compatible with Existing Version 6	New Standard Should Be Backwards Compatible	None Required

Module 6: Implementation Monitoring and Measuring Performance 6-17

Here is an example of the conformance assessment tool applied to the Utah port of entry project. Again, the information shown on this chart may not be completely accurate, but is intended to illustrate the use of this tool.

Implementation Tool: Systems Integration Testing

- **Purpose:**
  - **Ensure That Integration (Between Individual and Multiple Systems Components) Is Designed Into the Project**
- **Description:**
  - **Systematic Process of Testing for Optimal Integration at Every Stage of Implementation: During the Pilot, During Initial Deployment, and as New Functionality Is Added**
- **Related Tools:**
  - **Operations Concept**
  - **Deliverables Specification & WBS**
  - **Consistency Checking**
  - **Systems Training Plan**

Module 6: Implementation Monitoring and Measuring Performance 6-18

As we indicated earlier, one of the distinguishing characteristics of ITS/CVO projects is the high degree of interdependence of their component subsystems. If there is one or several potholes in a highway, trucks can find a way around them. But one bug or incompatibility in a system can send it crashing or make it too difficult to use.

So, project managers need to give extra attention to systems integration testing during implementation to ensure the system will work in an integrated manner when completed. This is frequently referred to as Alpha and Beta testing. This is not just a technical issue, since it encompasses all elements of ITS/CVO operations: roadside, onboard, and deskside.

For example, the SAFER project in Virginia included the final users including representatives of truckers and government entities in the test group to ensure “real-life” Beta testing, not just Alpha testing in a laboratory setting.

Systems Integration Testing: How To Use Tool

Step 1:

Identify System Integration Specifications at Various Implementation Phases Along with Testing Dates

Step 2:

During Implementation Test on Schedule & Analyze Results

Step 3:

Based on Analysis, Recommend Changes to System To Improve Integration

Integration Specification at Key Implementation Phases with Dates	Integration Testing Results & Analysis	Recommended Changes Requests
1. Pilot		
2. Etc.		

Module 6: Implementation Monitoring and Measuring Performance 6-19

Here are the steps in using this tool. The most difficult part is Step 1 where integration specifications need to be identified for different stages of implementation. There are two types of integration that need to be specified and tested. First is specifying how individual components work together (referred to as "pairwise" integration). Second is specifying how multiple components all work together (referred to as "end-to-end" integration). The WBS provides a good overall visual display of a project's components and where integration (both kinds) will need to be tested. In most cases testing will be done incrementally starting with "pairwise" and moving to "end-to-end" acceptance. The team's system engineer and representatives of involved user agencies will need to be involved in identifying these specifications and testing for their adequacy.

The major point to be made here is to keep systems integration in mind throughout implementation, and do what you can to test for its occurrence at key steps in the process. The project manager's should focus on incremental system development with increasing capability leading to functionality, consistency, and interoperability.

Systems Integration Tool
Utah Port of Entry ITS Project

Integration Specification at Key Implementation Phases with Dates	Integration Testing Results & Analysis	Recommended Changes Requests
DSRC Reader and Roadside Computer	**Pass**	**None Required**
WIM Scale and Roadside Computer	**Fail**	**Systems Architect Should Conduct Fault Analysis of Communications Line**
End-to-End	**Fail**	**Reexamine After WIM Roadside Computer Integration is Achieved**

Module 6: Implementation Monitoring and Measuring Performance 6-20

For example, the Utah project could test for "pairwise" integration between the WIM scale and roadside computer, or between the DSRC reader and roadside computer. In addition, integration could be tested among all components.

Implementation Tool: Systems Training Plan

- **Purpose:**
  - **Ensure that All Stakeholders Involved in Implementing, Operating, and Maintaining New Systems Are Adequately Trained**
- **Description:**
  - **Narrative Matrix Identifying System Implementation, Operation & Maintenance Skill Requirements, Skill Gaps, and Training Needs with Required Dates for Completion**
- **Related Tools:**
  - **Delivery Specifications**
  - **WBS**
  - **Bar Chart**
  - **Systems Integration Testing**

Module 6: Implementation Monitoring and Measuring Performance 6-21

A key lesson from early ITS/CVO deployment is that effective operations of new systems depends upon the acquisition of new skills by systems users.

Therefore, skill acquisition through dedicated training is an integral component of most ITS/CVO projects. Training may also be required for re-engineered business processes that accompany the deployment of ITS/CVO.

The systems training plan tool can assist a project manager in getting system implementers, operators, and maintainers to work effectively and together. The tool identifies skill (managerial and technical) requirements and gaps, and specifies training requirements. It also can help you identify resources to support training activities.

Systems Training Plan: How To Use Tool

Step 1:

Identify Key Project Phases Where New or Upgraded Skills May Be Required

Step 2:

Identify Skill Requirements for Relevant Stakeholder Groups Including Team Members

Step 3:

Identify Skill Gaps by Comparing Current Skills to Requirements

Step 4:

For Gap Areas, Identify Training Requirements (e.g., Learning Objectives Level, & Date Needed)

Project Deployment Phase	Skill Requirements for Successful Deployment by Stakeholder	Skill Gaps Identified Through Comparison of Skill Requirements & Current Skills	Training Requirements (Including Completion Dates) by Stakeholder
1. Implementation Start-up			
2. Pilot			
3. Full Deployment			

Module 6: Implementation Monitoring and Measuring Performance 6-22

Here is a simple format for a systems training plan. In the project start-up phase (step 1), for example, staff from several government departments may need to form a new implementation team and therefore may require team skills. A half-day team building training session could both provide required skills and assist the project manager in getting the project started on the right foot.

In Steps 2 to 4, it is useful to differentiate managerial and technical requirements (skills, knowledge, and capabilities). Several managerial skills that have demonstrated high value in ITS/CVO projects are negotiation and conflict resolution. As scope, schedule, and cost changes occur, project team members and system users need to know how to negotiate change requests and resolve conflicts. These skills can be acquired, along with more technical ones, in training sessions.

We will have a chance to look more closely at the system training issue in our case exercise, so let's not spend more time on it now.

Systems Training Plan
Utah Port of Entry ITS Project

Project Deployment Phase	Skill Requirements for Successful Deployment by Stakeholder	Skill Gaps Identified Through Comparison of Skill Requirements & Current Skills	Training Requirements (Including Completion Dates) by Stakeholder
Startup	• WIM Operation • Information System Use	• Basic Use and Operation of System • Awareness of Credentials Requirements	• Orientation by Contractor • Seminar on Credentials Requirements and Databases by DMV
Full Deployment	• WIM Operation	• WIM Maintenance	• Seminar on Maintenance Management Systems

Module 6: Implementation Monitoring and Measuring Performance 6-23

Here are some of the training needs that might be identified using this tool.

Module VI Learning Objectives

- **Major Steps In the ITS/CVO Project Implementation Process**
- **Key ITS/CVO Project Manager Roles and Skills During Implementation**
- **ITS/CVO Project Implementation Tools and Techniques**
- **Application of Implementation Tools to the Management of an Illustrative ITS/CVO Project**

Module 6: Implementation Monitoring and Measuring Performance 6-24

The final objective for this module is learning to apply several of the implementation tools in an ITS/CVO context. Let's do this by returning to the Midland weigh station case.

Case Exercise: Implementation

Module 6: Implementation Monitoring and Measuring Performance 6-25

Now we will continue with the Midland Weigh Station case illustration that we worked on yesterday, and apply the tools we have just discussed to a simulated implementation of this ITS/CVO project.

For this exercise, assume that one year has passed since you completed the Implementation Plan, and that the project is now underway. Your project management role is one of managing implementation progress including monitoring, reporting and problem solving.

To complete this exercise, please work in the same groups, in the same locations as yesterday.

Module VI Summary

- Project Implementation Steps
  - Mobilization, Piloting, Deployment, and Preparing for Operations and Maintenance To Begin
- Project Manager Skills for Successful Implementation
  - Communications, Monitoring, Reporting, Consistency Checking, Systems Testing, and Training
- Tools a Manager Needs To Be Successful
  - Monitoring Plan, Performance Reporting, Conformance Assessment, Systems Integration Testing, and Systems Training Plan

Module 6: Implementation Monitoring and Measuring Performance 6-26

Let's summarize Module VI by reviewing the key learning points.

MODULE 7 - CONCLUSION

Module VII: Conclusion

ITS/CVO Technical Project Management For Non-Technical Managers

Module VII: Conclusion 7-1

This is the last module in this course. It is a concluding module intended to be quick and comprehensive. In this module we will review how well this course has met your expectations. We will also discuss some of the lessons, tips and techniques you have learned in the past two days and discuss the steps you can take to apply what you have learned back on the job.

Course Goals

- Identify and Define the Key Issues and Constraints Unique to ITS/CVO Projects
- Understand Some Key Lessons Learned From Other States' Prior ITS/CVO Project Experience
- Apply Some Basic Project Skills to an Illustrative Case Situation

Module VII: Conclusion 7-2

Let's review the course goals we discussed at the beginning of the course.

Identifying New Learning Acquired Through The Course

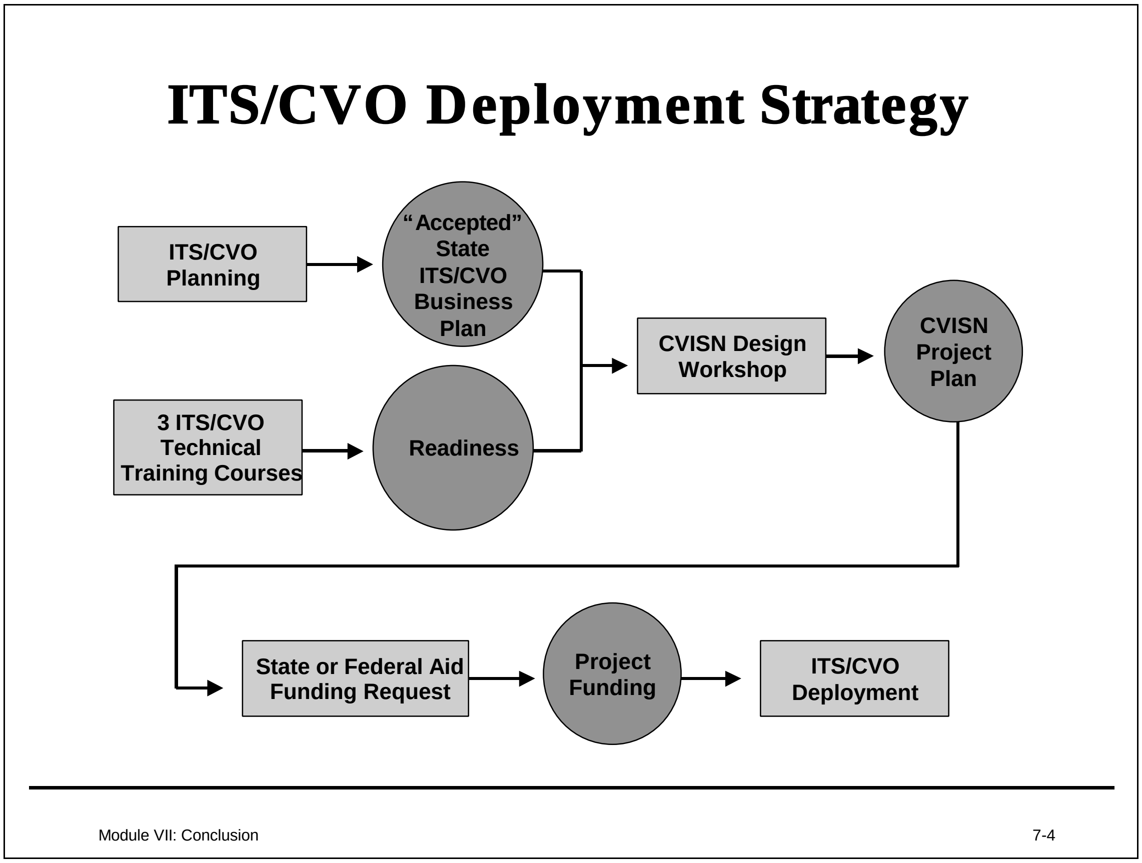
- What Is the Most Important Thing You Have Learned From This Course?

Module VII: Conclusion 7-3

Let's briefly identify the most important things you have learned in this course. To do this, I have a simple exercise for you to do.

Take a minute or two to identify the one most important learning you are taking away from this course. Then write it down in five words or less on your index card.

Let's discuss some next steps for applying these learnings to your jobs.



This exhibit illustrates the current thinking regarding the ITS/CVO Deployment Strategy. States that complete an approved ITS/CVO Business Plan and a series of initial training courses will be eligible to participate in a series of CVISN Design Workshops. The workshops will be structured to produce a detailed CVISN Project Plan, using many of the tools we covered in Module IV. The project plan will enable states to prepare for ITS/CVO deployment in a manner that is consistent with the CVISN architecture and standards, and also reflects the lessons learned by the initial CVISN prototype and pilot states.

Depending on funding levels, states may use their project plan to guide deployment using funding from Federal-aid, state, or other sources. Consistency with the national CVISN architecture is a requirement for using Federal funding, so these plans will play a critical role in ensuring compatibility.

Technical Training Course Descriptions

Course Title	Introduction to ITS/CVO	ITS/CVO Technical Project Management for Non-Technical Managers	Understanding ITS/CVO Technology Applications
Duration	1 1/2 days (12 hours)	2 days (16 hours)	2 days (16 hours)
Content	ITS/CVO program's purpose, structure, components, current and future implementation, and technology	Skills development for managing the design and implementation of ITS/CVO technology	Overview of CVISN architecture and technology, standards, and interoperability
Target Audience	Technical or non-technical managers and staff from the states, FHWA (OMC and Federal-aid), motor carrier industry, and other key stakeholders	Technical managers and staff from the states and FHWA (OMC and Federal-aid)	Technical managers and staff from the states, FHWA (OMC and Federal-aid), motor carrier industry, and other key stakeholders
Required for Workshops?	Recommended	Required	Required

Module VII: Conclusion 7-5

This exhibit lists the full series of ITS/CVO training courses. Note that this class and the third course, "Understanding ITS/CVO Technology Applications," are prerequisites for participation in the CVISN Design Workshops. The first course, "Introduction to ITS/CVO," is strongly recommended. Participants in the second and third courses must have either completed the introductory course or have an equivalent level of expertise.

Next Steps for Applying Learning

- How Can You Apply What You Have Learned During this Course To Advance ITS/CVO Deployment in Your State or Region?

Module VII: Conclusion 7-6

Take a minute or two to identify something that you can do following this course that will apply what you have learned to your job. Then write it down in five words or less on your index card.

Module VII: Conclusion

ITS/CVO Technical Project Management
For Non-Technical Managers

Module VII: Conclusion 7-7

It is time to complete your Course Evaluation Handout. Please take a few minutes to complete it with your feed-back.

When you are finished please bring your completed Course Evaluation forms forward. That is the end of this course. Thank you all for your attention and involvement. Good luck!

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Glossary

Glossary of Terms and Acronyms

Bar Chart – A planning tool that graphically helps determine the length of time and scheduling flexibility involved in implementing a project. Also known as a Gantt Chart.

BCWS – Budgeted Cost of Work Scheduled

Carrier Operations – One of four ITS/CVO program areas. Includes public sector programs and services designed to manage the flow of commercial vehicles, including travel information services and hazardous material incident response services. The private sector is taking the lead in the deployment of fleet and vehicle management technology.

CMAQ (Congestion Management and Air Quality Improvement Program) – A grant program that can fund transportation activities that are likely to improve air quality.

COAT – A Consistency Assessment Team which evaluates a project's architectural consistency at various points in the ITS/CVO project life cycle.
Concept of Operations Document – A document describing what work will be done and who will be doing it.

Conformance Assessment – An implementation tool used to allow project managers to determine if specific systems configuration is consistent with relevant architecture and standards. It typically includes a narrative matrix description that allows a comparison of a configured system with relevant standards to eliminate inconsistencies.

CVISN (Commercial Vehicle Information Systems and Networks) – The collection of state, federal, and private sector information systems and communication networks that provide support to CVO. CVISN includes information systems owned and operated by governments, carriers, and other stakeholders. The CVISN architecture, part of the National ITS Architecture, provides a technical framework that describes how ITS/CVO elements fit together into an overall system.

CVO (Commercial Vehicle Operations) – all of the operations associated with moving goods and passengers via commercial vehicles over the North American highway system and the activities necessary to regulate the operations.

Credentials Administration – One of four ITS/CVO program areas. Includes program and services designed to improve the deskside procedures and systems for managing motor carrier regulation. These include electronic application, purchasing, and issuance of credentials; automated tax reporting and filing; interagency data exchange; and interstate data exchange.

Critical Path Method (CPM) – A mathematical model that calculates the total duration of a project based on individual task duration and dependencies and identifies which tasks are critical.

Deliverables Specification – A planning tool used to state intended project deliverables in measurable terms so they can be communicated to others. It typically includes a narrative listing of key project deliverables or outputs, accompanied by one or more targeted performance measures (in terms of quantity, quality, timing, or user group) for each.

Electronic Screening – One of four ITS/CVO program areas. Includes programs and services designed to facilitate the verification of size, weight, and credential information, including automated screening and clearance of commercial vehicles and international electronic border clearance.

FAR – Federal Acquisition Requirements

FOT – Field Operational Test.

Gantt Chart – A planning tool that graphically helps determine the length of time and scheduling flexibility involved in implementing a project. Also known as a Bar Chart.

GARVEE Bonds – Grant Anticipation Revenue Vehicle (GARVEE) bonds, which enable states to assemble up-front capital that is secured, at least in part, by future years' federal-aid highway apportionments. A state may use future federal-aid obligations to retire the principal, interest, issuance, insurance, and other costs incidental to the sale of an eligible financing instrument. The state would designate the advance construction amount up front, and would repay the debt service each year using its federal-aid grant monies. This financing mechanism is particularly effective for non-revenue-generating projects seeking debt financing.

Goals – Broad achievements toward which the project/program/plan is directed

ITS (Intelligent Transportation Systems) – integrate advanced computer, information processing, communications, sensor, and electronics technologies and management strategies to increase the safety and efficiency of the surface transportation system.

ITS / CVO (Intelligent Transportation Systems / Commercial Vehicle Operations) – The ITS / CVO program is a voluntary effort involving public and private partnerships focused on improving highway safety and motor carrier productivity through the use of technology. The Federal Highway Administration is the lead federal agency for the program and the Office of Motor Carrier's ITS / CVO Division is directly responsible for oversight of the program.

IV & V – Independent Verification and Validation

Life Cycle – A series of steps that projects cycle through, from definition, to planning, to implementation, and to operations and maintenance. This process is iterative involving feedback, through monitoring and evaluation, at every step.

Life Cycle Costing – Determining the funding needed at every project cycle phase.

LOI – Letter of Interest

Mainstreaming – An initiative to organize and manage ITS / CVO deployment and communicate the ITS / CVO program to all stakeholders to gain support and participation.

Milestone – A significant project output.

Mission – The overall, long-range intent of a program.

MOA – Memorandum of Agreement

Monitoring Plan – An implementation tool used to ensure that project performance is tracked and measured in an efficient and timely manner. It typically includes a matrix that indicates when and by whom key project performance indicators (physical and financial) should be measured, assessed, controlled, and reported.

Motor Carrier Safety Assistance Program (MCSAP) – A grant program from the federal government to the states to enforce uniform federal and state safety and hazardous materials regulations and rules applicable to commercial vehicles and their drivers.

MOU – Memorandum of Understanding

NHS (National Highway System) – A grant program that can fund capital, operational, and highway safety improvements on segments of the 161,108-mile NHS network.

O & M – Operations and Maintenance

Objectives – Specific components of goals

ORC – Organizational Responsibility Charting

Partnerships – Taking advantage of private sector participation in return for opportunities for profit-making.

Performance Reporting – An implementation tool used to provide stakeholders with information on how resources are being used to achieve project objectives. It typically includes information on a project's status (where it now stands), progress (accomplishments and recommendations), and forecasting (predictions of future progress).

PM – Project Manager

Policy – A high-level overall plan embracing general goals and acceptable procedures

Pooling – Multiple agencies/groups share the cost of various stages of a project

Process Mapping – A planning tool used to map a process and the likely cost of resources or inputs.

Program Evaluation Review Technique (PERT) – A scheduling system, which uses statistical probabilities to calculate expected duration of activities.

Program – A group of projects managed in a coordinated way to obtain benefits not available from managing them individually; often include elements of ongoing operations; may involve a series of repetitive or cyclical undertakings

Project – A temporary endeavor undertaken to create a product or service; a project is often a sub-set of a program.

Project Plan – A detailed plan for a project, including a justification, objectives and requirements, work breakdown, schedules and responsibilities, resource requirements, risks, and team organization.

Rationale Description – A planning tool used to describe the rationale or justification for a project by showing how it fits with the policy context and Business Plan priorities.

Resource Estimates – A planning tool used to assess the likely cost of project resources or inputs. It typically includes a list of required level of resources needed to carry out project activities, along with their estimated costs.

RFP – Request for Proposal

RFPP – Request for Project Partners

RFQ – Request for Qualifications

Risk Mitigation – A planning tool used to identify likely project risks and ways to reduce them. It typically includes a narrative description of events that are both likely and will have a negative consequence for the project, along with ways to deal with them.

SAFER (Safety and Fitness Electronic Records) – An on-line system that is available to users over a nationwide data network. The system returns a standard carrier safety fitness snapshot or record to the requester within a few seconds.

SAFER Data Mailbox – An electronic mailbox to facilitate the electronic exchange of motor carrier snapshots, records, and vehicle/driver inspection reports.

Safety Assurance – One of four ITS/CVO program areas. Includes programs and services designed to assure the safety of commercial drivers, vehicles, and cargo. These include access to driver, vehicle, and carrier information on inspections and accidents; automated inspections and reviews; and onboard safety monitoring.

Scope – A detailed document specifying what the project will accomplish.

Scope Creep – Changes in the scope which occur during implementation.

SIB (State Infrastructure Bank) – A state or multi-state investment fund that provides loans, credit enhancements, and other forms of financial assistance to transportation projects that anticipate generating future revenues. The FHWA has instituted a pilot SIB program, in which 38 state and Puerto Rico are participating.

SOW – Statement of Work

STP (Surface Transportation Program) – A grant program that can fund a wide range of capital and operational improvements to the federal-aid highway system.

Stakeholder – A person, institution or group with an interest or stake in a project

Stakeholder Analysis – A tool for determining the ITS/CVO project-related interests of important stakeholders and taking these interests into account in a manner which ensures their commitment.

State ITS/CVO Business Plan – A document that defines broad goals and strategies for a state's ITS/CVO program, as well as projects with specific objectives, outcomes, technical and management approaches, milestones, and budgets.

Systems Integration Testing – An implementation tool to ensure that integration, between individual and multiple systems components, is designed into the project. It involves a systematic process of testing for optimal integration at every stage of implementation: during the pilot, during initial deployment, and as new functionality is added.

Systems Training Plan – An implementation tool to ensure that all stakeholders involved in implementing, operating and maintaining new systems are adequately trained. It typically includes a narrative matrix identifying system implementation, operation, and maintenance skill requirements, skill gaps, and training needs with required dates for completion.

Targeted Indicators – Measure the occurrence of an output or milestone, in terms of quantity, quality, timing or user group.

TEA-21 – Transportation Equity Act for the 21st Century

Team Building – A planning tool used to involve key team members in the project in order to enhance project performance.

Technical Specifications and Requirements – A planning tool that identifies requirements and specifications required for conformance. This typically includes of applicable CVISN standards, requirements, timing, and strategies for conformance for a project.

TIFIA – Transportation Infrastructure & Innovation Act, a federal credit instrument to support state and local government sponsored transportation projects

Vision – 'The Best', an ideal, the direction in which you want to proceed

Work Breakdown Structure (WBS) – A planning tool that helps to define the scope of the project and to organize the project components and activities. It includes a hierarchical breakdown of project elements that defines and organizes the total scope of the project.

Handouts

ITS/CVO Training Program

ITS/CVO Technical Project Management for Non-Technical Managers

Date:_____________________

COURSE ATTENDANCE

NAME & POSITION	ADDRESS	PHONE	FAX	EMAIL
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				

NAME & POSITION	ADDRESS	PHONE	FAX	EMAIL
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				

ITS/CVO Training Program
ITS/CVO Technical Project Management for Non-Technical Managers
Date: ______________________

COURSE EVALUATION

Part I. Module Evaluation

Please take a few moments to fill out this evaluation. Your feedback helps us measure and improve the quality of training provided. Your responses will help us identify any revisions that are needed to the course.

I. Welcome

My overall impression of this module's effectiveness is:

Poor	Fair	Adequate	Good	Excellent
1	2	3	4	5

The most useful information in this module is: ______________________________________

____

Improvements needed in this module are: ______________________________________

____

Comments: ____

____

II. Introduction to ITS/CVO Programs and Project Management

My overall impression of this module's effectiveness is:

Poor	Fair	Adequate	Good	Excellent
1	2	3	4	5

The most useful information in this module is: ______________________________________

____

Improvements needed in this module are: ______________________________________

____

Comments: ____

____

III. ITS/CVO Deployment Context: the Stakeholders and Their Roles

My overall impression of this module's effectiveness is:

Poor	Fair	Adequate	Good	Excellent
1	2	3	4	5

The most useful information in this module is: ______________________________________

____

Improvements needed in this module are: ______________________________________

____

Comments: ____

____

IV. Implementation Planning of ITS/CVO Projects

My overall impression of this module's effectiveness is:

Poor	Fair	Adequate	Good	Excellent
1	2	3	4	5

The most useful information in this module is: ______________________________

____

Improvements needed in this module are: ______________________________

____

Comments: ______________________________

____

V. Procurement of ITS/CVO Technical Services

My overall impression of this module's effectiveness is:

Poor	Fair	Adequate	Good	Excellent
1	2	3	4	5

The most useful information in this module is: ______________________________

____

Improvements needed in this module are: ______________________________

____

Comments: ______________________________

____

VI. Implementing, Monitoring and Measuring Performance

My overall impression of this module's effectiveness is:

Poor	Fair	Adequate	Good	Excellent
1	2	3	4	5

The most useful information in this module is: ______________________________

____

Improvements needed in this module are: ______________________________

____

Comments: ______________________________

____

VII. Conclusion

My overall impression of this module's effectiveness is:

Poor	Fair	Adequate	Good	Excellent
1	2	3	4	5

The most useful information in this module is: ______________________________

____

Improvements needed in this module are: ______________________________

____

Comments: ______________________________

PART II. Overall Course Feedback

We appreciate your detailed evaluation of the overall course. Using the scale shown below, please circle a number that indicates your opinion on each item. Add any additional comments on the back of the form.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
Content					
1. The course provided an appropriate amount of information for my experience.	1	2	3	4	5
2. The exercises were relevant to my work.	1	2	3	4	5
3. The exercises helped me understand and apply the content of the course.	1	2	3	4	5
4. The course content will be useful to me on the job.	1	2	3	4	5
5. The course is an appropriate length for the material presented.	1	2	3	4	5
Instructors					
1. The instructors were knowledgeable in the subject matter.	1	2	3	4	5
2. The instructors presented the information clearly.	1	2	3	4	5
3. The instructors answered questions adequately.	1	2	3	4	5
4. Instructor(s) were available to help me and other participants during the class.	1	2	3	4	5
Materials					
1. The Participant Guide provided clear, concise information.	1	2	3	4	5
2. Other course materials (overheads, handouts, charts, etc.) were easy to read and related to the subject matter.	1	2	3	4	5
3. I will be able to use the materials as a reference guide back on the job.	1	2	3	4	5
Facilities					
1. I was able to see and hear the instructors.	1	2	3	4	5
2. I could see the screens and demonstrations being presented at the front of the class.	1	2	3	4	5
3. The temperature, lighting, seating, etc. in the classroom was favorable to learning.	1	2	3	4	5
General					
1. I had the chance to ask questions.	1	2	3	4	5
2. The pace of the course was well suited to the material presented.	1	2	3	4	5

3. The course met my expectations based on the stated course objectives.	1	2	3	4	5

U.S. DEPARTMENT OF TRANSPORTATION
OMC NATIONAL TRAINING CENTER

STUDENT REGISTRATION FORM

PLEASE PRINT LEGIBLY AND COMPLETE ENTIRE FORM

COURSE: **ITS/CVO TECHNICAL PROJECT MANAGEMENT FOR NON-TECHNICAL MANAGERS**

LOCATION: DATES:

NAME: ____

POSITION TITLE: ____

ORGANIZATION NAME: ____

STREET ADDRESS: ____

CITY: ____________________ STATE: ________ ZIP CODE: ________

OFFICE PHONE NUMBER: (___) ______________

FAX NUMBER: (___) ____________________

E-MAIL: ____________________________

Exercise: Grouping Stakeholders for ITS/CVO Projects

	Customers/Users (Multiple Layers)	Sponsor (Financial, Technical, Political)	Project Management (in Project Organization)	Project Team (Involved in Doing Project Work)	Other Interested Parties
Commercial Drivers					
Industry & Trade Associations					
Special Interest Groups					
FHWA					
State Government Agencies					
Politicians					
Private Contractors					
State ITS/CVO Project Manager					
Motor Carriers (motor coach and trucks)					
Local Agencies					
Federal Agencies (e.g. Treasury, Justice)					
State Procurement Office					
Shippers, Receivers & Insurers					
State ITS/CVO Systems Architect					
Other					
Other					

ITS/CVO DEPLOYMENT IN MIDLAND STATE– THE CASE SITUATION

The State of Midland, with a population of 8 million, occupies a land mass of 45,000 square miles and has 10 counties. The Capital is Midburg. The main industries are manufacturing, food processing, and agriculture. The State's climate fluctuates with the seasons.

Midland's economy is prospering (at a 4.2% rate in GDP per year), and along with this growth has come a substantial increase in intrastate and interstate commercial vehicle (CV) operations. A large part of this growth comes from industries that transport goods by road throughout the state and across state lines. It is projected that the number of intrastate CVs based in Midland will increase from 35,000 to 43,000 from 1995 to 2005. Likewise, the number of interstate CVs will increase from 25,000 to 28,750. The total truck vehicle miles traveled (VMT) in 1994 was estimated at 6 billion.

The increase in the number of CVs and miles traveled has resulted in a deterioration of safety conditions for CVOs and other highway users. In 1995, Midland was ranked 11th in the nation in the number of fatal large truck crashes, with 3.5% of the national total. In a related development, the state motor truck association has stated in a trade journal that transport fees will need to be increased to cover escalating operational costs brought about by outdated roadside checking processes.

The Midland DOT, with the active support of the Governor, announced a Commercial Vehicle Operations Strategy in 1996 to address the State's safety and other regulatory enforcement concerns. The CVO Strategy has several broad goals, including:

(1) Improving highway safety.
(2) Streamlining credentials and tax administration.
(3) Reducing congestion costs for motor carriers.
(4) Ensuring regulatory compliance and equitable treatment.

The Midland CVO Strategy responds to the growing national climate in support of change in regards to CVO operations. With a national initiative aimed specifically at automating CVO, and tentative budget allocations targeted to reward further ventures in this area, there appears to be a 3 to 5 year window of Federally-supported opportunity for the deployment of ITS/CVO improvements at the state level.

In support of the CVO Strategy, the state budget allows for expenditures to continue the enhancement of network and computer systems, but does not allow for adding permanent administrative staff. A statewide information technology initiative is supporting the upgrading of CV administrative systems and networks to exchange more information electronically. As a result, many agencies are computerizing their operations.

Several months ago, the Midland DOT acted as the lead (in cooperation with several other state agencies) in developing an ITS/CVO business plan. This plan: (1) Provides a framework for identifying problems and project opportunities in current CVO procedures and operations; (2) Improves ITS/CVO communications among and between state agencies and the motor vehicle industry; and, (3) Allows ITS/CVO projects to be developed and deployed in a coordinated manner so as to conserve resources and to ensure that "balkanized" CVO regulatory programs are not replaced by equally uncoordinated ITS/CVO programs and projects.

The ITS/CVO Business Plan recognizes that Midland is laying its groundwork for success somewhat later than the CVISN pilot states. The Business Plan argues that Midland should build on the lessons of other states, and identify a number of high value programs that will take full advantage of promising technologies and funding opportunities.

Last week, the Secretary of the DOT approved the ITS/CVO business plan. The plan accords high priority to an "Electronic Screening Program." This program includes several high priority projects that were selected from a list of alternatives. One project funded for immediate implementation is the "Midland Weigh Station Electronic Screening Pilot Project." The goal of this pilot project is to demonstrate the benefits of electronic screening at an existing Midland weigh station. A diagram of the proposed pilot project along with an initial work breakdown structure (WBS) is attached. A Project Manager has been assigned to this pilot project from the DOT. A Project Organization Chart of the state departments involved with the weigh station pilot project is also attached.

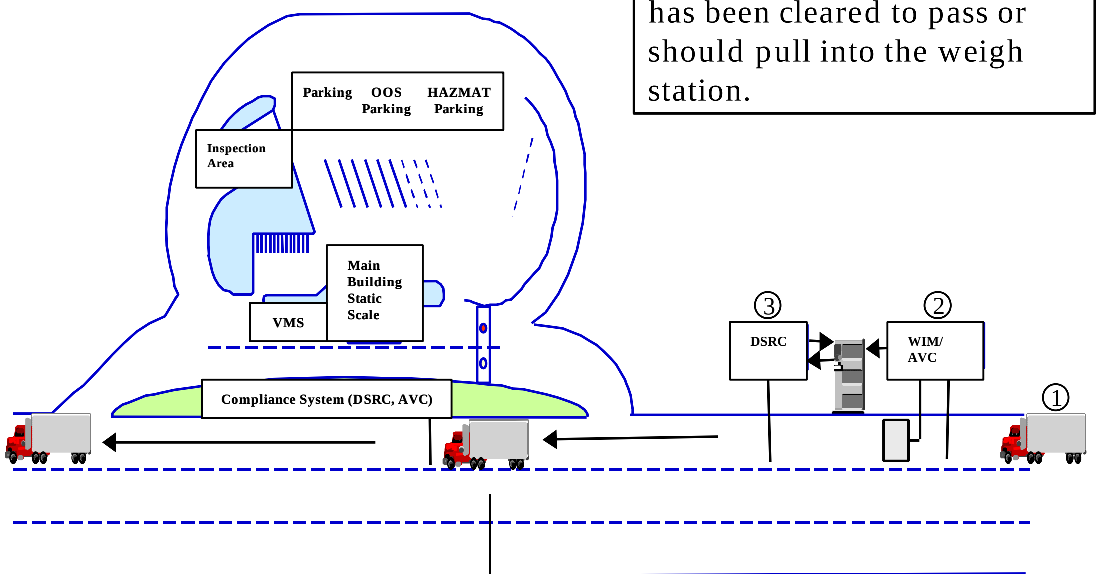
There are several risks associated with the business plan as approved. One is that several of the relatively non-computerized agencies in the State– including the DOT Motor Vehicle Administration and the State Police– may be reluctant to support the plan and its programs because they will need to change some of their administrative processes. Another risk is that the motor truck association may not be supportive since it previously has exhibited a lack of trust in the government's handling of high technology initiatives.

ILLUSTRATIVE OPERATIONAL SCENARIO
MIDLAND WEIGH STATION ELECTRONIC SCREENING PILOT PROJECT

1. Commercial vehicle approaches weigh station. Screening system identifies the carrier, vehicle, and driver; reads the last screening event from the tag; classifies the vehicle; and weighs the vehicle.

2. WIM/AVC data and infrastructure data (carrier, vehicle, driver snapshots) are processed to determine clearance status (Bypass). Data are sent to the main

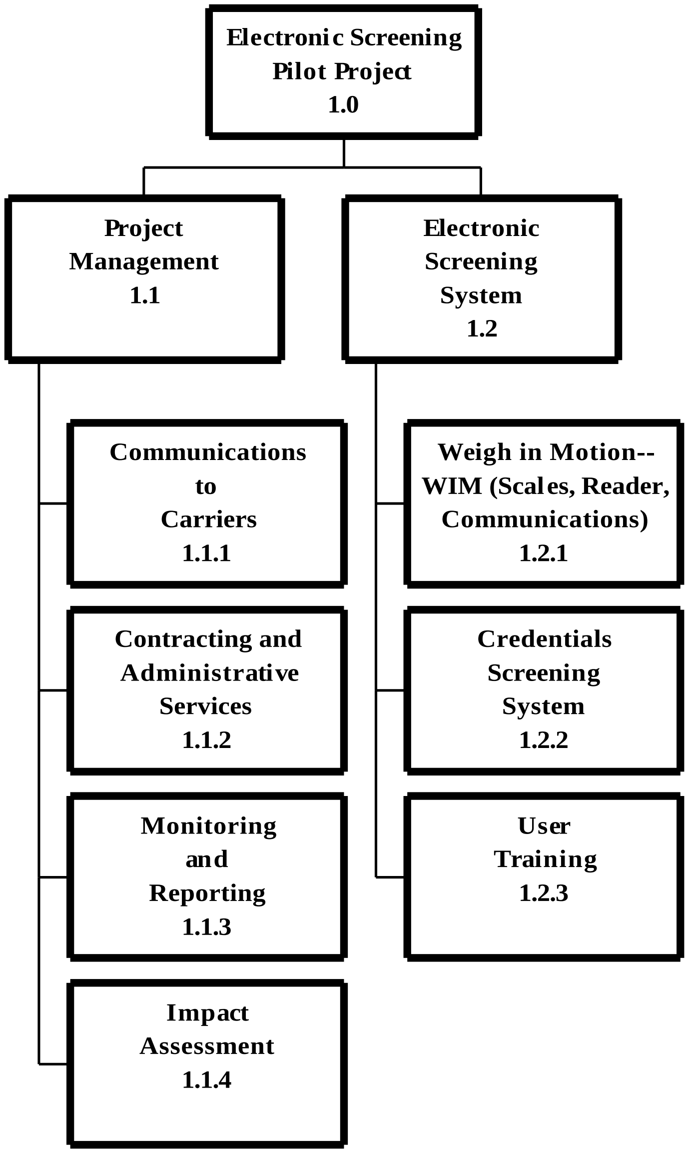
3. DSRC sends clearance status (Bypass) to the tag. Driver is notified of whether the vehicle has been cleared to pass or should pull into the weigh station.



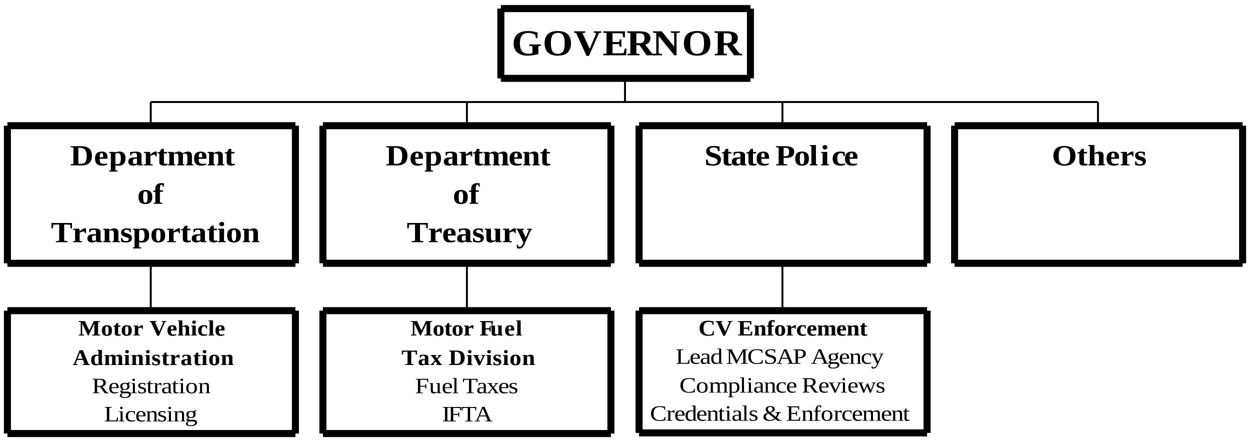
4. Compliance reader interrogates tag to verify that vehicle has been cleared to Bypass.

<u>Acronyms</u>
AVC- Automatic Vehicle Classification
DSRC- Dedicated Short Range Communication
WIM- Weigh in Motion
VMS- Variable Message Sign

MIDLAND WEIGH STATION ELECTRONIC SCREENING PILOT PROJECT
INITIAL WORK BREAKDOWN STRUCTURE (WBS)



MIDLAND WEIGH STATION
PROJECT ORGANIZATION



APPROVED IMPLEMENTATION PLAN

Project Title: Midland Weigh Station Electronic Screening Pilot Project

A. Project Justification

1. Major Benefits	Major Beneficiaries (stakeholders)
• Unnecessary delays	- Commercial vehicle operators and owners
• Increased safety	- All highway users
• Increased compliance	- State citizens
• Cost reductions	- Commercial vehicle owners and taxpayers

2. Fit of Project with Midland Needs:

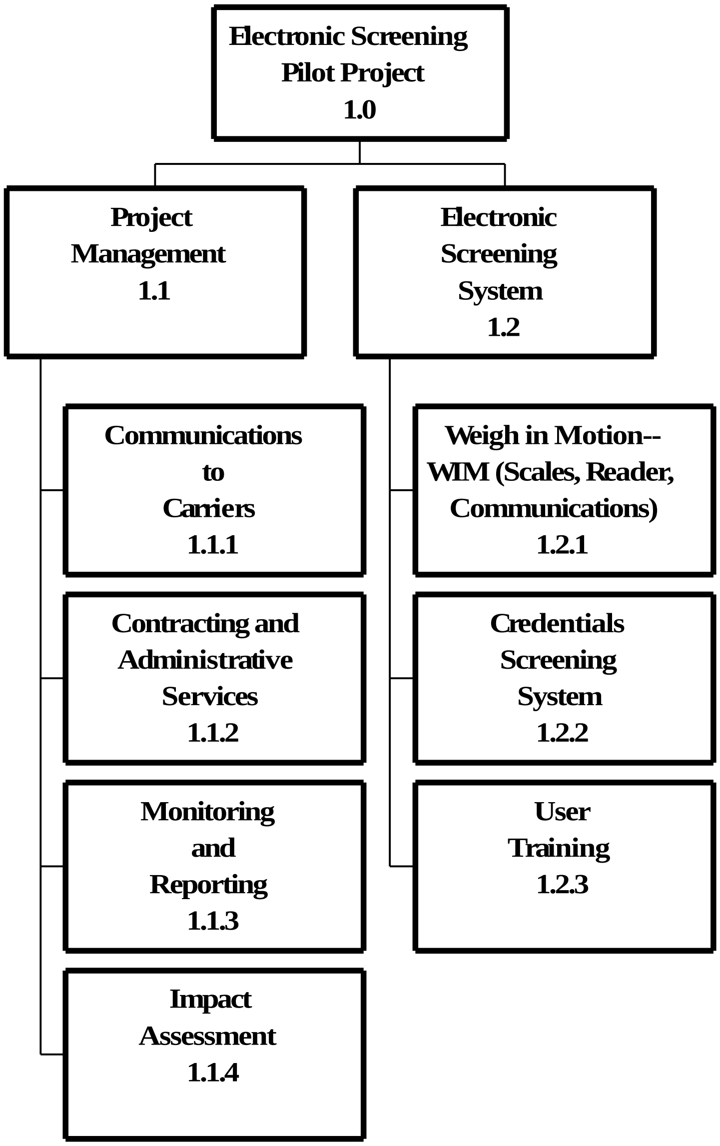
The goals of the Midland CVO Strategy include: improving safety, reducing congestion and its associated costs, and ensuring regulatory compliance.

The Midland Weigh Station Electronic Screening Pilot Project will contribute to the achievement of these CVO strategic goals by reducing the number of high risk commercial vehicles using the highway network.

B. Project Deliverables

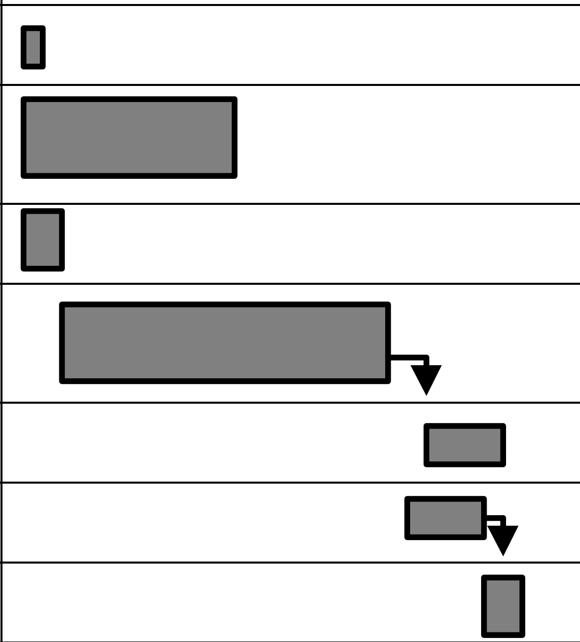
Deliverables / Milestones	Indicators (Quantity, Quality, Clients, Time)
1. Weigh in motion system installed	- One weigh station near the Midland / Next State border is upgraded with electronic screening including WIM scales and DSRC readers by month 6.
2. Credentials screening system installed	- A roadside computerized operations system is operational with a communications link to state credentials databases by month 7.
3. Weigh station staff trained in new computerized electronic screening process	- 10 staff are trained by month 9 in the new system, including credentials enforcement procedures.

C. Modified Work Breakdown Structure



D. Project Schedule with Key Responsibilities

(1) Project Activities	(2) Time Periods in Months 1 2 3 4 5 6 7 8 9 10	(3) Responsible Actor
1. Contract award		**Procurement Officer**
2. Public awareness campaign		**Consultant & DOT**
3. Launch workshop		**Stakeholders & Contractor**
4. System development & installation		**Contractor**
5. User Training		**Contractor**
6. Test run & Evaluation		**Contractor & Consultant**
7. Inauguration		**Consultant & DOT**



E. Risk Mitigation Plan

Potential Risks	Suggested Mitigation Actions
1. Lack of stakeholder support including motor carrier participation	- Regular and frequent meetings/workshops among all stakeholders
2. Uneducated choice of contractor	- Leverage other states' experience through benchmarking
3. Lack of resources (time, money)	- Prioritize needs and reduce scope of work
4. Institutional issues: lack of institutional support from different implementing agencies	- Internal education, top and middle management involvement

F. Initial Budget Estimate

Type of Resources		Estimated Costs
1. Weigh in motion system		$500,000
2. Credential screening system		$200,000
3. Training		$100,000
4. Project Management		$350,000
5. Contingency		$50,000
	Total Estimate:	$1,200,000

ITS/CVO PROJECT MANAGEMENT CHALLENGES, SKILLS, AND TOOLS
PLANNING PHASE

Project Characteristic	Management Challenge	Project Manager Skills	Project Management Tools	Module Covered
Commitments needed from multiple stakeholders in public and private sectors	How to foster multiple stakeholder commitment?	• Building early and continuing stakeholder ownership	• Stakeholder analysis • Rationale description	III IV
Specifications involve standards that are abstract, evolving, competing, and not uniformly accepted	How to build consensus on evolving standards and communicate them effectively?	• Determining and communicating performance specifications and work steps	• Deliverables specification • Work breakdown structure	IV IV
Schedule, cost, and risks are less reliable and difficult to estimate accurately	How to plan for uncertainty and build in flexibility?	• Developing adaptable schedules and budgets • Anticipating risks	• Bar charts • Resource estimation • Risk mitigation plan	IV IV IV
Life cycle is shorter, with potential for significant technological and process change	How to prepare for technological change and potential obsolescence?	• Understanding architecture and standards	• Technical specifications/ requirements analysis	IV
Team structures are dispersed and cross-cut administrative borders	How to ensure components and teams work together?	• Developing cross-organization teams	• Team staffing and building	IV

ITS/CVO IMPLEMENTATION PLANNING EXERCISE

Objectives:
1. Participants have an opportunity to simulate the ITS/CVO project implementation planning process.
2. Work groups can prepare a summary project implementation plan.

Instructions

1. Participants will work in preassigned groups, and assume a "State ITS/CVO Project Manager" role with responsibility for managing the detailed planning of the "Midland Weigh Station Electronic Screening Pilot Project

2. Groups will have about 1 1/2 hours to complete the following:

   2.1 Select a group leader and group recorder, and review these instructions.

   2.2 Using the planning information provided to you (i.e., the Case Situation and the Midland Situation Report in Attachment 1), complete a project implementation plan. Your group's plan should provide the basis for both procurement and implementation, and include the following summary elements as detailed in Attachment 2:

   - Project Justification;
   - Deliverables;
   - Work Breakdown Structure;
   - Bar Chart with Key Responsibilities;
   - Risk Mitigation Plan; and
   - Budget Estimate.

   2.3 The group reporter should prepare for a 5- to 7-minute presentation using overhead transparencies or flip charts of Attachment 2 to summarize the group's work.

3. If you finish early, you can apply other tools covered in Module IV, such as Team Staffing and Building or Technical Specifications and Requirements.

ATTACHMENT 1
MIDLAND SITUATION REPORT

1. You are the DOT Project Manager responsible for the "Midland Weigh Station Electronic Screening Pilot Project." Your supervisor is requesting that you develop an implementation plan to deal with the problem of escalating commercial vehicle (CV) operational costs brought about by outdated roadside checking processes. The pilot project should involve several state agencies, should be completed in 10 months, and should outsource the electronic screening component to a private contractor.

2. Your supervisor also suggests that you base your plan on the "best practice" experience with electronic screening in the adjoining states, which:

   - Focuses on improved enforcement of carriers, vehicles, and drivers operating unsafely or illegally;

   - Seeks to reduce the frequency and duration of stops for safe and legal carriers; and

   - Enables increased use of remote or mobile enforcement.

3. A review of other available information indicates:

   - Midland's weigh stations were built about 30 years ago, and although well maintained, they have not been upgraded to take advantage of new electronic weigh-in-motion (WIM) and roadside vehicle screening technology.

   - Vehicle inspections occur at fixed CV check sites, and at least one CV check site on each interstate highway also weighs vehicles using static scales.

   - The interstate highways are intended to support most of the commercial vehicle traffic, but vehicles are increasingly using bypass routes to avoid weigh stations.

   - The stations close to agriculture and manufacturing industries are often overloaded and must close temporarily to avoid creating roadway hazards.

   - The state legislature has earmarked $1,200,000 to pilot CV electronic screening in Midland. The budget includes the DOT's project management costs, the contract amount, and a contingency. These funds are available this fiscal year.

   - The Motor Vehicle Administration (MVA) is reluctant to get involved in this project due to their relatively non-computerized administrative processes. However, MVA staff have indicated an interest in using the roadside information gathered from the electronic screening process for checking registration.

ATTACHMENT 2
PROJECT IMPLEMENTATION PLAN
GROUP __

Project Title: Midland Weigh Station Electronic Screening Pilot Project

A. Project Justification

(What are the major benefits, to Midland in general, and various stakeholders in particular, of this project, and how does the project fit into Midland's ITS/CVO needs?)

1. Major Benefits Major Beneficiary (stakeholders)

-
-
-
-
-

2. Fit of Project with Midland Needs:

B. Project Deliverables

(What are the tangible deliverables/milestones [i.e., systems, reports] that are expected during this project, and what performance indicators will be used to measure their achievement? Hint: Refer to WBS.)

Deliverables/Milestones	Indicators (Quantity, Quality, Clients, Dates)
1.	-
2.	-
3.	-
4.	-

C. Modified Work Breakdown Structure

(Instructions: Based on your team's understanding of this project, modify the "Initial Work Breakdown Structure" provided in the Midland Case Situation handout. Check to make sure that your revised WBS contains all key elements and sub-elements for your project.)

D. Project Schedule with Key Responsibilities

(Instructions: Complete the following chart by first listing the 5 to 7 most important activities for the project in column 1. Then, in column 2 estimate the beginning and ending time for each activity in the form of a 'bar'. Where applicable, show dependency relationships with arrows. Finally, in column 3 indicate the actor responsible for each activity.)

(1) Project Activities	(2) Time Periods in Months 1 2 3 4 5 6 7 8 9 10	(3) Responsible Actor
1.		
2.		
3.		
4.		
5.		
6.		
7.		

E. Risk Mitigation Plan

(What are 2 to 3 key risks that you foresee in implementing the project, and how do you suggest they be mitigated?)

Potential Risks	Suggested Mitigation Actions
1.	-
2.	-
3.	-

F. Initial Budget Estimate

(What types of resources– personnel costs, equipment, software, etc.– will be required to complete the project and how much do you estimate this will cost?)

Type of Resources	Amounts	Estimated Costs
1.		$
2.		$
etc.		
	Total Estimate:	$

Safety Assurance Project

6.2.2.1 Access To SAFER System

Project Title: ACCESS TO SAFER SYSTEM
Project Description: Provide access to SAFER via penbased, laptop, and desktop computers in all offices and locations where motor carrier safety data are needed to make credentialing or permitting decisions or Inspection selection decisions.
Goals & Objectives: • Improve highway safety by identifying and eliminating carriers not complying with established safety regulations (SA1) • Increase and improve ability to identify non-complying carriers and / or divers. (SA3, ES 1 & 2)
Desired Outcome: • Assist carriers in correcting weaknesses within their own operations • Eliminate the need for "good" carriers to stop at inspection sites except for random selection • Encourage Carriers and Insurance companies to utilize the system to monitor status.
Project Location • Port of entry sites • Point of stop inspections • UDOT / MCS.
Technical Approach: 1. Purchase laptop computers capable of running Cellular Digital Packet Data (CDPD) Technology. 2. Subscribe to SAFER for each projected location 3. Purchase CDPD software and build out the CDPD server infrastructure to accommodate Roadside inspectors and inspectors at POEs 4. Train officers / agents in use of SAFER 5. Locate SAFER on same PC as POE system & integrate interface.
Organization & Management: • Lead Agency– UDOT Motor Carrier Safety • Supporting agencies– UDOT Port of Entry Division, DPS / UHP, USTC.
Funding Approach • MCSAP & special Federal funding • Implementation money required– approximately $100,000 for computers w / CDPD • Approximately $50,000 per year to maintain operability.
Key Issues/Concerns: None identified at present.
Schedule and Milestones: • Obtain funding • Procure Hardware • Install software

• Train inspectors / agents • 6 months after implementation, evaluate problem areas.
Funding Approach • MCSAP & special Federal funding • Implementation money required– approximately $100,000 for computers w / CDPD • Approximately $50,000 per year to maintain operability.
Key Issues/Concerns: None identified at present.

FHWA Federal-Aid ITS Procurement Regulations and Contracting Options

FHWA-RD-97-145   OCTOBER 1997

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FHWA contract no. DTFH61-94-c-00207

Prepared for:

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U.S. Department of Transportation
400 Seventh Street
Washington, D.C. 20590

U.S. Department of Transportation

Federal Highway Administration

Copies of this report will be available from the National Technical Information Service.   5285 Port Royal Road. Springfield. VA 22161 or at: http://www/tfhrc.gov/qkref/gene/title.htm.

Table of Contents

6. CONCLUSION

- Appendix A— Listing of FHWA and Private Industry Participants
- Appendix B— The FHWA Approval Process Under SEP-14
- Glossary
- References

1. INTRODUCTION

This report, sponsored by the Federal Highway Administration (FHWA), has been developed to assist State and local transportation agencies understand the contracting techniques [1] available for design and construction of Intelligent Transportation Systems (ITS) projects. The report will inform State and local transportation agencies about the contracting practices that are permissible within the FHWA Federal-aid regulations. It highlights the benefits , drawbacks, FHWA approval requirements, examples, and lessons learned associated with each contracting technique. Additionally, the report is intended to serve as a guide—referencing various sources of information pertaining to procurement issues. This report does not address potential procurement issues that may be applicable to a specific State or local agency's procurement legislation, regulations, or practices. These issues may vary significantly from one agency to another. They need to be addressed by each agency in assessing the contracting technique or approach most appropriate for designing and constructing a particular ITS project. Additionally, other ITS deployment issues, including innovative financing and partnerships, have been addressed by other recent work and are therefore not included in this report. The report is organized into five sections and two appendices:

Section 1 describes the study purpose, audience, and scope.

Section 2 highlights the procurement issues associated with deploying ITS projects.

Section 3 identifies the Federal-aid procurement regulations applicable to ITS projects.

Section 4 describes possible Federal-aid contracting options and associated benefits, drawbacks, and FHWA approval requirements.

Section 5 highlights some examples and lessons learned associated with each contracting option.

Section 6 is the report's conclusion and presents some closing thoughts.

Appendix A lists the team members from the FHWA and private industry that participated in the development of this report.

Appendix B documents the FHWA approval process for innovative contracting techniques.

The report also includes a glossary and a listing of references.

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[1] The term "contracting technique" describes the particular approach used to procure the services of an engineering consulting firm and/or contractor to design and/or construct and ITS project. It defines the method of award and the roles and responsibilities of project participants.

2. BACKGROUND

Intelligent Transportation Systems consist of a group of advanced technologies and systems that collectively offer the opportunity to address such surface transportation issues as safety, efficiency, congestion, mobility, and quality of life. These technologies and systems encompass 6 functional areas and 30 user services, which are presently at various stages of development and deployment. The functional areas include advanced traffic management systems, advanced traveler information systems, advanced vehicle control systems, commercial vehicle operations, advanced public transportation systems, and advanced rural transportation systems. The user services are grouped into seven "bundles" including travel and transportation management, travel demand management, public transportation operations, electronic payment, commercial vehicle operations, emergency management, and advanced vehicle control and safety systems.

ITS systems are complex, versatile, and diverse. They often leverage the latest in telecommunications, computers, software, sensing, and electronics technologies to effectively meet the management needs of surface transportation systems. They are often designed to incorporate one or more of the user service areas and technologies and are deployed either incrementally or all at once. These technologies can be included in tailored or standalone projects, legacy system expansion projects, or deployed as part of traditional roadway construction projects.

Procurement of ITS projects with Federal highway funds presents unique challenges to State and local agencies. These agencies must choose appropriate contracting techniques that optimize project quality and cost while meeting applicable Federal, State, and local procurement regulations. The challenges are especially paramount when procuring ITS projects that involve advanced technologies which require specialized skills and knowledge. Even deployment of simple ITS system expansions have become complex undertakings to ensure consistency with National ITS Architecture and evolving standards. Typically, the requirements of ITS projects cannot easily be specified at the outset of the project—resulting in the difficulty of establishing realistic low bids and ensuring end-product quality. The difficulty in deploying ITS projects frequently stems from adding unfamiliar and rapidly evolving technologies with elements more familiar to transportation agencies such as excavation, concrete, conduit, and structures. These familiar elements often represent the majority of the costs for a project and lead to the selection of a traditional contracting technique—with the assumption that the unfamiliar components can somehow be handled by the contractor. This can be a costly error, which typically does not become obvious until it is much too late to correct the problem. Mixing sophisticated technologies with traditional construction projects must be done with care and effective planning and only when the required ITS products, systems, and services can be clearly specified at the outset of the project (available off-the-shelf). This is especially true if the traditional contracting technique of design-bid-build is the procurement vehicle.

Design-bid-build is the contracting technique that has historically been used by transportation agencies. The technique uses two independent but sequential contracts to design and construct the project. This technique may not be best suited for ITS projects that involve advanced technologies, software engineering and development, and computer based integrated systems. This can be attributed to the fact that the demarcation line between design and construction phases of ITS projects may not be easily established as is typically the case in the traditional roadway construction projects. The result may be difficulties in finding a single vendor with the expertise and resources to perform all required services at a fixed price.

There are various contracting techniques, features, and provisions allowed within the Federal-aid regulations that can effectively serve the procurement needs of transportation agencies. These contracting options, their applicability to ITS projects, and resulting FHWA approval requirements are the focus of this report.

3. FEDERAL-AID PROCUREMENT REGULATIONS AND CONTRACTING OPTIONS

Title 23 CFR Part 655 includes policies and procedures specifically applicable to Federal-aid requirements of traffic surveillance and control system projects. It defines a traffic surveillance and control system as "an array of human, institutional, hardware and software components designed to monitor and control traffic, and to manage transportation on streets and highways and thereby improve transportation performance, safety, and fuel efficiency." It highlights that these systems may have various degrees of sophistication and provides some examples of qualifying systems. These examples include "traffic signal control, freeway surveillance and control, highway advisory radio, reversible lane control, tunnel and bridge control, adverse weather advisory, remote control of movable bridges, and priority lane control." It further points out that considerable flexibility is provided by Federal-aid laws, regulations, policies, and procedures to accommodate the special procurement needs of these systems.

The definition, examples, and objectives of traffic surveillance and control systems are very consistent with the ITS systems and national goals of the ITS program. The regulations require projects containing these systems to be based on a traffic engineering analysis commensurate in scale with the project scope. The traffic engineering analysis should include the following basic elements:

Preliminary analysis

Alternative systems analysis

Procurement and system start-up analysis

Special features analysis

Analysis of laws and ordinances

Implementation plan.

The implementation plan consists of needed legislation, system design, procurement methods, construction management procedures including acceptance testing, system start-up plan, operation and maintenance plan, institutional arrangements, dedication of needed personnel, and budget resources required for the proposed system.

State or local agencies can directly perform highway construction work, when an emergency exists, following "force account" procedures prescribed in Title 23 CFR Part 635.203. These procedures apply to construction of highway projects financed by Federal funds with labor, equipment, materials, and supplies furnished by the agency and used under its direct control. The agency must submit an approval request and a "finding of cost effectiveness" to the FHWA Division Administrator, "identifying and describing the project, the kinds of work to be performed, the method to be used, the estimated costs, the estimated Federal funds to be provided, and the reason or reasons that an emergency exists."

3.2 Engineering and Design Services Contracts

Title 23, USC, Section 112(b)(2) states that "engineering and design services" contracts shall be awarded in the same manner as contracts for architectural and engineering services are negotiated under title IX of the Federal Property and Administrative Services Act of 1949 or equivalent State qualifications-based requirements. These requirements are commonly referred to as the "Brooks Act" and are codified in Title 40, USC, Sections 541-544.

Title 23 CFR Part 172 defines "engineering and design services" as program management, construction management, feasibility studies, preliminary engineering, design, engineering, surveying, mapping, or architectural related services. A consulting firm may be retained to provide these services as the agency designs a project prior to construction. The deliverables typically include such documents as a system feasibility analysis; functional definition; preliminary or final designs; and plans, specifications, and estimates (PS&E). These contract documents are subsequently used in bid invitation, evaluation, and award to construct the project. The engineering and design services are further detailed by the Brooks Act's definition of architectural and engineering services:

Professional services of an architectural or engineering nature, as defined by State law, if applicable, which are required to be performed or approved by a person licensed, registered, or certified to provide such services.

Professional services of an architectural or engineering nature performed by contract that are associated with research, planning, development, design, construction, alteration, or repair of real property.

Such other professional services of an architectural or engineering nature, or incidental services, which members of the architectural and engineering professions may logically or justifiably perform, including studies, investigations, surveying and mapping, tests, evaluations, consultations, comprehensive planning, program management, conceptual designs, plans and specifications, value engineering, construction phase services, soils engineering, drawing reviews, preparation of operating and maintenance manuals, and other related services.

Many of ITS professional services such as software engineering, software development, systems engineering, system integration, system testing, etc., may be considered as developmental or incidental services depending on the scope of work of the project. These services are typically defined as performing an identifiable task rather than furnishing end items of supply (goods). These services meet the definition of engineering and design services.

Title 23 CFR Part 172 specifies three methods of award for engineering and design services contracts:

Competitive negotiations following qualification-based selection procedures or another selection procedure codified in State statutes, as long as it follows an equitable selection process.

Small purchase procedures to procure engineering and design related services when the contract cost is $100,000 or less. These typically follow State or local agency established procedures.

Noncompetitive negotiations where contract award for engineering and design services is not feasible under competitive negotiations or small purchase procedures. The transportation agency is required to submit justification and receive FHWA approval before using this contract award method. Qualifying circumstances include emergency conditions limiting the needed time to conduct competitive negotiations, service availability from only one source, and inadequate competition after unsuccessful solicitation from a number of sources. For example, system expansion of an existing legacy system may require software development that may be more cost-effective to sole-source.

3.3 Non-Engineering/Non-Architectural Contracts

Title 49 CFR Part 18 "establishes uniform administrative rules for Federal grants and cooperative agreements and subawards to State, local, and Indian tribal governments." It pertains to contracts that are neither engineering nor architectural, and contracts that do not meet the definition of construction in 23 USC 101. These contracts typically apply to procuring real property, equipment, supplies, goods, non-engineering non-architectural/services, and research and planning projects including ITS field operational tests and ITS early deployment planning studies. The transportation agencies may procure these contracts using State procurement procedures in accordance with 49 CFR 18.

3.4 Innovative Contracts

FHWA established SEP-14 in 1990 to allow States to evaluate certain innovative contracting techniques that have the potential to reduce life cycle costs and maintain product quality. There were four original innovative contracting practices under SEP-14. These included cost-plus-time bidding, lane-rental, warranty, and design-build. Except for design-build, the remaining three practices were subsequently approved by FHWA as "non-experimental" after several years of evaluation and now only require approval from the FHWA Division Administrator.

The basis for SEP-14 is Title 23 United States Code, Section 307, which authorizes the Secretary of Transportation to conduct research or experiment on all phases of highway construction. The Office of Chief Counsel of FHWA, in April 1991, reviewed the design-build concept for compatibility with current Federal laws and regulations. The Office of Chief Counsel concluded that Federal-aid funds may participate in design-build contracts when awarded using competitive bidding procedures and subject to FHWA approval under SEP-14.

Concept approval from the FHWA Headquarters is necessary for "experimental" types of SEP-14 contracting practices including:

Construction projects that utilize other factors in addition to price in the award process (e.g., life cycle cost)

Projects that incorporate both design and construction services in one contract.

Innovative contracting practices are not limited to those presented in this report. Consistent with the experimental basis of SEP-14, the FHWA encourages the submission of other promising concepts or practices that meet SEP-14 objectives.

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[2] Except for the Cost Principles in FAR Part 31, which applies to contracts with commercial organizations as set forth in 49 CFR 18.22.

[3] Except for special cases involving sole source purchases that require justification and FHWA approval.

3.1 Traditional Construction Contracts

Title 23, United States Code (USC), Section 112 and Title 23 CFR 635 require a transportation agency to award construction projects based on a free, open, and competitive bidding process unless the agency can demonstrate that some other technique is more cost effective or that an emergency exists. Title 23, USC, Section 112(b)(1) states that contracts for construction projects shall be awarded only on the basis of the lowest responsive bid submitted by a bidder who meets the established criteria of responsibility. The term responsive indicates that the submitted bid meets the requirements of the advertised proposal or request for proposal. The term responsible refers to the ability of the contractor to perform the work. Title 23 CFR 635.10 specifies that this ability can be determined prior to the receipt of bids through a prequalification process. This prequalification process is described in Section 4.2.1.

Title 23, USC, Section 101 defines the term "construction" as (bold text added for emphasis): *"…the supervising, inspecting, actual building, and all expenses incidental to the construction or reconstruction of a highway, including bond costs and other costs relating to the issuance in accordance with section 122 of bonds or other debt financing instruments, locating, surveying, and mapping (including the establishment of temporary and permanent geodetic markers in accordance with specifications of the National Oceanic and Atmospheric Administration in the Department of Commerce) resurfacing, restoration, and rehabilitation, acquisition of rights of way, relocation assistance, elimination of hazards of railway grade crossings, elimination of roadside obstacles, acquisition of replacement housing sites, acquisition and rehabilitation, relocation, and construction of replacement housing, and improvements which directly facilitate and control traffic flow, such as grade separation of intersections, widening of lanes, channelization of traffic, traffic control systems, and passenger loading and unloading areas. The term also includes capital improvements which directly facilitate an effective vehicle weight enforcement program, such as scales (fixed and portable), scale pits, scale installation, and scale houses and also includes costs incurred by the State in performing Federal-aid project related audits which directly benefit the Federal-aid highway program."*

This definition of "construction" is necessary to evaluate the various components of ITS projects. Projects meeting this definition must be awarded to the lowest responsive and responsible bidder. This allows agencies to optimally group project elements into one or more projects for subsequent design and construction using the most appropriate contracting techniques. This requires a thorough understanding of the proposed components, skills, and experience required to design and construct the project; the agency's capabilities; and the project's implementation schedule.

For example, contractor installation of field devices and hardware typically meets the definition of construction, whereas such services as software development, system integration, and system engineering and design do not meet the definition of construction. It is recommended that State and local agencies consult with the FHWA Division and Region offices when attempting to choose appropriate contracting techniques for their planned ITS projects.

Attempts have been made to classify various components of ITS projects by the application of the term construction as defined in Title 23 USC Section 101. The results are presented in Table 1.

Table 1. Project Component Classification

Direct Federal procurements for goods and services are performed under the rules of the Federal Acquisitions Regulations (FAR). Research projects funded by the Federal government are generally procured under the rules of FAR and the U. S. Department of Transportation's (DOT) supplemental regulations, since these research activities are undertaken to meet the needs of the Federal government. These regulations do not apply to ITS projects funded by the Federal-aid highway funds [2] and procured by State and local agencies.

The Federal-aid procurement regulations as set forth in the Code of Federal Regulations (CFR) Title 23 Parts 172, 635, and 655 and Title 49 CFR Part 18 define the requirements that State and local agencies must adhere to when procuring projects with the Federal-aid highway funds. These procurement regulations identify possible contracting options available for designing and constructing projects including such contracts as "engineering and design related services," "construction," and "non-engineering/non-architectural."

The regulations require State and local agencies to award:

Construction contracts on the basis of competitive bidding

Engineering and design services contracts on the basis of qualifications-based selection, followed by competitive negotiations

Non-engineering/non-architectural contracts using State-approved procurement procedures in accordance with 49 CFR 18.

The regulations also require use of competitive contract award procedures for any project financed by Federal highway funds. Under regular Federal-aid procedures, negotiated procurement without the element of competition [3], or contract award on the basis of "other than low bid," is not permitted.

There are also a number of nontraditional contracting techniques and optional contracting provisions that can be used on Federal-aid projects. These are characterized as innovative practices, which were evaluated by the States under FHWA's Special Experimental Project No. 14 - Innovative Contracting Practices (SEP-14). SEP-14 enables transportation agencies to implement and evaluate innovative contracting practices that maintain the advantages of competition while adding project quality and timeliness to the procurement process.

The scope of this report is limited to the Federal-aid procurement regulations. It is not intended to address potential procurement issues that are particular to a specific State or local agency's procurement legislation, regulations, or practices. As a result, it is important to point out that the regulations of some State and local agencies may be more restrictive than the Federal-aid regulations. State and local agencies should consider their respective statutory requirements and pertinent case law in determining the legal feasibility of utilizing a particular contracting technique, feature, or provision. The following sections describe the FHWA Federal-aid regulations that are applicable to traditional construction, engineering and design services, non-engineering/non-architectural, and innovative contracts. Figure 1 maps various types of contracting techniques, features and optional contracting provisions that are possible under the FHWA Federal-aid procurement regulations.

Figure 1. FHWA Federal-Aid Procurement Regulations and Contracting Options

Classification	Component
Improvements that typically meet the definition of construction	Physical installation of field hardware and devices for freeway management and traffic signal systems including changeable message signs, ramp meters, new traffic signals, new controller cabinets, lane use control signs, and vehicle detectors. Installation of towers to support wireless communication, direct-bury conduit and hardwire interconnect between signals and field devices or systems. Installation of field hardware and devices to provide detection and verification capabilities.
Improvements that individually may not meet the definition of construction	Procurement of portable message signs, field device and communication system interfaces, operating system software development, and computer hardware. Communication devices which are wireless or require only limited installation in concept. Coordination and pre-planned incident management activities such as service patrol, route diversion, *911 systems, computer aided dispatch systems, radio systems and special events coordination.

Source: Federal Highway Administration, Memorandum - Procurement Information for ITS projects, May 1997.

4. CONTRACTING OPTION AND FHWA APPROVAL

The selection of appropriate contracting options for designing and constructing an ITS project depends on many variables. These variables include:

Type and complexity of the required products, systems, and services

Interdependence of project components and subsystems

Inclusion of ITS systems components with roadway construction projects

Use of varied and rapidly changing advanced technologies

Need to prequalify consultants and/or contractors

Constrained deployment schedule

Magnitude of construction impacts on road users

Risk management factors associated with capital investments in transportation systems.

As previously stated, the definitions of "construction," "engineering and design services," and "non-engineering/non-architectural" form the framework for determining how to procure an ITS project. Component interrelationships and system integration requirements must be considered in effectively grouping project elements into one or more component projects that individually meet these definitions. These component projects are procured using the most appropriate contracting options that will optimize project quality, deployment schedule, and cost.

Logical and creative grouping of project elements into one or more component projects and selecting appropriate contracting options are critical for achieving success in procuring ITS projects. For example, an advanced traffic management system project may involve such elements as:

Products. Vehicle detectors, CCTV cameras, lane control signals, dynamic message signs, communication medium and devices, traffic management building, conduit, pull boxes, foundations, structures, poles, hardware, computers, software, and traffic controllers

Systems. Incident detection, verification, and response systems; emergency dispatch systems; freeway management system and associated metered ramps; and legacy arterial traffic signal systems

Services. Architectural, surveying, mapping, engineering, design, construction, construction management, software development, system testing , and system integration.

These elements may be grouped in many different ways. Each product or system can be designed and constructed independent of the others. Many of the physical installations may be designed and constructed using the design-bid-build technique. If system integration is a critical component of the project (e.g., new systems encompassing significant interface requirements to other systems, software development, and computer hardware), a systems manager may be retained to represent the public agency's interests in design of the system as a whole. This will ensure seamless integration of system components, while allowing project deployment by other contractors under the auspices of the transportation agency. However, the design-build technique may be an appropriate procurement vehicle if the implementation schedule is significantly constrained and/or the project is very complex. The key element in this discussion is the need to maintain a flexible approach in choosing the most effective procurement technique for ITS projects.

Additionally, it is important to point out that the need to provide quality and competent project administration, management, and inspection on the part of the transportation agency remains paramount regardless of the choice of contracting option.

The following sections present possible contracting options that can be used to design and construct an ITS project. The contracting techniques that use separate contracts for "engineering and design services" and "construction" include design-bid-build and systems manager. The contracting technique that combines the "construction" and "engineering and design services" activities under one contract is design-build. The contracting feature that can be used to complement these contracting techniques by prequalifying consulting firms or contractors is the prequalification feature. Examples of optional contracting provisions that can be employed to augment the contracting techniques include cost-plus-time bidding, lane rental, and warranty.

4.1 Contracting Techniques

The following sections describe the characteristics, benefits, and drawbacks for each contracting technique. 4.1.1 Design-Bid-Build

Design-bid-build is a project delivery system in which a transportation agency utilizes the services of an engineering consulting firm (or in-house staff) to design a project (design step), invites contractors to submit bids (bid step), and subsequently constructs the project using the services of a contractor (build step). The technique utilizes two independent but sequential contracts - engineering and design services and construction.

The engineering and design services contract will result in the development of PS&Es for the project. The Federal-aid regulations require the engineering and design services contract to be awarded on the basis of qualification based selection, followed by competitive negotiations. The construction contract must be awarded to the responsive and responsible bidder with the lowest submitted bid.

The design-bid-build technique has historically been used by transportation agencies for designing and constructing construction projects. It is an effective procurement vehicle for ITS projects that meet the definition of construction. These projects typically incorporate physical installations of field hardware, devices, cables, foundations, pull boxes, conduit system, poles, or other definable physical components such as traffic management buildings.

However, the design-bid-build technique may not be best suited for ITS projects that contain rapidly-changing technologies, unknown factors and specifications, software, computer hardware, communications, and system integration. This is attributed to the fact that the special services required to ensure proper design and construction of these critical components cannot be easily demarcated between the design and construction phases of project deployment as is typically the case in traditional roadway construction projects. This may make design-bid-build a cumbersome and counterproductive procedure due to the difficulties associated with:

Establishing PS&E to procure an ITS project that can result in realistic low bids

Finding a single vendor with the expertise and resources to perform all required services to ensure seamless system integration, operation, and end-product quality.

The typical characteristics of ITS projects that are most suited for design-bid-build technique may include constructing the traffic management center building, well specified (off-the-shelf) ITS products and systems, proprietary components, system expansion based on detailed design and specifications of project components, and physical installation or construction.

Some of the potential benefits associated with this contracting technique include:

Competition

Well-known, traditional method for transportation agencies, designers, and contractors

Larger universe of potential bidders

Simple process

No requirements for justifying use of this technique.

Some of the potential drawbacks associated with this contracting technique include:

Less flexible in procuring advanced or rapidly changing technologies since system components, detailed integration requirements, and specifications may not be easily definable.

May involve contract administration challenges caused by dissimilar work between the prime contractor and subcontractors. This is especially true in projects involving entirely ITS components when non-highway prime contractors may not be familiar with the administration requirements of the agency.

May be difficult to prepare project estimates or establish life cycle costs for ITS projects involving unknown factors, complex systems, and rapidly changing technologies.

Highway consultants and contractors who are familiar with traditional construction projects may not have the experience and expertise to design and construct ITS projects.

4.1.2 Design-Build

Design-build is a project delivery system in which a single entity provides design services and constructs the project—all under one contract. Design-build may be effectively leveraged to overcome some of the challenges of the traditional contracting techniques when designing and constructing technologically complex ITS projects. As previously mentioned, these challenges include specifying detailed project requirements at the outset of the project, establishing realistic low bids, finding a single vendor capable of performing all required services at a fixed price, and minimizing deployment schedule. Design-build is a contracting technique that combines the procurement procedures employed with the traditional engineering and design services contracts with those used in the traditional construction contracts, and thus embodies characteristics of both. These procedures may include pre-qualification, competitive sealed bidding, and award criteria based on price and other factors.

The design-build contracting technique is best suited for:

Projects that can best be defined by functional or performance based specifications.

Projects that have the propensity to benefit significantly from innovative design and construction solutions.

Projects containing complex systems and subsystems that require major integration efforts and involve many unknown and indefinable factors and rapidly changing advanced technologies.

Projects that have deployment time constraints due to emergency, traffic safety, or road user impact/cost associated with prolonged deployment process

Project specifications and design criteria must be properly defined to obtain best results. For example, if the functional specifications are too detailed, the opportunity for contractor innovation may be lost. Conversely, if the functional specifications are too vague, the agency may be presented with a very different technical solution than it envisioned, or contractors may be encouraged to submit high cost proposals to provide for contingencies and risk management.

The design-build concept provides the contractor with maximum opportunity and flexibility for innovation in designing and constructing an ITS project and associated products, systems, and services. The transportation agency typically develops a Request for Proposal (RFP) document that includes a scope of work, detailed specifications, design criteria, and preliminary plans—which may be as much as 30 percent complete. These contract documents are used by prospective bidders to complete the design. The prospective bidders develop and submit proposals that include all work activities associated with designing and constructing the project. The proposals may be ranked by the transportation agency on such factors as design quality, timeliness, management capability and cost.

A single contract is awarded based on the specified award method to a design-build contractor who is responsible for detailed (100 percent) system engineering, design, and specifications; procurement and provision of all products, systems, and services; construction of all system elements; testing, inspection, and integration of the various subsystems; application of quality control measures; and final system deployment. The deployed system may be leased, operated, and maintained by the contractor for a specified period of time prior to turning it over to the transportation agency.

The decision to proceed with the design-build technique requires a certain amount of up front analysis and evaluation of applicable State and local procurement regulations. For example, new legislation may be necessary to change the requirements of State competitive bidding statutes to support design-build, even though it is experimentally allowed by FHWA under SEP-14. The absence of enabling legislation may preclude some agencies from using this technique.

The selection of the design-build technique requires the transportation agency to undertake several key actions including:

Developing an informed vision of the completed project including how it will be operated and maintained after the deployment phase is completed. This vision will affect control facility layouts, equipment selection, and the feasibility of the overall project in meeting the expectations of the agency.

Considering who will operate and maintain the system over its expected lifetime. A decision to use agency resources to operate and maintain the system may result in different equipment selections and system configurations than a system expected to be operated and maintained by outside subcontractors. The agency should consider these costs on a life-cycle basis and ensure that they are communicated clearly to the design team.

Examining the numerous issues related to the expected evolution of the system, which should be clarified before the system design is started. The geographical layout of system expansions, the expected frequency of equipment upgrades, and the availability of funding for future system enhancements may all drive the selection of equipment during design.

Design-build contract awards have typically been based on cost alone or based on cost and other factors that maintain the element of competition. There is no prescribed method for defining the award criteria other than cost being a factor. Some examples include:

Highest composite score based on weighted criteria for cost and quality factors

Adjusted bid score computed by dividing price by the qualification score

Best value-fixed budget where the available funds are advertised and best value designs are invited

Best value, price, and other factors

Lowest bidder who meets criteria.

Some of the potential benefits associated with this contracting technique include:

Provides maximum flexibility for innovation in the selection of design and construction techniques that are complementary and result in efficiencies from optimizing project development and deployment. Minimizes implementation timeline since construction activities can be initiated prior to finalizing all design details, thus allowing seamless transition from design to construction.

Results in project development and deployment consistency, continuity, and overall quality assurance throughout the project due to a single point of responsibility for design, construction, integration, testing, and start-up operation of the project.

Enables the contractor to optimize use of work force and equipment.

Shifts risks to the contractor for design related issues within the confinements of project budget.

Reduces the potential for contractor claims for design errors or construction delays due to redesign.

Some of the potential drawbacks associated with this contracting technique include:

Requires well defined and articulated functional or performance-based specifications. As a result, the agency and contractor must have operational and management experience with the type of system being deployed.

May place smaller construction and design companies at a competitive disadvantage since design-build projects may require large up front investment of time and funds for preparing detailed proposals without compensation.

Potential for misapplication or overuse of this technique due to the assumption that it may be "easier" than the traditional techniques.

Some transportation agencies' perception that they have less decision authority in design-build, which may preclude them from obtaining their desired system.

Use of design-build requires additional steps to attain FHWA approval.

Burdens the contractor with greater responsibility associated with greater flexibility for innovation.

May result in increased project cost.

May require the contractor to meet extended bonding, liability insurance or warranty provisions as the transportation agency strives to protect project quality and performance.

The typical highway design and highway construction firms may have difficulty bidding on design-build projects due to the requirement for overlapping skills and work experiences applicable to system design, integration, and construction.

May increase the potential for contract award protests.

Shifts greater risks to the contractor for unforeseen factors and project issues that should have been resolved prior to contract award (e.g., right-of-way).

4.1.3 Systems Manager

Also known as "system integrator-system manager" or "systems integrator," the systems manager technique is a project delivery strategy in which all project design and interface functions are performed by a consultant under engineering and design services contracts, and all construction activities are performed by various contractors under different construction contracts. The responsibilities of a systems manager overlap both design and construction phases of the project and typically include development of project sequencing and coordination of the various subsystems, design, preparation of PS&Es, inspection, testing, and integration of the various subsystems into a total operating system.

The transportation agency uses the PS&Es and issues multiple contracts to construct the various subsystems of the project following the typical process of bid invitation, review, and award. Examples may include construction of the traffic management center; construction of support structures; installation of computer hardware; installation of communications media and hubs; and installation of field devices including electronic devices, vehicle detectors, surveillance cameras, lane control signals, dynamic message signs, and controllers. The agency maintains direct management, administration, and control authority over the contractors and may use its own procurement processes to acquire individual products and systems or require the contractors to provide and install them. Additionally, the agency may choose design-build as the contracting option to design and construct appropriate subsystems based on 30 percent complete designs developed by the systems manager.

The role and responsibilities of the systems manager are frequently defined, on a task order basis, under negotiated cost-plus-fixed-fee contracts. These contracts may be entitled as "systems manager," "systems integrator," or "systems integrator-systems manager" reflecting the consultant's limited or expanded role in project deployment applicable to system integration work. The role and responsibilities may include:

Systems engineering, integration, and testing throughout all phases of the project including construction

Hardware configuration analysis and design including system architecture, interfaces, communications, equipment, devices, and computers

Preparation of PS&Es

Development of proper sequencing and coordination of the various subsystems

Construction engineering and inspection

Software design and development

Technical support during project procurement and management phases

Procurement support for all equipment and devices including software-dependent hardware

Acceptance testing and configuration of all devices, equipment, and hardware installed by contractors

Timing plans development

Training

Documentation.

Although normally not permitted in engineering and design services contracts, the systems manager may procure and provide specific equipment needed for system design and development (e.g., control center computer). This may be permitted as long as the equipment cost is not a controlling factor of the contract and the engineering and design services constitute the majority of the work. However, it is recommended that agencies procure separately as much of the equipment as possible through their own equipment contracts or through a low-bid product procurement process.

The services of the systems manager are governed by the engineering and design services contracts as established between the agency and consultant. They are procured on the basis of qualifications-based selection, followed by competitive negotiations or alternate procedures for consultant selection (if codified in State statutes). The systems manager technique incorporates characteristics of both design-bid-build and design-build techniques. It deploys the project using the separate services of "engineering and design" and "construction" while leveraging the advantages of having a single point of authority for system *design and integration*, without foregoing the control and management authority of the agency.

Care should be exercised in differentiating between a systems manager and a *project manager*. A systems manager provides design and integration functions and technical assistance to the agency with no direct management and control authority over the contractors. However, a project manager is typically the project administrator and construction manager of the project with direct management and control authority on behalf of the agency and without any responsibility for design functions. State and local agencies may retain the services of a project manager to work on their behalf only if the agency lacks professional skilled staff. Title 23 CFR 172.5 requires that the transportation agency obtain FHWA approval before retaining the services of a project manager to act in a direct management role for the agency. It further limits its use for unique and unusual circumstances and requires adequate justification.

The typical characteristics of ITS projects that are most suited for systems manager technique include:

Projects that involve complex electronic systems and subsystems, communications, software, and computer hardware and require system integration, functionality, and compatibility. These projects typically contain rapidly-changing advanced technologies that can best be defined by functional or performance-based specifications.

Projects containing integration of legacy systems or support system expansion.

Projects constrained by time pressure due to emergency, safety, and road user impacts.

The benefits associated with this contracting technique include:

Provides expertise or augment staff resources that the agency may lack.

Single point of authority and accountability for system design, software development, and system integration activities that could enhance the potential for seamless system integration, design continuity, and cost-effectiveness.

May reduce implementation timeframe by allowing the designed project components or sub-projects to be deployed prior to 100 percent design completion.

Reduces the likelihood for design related contractor claims.

Optimizes design, coordination, and integration efforts and use of advanced technologies pertaining to field devices, software, and computer hardware.

Offers the agency more flexibility compared to the design-build technique due to negotiated engineering agreement, which allows joint determination of the scope of work, duties and responsibilities, costs, and system requirements.

Allows the transportation agency to maintain authority for project control and management.

Better identifies sources and causes of system incompatibility issues that are the basis for change order process.

The drawbacks associated with this contracting technique include:

May result in increased project cost.

Systems manager may not have control of construction contracts.

Potential perception by consulting firms that engineering and design work opportunities are not distributed uniformly. Traditional systems managers may be relatively unfamiliar with transportation projects. Potential for design errors and omissions without quality project oversight and management by the transportation agency. Change orders for design errors and omissions require special attention if the systems manager inspects its own design.

4.2 Prequalification feature and optional provisions

State and local agencies may prequalify the prospective contractors or consultants by use of a prequalification feature. This feature can be used to complement each possible contracting technique. There are also several optional contracting provisions that have historically been used in non-ITS construction projects, which can be applied to ITS projects if appropriate. These provisions include cost-plus-time bidding, lane rental, and warranty.

The following sections describe the characteristics of the prequalification feature and optional contracting provisions.

4.2.1 Prequalification Feature

The feature is used to prequalify contractors or consultants and can be used to complement each contracting technique. It limits further consideration to only prequalified firms and awards the contract based on procedures specified for the selected contracting technique. The objective of the prequalification feature is to remove those firms from the bid process that may not possess the required skills, familiarity, and experience level to design or construct an ITS project that uses advanced technologies and complex systems.

ITS projects that incorporate highly technical and dissimilar work involving complex systems and subsystems require special skills and experience. These projects may significantly benefit from the use of the prequalification feature. Roadway construction or reconstruction projects that include ITS products and systems, for example, may be good candidates for use of this feature to prequalify the contractor or subcontractors responsible for deploying the ITS components within the project. These firms may attempt to participate in construction projects that contain advanced technologies without a clear understanding of the project specifications or potential risks. For example, the prime contractor of a traditional construction project may inadvertently select unqualified subcontractors to deploy ITS components, especially if these components comprise a small portion of the total project.

Generally, contractor prequalification may be based on work experience, personnel, equipment, financial resources, and performance history. For consulting firms, the prequalification may be based on technical experience, ability to perform the work, staff capability, approach to performing project requirements, and level of effort estimates on tasks including software development.

The benefits associated with this feature include:

Enhances potential for quality product

Increases the likelihood of selecting a qualified contractor while using competitive bidding process especially for technical and complex projects

Can prequalify prime and subcontractors

Requires agency to identify specific skills and experience desired from firms and/or individuals to complete specific tasks, develop, or deploy the project

Optimizes proposal review process.

The drawbacks associated with this feature include:

Technical prequalification may be based on the largest component of the project, thus failing to incorporate subcontractors who may be performing the complex work pertaining to ITS products and systems

Adds an extra step in the selection process causing more expense and time

May result in increased cost for proposal preparations

May result in increased appeals and protests if the prequalification criteria is ambiguous

Requires investment of time and resources by the agency to develop appropriate and effective prequalification criteria.

4.2.2 'nbsp;Optional Contracting Provisions

There are several optional contracting provisions that are no longer considered experimental under SEP-14. There provisions have historically been used in construction projects but may be used in ITS projects if applicable. These provisions include cost-plus-time bidding, lane rental, and warranty.

4.2.2.1 Cost-Plus-Time Bidding

This contracting provision, commonly referred to as the A+B method, is used to encourage contractors to complete a project on schedule or earlier. It uses a contract award process that is based on determining the lowest adjusted bid using the following formula:

Lowest Adjusted Bid = (A) + (B x Road User Cost/Day)

Each submitted bid must include the bidder's cost to deploy the project (the "A" component) and estimated time in calendar days to complete the project (the "B" component). The road user cost is established and published by the transportation agency and represents the cost per day of construction. The formula is only used to award the project to the lowest adjusted bidder. It is not used to determine payment to the contractor.

The assessed road user cost is incorporated into the contract as a disincentive to discourage the contractor from overrunning the time specified in the bid document. The contractor is typically assessed a fee based on the road user cost for each day construction completion exceeds the "B" component. Incentive provisions should also be included to reward the contractor for completing the project earlier than specified.

Cost-plus-time bidding may be applicable to construction projects that could have a significant impact on road users. It is used to minimize deployment time of the project. It has been used by many States in roadway construction projects with generally good results in reducing contract times without diminishing project quality. It can be leveraged for application in ITS projects as well.

4.2.2.2 Lane-Rental

Lane-rental contracting provisions are used to minimize construction impacts on road users by discouraging contractors from obstructing traffic lanes or ramps, especially during peak travel periods. The provisions use an assessed fee for lane or ramp closures (rental) based on an estimated value of road user cost (delay or inconvenience). The fee structure may vary by time of day and may depend on the number and type of lanes closed. It is typically stated in the bid documents as cost per lane per time period and is subtracted from monthly progress payments. Contract award is based solely on low bid.

The lane-rental provisions have been used in roadway construction projects by many States including Colorado, Indiana, Maine, Oregon, and Washington—with positive results. They can be leveraged to benefit ITS projects that interfere with traffic flow during installation of field devices and associated structures. Examples include vehicle loops embedded in the pavement and field devices and support structures for lane control signals, dynamic message signs, surveillance cameras, machine-vision or other sensing vehicle detection systems.

4.2.2.3 Warranty

Warranty provisions, as referenced in 23 CFR Part 635.413, are used to protect capital investments in the transportation systems and can be leveraged for application in ITS projects. These provisions are used by transportation agencies to require the prime contractor to guarantee workmanship or materials for a limited time period. It is separate from the typical manufacturer's warranty provided with equipment acquisitions. On National Highway System (NHS) projects, a warranty provision must be approved by the FHWA Division Administrator. On non-NHS projects, the State may use warranty provisions in accordance with its own procedures.

Warranty provisions should not be used for routine maintenance items. They should only be applied to items considered to be within the control of the contractor with the coverage period long enough to allow defects in materials and workmanship to become evident. Ordinary wear and tear, damage caused by others, and routine maintenance should remain the responsibility of the transportation agency.

4.3 FHWA Approval Process

FHWA Division Offices have approval authority for construction, engineering and design services, and non-engineering/non-architectural projects. The level of FHWA review and oversight for any given project depends on the stewardship agreement that exists between the

FHWA Division Office and the State transportation agency.

The design-bid-build technique is governed by the Federal-aid regulations for "engineering and design services" and "construction" contracts since it incorporates both contracts sequentially to design and construct ITS projects. Projects incorporating these contracts require approval by the FHWA Division Administrator. Approval is typically issued at the time of preliminary engineering authorization or construction authorization as appropriate.

The implementation plan for traffic control and surveillance systems must be approved by the FHWA Division Administrator prior to authorization of funds for construction, or prior to retaining a consultant to prepare the implementation document. Projects containing traffic surveillance and control systems that cost more than $1,000,000 require review by the FHWA Regional Administrator. These projects are subject to review prior to PS&E approval (23 CFR § 655.411).

The design-build technique and optional contracting provisions of cost-plus-time bidding, lane-rental, and warranty require approval by FHWA:

Projects that use the design-build technique or other "experimental" innovative contracting techniques under SEP-14 should be submitted to the FHWA Headquarters through the FHWA Division and Region offices for concept approval at an early stage of project development process. The optional contracting provisions are approved as part of the regular project approval process in each State. These provisions are approved by the FHWA Division Administrator typically during the review and approval process of PS&E prior to authorizing the project for construction.

On National Highway System (NHS) projects, a warranty provision must be approved by the FHWA Division Administrator. On non-NHS projects, the State my use warranty provisions in accordance with its own procedures.

Appendix B details the FHWA approval process for innovative contracting practices under SEP-14.

The systems manager technique is governed by the Federal-aid regulations for engineering and design services contracts. Projects procured by this technique require approval by the FHWA Division Administrator. Approval is typically issued at the time of preliminary engineering authorization.

5. EXAMPLES AND LESSONS LEARNED

The Congestion Avoidance and Reduction for Autos and Trucks (CARAT) is the first ITS design-build-warrant project in the United States. Its scope covers the detailed design and construction ($13.7 million) of intelligent transportation infrastructure for 15.2 centerline miles of I-77 through the center of Charlotte, North Carolina. It includes a two year warranty (with the option to extend the warranty for an additional two years) for all products delivered under the contract. Technologies to be deployed include CCTV cameras, fiber optic communications, variable message signs, and multiple traffic detector types. A transportation management center is also included, along with the computer hardware and software to operate the system. The lead agency is the North Carolina Department of Transportation. The contractor was selected based on a "best value" evaluation, considering both cost and technical submissions from three teams which had been short listed based on qualifications. Prior to the selection, NCDOT had retained a consultant to develop functional specifications to various levels of detail for each of the major subsystems. The procurement also included multiple tiers of project options, which could be selected based upon available funding.

The Utah procurement laws were modified to authorize the use of the design-build contracting technique. Utah, in preparation for the 2002 Winter Olympics, is deploying two projects using design-build as the project delivery system:

The first project includes the design and construction of an interim area-wide freeway surveillance infrastructure in the Salt Lake City metropolitan area—at a cost of $1.5 million. The award is based on best value-fixed budget, where the prospective bidders are rated on specific criteria.

The Utah Department of Transportation (UDOT) is also deploying a design-build project to rebuild a 26 km section of I-15 at a cost of $1.59 billion. It is anticipated that the implementation schedule can be reduced by approximately 3 years. It involves replacement of more than 130 structures, reconstruction of 7 urban interchanges, reconstruction of 3 major junctions with other interstate routes, additional general purpose and high occupancy vehicle lanes in each direction, and construction of a region-wide ATMS. The design-build technique was selected by UDOT to optimize deployment schedule, design and construction quality, and project cost. Project award is on the basis of best value, considering price and other factors.

The deployment of the Atlanta ATMS project incorporated a variety of contracting options including prequalification feature, design-bid-build, and systems manager. Field devices and communications media were deployed in numerous component projects and procured through the design-bid-build technique. The systems manager technique was also used to retain the services of a engineering consultant to perform system engineering, testing, and integration including software design and development. Other services were procured under engineering and design services contracts.

5.2 Lessons learned

The following sections describe various lessons learned for each contracting option, which should be considered and applied by transportation agencies during the project planning process.

5.2.1 Design-Bid-Build

Some lessons learned from application of the design-bid-build option to ITS projects are:

An adversarial relationship between the agency and the contractor is not uncommon.

The agency may have limited opportunity for input to software design.

There will probably be many change orders and claims.

An effective value engineering program may allow this technique to generate innovation outside the boundaries of the initial design.

A detailed project schedule is necessary to determine project status and to create realistic expectations due to the mix of products and services delivered.

Defining meaningful pay item measures for software and systems integration may be difficult.

Without a sole-source procurement (or using a basic ordering agreement arrangement), it may be difficult to assure that the same equipment is installed in successive phases of a project. Even though standards may assure interoperability, the agency may still have to maintain separate tools, test equipment, spares, training, and documentation for each brand of equipment owned and installed.

5.2.2 Design-Build

Some lessons learned from application of the design-build option to ITS projects are:

The agency needs to have well developed functional or performance based specifications. Lacking direct experience, the agency may need the services of a qualified consultant to develop these specifications.

The agency will need to develop or modify its administrative processes; those created for other procurement types may not work well. The processes may continue to evolve as the project progresses through its stages.

The price may be higher than expected in order for the contractors to recover high proposal costs and to pay for the professional services content.

The agency will need the technical expertise and time to interact extensively with the contractor during procurement, design, and implementation.

If the functional specifications are detailed and "tight," the opportunity for contractor innovation will be lost, and much of the benefit of design/build with it. If the functional specifications are vague and "loose," the agency may be presented with a very different technical solution than it envisioned. It may also cause vendors to submit cost proposals that are significantly larger than required in order to cover contingencies and risk management.

It is necessary to pre-qualify and short-list design-build teams since the proposal process will be expensive and time consuming to both the agency and the contractor teams.

The definition of "best value," used in awarding the contract, should reflect the priorities of the agency as applied to the project.

State departments of transportation report that the contractor team will work more closely as a "team" than is typically experienced in the traditional prime/sub relationship.

Payment terms need to consider the variety of items (equipment, installation, design documents, software, systems integration, building) that will be delivered under the contract. Some of these are challenging to measure to determine payment appropriate to the level of progress achieved.

5.2.3 Systems Manager

Some lessons learned from application of systems manager option to ITS projects are:

The agency should exercise great restraint to keep the cost from increasing beyond expectations, due to the temptation to have the latest in technology.

The systems manager should have experience in all components of the project life cycle (including design, construction, inspection, integration) in order to identify and resolve problems in a timely manner.

Assembling and evaluating selection criteria for the systems manager may be difficult if these tasks are unfamiliar to the agency and its typical consultants.

It may be challenging to determine the causes (designer, contractor, software provider, integrator) for problems in getting the system operational.

Separating software design/development and systems integration reduces the benefit of this approach.

Multiple deployments of field equipment can be undertaken simultaneously (using design-bid-build), with a single responsible systems manager speeding total deployment.

It may be useful to have access to a qualified independent technical opinion since the systems manager has such extensive importance to the project's success.

The systems manager must understand the agency's procurement processes in detail.

The agency may need to develop or adapt its administrative processes to make the systems manager process work effectively.

The project is likely to take longer than expected due to the serial nature of activities (integration cannot be finalized until the construction work has been completed and accepted).

The systems manager should be extensively involved in defining installation acceptance criteria and in verifying that the criteria have been met.

There is a great benefit to bringing the systems manager under contract as early as possible so that they can influence and be involved in decision-making during the design.

The systems manager should have experience managing large teams of diverse talents, in order to effectively oversee the work of the contractor(s) performing the deployment.

An agency involved in its first systems manager selection should have professional assistance to ensure agency procures a quality service provider.

5.2.4 Prequalification Feature

Some lessons learned from application of the prequalification feature to ITS projects are:

The overall project cost will increase if firms are required to use pre-specified vendors.

There may be significant variations in the quality and detail of qualification requirements and submitted proposal documents.

The prequalification criteria should correlate with the most critical features or services required in the project.

Both key personnel (committed to the project) and corporate experience are relevant prequalification issues that should be addressed to ensure that the agency receives the necessary skills and experience required on the team. Even prequalification does not ensure that adequate quantities of qualified resources will be applied to the project when needed.

Prequalifying team members should be complemented with procedures that ensure effective interaction between the agency and the lower-tier subcontractors according to the criticality of their service.

The prequalification feature will still not control which type of firm is the prime contractor, so it is possible that the prime will not be experienced with the most critical parts of the project.

6. CONCLUSION

The primary barrier to deploying ITS technologies has been identified as institutional, not technical. Procurement is one of the institutional issues that requires special attention. One of the greatest difficulties that transportation agencies face in attempting to deploy ITS projects is that they are "atypical" of highway construction projects, and may not lend themselves to the traditional procurement vehicles.

How an agency decides to procure an ITS project significantly affects the effectiveness of deployment. The current regulations facilitate use of the design-bid-build technique, which takes advantage of competition during the highest cost component of the deployment (construction). However, it may also hinder design and construction innovations or the opportunity to reduce life cycle costs. The design-bid-build technique also affects the deployment schedule since separation of design and construction activities prolongs implementation. ITS projects that deploy rapidly changing technologies may benefit from the choice of a contracting technique that minimizes deployment schedule.

The definitions of "construction," "engineering and design services," and "non-engineering/non-architectural" form the framework for grouping project requirements in terms of products, systems, and services. These requirements may be divided into component projects that individually meet these definition. This is where the challenge lies since the system-based complexity and diversity of ITS projects make demarcation of design and construction functions a difficult task. The various component projects can subsequently be procured using appropriate contracting techniques that optimize the balance of technical sophistication, system quality, cost effectiveness, and deployment schedule.

ITS products, systems, and services can be deployed through various types of projects:

The definable physical components such as field devices may be included in roadway construction/reconstruction projects or procured as stand-alone projects. The traditional construction contracting techniques govern these projects.

Some ITS items such as permanent traffic management center buildings, may be designed as standalone projects and procured using the traditional construction contracting techniques as well.

Some ITS items such as communication interfaces, software design and development, and computer hardware may be designed and implemented as a design-build project or incorporated within a construction project. These projects can be deployed using design-build and/or systems manager techniques.

It is important to emphasize that deployment of ITS projects should not follow an either-or approach in the choices of contracting techniques. There are many variations to how an ITS project can be deployed. It is important to maintain a creative, innovative, and flexible procurement approach to identify the optimum grouping of project requirements into component projects.

For example, the systems manager technique may be chosen for overall project design and integration. However, this choice does not preclude the procurement of component projects using design-bid-build and/or design-build techniques. Some component projects may be developed by consulting firms using engineering and design services contracts and/or by in-house staff. Component projects encompassing field equipment and devices may be deployed under the design-bid-build technique. Or, the systems manager may recommend a specialized subsystem that is best procured through the design-build technique. The prequalification feature can also be utilized to complement these techniques as well. Conversely, a contract for an engineering and design services may be used to develop functional requirements and specifications that are subsequently used to deploy the entire project under one contract using the design-build technique.

During the project planning process, the transportation agency should consider many issues that define how an ITS project should be developed. These issues include institutional barriers; project requirements in terms of products, services, systems, and integration; funding and phasing options for project/system implementation; compatibility with the National ITS Architecture and other emerging national standards; choices of contracting techniques; FHWA approval requirements; project specifications; availability and responsibilities of qualified and competent project managers; and project inspection needs. Proactive consideration and resolution of these issues are critical in achieving a successful project procurement as measured by project quality and cost-effectiveness.

APPENDIX A

LISTING OF FHWA AND PRIVATE INDUSTRY PARTICIPANTS

FHWA Region and Division

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Julie Dingle, FHWA Region 1
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APPENDIX B

FHWA APPROVAL PROCESS UNDER SEP-14

Innovative contracting practices, proposed to be evaluated under SEP-14, must be submitted by the FHWA Division Office (through the Region Office) to the FHWA Office of Engineering (HNG-22) for approval. Review comments and recommendations made by the Division and by the Region should accompany the proposal. Submittals should be made early in the development of the project to allow review comments from the FHWA Office of Engineering be incorporated in the project design and/or documents.

The basic component of an SEP-14 proposal should be a work plan, which includes a brief description of the innovation to be evaluated, and a proposed evaluation plan. It is recommended that draft special provisions, pertinent to the innovative practice, also be included if available at the time of the submission. Design-build proposals should describe the proposed procedures for selecting the successful firm. The following items should be addressed in the work plan:

Purpose: A brief description of the innovation which is to be evaluated and the expected results.

Scope: A brief discussion as to how the experiment will be conducted, including the number of project(s), a description of the location, existing conditions, etc.

Schedule: An approximate schedule for the project(s), including advertisement, letting, award, project completion, and evaluations and reports.

Measures: A brief description of how the innovation is going to be evaluated (i.e., cost savings, time savings, improved quality, etc.).

Reporting: Both an initial and a final report should be prepared for all projects. The need for an intermediate report should be determined based on the complexity of the experiment and the length of time between completion of the work and completion of the experiment. All reports should be forwarded to the FHWA Office of Engineering (HNG-22).

The initial report should be prepared approximately at the time of project award and should discuss any industry reaction to the innovation and any identifiable effects on the bids received. A copy of the bid tabulations should be included.

Intermediate reports should be prepared upon completion of the work and/or periodically until completion of the experiment. These reports should discuss the effects on work performance and monitoring, quality, completion time, claims, and other contract administration or legal issues. The final report should be prepared upon completion of the experiment and should contain an overall evaluation of the innovation. Suggestions for improvements, pitfalls to avoid, and a recommendation as to further use of the innovation should be included in the final report.

GLOSSARY

ATMS:	Advanced Traffic Management Systems
CFR:	Code of Federal Regulations
Competitive Negotiations:	A process for awarding engineering and design services contracts. It is used after a consultant has been selected based on qualifications.
Cost-Plus-Time Bidding:	A contracting provision commonly referred to as the A+B method. It is used to discourage contractors from overrunning the time component of the project.
Design-Bid-Build:	A contracting technique in which a transportation agency utilizes the services of an engineering consulting firm (or in-house staff) to design a project (design step), invites contractors to submit bids (bid step), and subsequently constructs the project using the services of a contractor (build step). The technique utilizes two independent but sequential contracts—engineering and design services and construction.
Design-Build:	A contracting technique in which a single entity provides design services and constructs the project all under one contract.
FAR:	Federal Acquisitions Regulations
FHWA:	Federal Highway Administration
Integration:	The process by which interacting parts of a system or subsystem are interlinked to make a whole.
ITS:	Intelligent Transportation Systems
Lane-Rental:	A contracting provision used to minimize traffic interference of projects that may require traffic lane closures to deploy the project. It is used to discourage contractors from obstructing traffic lanes during peak periods and eliminate the contractor's unnecessary blockage of traffic lanes.
Life Cycle Cost:	The total cost associated with deploying, operating, and maintaining a project over its estimated life. It is based on capital, operations, and maintenance costs amortized over the life of the system.
PS&E:	Plans, Specifications, and Estimates.
Responsive and Responsible:	The term responsive refers to the bidder's submittal meeting the requirements of the advertised request for proposal. The term responsible refers to the ability of the contractor to perform the work. This ability can be determined prior to bid invitations.

System:	A system is composed of a set of interacting components that collectively contribute to a common purpose.
SEP-14:	Special Experimental Projects No. 14 - established by FHWA to provide a means to evaluate project-specific innovative contracting practices that may have the potential to reduce the life cycle cost of projects while maintaining product quality.
Small Dollar Value:	Contracts for engineering and design services costing less than $100,000 administered using appropriate State or local procurement procedures.
Systems Manager:	A contracting technique in which all project design and integration functions are performed by a systems manager, typically a professional consultant, and all construction activities are performed by various contractors under the agency's direct management and control.
Prequalification Feature:	A procurement feature that first identifies responsible bidders through a prequalification process before following the typical process of bid invitation, evaluation, and award.
USC:	United States Code
Warranty:	A contracting provision that is used to protect capital investments in the transportation systems by requiring contractors to guarantee workmanship or materials for a limited time period.
Turnkey Project:	Equivalent to a project that is procured by the design-build technique in which a single entity provides design services and constructs the project all under one contract.

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PROCUREMENT PLANNING

Description	This Step Initiates the Procurement Process, and Results in the Development of the Procurement Management Plan and the Statement of Work
Activities	• Development of SOW • Identification and Enrollment of Other Agencies/Organizations • Make or Buy Decision • Selection of Procurement Type
Project Manager Responsibilities	• Development of Procurement Management Plan and SOW • Technical Direction for Procurement Type Selection and Procurement Schedule • Interagency Coordination
Key Challenges	• Selection of a Procurement Type that Allows for the Appropriate Combination of Control and Flexibility • Development of an Accurate SOW
Potential Risks	• Selection of Procurement Method Incompatible with Project Requirements • SOW Requirements Inconsistent With Budgetary and/or Scheduling Constraints
Useful Tools and Techniques	• Consultation With Previous Implementors • Work With Contract Office

SOLICITATION

Description	This Step Includes the Preparation of Solicitation Documents, the Coordination of Inputs From Other Agencies, and the Issuance and Advertisement of the Solicitation
Activities	• Identification of Selection Criteria • Development of RFP • Identification of Prospective Bidders • Issuance / Advertisement of RFP
Project Manager Responsibilities	• Coordination of Identification of Selection Criteria • Technical Input and Review of RFP
Key Challenges	• Identification of Appropriately Qualified Potential Bidders • Identification of Appropriate Selection Criteria and Scoring Methodology
Potential Risks	• Omission of Qualified Bidders May Lead to Legal And / or Financial Repercussions • Inappropriate Selection Methodology Can Lead to Sub-Optimal Selection
Useful Tools and Techniques	• Cooperate With Contract Office Staff

PROPOSAL EVALUATION AND SELECTION

Description	This Step Includes the Evaluation of Technical and Cost Proposals, and Contractor Qualifications, and the Selection of the Contractor(s)
Activities	• Proposal Evaluation • Verification of Contractor • Qualifications and References • Notification of Selection
Project Manager Responsibilities	• Coordination of Technical Input to Evaluation
Key Challenges	• Identification of Accurate Evaluation and Scoring Criteria • Selecting Evaluation Committee Members With Understanding of ITS/CVO
Potential Risks	• Improper Scoring Criteria Can Lead to Sub-Optimal Selection • Lack of ITS/CVO Knowledge Can Lead to Misinterpretation of Contractor Proposal • Contract Appeals
Useful Tools and Techniques	• Use Orals Selection Process

CONTRACT NEGOTIATION AND AWARD

Description	This Step Includes Negotiations with the Selected Contractor(s) to Finalize the Terms of the Contract, and Award of the Contract
Activities	• Notification of Selection of Contractor(s) • Negotiation of Contract Terms and Conditions • Issuance of Notice to Proceed
Project Manager Responsibilities	• Technical Input and Oversight of Negotiation
Key Challenges	• Design-Build and Public-Private Partnerships Are New Territory • Agreement Upon Contract Deliverables and Schedule
Potential Risks	• Partnership MOA Negotiation Might Get Drawn Out • Agency and Contractor Contracts Personnel Unfamiliar With New Approaches May Be Hesitant
Useful Tools and Techniques	• Use Performance-Based Measures • Consider Negotiating for IV&V Agreement for Verification of Adequacy of Deliverables • Use MOA from Other Successful Implementations

CONTRACT ADMINISTRATION

Description	This Step Includes the Execution of the Contract, and the Management of the Technical, Programmatic, and Administrative Terms of the Agreement
Activities	• Completion of Contract Tasks and Deliverables • Monitoring of Contractor Performance • Verification and Validation of Technical Adequacy
Project Manager Responsibilities	• Technical Direction of Contractor Activities • Management and Approval of Contract Deliverables • Invoice Review and Approval
Key Challenges	• Innovative Contracts / Agreements Can Limit or Impair Agency Authority to Direct Work • Unexpected Events May Affect Deliverable Schedule
Potential Risks	• Vaguely Defined Partnership MOA Puts Agency at Risk • Software Development Often Takes Longer to Complete Than Originally Anticipated
Useful Tools and Techniques	• May Want to Consider IV&V Agreement as Means to Assess Compliance With MOA

CONTRACT CLOSE-OUT

Description	This Step Concludes the Procurement Process, Including Any Audits and Performance Reviews Required by Law
Activities	• Final Review of Contractor Performance • Payment of Final Invoice • Retirement of Legal Commitments
Project Manager Responsibilities	• Technical Input to Final Contractor Performance Review • Approval for Payment of Final Invoice
Key Challenges	• Verification that All Contractual Obligations Have Been Satisfied
Potential Risks	• Omission of One or More Contractual Requirements
Useful Tools and Techniques	• Sound Administrative Practices During Earlier Procurement Phases

ADDITIONAL SCENARIOS FOR PROJECT IMPLEMENTATION EXERCISE

(Note to instructor: During the case study, each group will work on the two common problems presented in the exercise instructions, plus two to three unique problems that you provide. Attached are some suggestions for additional problems; it is suggested that you provide each group with two to three different problems off this list.)

1. The weigh-in-motion system was installed in month 7 after several delays due to bad weather.

2. Midland Motor Carrier Association data show that only five percent of participating carriers have installed transponders on their commercial vehicle fleets. Sources report resistance to the use of this new technology due to cost and privacy concerns.

3. The Department of the Treasury has declined to provide the information required to establish electronic roadside access to fuel tax payment records, citing the cost that would be involved in updating their information systems as well as concerns about sharing these data.

4. The DOT secretary has indicated that due to shifting state and federal funding priorities, the full amount originally allocated for this project may not be available. He has asked you to see if you could reduce the project budget by $200,000.

5. The systems architect responsible for overseeing the systems design, development, and testing accepted an early retirement offer. No one else within the DOT appears to have the right set of skills to step in at this time.

6. The Governor has announced a reorganization of the state agencies that will include moving responsibility for weigh station operation from the DOT to the State Police.

7. The DOT is planning to resurface the section of the Interstate near the weigh station in the next fiscal year. DOT highway engineers have suggested that installation of the WIM scales should be delayed until that time.

8. The contractor planned to model the credentials screening system based on a similar package being developed for another state. That state, however, is now six months behind schedule on completing its systems development.

9. The WIM scales are installed and operational, but their accuracy has been disappointing. The roadside reader has been performing inconsistently. You would like to delay the ribbon cutting ceremony planned for next month, but you've just learned that the Secretary of the U.S. DOT and Midland's Senior U.S. Senator have accepted your invitation to attend the event.

10. The DOT Secretary has announced an incentive program to encourage effective project management. The project managers and other core team members of projects that are completed at least 10 percent under budget and 10 percent ahead of schedule are eligible for a 10 percent year-end bonus.

ITS/CVO PROJECT IMPLEMENTATION EXERCISE

Objectives:
1. Participants can participate in a simulation of the ITS/CVO project implementation process.
2. Participants can monitor implementation progress of the Midland project, and prepare a progress report with corrective recommendations.

Instructions:

1. Participants will return to their Midland Case workgroups. Continuing in your State ITS/CVO project manager role, you are now responsible for managing the implementation of the Midland “Electronic Screening” pilot project. Background information for this exercise is provided in the “Midland Situation Report II” in Attachment 1.

2. Each group will have about 90 minutes to complete the following task:

   With the project implementation information provided in the lectures and the attached Midland Situation Report II, complete a summary implementation progress report. The report should include the following elements:

      Monitoring of Planned-versus-Actual Project Status
      Recommended Corrective Actions

   (OPTION: If your team finishes early, reflect on one or more additional implementation problems along with recommended corrective actions.)

3. The group reporter should prepare for a 3 to 5 minute presentation using overhead transparencies of the enclosed monitoring forms to summarize the group’s work.

ATTACHMENT 1
MIDLAND SITUATION REPORT II
MONTH 9 OF PROJECT IMPLEMENTATION

1. The DOT accepted a 10-month Electronic Weigh Station pilot project plan for implementation. The final scope of work for this project (which was used in procuring the services of a contractor) is summarized in the table below:

Scope of Work (SOW) Elements	Approved Features of the "Midland Weigh Station Electronic Screening Pilot Project"
A. Project Justification	1. Benefits: a. Improve safety by focusing enforcement on high-risk carriers, drivers, and vehicles; b. Reduce congestion costs for carriers; c. Ensure regulatory compliance. 2. Justification: Project contributes to achievement of Midland's ITS / CVO Business Plan objectives.
B. Project Deliverables	1. Weigh in motion system is installed at pilot fixed scale site (Performance Milestone: One weigh station near the Midland / Next State border is upgraded with electronic screening (including automated weigh in motion scales in one lane by end of month 6.) 2. Credentials screening system is installed (Performance Milestone: By end of month 7 a roadside computerized operations system is operational with a communications link to state office credentials databases.) 3. Weigh station staff trained in new computerized electronic screening process (Performance Milestone: Ten (10) staff are trained by end of month 9 in new system use and credentials enforcement procedures.)
C. Budget	$800,000 (for contractor); $1,200,000 (total)

2. <u>Assume that you are now in month 9 of the 10-month project.</u> Here is the status information that you have just received from the contractor and other sources:

   a. The roadside computerized operations system was installed in month 8 and is now operational. The state is pleased with the new customized credential software provided by the contractor, but failed to budget sufficiently for the $50,000 that will be needed to modify their legacy compliance systems to the open systems, interoperable standards.

b. Training, expected to be completed this month, was delayed due to the late installation of the roadside antenna. The contractor is asking for a contract extension to complete the training, including $50,000 in additional funding.

(Additional information to be provided by instructor.)

3. Your supervisor has asked you for an executive status report on this project along with corrective action recommendations, to be presented later today.

MONITORING OF PLANNED-VERSUS-ACTUAL PROJECT STATUS AND RECOMMENDED CORRECTIVE ACTIONS

Project Title:________________________________ Group___

Planned Deliverables and Dates	Actual Status	Technical Manager Conclusions	Action Recommendations (Give details on person responsible and date due)	Rationale for Corrective Action
a.				
b.				
c.				

Planned Deliverables and Dates	Actual Status	Technical Manager Conclusions	Action Recommendations (Give details on person responsible and date due)	Rationale for Corrective Action
d.				
e.				
f.				

ITS/CVO PROJECT MANAGEMENT CHALLENGES, SKILLS, AND TOOLS
IMPLEMENTATION PHASE

Project Characteristic	Management Challenge	Project Manager Skills	Project Management Tools	Module Covered
Commitments needed from multiple stakeholders in public and private sectors	How to maintain stakeholder commitment by demonstrating value?	• Ensuring stakeholder outreach and participation	• Stakeholder analysis	III
Specifications involve standards that are abstract, evolving, competing, and not uniformly accepted	How to ensure specifications meet evolving priorities and standards?	• Refining operations concept and communicating priorities	• Deliverables Specification • Work breakdown structure • Procurement measures	IV IV V
Schedule, cost, and risks are less reliable and difficult to estimate accurately	How to measure performance and address opportunities or risks?	• Monitoring and reporting on corrective actions	• Monitoring plan • Performance reporting	VI VI
Life cycle is shorter, with potential for significant technological and process change	How to manage technological change and potential obsolescence?	• Checking for configuration consistency and readiness	• Conformance assessment	VI
Team structures are dispersed and cross-cut administrative borders	How to facilitate component integration and active teamwork?	• Encouraging integration through testing, system training	• System integration testing • System training plan	VI VI