I-81 ITS Program Evaluation Framework

Stephanie Baker, Dr. Aaron Schroeder, Dr. Hesham Rakha, Rewa Hintz
Virginia Tech Transportation Institute
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Executive Summary

Purpose of the Framework

This document presents the evaluation framework that the Virginia Tech Transportation Institute (VTTI) has prepared for Phase II of the Virginia Department of Transportation's (VDOT) I-81 ITS Model Safety Corridor Program, more commonly referred to as the I-81 ITS Program.

The evaluation framework has three purposes:

1. To serve as input into the development of infrastructure in the I-81 Corridor that will generate baseline data for evaluation purposes.
2. To guide the evaluation of ITS projects funded through the I-81 ITS Program.
3. To assist the VDOT Mobility Management Division in the development of performance indicators for the I-81 Corridor.

The document also includes a description of the I-81 ITS Program, how this evaluation framework was developed, and who has been involved.

Process for using the Framework

The framework is based on program goals and objectives that were determined through a strategic-planning process with program stakeholders. Some of the goals, objectives, and measures of effectiveness (MOEs) in the framework include:

- **Goal: Safety**
    - Objective: Reduce Total Crashes
        - Measure: Change in Number of Crashes
- **Goal: Safety and Mobility**
    - Objective: Improve Emergency Response
        - Measure: Change in Clearance Time
- **Goal: Mobility and Efficiency**
    - Objective: Reduce Travel Delays
        - Measure: Change in Travel Time
- **Goal: Customer Satisfaction**
    - Objective: Improve Travel Satisfaction
        - Measure: Corridor Traveler Awareness of Real-Time Conditions
- **Goal: Energy and Environment**
    - Objective: Reduce Energy Consumption
        - Measure: Change in Fuel Consumption

The process for evaluating projects using these goals, objectives, and measures is presented in the framework through a series of steps. Taken together, these steps create an evaluation planning and reporting process that evaluators can follow.

Testing and Maintaining the Framework

This framework is a work in progress and must be tested and maintained if it is to remain a viable document. Thus, the next steps in this evaluation planning process are to:

- Select several ITS projects that can be evaluated using this framework to test its usefulness and to make adjustments to improve upon it,

- Identify an agency or organization to maintain the framework over time to ensure that the information is updated.

If the document is tested and maintained, it should become a useful tool for evaluating ITS projects funded through the I-81 ITS Program.

Acronyms

Throughout this report, numerous organizations and technologies are discussed. Many of these organizations and technologies have acronyms assigned to them. Below is a list of all those that appear in this report.

Concept of Operations	**COO**
Federal Highway Administration	**FHWA**
Intelligent Transportation Systems	**ITS**
Measure of Effectiveness	**MOE**
Planning District Commission	**PDC**
United States Department of Transportation	**USDOT**
University of Virginia	**UVA**
Virginia Department of Motor Vehicles	**DMV**
Virginia Department of Transportation	**VDOT**
Virginia State Police	**VSP**
Virginia Tech Transportation Institute	**VTTI**

Background

Program History

The I-81 ITS Program is a framework for on-going coordination, planning, design, and implementation of ITS investments along the 325-mile length of the I-81 Corridor in Virginia. Numerous stakeholders are involved in the program, including the Virginia Department of Transportation (VDOT), who sponsors the program, the Virginia State Police (VSP), the Department of Motor Vehicles (DMV), the Virginia Tech Transportation Institute (VTTI), and ITS Consultants working on the corridor. The program officially began in June of 2000, although discussions about the need for the program began much earlier.

The I-81 ITS Program traces its roots to a meeting in Salem, Virginia on November 15, 1999. The meeting involved senior representatives from VDOT's Staunton, Salem, and Bristol Districts, along with staff from VDOT's Central Office. The meeting focused on the need for efficient and effective planning and implementation of ITS investments in the I-81 Corridor.

Over the period from November 1999 to March 2000, the objectives for the program were refined, and recommendations were made by VDOT concerning how the program should be carried out. Work began on the I-81 ITS Program in June 2000.

In March 2002, an evaluation of the program was completed by VTTI. The evaluation detailed the program's history, successes, lessons learned, and recommendations for its future. To learn more about the first eighteen months of the program, please read the report "Case Study Evaluation of the I-81 ITS Program," which can be found in the Federal Highway Administration's (FHWA) Electronic Document Library at: *http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13659.html*

After the Case Study Evaluation was completed, VDOT asked VTTI to develop an evaluation framework for Phase II of the program. There were three steps in the framework development process: setting up an evaluation team, developing a strategy, and drafting the framework.

Evaluation Team

As a first step, an evaluation team was created to guide the development of the evaluation framework. Team members were selected because of their expertise and their affiliation with the various organizations involved in the I-81 ITS Program. Members were drawn from VDOT, FHWA, Department of Motor Vehicles (DMV), Virginia State Police (VSP), and the Planning District Commission (PDC). Each member of the evaluation team was responsible for providing guidance and input for the evaluation framework, and each spoke for a particular interest area in the program. Team members include:

- JR Robinson (VDOT Mobility Management)
- Mshadoni Smith (FHWA ITS) replaced in 2003 by Jim Hunt (FHWA ITS)
- Fred Altizer (VDOT Policy Committee Representative)
- Lawrence Caldwell (VDOT Mobility Management) joined in 2003
- Jim Diamond (VDOT Staunton District)
- Bob Yates (VDOT Salem District)
- Ronnie Hubble (VDOT Bristol District)
- Todd Kell (VDOT Traveler Information)

- Steve Shergold (VDOT Systems Operations)
- Cyndi Ward (VDOT Commercial Vehicle Operations)
- Cheryl Lynn (VDOT Research Council Public Safety)
- Sandy Myers (VDOT Communications)
- Cathy McGhee (VDOT Research Council)
- Lt. Gary Taylor (VSP Representative)
- Ken Jennings (DMV Representative)
- Stephen Kerr (PDC Representative)
- Wayne Spaulding (I-81 ITS Program Manager)

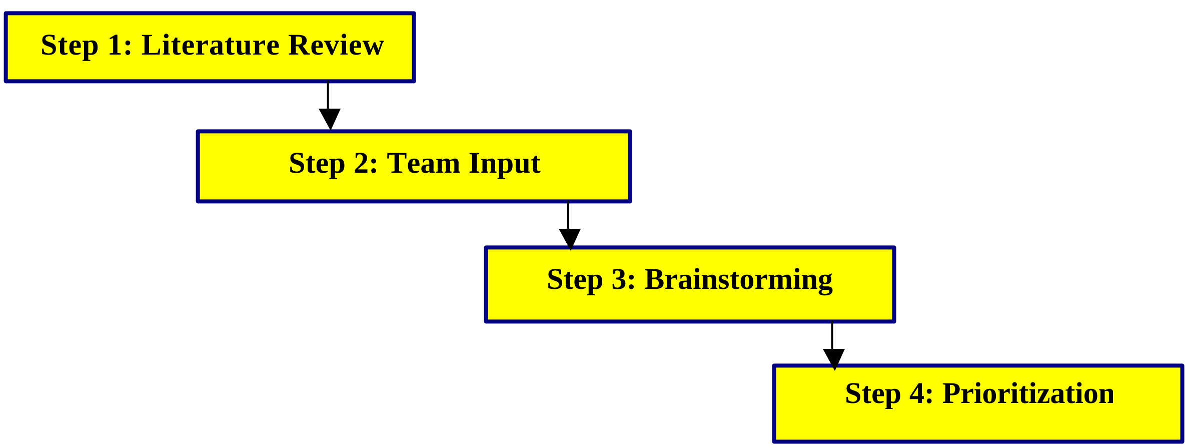
The evaluation team has been critical to the development of the framework. The team was involved in generating and prioritizing evaluation objectives and reviewing draft documents.

Strategy

The strategy was an important step in the evaluation planning process because the I-81 ITS Program has undergone many changes. It was important for the evaluation team to spend time considering the impacts that they believed the program should have on the corridor. The process of creating the strategy gave participants an opportunity to discuss the program's priorities. The goals and objectives generated in the strategy became the backbone of the evaluation framework.

The evaluation goals and objectives were determined through a four-step strategic-planning process. A diagram of the process is shown below.

Strategic Planning Process for Evaluation Objectives



First, a literature review of United States Department of Transportation (USDOT) case studies was conducted to find out what goals and objectives other organizations were using in their evaluations of ITS projects. From this review, a list was created of USDOT ITS evaluation goal areas (i.e., safety, mobility) and objectives (i.e., reduce total crashes, reduce travel delays). The list of objectives was a starting point for discussions with program participants about what goals and objectives should be integrated into the evaluation framework.

The literature review results were sent to the evaluation team for comments. The team reviewed the list and added several more objectives. The list was then revised and prepared for a workshop held at VTTI on May 30, 2002. At this workshop, participants from the I-81 ITS Program took part in a brainstorming session. The session resulted in a list of 32 new objectives that participants thought should be added to the list and considered for integration into the evaluation framework. The final list of 59 evaluation objectives, from the literature review, evaluation team input, and brainstorming session, is presented in Appendix A.

After the brainstorming session, the evaluation team was sent the list in Appendix A and was asked to prioritize the objectives. Each member was asked to distribute 100 points across the objectives, giving points to the objectives they thought should be integrated into the evaluation framework. When voting, priority objectives were to be given at least 5 points, and all 100 points had to be assigned. The point distributions were tallied, and a final list of evaluation objectives were created. The top 15 (25%) of the original objectives were carried forward. The prioritized list of evaluation objectives, found in Appendix B, was the main output of the strategy and the basis of the framework.

Though the framework focuses on the top evaluation objectives identified through the strategic planning process, the list of objectives in Appendix B should serve as a resource for future evaluations, and evaluators can refer to this list to supplement their plans. While referencing Appendix B, evaluators should bear in mind that the list is raw and that some of the items listed as objectives may be used more appropriately as measures of effectiveness (MOE). Whether used as objectives or measures, many good ideas that were generated through the strategic planning process by program stakeholders and evaluation team members may be helpful for evaluation purposes.

Prioritized Evaluation Objectives
Members of the evaluation team deemed objectives in the safety goal area as most crucial. Other objectives perceived as important fell under the goal areas of mobility/efficiency and customer satisfaction. These goals and their accompanying objectives were carried forward into the evaluation framework.

Evaluation team members also recommended that a section on analyzing lessons learned be integrated into the evaluation framework. Lessons learned topics suggested by the team included institutional, technical, and funding issues. Many lessons were learned from participants during the first program evaluation, which focused on institutional and funding issues. Considering lessons learned can help the program adapt and provides rich qualitative data that can be shared with others.

Cost/benefit analysis is another tool that the evaluation team wanted to include in the framework. The team recommended several types of analysis, including an analysis of benefits related to costs of deploying, operating, and maintaining ITS and an analysis of an ITS solutions ability to extend the life of current facilities.

All of the team’s recommendations were considered during the drafting of the framework.

Revision Process
During the prioritization process evaluation team members noted several problems with the evaluation objectives that needed to be addressed before the framework was drafted. For example, the objective “reduce crashes in work zones” is a subset of “reduce total crashes.” Evaluation team members commented that the two objectives needed to be placed together instead of being listed separately. The VTTI team decided a thorough revision process was needed to address the problems raised by the evaluation team.

To address these problems, a "strawman" framework was created. In the process of creating the strawman, each priority evaluation objective was considered carefully, a decision was made regarding where it fit in the framework, redundant objectives were merged together, and gaps in the framework were filled. The strawman framework was then presented to the evaluation team at a meeting in Staunton, VA on September 6, 2002.

VTTI's main purpose for the team meeting was to find out what modifications needed to be made to the framework. The team approved the framework with minor revisions. The recommended revisions were then discussed with the VDOT Central Office, and an agreement was reached on what revisions should be made (i.e., a definitions section should be added describing each evaluation objective in the framework) and which ones were inappropriate at this stage in the process but that may be considered later (i.e., a section should be added on the availability of data). After VDOT approved the strawman, the VTTI team began to draft the final evaluation framework.

In the Spring of 2003, VTTI was offered the services of an advisor from the Federal Highway Administration (FHWA) to review and guide the final steps in the development of the framework. A meeting was held on March 24, 2003 with representatives from VDOT and FHWA. Many helpful suggestions were made for how the framework could be clarified and improved. Based on these suggestions, revisions were made during April and May of 2003, and a final draft was sent to Evaluation Team members for review in June 2003. After this review, the framework will be finalized and an effort will be made to circulate the framework and to encourage its use by VDOT Technical Committee members and evaluators.

Corridor Definition

Another issue that arose in the September 6, 2002 meeting was how "corridor" was going to be defined in the evaluation framework. The VDOT ITS Division decided to use the following definition, which is drawn from the second draft of the I-81 Corridor Concept of Operations (COO) developed by PB Farradyne. Below is an excerpt from the COO document that defines the I-81 Corridor and its boundaries.

> **I-81 Corridor Boundaries**
>
> The Corridor is defined by a "fuzzy boundary" extending the length of I-81 from the West Virginia (WV) line in the North, to the Tennessee line in the South. The area should also include I-77 from the WV line on the west, to the North Carolina line on the south, and I-64 from the WV line on the west, to the Charlottesville area on the east. The need for a fuzzy designation of the Corridor boundary derives from perceived operation impacts. That is to say, I-81 operations have impact on other parts of the highway network and the opposite is true. As a fuzzy definition, the I-81 Corridor is any part of the road network that is affected by operations on I-81 proper, and conversely, any part of the road network whose operations impact I-81. The following map depicts the I-81 Corridor:

Framework Purpose

At the meeting on September 6, 2002, two purposes for the framework were identified, and a third purpose was added by VDOT on March 24, 2003. The purpose of the I-81 ITS Program Evaluation Framework is:

1. To serve as **input** to Technical and Policy Committee decisions about what infrastructure should be developed in the I-81 Corridor.
2. To **guide** the evaluation of ITS projects funded through the I-81 ITS Program.
3. To **assist** the VDOT Mobility Management Division in the development of performance indicators for the I-81 Corridor.

The evaluation framework should serve as input to Technical and Policy Committee decisions about what infrastructure should be developed in the I-81 Corridor so that baseline data can be generated for evaluation purposes. Without infrastructure in place to collect baseline data, evaluation of ITS on the corridor will be limited. However, this does not mean that ITS evaluations cannot be done while infrastructure is being developed; rather, it means that evaluators should rely primarily on project-specific data collection and simulation.

Though baseline data in the I-81 Corridor may be limited at this point in time, things are changing. In September 2002, the I-81 ITS Policy Committee approved several infrastructure projects in the corridor. Funding was approved for the installation of cameras, road weather information systems, and detectors. A list of the projects approved for funding can be found in Appendix C.

The development of this infrastructure is important to the I-81 ITS Program because it will generate data that will support ITS project implementation and evaluation. For instance, the presence of cameras along I-81 will feed real-time images of road conditions into the 511 Virginia service which should improve traveler awareness. Also, sensors installed along I-81 should provide data for the evaluation of projects attempting to post travel times and/or reduce queue lengths.

While these infrastructure projects should be evaluated, the evaluation of infrastructure is not within the scope of this framework. Though infrastructure supports ITS implementation and evaluation, in and of itself, it is not ITS. Rather, projects that utilize infrastructure to provide a service are ITS. For example, a camera is not ITS. Yet a series of cameras that feed into a traveler information system is ITS. Therefore infrastructure may be considered during the evaluation of ITS projects, yet this framework will not be used to evaluate isolated infrastructure applications, such as cameras or detectors.

The second and primary purpose of this framework is to guide the evaluation of ITS projects funded through the I-81 ITS Program. This framework is designed to walk evaluators through a simple seven-step evaluation planning process. The evaluation framework begins on page 13 of this document.

The final purpose of the framework is to generate evaluation information that can be used by VDOT to develop performance measures for I-81. Results from cumulative ITS evaluations should indicate performance across key areas, such as safety and mobility. For instance, if evaluation results point to problems with safety on certain sections of I-81, steps can be taken to address performance in those areas.

Though the primary purpose of the Evaluation Framework is to guide ITS evaluations, the results of the ITS evaluations should inform infrastructure development at the micro level by pointing out gaps in data availability, and overall performance of I-81 operations at the macro level by pointing out problems in key areas such as safety and mobility.

Framework Process

The evaluation framework is designed as a toolbox from which evaluators can choose recommended MOEs and evaluation methods to include in their evaluation plans, according to their goals and objectives. This design assumes ITS projects funded through the program will pursue some of the goals and objectives generated during this evaluation planning process. Because it is a set of recommendations, not everything in the framework has to be used, and other items can be added as appropriate.

There are seven steps that create the I-81 ITS Program Phase II Evaluation Framework. Each step in the framework builds upon the step before it to form a simple evaluation planning process. Several of the steps are also designed as worksheets that can be filled in and submitted to the Technical and Policy Committees. These steps and their accompanying worksheets include the following:

- **Step 3** is a template that all projects (infrastructure and ITS) should use when submitting requests for funding to the Policy Committee. The template should be completed and filed by the ITS Manager in each VDOT District and brought to I-81 ITS Program Technical Committee meetings, where all of the projects can be discussed. Sharing this project template information regularly should create cohesion and awareness across districts.
- **Step 6** is an outline of a basic evaluation strategy that can be completed using the information generated in Steps 3 through 5. This evaluation strategy should be completed and filed by the ITS Manager in each district and sent to the I-81 ITS Program Coordinator, whose contact information can be found in Appendix G.
- **Step 7** is a table that includes space for an evaluator to report the basic findings discovered through his or her evaluation. These findings should also be reported to the I-81 ITS Program Coordinator and saved by the ITS managers.

The reason the worksheets were integrated into this framework is so that it can become a tool for evaluation planning purposes and so that information about ITS project performance begins to be shared and accrued. This information about performance can be used by the Technical and Policy

Committees to assess how well the projects they are funding are performing across program goal areas. It can also be used by the VDOT Mobility Management Division to monitor overall performance of I-81 operations across key areas including safety and mobility.

This framework is designed to be used, tested, refined, and maintained. If this document sits on a shelf in its current form, it may be useful as a historical summary of the I-81 ITS Program and its evaluation goals and objectives, yet it will not be useful as the evaluation planning tool it is designed to be.

Evaluators should not limit themselves to the information in this document when generating ideas for evaluation plans; rather, this framework should be used as a starting point that can reduce the preliminary work evaluators must do. For instance, a helpful resource that can supplement this framework can be found at the Federal Highway Administration's (FHWA) web-site: **www.its.dot.gov/EVAL/eguide.htm**. This site includes self-evaluation guidelines and cost-reporting procedures recommended by FHWA. A list of other useful evaluation documents can be found in the reference section of this framework. Hopefully, this document will be used as a starting point for those individuals who are evaluating ITS projects in the I-81 Corridor.

I-81 ITS Program Evaluation Framework
A Step-by-Step Guide for
Designing ITS Project Evaluations

Step 1: Determine if Evaluation is Appropriate

↓

Step 2: Choose Goals, Objectives and MOEs

↓

Step 3: Fill in Project Template

↓

Step 4: Choose Evaluation Methods

↓

Step 5: Select Lessons Learned Questions

↓

Step 6: Draft an Evaluation Plan

↓

Step 7: Report Findings

Step 1: Determine if an ITS Project Evaluation is Appropriate

The first step in this evaluation planning process is to consider if an evaluation using this framework is appropriate. This step should be considered by the VDOT manager who will be in charge of the project in question. To determine if an evaluation is appropriate, answer the following questions.

1. Does this project use ITS to provide a service (i.e., 511 Virginia)? Yes____ No____

Projects that use ITS to provide a service should be evaluated to determine how well they are serving the I-81 ITS Program's goals and objectives.

2. If this is primarily an infrastructure project (i.e., putting in cameras, detectors, etc.), is it being combined with other projects to create an improved system or service?
Yes____ No____

For instance, a camera project would not need to be evaluated using this framework, yet if a camera project will add new capabilities to an existing service (i.e., 511 Virginia) or a Smart Traffic Center, it may be a good candidate for an evaluation using this framework.

3. If this is primarily an infrastructure project (i.e., putting in cameras, detectors, etc.), can important lessons be learned through an evaluation? Yes____ No____

For example, if an infrastructure project is being procured in a new way, such as via performance based contracting, it may be a candidate for evaluation. If significant lessons may be learned about how to better procure, manage, and implement infrastructure projects, then an evaluation using this framework may be appropriate. In this case, only Step 3 (Fill out the Project Template) and Step 5 (Select Lessons Learned) would need to be completed by the evaluator.

If the answer is 'Yes' to any of the above questions, an evaluation using this framework may be appropriate. If there is any question about whether a project should be evaluated, contact the I-81 ITS Program Coordinator, whose contact information is found in Appendix G.

Regardless of how the questions above are answered, all projects funded through the I-81 ITS Program need to fill out the project template found in Step 3. Project templates should be filed by each VDOT District ITS Manager and distributed at Technical Committee Meetings. Reviewing these templates will provide Technical Committee members with an overall picture of what is being funded through the program and should inform management and evaluation decisions.

Step 2: Choose Goals, Objectives, and Measures of Effectiveness (MOE)

For Step 2, the evaluator, in cooperation with a VDOT manager, should choose the goals, objectives, and MOEs to be evaluated. The table below should serve as a guide. During the development of the Evaluation Strategy, evaluation objectives were generated via a literature review and participants brainstorming. The objectives were then prioritized. The evaluation objectives listed in this table were the ones rated highest during the prioritization process.

For other potential evaluation objectives and MOEs, please refer to Appendix B. Many good ideas that were not included in the table below, are listed in Appendix B and can be used as another resource for evaluators in shaping evaluation objectives and measures.

Once you have chosen your goals, objectives, and MOEs, please document them on page 16 in the space provided.

Goal	Objective	Measure of Effectiveness (MOE)	Surrogate MOEs
Safety	Reduce Total Crashes • Secondary • Work Zones • Commercial Vehicles	Change (Δ) in # of crashes.	Δ in speed variability.
			Δ in # of conflicts.
		Δ in severity of crashes.	Δ in speed variability.
			Δ in # of conflicts.
	Increase Compliance	Δ in speed compliance.	
Safety & Mobility	Improve Emergency Response	Δ in response time.	
		Δ in clearance time.	
		Δ in number of fatalities.	
Mobility & Efficiency	Reduce Travel Delays (Increase Level of Service)	Δ in travel time.	Δ in vehicle queue lengths.
	Improve Throughput	Δ in roadway capacity.	Δ in vehicle speed differential by vehicle type.
Customer Satisfaction	Improve Travel Satisfaction	Corridor traveler satisfaction.	
		Corridor traveler awareness of real-time conditions.	
Energy & Environment*	Reduce Energy Consumption	Δ in fuel consumption (trucks & cars).	
	Reduce Environmental Impacts	Δ in vehicle emissions.	

Δ = Change

Energy and Environment Goal Area: One goal area that was not chosen by the evaluation team during the prioritization process, but that should be considered for inclusion in the framework , from an evaluation standpoint, is the goal area "Energy and Environment." A description of this goal area and why it is included in the framework can be found in Appendix D.

Evaluation Goals, Objectives, and MOEs

Goal________________________________

Objective____________________________

MOE / Surrogate______________________

Objective____________________________

MOE / Surrogate______________________

Objective____________________________

MOE / Surrogate______________________

Goal________________________________

Objective____________________________

MOE / Surrogate______________________

Objective____________________________

MOE / Surrogate______________________

Objective____________________________

MOE / Surrogate______________________

Goal________________________________

Objective____________________________

MOE / Surrogate______________________

Objective____________________________

MOE / Surrogate______________________

Objective____________________________

MOE / Surrogate______________________

Please use this form as a reference for Steps 3, 4, 6, and 7.

Step / Worksheet 3: Fill out the ITS Program Template

The third step in the evaluation process is to complete this project template designed by the Technical Committee for use in submitting projects to the I-81 ITS Policy Committee. Every VDOT ITS manager should submit this form whether or not an evaluation using this framework is required. It may be helpful to reference Step 2 when filling out the evaluation table at the end of this template. Once this template is completed, it should be sent to the I-81 ITS Program Coordinator, whose contact information can be found in Appendix G. ITS Managers in each district may wish to keep copies of these templates on file to review them at Technical Committee meetings.

6 Year Program Title: ___________________
Project Title: ____________________

1) Problem Description

2) Project Objectives
   a) Include the coverage area as part of the objectives

3) Project Narrative
   a) Include Conduct of Work as part of the narrative
   b) General statement of Stakeholder involvement
   c) Preliminary list of project outcomes (deliverables)
   d) Special programming

4) Estimated Cost
   a) Estimating basis
   b) Procurement type

Project Functional Class	
Federal Aid Eligibility Fund Match	( ) Interstate ( ) NHS ( ) Non-NHS ( ) CMAQ ( ) ___________ ( ) State ___% ( ) Local ___%
TIP Required	( ) Yes ( ) No
Statewide Significance	( ) No ( ) Yes (explain)______________________________ ____
Special Requirements (Check all that apply)	( ) Public Hearing ( ) Major Permits ( ) Environmental Review ( ) ROW ( ) MPO ( ) STIP ( ) Utility Coordination ( ) DTE review ( ) Agency Procurement Request ( ) Technology Oversight Committee Review ( ) Other ____
NEPA Rec.	( ) Categorical Exclusion ( ) Environmental Assessment ( ) EIS

Estimated Duration

Phase	*Activity Duration* (months)	*Estimated Cost*	*Fund Source*	*Obligation Date*	*Consultant Required* (Yes/No)
Scoping	______________	______________	____________	______________	________________
Design	______________	______________	____________	______________	________________
Construction	______________	______________	____________	______________	________________
Operation	______________	______________	____________	______________	________________
Maintenance	______________	______________	____________	______________	________________
Evaluation	______________	______________	____________	______________	________________

Total Project Duration ____________ Total Project Cost_________________

Evaluation

If the project is to be evaluated using the I-81 ITS Program Evaluation Framework, please check the goals/objectives and MOEs that will be considered in the evaluation.

Goal: Objective	**Measure of Effectiveness**	Ö **if MOE will be evaluated.**	Ö **if surrogate MOE will be used.**
Safety: Reduce Total Crashes	Change ? in # of crashes.		
	? in severity of crashes.		
Safety: Increase Compliance	? in speed compliance		
Safety & Mobility: Improve Emergency Response	? in response time		
	? in clearance time		
	? in number of fatalities.		
Mobility & Efficiency: Reduce Travel Delays	? in travel time.		
Mobility & Efficiency: Improve Throughput	? in roadway capacity.		
Customer Satisfaction: Improve Travel Satisfaction	Corridor traveler perceptions.		
	Corridor traveler awareness of real-time conditions.		
Energy & Environment: Reduce Energy Consumption	? in fuel consumption (trucks & cars).		
Energy & Environment: Reduce Environmental Impacts	? in fuel emissions.		

Data Approved by Policy Committee: _____________

Please fill in this template and submit it to the I-81 ITS Program Coordinator (contact information located in Appendix G).

Step 4: Choose Methods by MOE

The fourth step in the framework describes the methods and data sources that may be used to analyze each MOE. This is a list of potential data sources and methods. However, others can and should be used, as appropriate, and added to this methods section. Once MOEs are chosen, please read through Appendix E for suggestions regarding what methods and data sources can be used to address each MOE. This section of the framework should be enhanced over time as new infrastructure is put into place and baseline data becomes available.

Before selecting the methods that will be used to analyze each MOE from Appendix E, there are some things each evaluator should consider. These considerations include the collection of control data, the integration of data collection efforts across MOEs, and the comparison of site specific results to other cases with similar conditions. Evaluators also need to weigh the advantages and disadvantages of using a field, simulation, or combination approach to data collection. Each of these considerations is discussed briefly below.

The proposed methodology may include the collection of “control” data to serve as the base case for evaluations in addition to the collection of “after” data for an evaluation of the ITS implementation under consideration. The control data serves a number of purposes. First, the control data characterize the before conditions in the case of a field evaluation. Second, the control data are required to calibrate any modeling tools to the before conditions in the case of a modeling evaluation.

In order to reduce data collection expenses, the evaluator should investigate the potential for integrating data collection efforts across various MOEs. For example, the collection of floating car second-by-second vehicle trajectory data can serve to evaluate a number of MOEs, including traffic delay, vehicle stops, vehicle fuel consumption, vehicle emissions, and safety modeling. Consequently, the evaluator should collect data, to the extent possible, in order to cover a wide range of MOE evaluations.

The evaluator should also consider comparing site-specific results to results of other evaluations that are similar in traffic, network, and roadway conditions. Such comparisons may provide an avenue to generalize site-specific results and provide an opportunity to characterize ITS benefits across different studies.

Finally, the evaluator needs to consider the advantages and disadvantages of the various approaches that can be used for an evaluation. The methods or approaches for evaluating ITS implementations tend to fall into three major categories: field evaluations, simulation evaluations, and, in some instances, a combination of both. The advantages and disadvantages of each of these approaches are discussed briefly in the table on page 20. It is recommended that the field evaluations involve a single “before” data collection effort and a number of “after” data collection efforts in order to characterize and quantify temporal changes in driver behavior. Modeling evaluations offer the flexibility to evaluate conditions that are not necessarily observed in the field and to extrapolate results for different traffic and roadway conditions. The combination of field and modeling evaluations offers considerable benefits because it validates the modeling findings for some base conditions.

Evaluation	Advantages	Disadvantages
Field	1. Direct comparison of before and after scenarios 2. Minimum assumptions required in deriving conclusions	1. Requires field implementation of ITS technology 2. Requires significant field data 3. Requires system to be implemented for a significant time for benefits to emerge 4. Other confounding factors can influence the results (e.g. traffic growth, changes in traffic demand, etc.) 5. Results may change with time as drivers change their driving habits
Modeling	1. Cost effective 2. Does not require the field implementation of the ITS application 3. Allows for modeling of various alternatives and the conduction of extensive sensitivity analyses 4. Extrapolation of results for conditions not observed in the field	1. Results may be easily challenged 2. Accuracy of evaluation depends on modeling tool, input variables, and model calibration to local conditions
Field and Modeling	1. Cost effective 2. Allows for modeling of various alternatives and the conduction of extensive sensitivity analyses 3. Extrapolation of results for conditions not observed in the field 4. Results are more credible, given that simulation results are validated against field observations	1. Requires limited field implementation of ITS technology 2. More expensive than alternative 2

After selecting sources and methods from Appendix E, please fill in the form on the next page titled "Methods and Data Sources by MOE."

Methods and Data Sources by MOE

Goal Area: ______________________________________

MOE / Surrogate:____

Data Source (s):____

Method: ____

MOE / Surrogate:____

Data Source (s):____

Method: ____

Goal Area: ____

MOE / Surrogate:____

Data Source (s):____

Method: ____

MOE / Surrogate:____

Data Source (s):____

Method: ____

Goal Area: ______________________________________

MOE / Surrogate:____

Data Source (s):____

Method: ____

MOE / Surrogate:____

Data Source (s):____

Method: ____

Step 5: Select Lessons Learned

Below is a table of sample lessons learned questions that can be applied to ITS project evaluations. This set of questions is not exhaustive but includes some of the questions found in the FHWA report prepared by Science Applications International Corporation "ITS Evaluation Guidelines—ITS Integration Self-Evaluation Guidelines," as well as some of the questions generated by the evaluation team. Most of these questions can be addressed through a mix of methods including: document review (i.e., scopes, budgets, contracts, financial statements, status reports, etc.), interviews (i.e., management, partners, stakeholders, etc.), and, in some cases, cost analysis (i.e., costs versus benefits, review of budgets versus deliverables, etc.). The column on the side can be used to keep track of the questions that will be considered in the evaluation.

	Sample Lessons Learned Questions	Ö here if it applies
Institutional	What types of organizations are involved with the project (i.e., public, private, non-profit)?	
	How was buy-in secured from all partners on project goals and objectives?	
	How did each of the partners assess the risks and benefits of the project?	
	What are each of the partners' roles and responsibilities? How were they defined and clarified?	
	Is there a steering committee or working group that oversees the project? If so, please describe how the group works and if benefits were realized from having such a group.	
	How did this project improve communication and coordination among implementing agencies?	
	What kind of reporting structure was in place for the project?	
	What institutional impediments were encountered and where in the life-cycle of the project did they occur?	
	What were the causes of the impediments, and how were they overcome?	
Technical	Why/how did you choose equipment (i.e., brand, capability, etc.)? Would you recommend it to others?	
	Can the technology be integrated with current and planned ITS on the corridor?	
	Does the technology meet transportation industry (private, if not public) standard? If not, why not?	
	What are the security issues with this type of technology? How have these issues been addressed?	
	What technical impediments were encountered while trying to achieve integration?	
	Where in the life cycle of the project did the impediments occur?	
	What were the causes of the impediments, and how were they overcome?	
	Were you able to apply lessons learned from other deployments to your deployment? If so, describe.	
Funding/Procurement	What were the sources of funding for this project?	
	What type of contracting was used for this project (i.e., low-bid, sole-source, performance based, design/build, other), and how well did this contracting method meet the needs of the project?	
	Were any public safety or other non-traditional organizations included in the procurement process?	
	How was the contractor selected (i.e., qualifications, cost, combined qualifications and cost, etc.)?	
	How was the work allocated (i.e., were there multiple contracts, a prime contract and sub-contracts, etc.)?	
	How was the contractor paid (i.e., fixed price, cost reimbursement, incentive, etc.)?	
	Did the project implement an ITS solution that extended the life of an existing facility? If so how?	
	Describe any software development issues. Who retains rights to the intellectual property?	
	What, if any, financial problems did the project face? How were these issues dealt with?	

If only a lessons learned/case study evaluation is being conducted please check the appropriate questions in the column provided and submit this form to the I-81 ITS Program Coordinator (contact information is located in Appendix G).

Step / Worksheet 6: Draft an Evaluation Strategy

This worksheet should be filled out, using Steps 2-5, and submitted to the VDOT I-81 ITS Program Coordinator prior to initiating the evaluation. The strategy worksheet is intended to guide the development of a formal detailed evaluation plan.

Goals, Objectives, MOEs / Surrogate MOEs, Data Sources, and Methods

Goal______________________________ Objective: ____________________________

MOE/Surrogate_____________________________

Data Source(s)____

Methods____

____

____

Goal______________________________ Objective: ____________________________

MOE/Surrogate_____________________________

Data Source(s)____

Methods____

____

____

Lessons Learned Questions

Institutional

1.
2.
3.

Technical

1.
2.
3.

Financial

1.
2.
3.

Please fill in this strategy and submit it to the I-81 ITS Program Coordinator (contact information is located in Appendix G).

Step / Worksheet 7: Report Evaluation Results

The I-81 ITS Program Technical and Policy Committees need to examine, across projects, how well program goals and objectives are being achieved. For this reason, evaluators should report results to the I-81 ITS Program Coordinator. Results should include detailed information about findings, data source(s), and what data would have been useful had it been available. The information on data sources will assist the Technical and Policy Committees as they consider what infrastructure they want to fund moving forward, and information on findings will assist VDOT as it considers performance indicators for the I-81 Corridor.

ITS Project Evaluation Results by Goal Area
(*Hypothetical Example*)

Project	Goal Area	Summary of Results	Data Source Used in Analysis	Data Required
Truck Fleet Alert	Safety	Decrease in # of truck accidents by x% between 2003-2005.	Interim Operations Center Crash Data	Data was adequate.
	Mobility & Efficiency	Increase in travel time reliability due to trucker awareness of incidents.	Survey of Truckers	Data was not available to conduct travel time analysis
	Customer Satisfaction	Trucker perception of service on corridor is moderately improved due to knowledge of travel conditions provided.	Survey of Truckers	Data was adequate.
	Energy & Environment	N / A	N / A	N / A
	Lessons Learned	Funding: Buying quality hardware is worthwhile even if it is more expensive. Lower quality hardware will cost more in the long run.	Interviews. Comparison of various equipment costs.	Data was adequate.
	Other	N / A	N / A	N / A
ITS Project X	Safety			
	Mobility & Efficiency			
	Customer Satisfaction			
	Energy & Environment			
	Lessons Learned			
	Other			

Please fill in this table and submit it to the I-81 ITS Program Coordinator (contact information is located in Appendix G).

Next Steps

This framework is a work in progress and must be tested and maintained if it is to remain a viable document. Thus the next steps for this evaluation planning process are to:

- Select several ITS projects that can be evaluated using this framework, test its usefulness, and make adjustments to the framework that improve upon it.
- Identify an agency or organization that can maintain the framework over time to ensure that the information is updated.

One important next step is to select several ITS projects that can be evaluated using this framework and test how useful the framework is to the evaluators. The framework can be refined and improved upon based on the outcomes from these test cases. Applying the framework will also begin the process of identifying where data is sufficient and where it needs to be generated through new infrastructure investment.

Currently, 511 Virginia is being evaluated using this framework. The evaluation will be completed by January 2004. A review was conducted in June 2003 to determine how well the Evaluation Framework is meeting the needs of the evaluation team. A brief case study is included in Appendix J so that other evaluators who use the framework will be able to see how it was used and how it worked.

Another important step is for the Policy Committee to designate an agency to maintain the framework (i.e., collect evaluation results, update the potential data sources listed in the methods section, update contact information, etc.). The contributions of many organizations, including VDOT, VSP, UVA (Mobility Data Store Project), and VTTI (Interim Operations Center), served as input to the current framework. Whatever agency is designated for maintenance should continue to coordinate with these agencies so that their work continues to be updated in the framework.

Finally, this evaluation framework needs to be closely aligned with implementation plans for the I-81 Corridor. To be successful, the I-81 ITS Program must encourage consistency and coordination in infrastructure development, ITS implementation, and evaluation. This framework can help the I-81 ITS Program focus its implementation efforts and evaluate its performance.

Appendix A: Evaluation Goals and Objectives

In the table below, the information contained in the third column (Source) lists the source of each objective. An explanation of the letter codes is as follows:

- Objectives found during the literature review are listed by the letters **A-G**. The reference corresponding to each letter is found in the list of references immediately following the table.
- Objectives suggested by **E**valuation **T**eam members during the initial review period are designated as **ET**.
- Objectives generated during the brainstorming session on May 30 are designated as **5/30**.

Evaluation Goals and Objectives for I-81 ITS Program Projects

ITS Goal Area	***Evaluation Objective (Desired Impact)***	***Source***
Improve **Safety** on the I-81 Corridor.	Reduce secondary accidents.	C
	Reduce accidents in Work Zones.	C
	Improve emergency response time.	E
	Increase the amount of safety information available to travelers.	F
	Reduce amount of calls to law enforcement and EMS regarding road conditions.	F
	Reduce worker-related accidents in work zones.	ET
	Reduce commercial vehicle accident rates.	ET
	Decrease accidents at and around weigh stations.	ET
	Reduce total accidents.	5/30
	Reduce severity of accidents.	5/30
	Reduce driver fatigue.	5/30
	Reduce stress and road rage.	5/30
	Enhance enforcement/increase compliance.	5/30
	Reduce duration of accidents/incidents.	5/30
	Improve survivability.	5/30
Enhance **Mobility** on the I-81 Corridor.	Reduce travel time variability during accidents.	C
	Increase ease of travel.	F
	Reduce trip time.	F
	Reduce trip time of Commercial Motor Carriers.	G
	Reduce travel delays.	G
	Reduce travel time through weigh stations.	G
	Increase efficiency through weigh stations.	ET
	Reduce length of back-ups on I-81 due to incidents.	ET
	Reduce impact on Route 11 resulting from incidents on I-81.	ET
Increase **Customer Satisfaction** on the I-81 Corridor.	Increase in level of customer satisfaction.	C

ITS Goal Area	*Evaluation Objective (Desired Impact)*	*Source*
Increase **Customer Satisfaction** on the I-81 Corridor.	Improve visitor experience.	E
	Increase visitors' ability to access desired destinations and activities.	F
	Increase commercial vehicle travelers' ability to access desired destinations and services.	ET
	Increase understanding of different types of traffic patterns.	5/30
	Increase real-time or travel time/travel delay data to individuals and truckers.	5/30
	Increase driver situation-based knowledge.	5/30
	Reduce car drivers' fears of driving with trucks.	5/30
	Increase public awareness of and information about interconnectivity between different modes of transportation.	5/30
	Improve the design of ITS products to meet needs of the elderly (transit applications, ease of use of technologies).	5/30
	Improve transportation for those with hearing, vision, and mobility impairments through ITS.	5/30
Increase **Economic Development** on the I-81 Corridor.	Increase length of visitation to businesses.	E
	Increased tourism revenue.	F
	Increased telecommunications and transportation capacity.	5/30
	Increase public awareness of ITS applications to help attract new business to the corridor (i.e., fiber optic network, etc.).	5/30
	Increase the utilization of e-pay/e-credentials in ITS projects.	5/30
	Increase accessibility to businesses/areas adjacent to 81.	5/30
	Increase the use of data warehousing research to attract new businesses.	5/30
	Increase tourism's reliance on ITS data (encourage them to proliferate themselves).	5/30
	Increase integration of ITS applications with private industry technologies (provide location-based traffic/mapping data for mobile-based gadgets such as PDAs, etc.)	5/30
	Increase the development of ITS products into for-profit products (i.e., use of fiber optic networks, data-sharing methods, etc.)	5/30
Increase **Operational Efficiency** of the I-81 Corridor.	Increase throughput.	A
	Optimize travel time.	5/30
	Reduce the number of customer complaints (associated with maintenance, accidents, weather conditions, and other variable events, such as college and event traffic).	5/30
	Reduce the number of customer calls that reference mile markers.	5/30
	Improve the level of service.	5/30
Enhance **Productivity** on the I-81 Corridor.	Reduce costs of I-81 improvements.	A

ITS Goal Area	***Evaluation Objective (Desired Impact)***	***Source***
Enhance **Productivity** on the I-81 Corridor.	Reduce man-hours required for response.	5/30
	Reduce crashes by improving work zone layouts.	5/30
	Reduce delay for Commercial Vehicles by using WIM and Electronic Clearance.	5/30
	Increase program consistency (training on same devices, increase driver expectations).	5/30
	Improve information dissemination.	5/30
	Improve information sharing with other offices, districts, and states.	5/30
Reduce **Energy** & **Environmental Costs** on the I-81 Corridor	Reduce Emissions on I-81.	A
	Reduce Fuel Consumption.	A

*Several resources were reviewed to develop the set of evaluation objectives that the evaluation team voted on. The letters before each of the titles below are the reference letters found in the "Source" column in the table above.

A: ITS, Joint Program Office U.S. DOT. (2002). *ITS Evaluation Resource Guide.*

B: FHWA, US DOT. (1998). *National Evaluation Strategy***,** *Metropolitan Model Deployment Initiative.*

C: Demetsky, B., Park, B., Venkatanarayana, R. (2001). *HRATIS First Year Evaluation Report: A Research Report for the VDOT.* Charlottesville, VA: UVA Center for Transportation Studies.

D: Battelle. (2000). *Arcadia National Park ITS Field Operational Test: Evaluation Strategic Plan*. Columbus, Ohio: Battelle.

E: Battelle. (2000). *Arcadia National Park ITS Field Operational Test: Evaluation Plan*. Columbus, Ohio: Battelle.

F: Battelle. (1998). *The Branson Travel and Recreational Information Field Operational Test*. Columbus, Ohio: Battelle.

G: Battelle. (1998). *The I-40 Traveler and Tourist Information System Field Operational Test*. Columbus, Ohio: Battelle.

H: Schroeder, A., Laskowski, K. (2001). *Data Infrastructure Assessment 'Findings Document.'* Blacksburg, VA: VTTI.

I: VDOT. (2000). *VDOT Strategic Plan for the 2000-2002 and 2002-2004 Biennia Summary.* Richmond, VA: VDOT.

J: Baker, S. (2002). *Case Study Evaluation of the VDOT's I-81 ITS Program.* Blacksburg, VA: VTTI.

Appendix B: Prioritized Objectives

Appendix B details how the evaluation team voted across the 59 evaluation objectives. The top 15 are shown in blue. The priority evaluation objectives were carried forward in some form (i.e., either as an objective, a measure, or a project idea) into the framework.

Safety Evaluation Objectives	***Scores***
Reduce total accidents.	**95**
Reduce secondary accidents.	**50**
Reduce accidents in work zones.	**70**
Reduce severity of accidents.	20
Reduce worker related accidents in work zones.	0
Reduce commercial vehicle accident rates.	**50**
Decrease accidents at and around weigh stations.	5
Reduce driver fatigue.	10
Reduce stress and road rage.	5
Enhance enforcement and increase compliance.	**90**
Increase the amount of safety information available to travelers.	**40**
Improve emergency response time.	**65**
Reduce amount of calls to law enforcement and EMS regarding road conditions.	25
Reduce duration of accidents/incidents.	**55**
Improve survivability.	5
Mobility/Operational Efficiency Evaluation Objectives	***Scores***
Reduce travel time variability during accidents.	15
Increase ease of travel.	0
Reduce trip time.	5
Reduce trip time of Commercial Motor Carriers.	10
Reduce travel delays.	**55**
Reduce time through weigh stations.	15
Increase efficiency through weigh stations.	10
Reduce length of back-ups due to incidents.	35
Reduce impact on Route 11 resulting from incidents on I-81.	**45**
Increase throughput.	**45**
Optimize travel time.	20
Reduce number of customer complaints (associated with maintenance, accidents, weather conditions, and other variable events such as college and event traffic).	15
Reduce number of customer calls that reference mile markers.	5
Improve level of service.	**50**
Customer Satisfaction Evaluation Objectives	***Scores***
Increase in level of customer satisfaction.	20
Improve visitor experience.	0
Increase visitors' ability to access desired destinations and activities.	10
Increase commercial vehicle traveler's ability to access desired destinations & services.	20
Increase understanding of different types of traffic patters.	10
Increase real-time or travel time/travel delay data to individuals and truckers.	**65**
Increase driver situation-based knowledge.	25
Reduce car driver's fears of driving with trucks.	15

Customer Satisfaction Evaluation Objectives	***Scores***
Increase public awareness of and information about interconnectivity between different modes of transportation.	0
Improve the design of ITS products to meet needs of the elderly (transit applications, ease of use technologies).	10
Improve transportation for those with hearing, vision, and mobility impairments through ITS.	0
Economic Development Evaluation Objectives	***Scores***
Increase length of visitation to businesses.	0
Increase tourism revenue.	10
Increase telecommunications and transportation capacity.	10
Increase public awareness of ITS applications to help attract new business to the corridor (i.e., fiber optic network).	5
Increase the utilization of e-pay/e-credentials in ITS projects.	5
Increase accessibility to businesses/areas adjacent to I-81.	10
Increase the use of data warehousing research to attract new businesses.	0
Increase tourism reliance on ITS data (encourage them to proliferate it themselves).	5
Increase the integration of ITS applications with private industry technologies (i.e., provide location based traffic mapping data for mobile-based gadgets such as PDAs).	**50**
Increase the development of ITS products into for-profit products (i.e., use of fiber optic networks, data sharing methods, etc.)	15
Enhance Productivity Evaluation Objectives	***Scores***
Reduce costs of improvements.	15
Reduce man-hours required for response.	5
Reduce crashes by improving work zone layouts.	20
Reduce delay for Commercial Vehicles by using WIM and Electronic Clearance.	25
Increase program consistency (training on same devices, increase driver expectations.)	10
Improve information dissemination.	**50**
Improve information sharing with other offices, districts, and states.	30
Reduce cost of maintenance of ITS systems*.	5
Energy and Environment Evaluation Objectives	***Scores***
Reduce emissions.	15
Reduce fuel consumption.	25

*Evaluation Objective added by JR Robinson of VDOT Central Office after prioritization process stated.

Appendix C: I-81 Model Safety Corridor Projected Expenditures FY02-FY04

FY 02

Funding Year	District	Project	Amount	Lead	Notes
	Corridor	511 Virginia	$ 275,000	T. Kell	No further funding.
	Corridor	1/10 mile markers	$ 451,000	DuFresne	
	Corridor	ITS PE and System Integration	$ 850,000	Shergold Robinson	
Corridor Total FY 02			$ 1,576,000		
		Total FY 02	**$ 3,152,000**		

FY 03

Funding Year	District	Project	Amount	Lead	Notes
	Bristol	CCTV (mp 1-13) & Exit 10	$ 425,000	M. Phipps	
		Over Height Detection Sys.	$ 100,000	M. Phipps	
		CCTV (I-81/I-77 overlap) MP 71-81	$ 350,000	M. Phipps	
		5 VMS	$ 1,300,000	M. Phipps	
Bristol FY 03 Total			$ 2,175,000		
	Staunton	CCTV (10 sites)	$ 300,000	Gustafson	
Staunton FY 03 Total			$ 300,000		
	Salem	Cameras 118 Exit	$ 150,000	T. Martin	
		STC PE	$ 125,000	T. Martin	
		Cameras 581	$ 250,000	T. Martin	
Salem FY 03 Total			$ 525,000		
		Total FY 03	**$ 3,000,000**		

FY 04

Funding Year	District	Project	Amount	Lead	Notes
	Bristol	STC PE	$ 200,000	M. Phipps	
Staunton FY 04 Total			$ 200,000		
	Staunton	CCTV/RWIS	$ 800,000	Gustafson	
Staunton FY 04 Total			$ 800,000		
	Salem	CCTV	$ 250,000	T. Martin	
		Smart Traffic Center	$ 800,000	T. Martin	
Salem FY 04 Total			$ 1,050,000		
	Corridor	System Integration	$ 797,000	Shergold	
		Count Station upgrade	$ 50,000	Robinson	
Corridor FY 04 Total			$ 847,000		
		Total FY 04	**$ 2,897,000**		

FY 05

	Bristol	Smart Traffic Center	$ 800,000	M. Phipps	
Bristol Total FY 05			$ 800,000		

	Salem	Smart Traffic Center	$ 200,000	T. Martin	
		Wireless LAN expansion	$ 500,000	T. Martin	
Salem Total FY 05			$ 700,000		

	Staunton	TMS field devices	$ 500,000	Gustafson	
Staunton Total FY 05			$ 500,000		

	Corridor	System Integrator	$ 706,000	Shergold	
Corridor FY 05 Total			$ 706,000		

Total FY 05 **$ 2,706,000**

Appendix D: Energy and Environment Goal Area

The Energy and Environment Goal Area is included in this framework for several important reasons. The significance of evaluating vehicle fuel consumption and emissions is threefold. First, the transportation sector is the dominant source of U.S. fuel consumption and emissions. Specifically, highway travel accounts for approximately 75 percent of the nation's total transportation energy use and more than 33 percent of the national emissions of the Environmental Protection Agency's (EPA's) six criteria pollutants (carbon monoxide, carbon dioxide, oxides of nitrogen, hydrocarbons, sulfur dioxide, and particulate matter). Consequently, an accurate assessment of motor-vehicle emissions is essential for any effective evaluation of transportation projects. Second, FHWA has included vehicle energy consumption and emissions as two important MOEs for the evaluation of transportation projects. Finally, it should be noted that data that are gathered to evaluate the efficiency and safety impacts of a project would also be used with minimum effort to evaluate the energy and environmental impacts.

Appendix E: Suggested Methods and Potential Data Sources

The definitions used in this methods section were generated from a number of sources including the Highway Capacity Manual (2000), the Fatality Analysis Reporting System (FARS), Virginia Traffic Crash Fact Sheet (2001), and FHWA ITS Evaluation Guidelines. The methods in this section tend to fall into two major categories: field evaluation and simulation evaluation. For more information on field and simulation evaluations, an overview is located in Appendix F.

Please review each of the recommended data sources and methods. This appendix is not exhaustive, and other data sources and methodologies should be used if they are more appropriate than what is included in this appendix. Moreover, this appendix is a resource that can and should be supplemented over time as new data becomes available.

Once data sources and methods are selected, please refer to page 21 and fill in the form provided.

Safety Measure: Change in Number of Crashes

Definition: A crash is an event that produces injury and/or property damage, involves a motor vehicle in transport, and occurs on a roadway or while the vehicle is still in motion after running off of the roadway.

Potential Data Source(s)

- **National Data**: Fatality Analysis Reporting System (FARS), General Estimates System (GES), etc.
- **State Data**: VSP Computer Aided Dispatch Records
- **District Data**: VDOT District Crash Database, Smart Traffic Center Data
- **Project Data**: Cameras
- **Private Sector Data**: Automatic Crash Notification

Methodology

- **Field Evaluation Approach**: This field evaluation can be divided into three sub-approaches. The first of these sub-approaches involves a direct comparison of before and after crash rates. The use of crash rates ensures that statistics can be compared across different facilities and conditions, given that crash rates represent a normalized measure of effectiveness. Specifically, the crash rate is computed as the number of crashes divided by the total vehicle miles of travel. The second approach involves collecting aggregate surrogate data (e.g., traffic volumes, traffic stream speeds) and estimating before and after crash rates using a crash risk model. The final approach involves collecting microscopic surrogate data (e.g., vehicle speed differentials, number of lane changes, number of close calls, etc.) and estimating the crash risk using a microscopic crash model. Typically, the first approach is recommended, however this approach requires a minimum of 10 years of field data (5 years before and 5 years after ITS implementation). However, if statistically significant crashes occur within a period of less than 5 years the analysis can be conducted over a shorter temporal time span. The data sources listed above could be used for this field evaluation. The main advantage of this field evaluation approach is that it provides a direct comparison of crash rates before and after a project is implemented. However, the major disadvantage of this approach is that conditions in the study area are likely to change over a 10-year period, making it difficult to isolate changes in crash rates as a result of the ITS implementation. For this reason, a pure crash rate comparison approach is problematic. Consequently, it appears that the second approach to field evaluation might be more realistic.

- **Simulation Evaluation Approach**: For a simulation approach, actual crash data are not required; only data such as traffic volumes and traffic speeds are required to construct and calibrate the simulation model. These data inputs can be run in a microscopic simulation software in conjunction with a crash model to simulate the crash risk before and after an ITS project is implemented. The major advantages of the simulation approach is that it provides an opportunity to evaluate conditions not necessarily observed in the field and that it does not require the actual implementation of the ITS project in order to conduct the evaluation.
- **Combination Approach**: A combination approach can be used to combine a field evaluation with a simulation evaluation. In this case, three years of data is recommended and can be plugged into a simulation model. While not extensive, three years of field data provides a benchmark for validating the simulation results. The data sources listed above could be used. As was mentioned earlier, the combination approach offers a significant advantage over the modeling approach because results may be validated against field findings.

Safety Measure: Change in Severity of Crashes

Definition: Crash severity is the level of damage for vehicles involved in a crash or the highest damage for passengers involved in a crash.

Potential Data Source(s)

- **National Crash Data** (FARS, GES, etc.)
- **Project Data:** Crashes

The National Database includes four severity levels (passengers) and five severity levels (cars).

Methodology

- Methodology is the same as that for the measure “change in number of crashes”.

Safety Measure: Change in Speed Variability

Definition: Speed variability is the level of variability in vehicle speeds traversing a roadway section or point on a roadway section.

Potential Data Source(s)

- **Project Data:** Detectors, GPS Vehicle Probe Runs, Video Surveillance (record over a period of time and analyze).

Methodology

- **Field Approach**: Several months of field data (before and after ITS implementation) is recommended. The data sources listed above could be used. The problem with the field approach is that the corridor is changing, work zones are being put up, and lanes are being added, so data collection will not be comparable over time.
- **Simulation Approach**: Actual speed variability data are not necessarily required; instead, the researcher can characterize field conditions for the construction of a simulation model.

Typically, data required for simulation include calibrating speed-flow relationships using loop detector data, characterizing geometric layout of a study section, and calibrating traffic volume and origin-destination demands. The use of origin-destination demands provides the opportunity to model traffic diversion effects.

- **Combination Approach**: A combination approach can be used that combines field data with simulation. In this case, a month's worth of field data is recommended and can be input into a microscopic simulation model. The data sources listed above could be used.

*****Note that speed variability is a surrogate measure of number of crashes and severity of crashes. A crash model is required to translate speed variability into crashes.

Surrogate Safety Measure: Change in Number of Conflicts

Definition: A conflict is an event involving two or more road users, in which the action of one user causes the other to make an evasive maneuver to avoid a collision.

Potential Data Source(s)

- **Project Data:** Localized vehicle data using an instrumented vehicle and surrounding traffic stream data using video surveillance, and/or a radar sensor.

Methodology

- **Field Approach**: Several months of field data (before and after ITS implementation) are recommended. The data listed above could be used. The problem with the field approach is that the corridor may change, work zones may be constructed, and lanes may be added, so data collection will not be comparable over time.
- **Simulation Approach**: Actual crash data are not required for a simulation; the researcher can characterize the field circumstances (speeds, traffic volume, number of lanes) and input it into the simulation model to estimate number of conflicts.
- **Combination Approach**: A combination approach can be used that combines field data with simulation. In this case, a month's worth of data is recommended and can be plugged into a microscopic simulation model. The data collected at the project level could be used.

*****Number of conflicts is a surrogate measure of number of crashes and severity of crashes.

Safety Measure: Change in Speed Compliance

Definition: Speed compliance is traveler compliance with the posted speed limit.

Potential Data Source(s)

- **Project Data:** Cameras, Detectors (record vehicle speed and compare to posted speed)

Methodology

- **Field Approach**: Several months of field data collection is recommended (before and after ITS implementation). Researchers could determine the percent of vehicles that exceed the speed limit before and after the installation of ITS. Periodic "after" surveys may also be conducted to determine if the impact of the intervention is sustained or diminishes over time.

Safety & Mobility Measure: Change in Response Time

Definition: The elapsed time from the first call to a state police dispatcher or response agency (Public Safety Answering Point) concerning an accident to the arrival of the first officer on the scene.

Potential Data Source(s)
- **State Data:** VSP Computer Aided Dispatch Records
- **District Data:** Smart Traffic Centers, Safety Service Patrol

Methodology
- **Field Approach:** Five years of field data collection is recommended (before and after ITS implementation). Researchers could determine a change in response times (from when dispatcher calls trooper to when trooper reports arrival on scene) before and after installation of ITS.

Safety & Mobility Measure: Change in Clearance Time

Definition: The elapsed time from the arrival of the first dispatched response vehicle to the time the scene is clear of all vehicles.

Potential Data Source(s)
- **State Data**: VSP Computer Aided Dispatch Records
- **District Data**: Smart Traffic Center, Safety Service Patrols

Methodology
- **Field Evaluation Approach:** Five years of field data collection is recommended (before and after ITS implementation). Researchers could determine change in clearance times (from when first trooper reports arrival on scene to when the last trooper reports the scene is closed) before and after installation of ITS.

Safety & Mobility Measure: Change in Number of Fatalities

Definition: Number of people who die within 30 days as a result of a traffic crash.

Potential Data Source
- **National Data:** FARS
- **State Data**: VSP Accident Reports
- **Project Data**: Record Fatalities

Methodology
- Methodology the same as with the measure “change in number of crashes”.

Mobility & Efficiency Measure: Change in Travel Time

Definition: Travel time is the average time spent by vehicles traversing a highway segment, including control delay, in seconds per vehicle or minutes per vehicle.

Potential Data Source(s)

- **Project Data**: Detectors (speeds for typical conditions vs. speeds at locations during an incident), video, radar gun, GPS equipped vehicles, traffic volume counts, network geometric features.

Methodology

- **Field Evaluation Approach**: Using the field approach, measure travel times before and after ITS project is implemented using the data sources provided above. Statistical sampling techniques should be employed to ensure that sample sizes are large enough to measure differences in travel times.
- **Simulation Evaluation Approach**: Construct a simulation model of the study area, and evaluate changes in travel time as a result of the ITS project. Traffic data in terms of traffic counts and network data in terms of roadway geometry would be required in order to construct a simulation model. Traffic counts will be used to calibrate traffic demand. The ability to capture traffic routing behavior is critical to the accurate modeling of traffic diversion effects.
- **Combination Evaluation Approach**: For a combined approach, construct a simulation model using the procedures identified in the simulation evaluation approach. Collect sample field data to serve as a benchmark for validation of simulation results. Use the simulation model to evaluate scenarios not observed in the field and to construct a database of expected travel times that can be broadcast to the public.

Surrogate Mobility & Efficiency Measure: Change in Vehicle Queue Lengths

Definition: A queue is a line of vehicles waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue. Slowly moving vehicles joining the rear of the queue are usually considered to be part of the queue. The internal queue dynamics can involve starts and stops.

Potential Data Source(s)

- **Project Data:** Detectors, Video, GPS equipped vehicles.

Methodology

- Methodology is the same as with the measure “change in travel time”.

*****Note that queue is a surrogate measure of travel time.

Mobility & Efficiency Measure: Change in Roadway Capacity

Definition: Capacity is the maximum sustainable flow rate at which vehicles or persons can traverse a point or uniform segment of a lane roadway during a specified time period under a given roadway, geometric, traffic, environmental, and control conditions; capacity is usually expressed in vehicles per hour, passenger cars per hour, or persons per hour.

Potential Data Source(s)

- **Project Data:** Weather, Percentage Trucks, Incidents, Lane Blockages, Grades, Work Zones, Detectors (count departure from queue to measure maximum system throughput).

Methodology

- **Field Evaluation Approach**: A field evaluation would require measuring a system's maximum throughput. However, given that it is highly unlikely that the facility will be operating at capacity, it would be very difficult to estimate the system capacity.
- **Simulation Evaluation Approach**: A simulation evaluation would require the construction of a simulation model of the study area and an analysis of the facility's operation when it is operating at capacity. The development of such a simulation approach requires research to study the effects of weather, heavy vehicles, and work zones on the capacity of roadways.

*****Note that it is difficult to measure roadway capacity; researchers are still grappling with the best way to do this (i.e., how to consider trucks in the measurement among other things).

Surrogate Mobility & Efficiency Measure: Change in Vehicle Speed Differential by Vehicle Type

Definition: Differences in vehicle speeds by type of vehicle.

Potential Data Source(s)

- **Project Data:** Weather, Percentage Trucks, Incidents, Lane Blockages, Grades, Work Zones, Detectors (record speeds of vehicles).

Methodology

- **Simulation Evaluation Approach:** This approach requires research to characterize the behavior of traffic in the vicinity of a slow-moving truck. Conducting the research would require gathering of field data to develop models. Once these models are developed the analysis of the system can be evaluated using simulation.

Customer Satisfaction Measure: Corridor Traveler Satisfaction

Definition: Traveler satisfaction is a measure of the quality of a trip from the perspective of the traveler.

Potential Data Source(s)

- **State Data**: VTRC Survey (on VDOT web-site)
- **Project Data:** Survey, Focus Group

Methodology

- **Field Evaluation Approach**: A field evaluation is necessary to assess traveler satisfaction. A sample of 384 travelers is sufficient at a 5% acceptable error rate. This number (384) is obtained by using the formula in the box to the right. Focus groups can also be used to either pre-test the survey or to delve deeper into issues revealed in the survey. At least two or three focus groups of 8-10 people should be conducted for each target group. The survey conducted by the University of Virginia's Center for Survey Research for VDOT can also be referenced when designing the survey instrument and certain aspects of the survey may be useful for comparison. The URL for this survey is:

$n=z^2(p \times q)/e^2$
n=sample size
z=std error
p=established variability
q=(100-p)
e=acceptable error
$n=(1.96)^2(50 \times 50)\ /5^2$
n=384.16

www.virginiadot.org/infoservice/resources/CustomerServiceRpt.pdf

Customer Satisfaction Measure: Traveler Awareness of Real-time Conditions

Definition: Traveler awareness of real-time conditions is a measure of how aware travelers are of the conditions on the roadway (i.e., weather, incidents, travel time, congestion).

$n=z^2(p \times q)/e^2$
n=sample size
z=std error
p=established variability
q=(100-p)
e=acceptable error
$n=(1.96)^2(50 \times 50)\ /5^2$
n=384.16

Potential Data Source(s)

- **State Data**: VTRC Survey (web-site)
- **Project Data:** Survey, Focus Group

Methodology

- **Field Evaluation Approach**: A field evaluation is necessary to assess traveler awareness. A sample of 384 travelers is sufficient at a 5% acceptable error rate. This number (384) is obtained by using the formula in the box to the right. Focus groups can also be used to either pre-test a survey or to delve deeper into some issue that was revealed in a survey. At least two focus groups of 8-10 people should be conducted for each target audience.

Energy & Environment Measure: Change in Fuel Consumption

Definition: Amount of fuel consumed**.**

Potential Data Source(s)

- **Project Data**: Instrumented Vehicle (infrared technology to measure emissions and on-board emissions), Detectors (speeds and accelerations), and/or video imagining software that extracts data on speeds, counts, etc.

Methodology

- **Field Evaluation Approach:** Collect data in the field with the instrumented vehicle.
- **Simulation Evaluation Approach:** Characterize fuel consumption and run a simulation.
- **Combination Approach:** VTTI has a fuel consumption model that can be run to determine consumption rates (just plug field data [speeds and acceleration] into the model).

Energy & Environment Measure: Change in Vehicle Emissions

Definition: Amount of emissions.

Potential Data Source(s)

- **Project Data**: Instrumented Vehicle (using infrared technology to measure emissions and on-board emissions), Detectors (speeds and accelerations), and/or video imagining software that extracts data on speeds, counts, ect.

Methodology

- **Field Evaluation Approach:** Collect data in the field with the instrumented vehicle.
- **Simulation Evaluation Approach:** Characterize emissions (speeds, accelerations, etc.) and run a simulation.
- **Combination Evaluation Approach:** VTTI has a fuel consumption model that can be run to determine emissions rates by plugging in field data, such as speeds and acceleration, into the model.

Appendix F: Discussion of Simulation and Field Evaluation

Simulation evaluation and field evaluation are two primary methods described in this framework. Below is a general discussion of each method. These two approaches are also discussed in depth in Step 4 of the framework. Each evaluator will need to decide what approach or combination of approaches to take because each approach has it benefits and drawbacks.

Transportation projects can be evaluated by conducting a field evaluation, a modeling evaluation, or a combination of both. Field evaluations provide a direct evaluation of transportation projects as they are implemented in the field. However, field evaluations suffer from a number of drawbacks. First, field evaluations are typically expensive to conduct and require that the system be implemented in the field prior to the evaluation. Second, field evaluations are restricted to conditions that have been observed in the field and, thus, cannot be utilized to extrapolate the benefits of a system in the future. Third, it is difficult to isolate the impacts of a specific project, given that projects are typically not implemented in the field in isolation.

Consequently, while modeling or simulation can never replicate reality perfectly, these approaches provide some major advantages when field evaluation is not practical or possible. The main purpose of simulation is to provide an opportunity to evaluate system changes in a benign environment and to generate a detailed evaluation of the system's performance that is not possible or is too expensive to implement in the field. Modeling also provides an opportunity to extrapolate the potential benefits of a project by considering future traffic conditions. However, the accuracy of a modeling evaluation depends on the modeling tool's accuracy and capability level of calibration and level of coding.

In terms of evaluating ITS projects, the optimum evaluation procedure is to conduct a limited field study together with a more extensive modeling study. The limited field study serves as a benchmark for validating the simulation results for the base case. Subsequently, the modeling study can investigate the impacts of traffic, environmental, and incident conditions that are not necessarily observed in the field, without the need to implement the system under consideration.

For more information on simulation modeling, view the article "The INTEGRATION Modeling Framework for Estimating Mobile Source Emissions" by Hesham Rakha and Kyoungho Ahn. The article can be accessed at http://filebox.vt.edu/centers/vtti/cia/SimulationArticle.doc. It provides a sample demonstration framework for estimating energy and environmental impacts of transportation projects. This sample application is presented for illustration purposes only.

Appendix G: Contact Information

Steve Shergold
VDOT I-81 ITS Program Coordinator
804-786-9744
Steven.Shergold@VirginiaDOT.org

Donny Necessary
VDOT Bristol District Technical Committee Representative
726-645-1603
Donald.Necessary@VirginiaDOT.org

Mike Phipps
VDOT Bristol District Technical Committee Representative & District ITS Manager
276-669-9987
Michael.Phipps@VirginiaDOT.org

Tim Martin
VDOT Salem District Technical Committee Representative & District ITS Manager
540-387-5395
TimL.Martin@VirginiaDOT.org

Chris McDonald
VDOT Salem District Technical Committee Representative
540-387-5393
Christopher.McDonald@VirginiaDOT.org

Dean Gustafson
VDOT Staunton District Technical Committee Representative & District ITS Manager
540-332-9143
Dean.Gustafson@VirginiaDOT.org

Wayne Spaulding
I-81 ITS Program Manager (Consultant Support)
302-438-1306
Spaulding@pbworld.com

Appendix H: Recent ITS Related Evaluations for the I-81 Region

Evaluation	Completion Date	Evaluator	Evaluator Contact
Staunton District Concept of Operations Lesson Learned Report	February 2001	Virginia Tech Transportation Institute	Stephanie Baker 540-231-6948
Real-Time EMS Helicopter Video Feasibility Study	November 2001	Pegasus Aeromedical Program	Debera Perina 434-243-6720
Northern Shenandoah Valley Public Safety Initiative (PDA Trial)	January 2002	The Pennsylvania State University Applied Research Laboratory	Ed Crow 814-863-9887
Case Study Evaluation of the VDOT's I-81 ITS Program	March 2002	Virginia Tech Transportation Institute	Stephanie Baker 540-231-6948
Historical Development of the Travel Shenandoah Pilot Service	May 2002	Virginia Tech Transportation Institute	Stephanie Baker 540-231-6948
Evaluation of the Truck Fleet Support Program	February 2003	Virginia Tech Transportation Institute and MaineWay Services	Niki Swan 540-231-6489
77 Fog System Evaluation	June 2003	Virginia Transportation Research Council	Cathy McGhee 434-293-1973
511 Virginia Evaluation	January 2004	Virginia Tech Transportation Institute	Niki Swan 540-231-6489
Wireless LAN Evaluation	June 2004	Virginia Tech Transportation Institute	Aaron Schroeder 540-231-6243
Technical/Technology Evaluations ITS Deployment Program	2003-2004	James Madison University	David Bernstein 540-568-1671
Northern Shenandoah Public Safety Initiative Case Study Report	January 2004	Quality Consultants Group	Patricia Harrison 703-836-4732

Appendix I: ITS Projects Submitted to the Technical Committee by MOE and FY.

MOE / Surrogate MOE	FY03 Projects	FY04 Projects
Change (Δ) in # of crashes.		
Δ in severity of crashes.		
Surrogate of crashes / severity of crashes. Δ in speed variability.		
Surrogate of crashes / severity of crashes. Δ in number of conflicts.		
Δ in speed compliance.		
Δ in response time.		
Δ in clearance time.		
Δ in number of fatalities.		
Δ in travel time.		
Surrogate of travel time. Δ in vehicle queue lengths.		
Δ in roadway capacity.		
Surrogate of roadway capacity Δ in vehicle differential by vehicle type.		
Corridor travel satisfaction.		
Corridor traveler awareness of real-time conditions.		
Δ in fuel consumption (trucks & cars).		
Δ in vehicle emissions (trucks & cars).		
Other Measures		

Appendix J: Case Study Review of 511 Virginia Evaluation

Background

This case study is based on an interview with Ms. Nicole Swan, manager of the 511 Virginia Evaluation. The interview concerned how Ms. Swan's evaluation team used this framework to craft the 511 Virginia Evaluation plan and what recommendations she has for others using the framework.

In summary, Ms. Swan used this evaluation framework to determine which goals, objectives, and measures would guide the 511 Virginia Evaluation. She also used the lessons learned questions to shape the interview instrument used in the analysis of 511 Virginia's transition from management by Virginia Tech to management by the private sector partner, Shentel.

Ms. Swan made several recommendations that may help other evaluators who use this framework. First, she recommended that evaluators should work with their sponsor from the beginning of the planning process to select goals, objectives, and measures. The entire evaluation process will run more smoothly if the evaluation team and the sponsor are on the same page from the start. Evaluators should also use the framework as a toolbox from which they can draw ideas and guidance for their evaluation plans. Ms. Swan also recommended that evaluators pick and choose what they need from the framework and not get caught up in the steps.

It is important to note that Ms. Swan used the framework while it was under development. The portion of the framework that was not complete at that time the 511 evaluation plan was written was the methods section. She also began using the framework at Step 2 instead of Step 1, as Step 1 deals with whether or not an evaluation should be conducted. This decision had been made by VDOT before VTTI was hired to conduct the evaluation.

Below are key excerpts from the interview between the author of this document, Ms. Baker, and Ms. Swan. The interview provides more detail about the 511 Evaluation Team's use of this Evaluation Framework.

Interview with Ms. Nicole Swan

Interviewer, Stephanie Baker (SB): How did you use this Evaluation Framework in designing the 511 Virginia Evaluation (i.e., which sections of the Framework did you use and how?)

Nicole Swan (NS): We started our evaluation planning with this framework and basically used two parts of it. We started with the Goals, Objectives, and Measures of Effectiveness Table (Step 2). Since we had already been working on 511, we looked at the table and determined what goals were applicable to the project. Then we figured out which objectives and measures of effectiveness to use and created a draft. From there we presented it to the VDOT project sponsors (JR Robinson and Todd Kell), and they modified it and added to it.

In retrospect, I would have liked our VDOT contacts to take the first crack at it. Or maybe it could've been something we did together the first time. Although I think we still came around to what they wanted, I think they had to work through our first understanding of it. However, I think we were able to make it work because we had worked together already on 511. But for another evaluation, if I were outside of the project, I would do it differently. Either way, using the goals, objectives, and measures worked very well for us.

Also, one of our sponsors suggested that we look through Appendix B, the prioritized objectives, to try and find objectives and measures of effectiveness, which was very useful for me because I had been working only with the table in Step 2. We came up with some other things from Appendix B that helped us to refine our goals, objectives, and measures of effectiveness. However, we ended up changing some of the wording. At first we wanted to stick exactly with what the table said, because it sounded good, but we had to change it to fit what we needed for our project. So that was a good lessons learned: that we didn't need to stay exactly with what was stated in the table.

We also used the lessons learned sample questions: that was great for me. I needed to create an interview instrument to evaluate the transition of 511 from VTTI to Shentel. I also, in this case, changed some of the questions but it gave me a good start.

SB: In terms of what was useful, it sounds like you used Step 2, Appendix B, and Step 5. Was there anything else that you found to be useful?

NS: Overall, what this did for us that I thought was very useful was that it put us all on the same page. I think a lot of people can come with different perceptions of what an evaluation should be, but this immediately focused us down to what the ITS overall goals were, and then we were all thinking along similar lines. It was a jumping-off point.

It also provided a way for me to organize my information because I ended up setting up a matrix like the one shown in Step 2. It made a lot of sense to me and gave me something to show people and to put in presentations, and I don't think necessarily that I would have created that on my own. So that was useful to me too.

The lessons learned and the goals and objectives really helped me focus. As a manager, I tend to think about the big picture, and I know what I want in a big picture, but it is hard for me to pull it down into something specific. This method, however, was so easy for me because it was already broken out, so I didn't have to spend time doing it on my own. The lessons learned questions were especially helpful because it put the questions into categories for me and gave me ideas that I could build on.

SB: Did you find that this framework helped you create the evaluation plan with VDOT, or do you think it constrained that process?

NS: No, I thought it was very useful because they could all look and see exactly where we were starting from, and that helped us focus. I think an evaluation, especially one as big and as important to VDOT as 511, could have gone a thousand different ways. It was very useful for all of us to look at the same piece of paper and make choices from there.

SB: Was there anything in the framework that was not useful that could be improved?

NS: I don’t know about improving things necessarily, but I didn’t use the whole template. I didn’t start from Step 1 and go all the way through. I just jumped right into what I knew that I needed.

I don’t know how it can be improved, but in thinking through your question, I think what is important for everyone using it, especially the project managers, to understand is that it is a toolbox. I just grabbed what tools I needed and made it fit within what we wanted to do. We also added components to our evaluation that are not in the framework, like the transition analysis. So what others need to understand is that they don’t have to go from Step 1 to Step 7 to use this framework; they can just pull from it. It was most useful to me in that way.

SB: In terms of the methods, VTTI actually did not have the methods section completed before you used this framework. The work that your 511 evaluation team did supplemented the methods section, specifically the methods for analyzing customer satisfaction. Do you think that if there had been a methods section ahead of time that you would have used it?

NS: It would’ve been nice to have had that ahead of time. So, yes definitely. I think a lot of these skills that are unique to doing an evaluation are not general skills that a project manager has; they are specialized skills. We were fortunate to have staff who understand methods well. But this methods worksheet could supplement our staff knowledge on another project.

SB: Is there anything you would recommend to other managers or evaluators who will use this framework?

NS: I would recommend that they become familiar with the framework before they jump into their evaluation. Once things get moving, you don’t have as much time to familiarize yourself, and it might not be as easy. But I think it was an advantage to me to be familiar with it. So once it is published, if people become familiar with it then they can pick it up at any time, and they will know where they need to jump in, and they’ll know how to use it. It is a wonderful tool, and I would definitely recommend it to anyone who is involved in an ITS evaluation.

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