Technical Memorandum No. 1

ITS Deployment Analysis System (IDAS) Customization

Project Technical Requirements

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APTS ..... Advanced Public Transit System
ATIS ..... Advanced Traveler Information System
ATMS ..... Arterial Traffic Management System
CARB ..... California Air Resource Board
CATS ..... Chicago Area Transportation Study
CBD ..... Central Business District
CCTV ..... Closed-Circuit Television
CEI ..... Construction, Engineering, and Inspection
CFP ..... *Cost Feasible Plan*
CHART ..... Coordinated Highways Action Response Team (Maryland)
CO ..... Carbon Monoxide
CO_2 ..... Carbon Dioxide
CVISN ..... Commercial Vehicle Information Systems and Networks
CVO ..... Commercial Vehicle Operations
DMS ..... Dynamic Message Sign
DS ..... Digital Signaling
EMC ..... Emergency Management Center
EMFAC2000 ..... Emissions Factor Model 2000
EPA ..... Environmental Protection Agency
ETC ..... Electronic Toll Collection
FDOT ..... Florida Department of Transportation
FFN ..... Florida Fiber Network
FHWA ..... Federal Highway Administration
FIHS ..... Florida Intrastate Highway System
FMS ..... Freeway Management System
FSUTMS ..... Florida Standard Urban Transportation Model System
HAZMAT ..... Hazardous Materials
HC ..... Hydrocarbon
I-4 ..... Interstate 4
IDAS ..... ITS Deployment Analysis System
IMS ..... Incident Management System

ISP ..... Information Service Provider
ITS ..... Intelligent Transportation System
IVHS ..... Intelligent Vehicle Highway System
JPO ..... Joint Program Office
LOS ..... Level of Service
MOT ..... Maintenance of Traffic
MPH ..... Miles Per Hour
MPO ..... Metropolitan Planning Organization
NITSA ..... *National ITS Architecture*
NO ..... Nitrous Oxide
O&M ..... Operations and Maintenance
ORNL ..... Oak Ridge National Laboratory
PDO ..... Property Damage Only
PHT ..... Person Hours Traveled
PM ..... Particulate Matter
RCI ..... Roadway Characteristics Inventory
ROG ..... Reactive Organic Gas
ROO ..... Regional Operating Organization
SAIC ..... Science Applications International Corp.
SEMP ..... *Systems Engineering Management Plan*
STEAM ..... Surface Transportation Efficiency Analysis Model
SUL ..... Special-Use Lane
TMC ..... Transportation Management Center
USDOT ..... United States Department of Transportation
V/C ..... Volume-to-Capacity
VHT ..... Vehicle Hours Traveled
VMT ..... Vehicle Miles Traveled
WIM ..... Weigh-in-Motion

1. Introduction

The Intelligent Transportation Systems (ITS) Deployment Analysis System (IDAS) is an ITS sketch-planning analysis tool that can be used to estimate the impacts and costs resulting from the deployment of ITS components. The set of impacts evaluated by the IDAS includes changes in several performance measures, such as travel time/speed, travel-time reliability, fuel costs, operating costs, accidents, emissions, and noise. The IDAS also provides benefit-to-cost comparisons of ITS improvements individually and in combinations.

The IDAS can assess the impacts and costs of 12 different categories of ITS deployments. These deployments include: arterial traffic management systems (ATMS); freeway management systems (FMS); advanced public transit systems (APTS); incident management systems (IMS); electronic payment collection; railroad grade crossings; emergency management services; regional, multimodal traveler information systems; commercial vehicle operations (CVO); advanced vehicle control and safety systems; supporting deployments; and generic deployments.

The Florida Standard Urban Transportation Model System (FSUTMS) provides the inputs required to run the IDAS. However, conversion of the FSUTMS data is required to achieve a format suitable for input into the IDAS. To make the IDAS more convenient for users, efforts are underway to develop an interface between the FSUTMS and the IDAS through the initiative of the Statewide Model Task Force.

The IDAS software includes default values for the inputs required to calculate the costs and benefits of ITS deployments. These defaults are based on the analysis of the data presented in the Federal Highway Administration's (FHWA) *ITS Benefits* and *ITS Unit Costs Databases*. The default benefits are also based on an extensive review of literature performed by the IDAS developers during the initial development of the software.

A more accurate analysis of Florida ITS deployments will be achieved if Florida-specific defaults can be used in lieu of the defaults used in the IDAS, which are based on national costs and benefits data. The IDAS program currently allows users to override the default values by inputting their estimates of ITS device costs, cost assumptions, benefit impacts, and benefit valuations. Although this flexibility will provide more specific results at a project or local level, standardized Florida costs and benefits are needed to provide more comparable results for ITS project evaluations across the state.

The IDAS also allows users to assign weights to ITS project performance measures to determine the overall benefit valuation of the project. Although this individual weighting of performance measures allows for more flexibility at a local level, a standardized project ranking methodology is necessary for the Florida Intrastate Highway System (FIHS) and other state highways for more comparable evaluation results on a statewide basis.

Many factors are expected to influence decision makers when selecting between alternative ITS and other transportation improvement implementations on a given highway segment. IDAS evaluates deployment alternatives based on a number of quantitative performance measures. A strategy is needed to combine the IDAS outputs, other quantitative and qualitative measures, and other factors to select between and prioritize ITS deployment alternatives. In addition to the IDAS outputs, other factors to be considered include technical issues, institutional issues, and synergy requirements.

A systems engineering approach will be applied during the Florida IDAS Customization Project, whereby the process for determining updated default values and recommended values and procedures will be consistent with the defined project technical requirements, and traceability to the requirements will be documented. The systems engineering approach will consist of identifying the customization project technical requirements, analyzing the requirements, and then designing, implementing, and testing the required modifications to the IDAS package based on the requirements.

This *Technical Memorandum* discusses the technical requirements for the Florida IDAS Customization Project. These requirements will define what needs the anticipated updates shall fulfill.

2. Document Organization

This document is organized in the following sections:

- *Section 1, Introduction* – This section presents background information and the document objectives**.**
- *Section 2, Document Organization* – This section presents a list of the subjects covered in the document.
- *Section 3, FHWA ITS Benefits and ITS Unit Costs Databases* – The IDAS uses these two databases in estimating the costs and benefits of ITS deployments. Thus, they are discussed in detail in this document.
- *Section 4, The IDAS Benefits and Costs Modules* – This section discusses the costs and benefits modules included in the IDAS and their default parameters.
- *Section 5, Florida Studies* – This section summarizes a number of studies performed in Florida to identify benefits, costs, performance measures, and prioritization strategies for statewide ITS deployments.
- *Section 6, Needs Analysis* – This section discusses the issues and needs associated with the selection of default parameters for the IDAS costs, benefits, and prioritization strategies in relation to the implementation of this software to evaluate ITS deployment alternatives in Florida.
- *Section 7, Concept of Operations* – This section presents the *Concept of Operations* for the customization of the IDAS software for Florida conditions. The *Concept of Operations* is based on the needs identified in *Section 6* and explains how the customization will operate.
- *Section 8, Functional Requirements* – This section discusses the technical requirements for the adoption and update of statewide costs and benefits data, and a prioritization process for ranking ITS projects using the IDAS. These requirements are based on the needs identified in *Section 6* and the *Concept of Operations* presented in *Section 7*.

3. The FHWA's *ITS Benefits* and *ITS Unit Costs Databases*

Since December 1994, the United States Department of Transportation's (USDOT) Joint Program Office (JPO) for ITS has been actively collecting information regarding the impacts of ITS projects on the operation of the surface transportation network. The JPO also collects information on ITS costs and maintains this information in the *ITS Unit Costs Database*. The *ITS Benefits* and *ITS Unit Costs Databases* are available at http://www.benefitcost.its.dot.gov/. Since the IDAS uses these two databases in estimating costs and benefits, they are discussed in more detail below.

3.1 The FHWA's ITS Unit Costs Database

The *ITS Unit Costs Database* consists of cost estimates for a set of ITS elements. These cost estimates are categorized as capital, and operations and maintenance (O&M) costs. Capital costs are the costs expended for one-time, non-recurring purchases. Examples include, but are not limited to, costs of equipment, system design, and development of integration software. The O&M costs, often referred to as recurring costs, are the costs that are incurred on an ongoing basis. Typical examples include utilities for a traffic operations center, leased wireline or wireless monthly fees, repairs and replacements of ITS equipment, and labor costs. Costs are presented in the *Database* in a range to capture the lows and highs of the cost elements from the different data sources that were used in deriving the *Database*. The *ITS Unit Costs Database's* Web site states, "The cost data are useful in developing project cost estimates during the planning process. However, the user is encouraged to find local/regional data sources and current vendor data in order to perform a more detailed cost estimate."

The set of ITS elements are based primarily on the unit cost elements in the *National ITS Architecture (NITSA) Cost Analysis*. As new cost data becomes available, existing costs for the unit cost elements are revised and new unit cost elements are added.

The current version of the *ITS Unit Costs Database* is dated September 30, 2002. Any new cost data sources are reviewed for content and applicability to the *ITS Unit Costs Database*. These new cost databases are obtained from state and local governments and agencies, congressionally-designated ITS projects, and ITS-related product vendors on a national level. The next scheduled update of the *Database* is March 30, 2003.

Direct and indirect sources for cost estimates in the current version of the *ITS Unit Costs Database* are listed below:

- Intelligent Vehicle Highway System (IVHS) Architecture, Initial Cost Analysis, Rockwell International, 1994;
- Core Infrastructure, FHWA, 1995;
- ITS Architecture Cost Analysis, Joint Architecture Team, 1996;
- *ITS National Investment and Market Analysis*, Apogee, 1997;
- Costs by TransCore, 1997;
- Seattle Study, CH2M Hill, 1998;
- In-Vehicle and Infrastructure Costs, Oak Ridge National Laboratory (ORNL), 1998;
- IDAS, Build 2, 1999;
- Kimley-Horn and Associates, Inc.;
- *Metropolitan Model Deployment Initiative: Seattle Evaluation Report (Final Draft)*, Science Applications International Corp. (SAIC), May 2000;
- *Final Draft: Phoenix Metropolitan Model Deployment Initiative – Evaluation Report*, Battelle, May 2000;
- *Metropolitan Model Deployment Initiative: San Antonio Evaluation Report (Final Draft)*, SAIC, May 2000;
- Deployment data, 2001, 2002;
- ITS product vendors, 2000, 2001, 2002; and
- ITS Integration Program self-evaluation data, 2001, 2002.

3.2 The FHWA's ITS Benefits Database

The *ITS Benefits Database* summarizes both national and international benefits described in evaluations, conference papers, and other reports from previous studies. The information in the *ITS Benefits Database* is classified in a number of ways. One classification groups benefits data into two major components: intelligent infrastructures and intelligent vehicles. These components are then divided into program areas and specific ITS application areas.

Data are also classified by a few measures of effectiveness. Termed "a few good measures," these measures were identified by the JPO to assist in tracking the nation's progress toward meeting ITS program goals. The measures are safety, delay or travel–time savings, cost savings, improvements in effective capacity, customer satisfaction, and energy and environmental impacts.

In addition, the benefits data are classified by the location of the project (i.e., the state and country) and the types of integration between the multiple ITS applications represented by the project, as well as the data most recently added to the *Database*.

Visitors to the JPO ITS benefits Web site can submit ITS benefits information by submitting an online form, by email, or by mailing printed copies to the *Database* administrator. Submitted data is carefully reviewed against a set of defined criteria upon which the decision is made whether or not to include it in the *Database*. Mitretek, the consultant that maintains the *Database* for the JPO, provides an updated version of the *Database* every four months.

Data submitted for the *Database* are reviewed based on the following criteria:

- Benefits information shall be derived from sound evaluation methodology. This methodology shall be stated in the source; and
- There shall be no known flaws in the analysis.

Benefit data sources and an assessment of their reliability as presented in the *ITS Benefits Database* Web site are presented below:

- Final evaluation reports are highly reliable;
- Draft evaluation reports are moderately reliable;
- Synthesis reports are highly reliable;
- Journal articles are reliable sources;
- Conference papers are reliable sources;
- Periodical articles are considered on a case-by-case basis;
- Conference presentations and other briefings are considered on a case-by-case basis;
- Web pages are considered on a case-by-case basis;
- Specialized benefits brochures are considered on a case-by-case basis;
- Fliers/Handouts are not included because they are less reliable;
- Company brochures and product literature are not reliable because they are biased towards individual products; and
- Newspaper articles and press releases are not included because they are less reliable.

4. The IDAS Benefits and Costs Modules

This section discusses the costs and benefits modules included in the IDAS and their default parameters.

4.1 The IDAS Benefits Module

The IDAS includes a number of submodules that calculate volume, travel time, travel-time reliability, safety, emissions, energy consumption, and noise. The IDAS has default values for these submodule parameters but allows the user to change these parameters to reflect locally- and regionally-calibrated values. Below is a brief description of these submodules.

4.1.1 Travel Demand/Travel Time

The travel time/throughput submodule provides for the examination of traveler responses to determining shifts of travel related to route choice (trip assignment), mode choice (modal split), temporal choice (time of day), and induced/foregone demand. Trip assignment and mode choice can be run for any time period of analysis, whether peak hour, peak period, off-peak hour, off-peak period, or daily travel. Temporal choice, if requested by the user, can only be run for the peak hour and for the vehicle mode, as the model is structured to estimate shifts from the peak hour to the off-peak hours of travel for vehicle trips only. The induced and foregone demand calculation, if requested by the user, can only be run for a daily time period analysis and for vehicle trips only. The IDAS provides default values for the above submodule parameters. However, the user can override the default parameters, such as mode choice coefficients, with locally derived values.

The trip assignment submodule uses enhanced speed versus volume-to-capacity (V/C) ratio curves segmented by facility type. These curves are stored as defaults in the IDAS database and may be replaced by user-defined curves, if desired. The IDAS has five speed versus V/C ratio curves available:

- Freeway – Urban;
- Freeway – Suburban/Rural;
- Arterial – Urban;
- Arterial – Suburban/Rural; and
- Ramp.

The freeway and arterial curves were developed in accordance with the relationship contained in the *1994 Highway Capacity Manual*. The ramp curve is the equation used in the Chicago Area Transportation Study (CATS) and involves the use of metered flow instead of capacity.

4.1.2 Environmental Impacts

The environmental submodule provides a method for estimating the changes in vehicle emissions, energy consumption, and noise impacts because of ITS strategies. Using the performance statistics generated from the travel time/throughput submodule, the environmental submodule estimates environmental performance measures by using a series of detailed lookup tables that consider emissions and energy consumption rates by specific network volume and traffic operating characteristics. The use of lookup tables provides the analyst with the ability to incorporate updated emissions, energy consumption, and noise rates as they become available.

The default IDAS lookup tables incorporate available emission rates from the federally-sponsored Mobile 5a and California Air Resource Board (CARB)-sponsored Emissions Factor Model 2000 (EMFAC2000) models. The IDAS default Mobile 5a emission rate lookup tables are based on the Chicago region rates as derived from CATS and are formatted by speed range [i.e., 2.5 to 65 miles per hour (MPH)], pollutant type [i.e., hydrocarbon (HC), carbon monoxide (CO), and nitrous oxide (NOx)], and eight vehicle type categories. For metropolitan areas in California, the IDAS also contains EMFAC-based emission rate lookup tables by pollutant type (i.e., HC, CO, and NOx), vehicle type (i.e., auto, truck-gas, and truck-diesel), speed range (i.e., 5 to 70 MPH), and temperature range (i.e., 55 to 95 degrees) by year (i.e., 1990, 1995, and 2010).

The IDAS calculates fuel consumption based on the network travel time and vehicle miles traveled (VMT) and uses fuel consumption rates generated from previous models developed by the Environmental Protection Agency (EPA), CARB, and other agencies. These rates are provided by facility type (i.e., freeways and arterials), speed range (i.e., 5 to 70 MPH, depending on the facility), vehicle type (i.e., autos and trucks), and fuel type (i.e., gas and diesel).

The noise impact rates are those incorporated in the Surface Transportation Efficiency Analysis Model (STEAM). STEAM is a sketch-planning tool that evaluates the performance of transportation system improvement alternatives.

4.1.3 Safety

Based on performance statistics calculated from the travel time/throughput submodule, the safety submodule determines the safety benefits by using detailed accident rates versus V/C ratio lookup tables. The user can override the default rates with locally specific rates. Accidents are stratified into fatal accidents, injury accidents, and property damage only (PDO) accidents.

4.1.4 Travel Time Reliability

Delay experienced by the vehicular traveler can be attributed to two primary sources: recurring delays caused by congestion on the roadway due to over-saturated conditions and non-recurring delays related to incidents, such as crashes and vehicle breakdowns.

Incident delay is a prime contributor to the reliability of travel times on a day-to-day basis and is, therefore, the impact measure used to describe travel time reliability. Improvements to the reliability of travel time are estimated in the IDAS as a function of the change in the number and duration of incidents. Travel time reliability is calculated from a set of default curves that calculate incident delay for freeway links only based on the number of lanes and the V/C ratio.

4.2 The IDAS ITS Benefit Adjustment Factors

In addition to the standard rates used in calculating various measures of performance as described in *Section 4.1, The ITS Benefits Module*, the IDAS maintains adjustment factors to account for the benefits of ITS components. These ITS component-specific benefit factors are maintained in an IDAS database and applied to adjust the performance measures, where appropriate.

The default values of these adjustment factors were selected by the IDAS developers based on information obtained from an extensive review of ITS benefits reported by previous ITS deployment evaluation studies. This information was initially obtained based on extensive review of literature by the IDAS developers and then supplemented by data obtained from the JPO *ITS Benefits Database*. The results from the studies are documented in the IDAS ITS Library, provided with the IDAS software, and sometimes referred to as the "Direct Benefits spreadsheet."

The performance measures included in the ITS Library are:

- Travel time/speed/delay;
- Throughput/capacity/vehicle stops;
- Change mode;
- Change time of day;
- Change route;
- Safety;
- Customer satisfaction;
- Emissions;
- Energy;
- Costs;
- Efficiency; and

- Other (e.g., fare evasion reductions, reduced passenger wait times, reduced response times, etc.).

As stated above, the default benefit values of ITS deployments were identified for the IDAS based on the results documented in the ITS Library. These default values can be changed by the user as more information becomes available.

4.3 The IDAS Cost Module

The IDAS cost module estimates the life-cycle expenditures by year and the average annual costs for ITS improvements. The costs estimated include:

- Public sector capital costs;
- Public sector O&M costs;
- Private sector capital costs; and
- Private sector O&M costs.

Each ITS component in the IDAS is associated with a set of default ITS equipment. The IDAS cost module calculates costs based on this set of default equipment's costs and the required number of units. The unit costs for the ITS equipment, which are provided as defaults in the IDAS database, were originally obtained from the *NITSA*. The default cost values in the IDAS are periodically updated based on the JPO *ITS Unit Costs Database* discussed in *Section 3, The FHWA's ITS Benefits and ITS Unit Costs Databases*. The default cost values used in the IDAS Release 2.2, which is the current release of the IDAS, are based on the values reported in the October 2001 version of the JPO *ITS Unit Costs Database*. The user may accept these default values or modify the type, quantity, and unit costs of equipment if more detailed or locally collected information is available.

4.4 The IDAS Performance Measures

IDAS produces the following performance measures:

- VMT;
- Vehicle hours traveled (VHT);
- Average speed;
- Person hours traveled (PHT);
- Number of person trips;
- Number of accidents –
    - o Fatalities;
    - o Injuries; and

  - PDO crashes;
- Travel time reliability (hours of unexpected delay);
- Fuel consumption (gallons); and
- Emissions –
  - HC and reactive organic gases (ROG);
  - CO;
  - NO_x; and
  - Particulate matter (PM 10).

The IDAS also produces benefit-to-cost calculation summaries including:

- Annual benefits –
  - Changes in user mobility;
  - Changes in user travel time (i.e., in-vehicle, out-of-vehicle, and travel-time reliability);
  - Changes in costs paid by users (i.e., fuel costs, non-fuel operating costs, and accident costs – internal only);
  - Changes in external costs [i.e., accident costs – external only, HC/ROG, NOx, CO, PM 10, carbon dioxide (CO_2), global warming, noise, other mileage-based external costs, and other trip-based external costs);
  - Changes in public agencies' costs, including efficiency;
  - Other calculated benefits; and
  - User-defined additional benefits;
- Annual costs –
  - Average annual private sector costs; and
  - Average annual public sector costs;
- Net benefits (annual benefits minus annual costs); and
- Benefit-to-cost ratios (annual benefits to annual costs).

5. Florida Studies

This section summarizes a number of studies performed in Florida to identify benefits, costs, performance measures, and prioritization strategies for statewide ITS deployments.

5.1 Florida's ITS Strategic Plan Performance Measures

Florida's ITS Strategic Plan outlines the recommended development of an *ITS Plan*, deployment priorities for ITS goals and objectives, and the performance measures to be reported. These performance measures are summarized as follows:

- Safety Measures –
  - Minimize response times to incidents;
  - Reduce commercial vehicle safety violations;
  - Reduce weather-related traffic incidents;
  - Minimize railroad grade crossing incidents;
  - Improve security for highway and transit; and
  - Improve security, safety, and convenience for bicycles and pedestrians;

- Protection of Public Investment Measures –
  - Reduce vehicular delay;
  - Improve peak period speed; and
  - Reduce CVO operating costs;

- Interconnected Transportation System Measures –
  - Reduce cost and delay on intermodal connections;
  - Minimize shipping and delivery delays;
  - Improve the predictability of travel times;
  - Improve the efficiency of fleet operations;
  - Improve tourist access and convenience; and
  - Increase employment in ITS; and

- Travel Choice Measures –
  - Improve mobility and choices for transit;
  - Improve tourist access;
  - Reduce the need to travel;
  - Reduce energy use and environmental degradation;
  - Improve multimodal travel;
  - Reduce delay from incidents;
  - Improve the efficiency of toll operations; and
  - Enhance ride-sharing opportunities.

5.2 ITS Plan Performance Measures

Performance measures for Florida's *ITS Plan* were recommended in *Technical Memorandum No. 3.3 – ITS Program Performance Measures: ITS Corridor Master Plans for Florida's Principal FIHS Limited-Access Corridors*. These performance measures include mobility- and safety-related performance measures and agency performance measures. Each of these measures was derived from the goals and objectives' statements used to summarize the needs, issues, problems, and objectives for ITS deployments on the FIHS corridor or to support a hierarchy of national performance measures. Below is a summary of the recommended ITS performance measures as reported in *Technical Memorandum No. 3.3*.

The following mobility- and safety-related measures are derived from the *ITS Plan* goals and objectives:

- Total delay in vehicle minutes;
- Predictability of travel times;
- Reliability of travel times;
- Accident rate per million VMT by severity type;
- Queue length and frequency of queue formation annually; and
- Throughput in passenger car equivalents per lane per hour.

The following are the performance measures needed to support the national ITS performance measures' objectives:

- Improved customer satisfaction;
- Reduced travel costs;
- Reduced emissions; and
- Reduced energy consumption.

Technical Memorandum No. 3.3 also listed a number of agency performance measures, including:

- Advanced traveler information system (ATIS) coverage;
- Overweight vehicle enforcement coverage;
- IMS coverage;
- FMS and IMS coverage of special-use lanes (SULs);
- Data collection system coverage;
- Data collection system functionality;
- Percent of ITS deployments with before and after studies;
- Publish guidelines on how to mainstream ITS in transportation planning;
- Branding of major services;
- Hazardous materials (HAZMAT) response team coverage;

- Designation and signing of detour routes;
- Continue research and development at existing or greater funding levels;
- Publish and implement statewide standards and specifications for ITS field devices;
- Publish and implement statewide standards for transportation management center (TMC) software;
- Publish and implement a statewide communications architecture;
- Communications backbone coverage;
- Publish and implement standard operating procedures;
- Publish statewide information exchange network standards and criteria;
- Publish and implement performance measures and archive data requirements;
- Publish a *Systems Engineering Management Plan* (*SEMP*);
- Establish a statewide-managed funds program for ITS;
- Implement ITS funding targets for the Florida Department of Transportation (FDOT);
- Publish work program instructions;
- Complete and implement training program assessment;
- Percent of project costs funded (total cost) by other agencies through public/public partnerships;
- Number of regions that implement regional operating organization (ROO) partnerships; and
- Percent of project costs funded (total cost) through public/private partnerships.

5.3 Florida Intelligent Transportation Systems Benefits White Paper

The *Florida Intelligent Transportation Systems Benefits White Paper* was prepared for FDOT in June 2002. The *Paper* outlines some of the benefits realized across the country and highlights potential benefits that can be assumed for Florida ITS deployments.

The *White Paper* listed the following types of results as tangible benefits from ITS projects:

- Reduced number of incidents;
- Provided motorists with choices through increased information;
- Increased speeds through toll plazas;
- Saved lives through emergency response; and
- Improved transit (on-time) performance.

In addition, the *White Paper* listed the following types of results as intangible benefits from ITS projects:

- Increased positive public perception of FDOT; and
- Enhanced perception of safety and technology.

To determine the effectiveness of proposed ITS deployments, the following benefits were identified from studies around the country and were determined to be applicable when evaluating ITS benefits in Florida.

- A five percent decrease in delay is anticipated as a result of IMS based on data provided by the Maryland Coordinated Highways Action Response Team (CHART) Program.

- A 15 percent reduction in injury-related accidents and fatalities is anticipated as a result of freeway management services based on data from the FHWA Fatal Accident Reporting System experience in San Antonio, Texas.

- A 35 percent reduction in PDO accidents is anticipated as a result of freeway management services based on data from the FHWA Fatal Accident Reporting System experience in San Antonio, Texas.

- A 7:1 benefit-to-cost ratio is anticipated for the sum of CVO that will be deployed in FDOT's Commercial Vehicle Information Systems and Networks (CVISN) program and the virtual weigh station proposed for Interstate 4 (I-4) in the Tampa area based on the experiences of the Colorado Department of Transportation.

- Benefits associated with ATIS include reductions in travel time and operating costs. Additional benefits are anticipated from congestion avoidance and improvement in the quality of driver convenience. Since no quantitative data was available to support an estimate of these benefits from other areas, a generally accepted benefit-to-cost ratio of 1.5:1 was used to estimate these benefits.

- Benefits associated with smart work zones are anticipated to include reductions in travel time and operating costs, reductions of accident rates and the severity of accident rates in work zones, and improvement in the quality of driver information. Since no quantitative data was available to support an estimate of these benefits from other areas, a conservative benefit-to-cost ratio of 1:1 was used to estimate these benefits.

5.4 The FIHS ITS Corridor Master Plans' Cost Estimates

As part of the development of the *ITS Corridor Master Plans*, the needed ITS devices were estimated for various corridor segments. Unit costs were then applied to the devices to determine construction and O&M costs for the proposed projects. The unit costs were based on estimates provided by the districts as well as the FHWA's *ITS Unit Costs Database*.

Costs for O&M were calculated based on the life cycle of the project devices, assuming a ten-year project life cycle. Once the construction and O&M costs were estimated, design and construction, engineering, and inspection (CEI) costs were calculated based on FDOT standard cost estimation methodology that assumes a percentage of the project construction cost. Fifteen percent of the construction cost was assumed for design and 20 percent was assumed for CEI.

5.5 Prioritization Strategy for the FIHS ITS Corridor Master Plans

To successfully prioritize projects for the five principal FIHS limited-access corridors in the *ITS Corridor Master Plans* and on a statewide basis in the *ITS Plan*, a formalized prioritization approach is needed. This approach needs to address as yet unfunded ITS projects and provide a set of objectively developed priorities that can be balanced with system continuity considerations to derive a final set of prioritized projects for implementation.

Technical Memorandum No. 5.2 – A Strategic Approach to ITS Deployment Prioritization for Florida's Principal FIHS Limited-Access Corridors presents criteria for prioritizing ITS deployments. The district coordinators and FDOT's ITS Office conducted a Delphi evaluation to identify prioritization criteria and candidate weightings for these criteria. Table 5.1 presents the criteria and their weightings.

Following the application of these prioritization criteria, the results were analyzed and adjusted to reflect the following:

- Systems continuity and connectivity to existing ITS services and communications systems;
- Coordination with capacity improvement projects that are included in the *Ten-Year ITS Cost Feasible Plan (CFP)*;
- Reasonableness and logical termini;
- Local needs and priorities addressed in corridor and regional ITS plans prepared by the districts and expressway authorities;
- Congestion mitigation for severely congested facilities;
- Safety considerations to address high accident locations; and
- Consideration of priorities provided by the expressway authorities.

The prioritization analysis was applied for each FIHS corridor. Based on this analysis, the FIHS implementation plans recommend high, moderate, and low ITS deployment priorities for the corridors.

It should be recognized that the objective of the prioritization strategy described above is to rank the FIHS corridor segments according to which segments within the statewide system will be considered first for ITS deployments. The analysis does not prioritize alternative ITS deployments on the same corridor segment.

Table 5.1 – Criteria for Prioritizing FIHS Corridor Segments for ITS Deployments

Criteria	*Measure*	*Score*	Weighting
Population and Urbanization	Population within each county	The score is based on the percentile rank of the most populated to the least populated.	10%
Incidents	Safety ratio along each corridor segment as defined in the Roadway Characteristics Inventory (RCI)	The score is based on the percentile rank from the highest safety ratio to the lowest safety ratio.	20%
Congestion Levels	Percent of travel heavily congested [Level of Service (LOS) E/F] along each corridor as defined in the RCI and the results of the Mobility Performance Measures Program	The score is based on the percentile rank from the highest percentage of travel congested to the lowest.	20%
Special Event Generators	Number of special events' attendees in each county each year as provided by Visit Florida as of the year 2000	The score is based on the percentile rank from the highest number of attendees to the lowest by county.	10%
Evacuation Coordination	Number of evacuees generated on each facility during critical storm events as determined using the demand-estimating tool generated by PBS&J for the U.S. Army Corps of Engineers	The score is based on the percentile rank from the highest number of evacuees to the lowest by county.	15%
CVO Operations	Truck volume as reported in the RCI	The score is based on the percentile rank from the highest truck volume to the lowest by segment.	5%
Production Capability	Product Phase Complete – Design Complete Design Criteria Design Underway Concept Plan No Effort	 100 67 67 33 0	5%
Programmed Improvement Construction Capacity	Programmed capacity improvement where permanent installation can be used to support smart work zone management	Improvement Fiscal Year: FY03 – 100% FY04 – 80% FY05 – 60% FY06 – 40% FY07 – 20%	15%
		Total	**100%**

5.6 FIHS ITS Corridor Market Package Prioritization

A methodology was used in *Technical Memorandum No. 3.2 – Technology Review: ITS Corridor Master Plans for Florida's Principal FIHS Limited-Access Corridors* to select ITS market packages for early deployments. The following factors were used in the selection:

- Percent of project costs funded (total cost) through public/private partnerships;
- The availability/maturity of the market package technologies;
- A qualitative estimate of the market package benefits in terms of their ability to satisfy Florida's principle FIHS corridors' ITS goals and objectives;
- Market package synergy requirement;
- The level of difficulty of institutional issues associated with the market packages; and
- The level of difficulty of technical issues associated with the market packages.

The ability of each market package to meet each of the above five criteria were assigned a rating between one and five. One indicates the lowest level of criteria satisfaction while five indicates the highest level of satisfaction. Furthermore, each criterion was assigned a weight reflecting its importance. Table 5.2 presents the weights used in the analysis.

Table 5.2 – Criteria for Selecting Early Winners among FIHS ITS Corridor Market Packages

Criteria	Weight
Benefits	23
Maturity	34
Prerequired Package	23
Institutional Difficulties	10
Technical Difficulties	10
Total	100

By multiplying a market package rating for a given criterion and the criterion weighting, a utility value can be obtained. By summing all utility values for each market package, a utility measure or a performance index can be obtained for the market package. The calculated utility measures were used in determining the early winners among the market packages.

6. Needs Analysis

This section discusses the issues and needs associated with the selection of default parameters for the IDAS costs, benefits, and prioritization strategy in relation to the implementation of this software to evaluate ITS deployment alternatives in Florida.

6.1 General Needs

Below are issues and needs that are applied to the calculations of both costs and benefits in the customized IDAS software:

1. The IDAS program currently allows users to input user-defined ITS device benefits and unit costs. Although this flexibility will provide more specific results at a project or local level, standardized Florida costs and benefits will provide more comparable results for ITS project evaluations across the state.

2. The IDAS includes benefit and cost impact calculations and default values for 13 different categories of ITS deployments. The ITS deployments addressed in the *ITS Plan* include eight categories. These are FMS, ATMS, IMS, regional multimodal traveler information, basic electronic toll collection (ETC), CVO, emergency management services, and supporting deployments, including TMCs, emergency management centers (EMCs), and information service providers (ISPs).

3. The *Florida Intelligent Transportation Systems Benefits White Paper* assumes a project life of ten years. The IDAS allows the user to enter the length of the project. For Florida ITS projects, the project life cycle needs to be entered for use as an input to the IDAS.

4. The IDAS benefits and costs analysis does not address certain ITS elements or aggregate these elements with other elements. This makes it difficult to evaluate the deployment of these elements. The costs and benefits of some of these elements are available in the current version of the JPO *ITS Unit Costs Database*. Examples include call boxes, weigh-in-motion (WIM) systems, red light enforcement, portable speed monitoring systems, and environmental sensing systems.

5. Florida's customized IDAS software will be used for ITS deployments on the state highway system and, where local costs, benefits, and prioritization information is not available, for local facilities. For local facilities, where more specific local data exists, these default values can be overridden by the user. There is a need to provide guidelines for updating the default costs and benefits for local conditions.

6. The JPO *ITS Unit Costs* and *ITS Benefits Databases* are frequently updated to reflect information gathered from national ITS deployment and evaluation studies. The benefits and costs data, collected as part of Florida's IDAS customization study, shall be made available to the JPO for possible use in future updates of the *Databases*.

7. After updating and customizing Florida ITS costs and benefits, a process for annually updating and maintaining the customized Florida benefits and costs databases will be needed to ensure that national and statewide technological and cost trends and evaluation studies are reflected in the Florida's customized ITS unit costs database.

8. A distribution and installation process shall be established to assist users in obtaining and installing the revised costs and benefits modules. Additionally, a user's guide shall be developed to assist users in the application of the customized Florida IDAS defaults and prioritization methodology.

9. Upon project completion, validation and verification of the project requirements are necessary to ensure that the project goals and objectives were satisfactorily accomplished.

10. An important part of the IDAS customization is determining a standard time period for evaluating ITS projects. Currently, the IDAS allows the option for six different evaluation time periods when analyzing the projects. Because the FSUTMS/IDAS interface will be formatting the model network and volume data into an IDAS-ready format, the data conversion provides an opportunity for automated conversion of model volumes to a standard analysis time period. A consistent analysis period for statewide ITS projects is necessary for more comparable evaluation results on a statewide basis.

6.2 Cost Estimate Needs

The following are the issues associated with Florida's IDAS cost estimates as they relate to the purpose of this study:

1. The IDAS cost estimates are based on the JPO *ITS Unit Costs Database*. As described above, the unit costs in the JPO *Database* are based on data collected from different parts of the country. Costs are expected to vary considerably by state/region. The *ITS Unit Costs Database* Web site recommends that the user find regional data sources and current vendor data in order to perform a more detailed cost estimate.

2. The *Florida Intelligent Transportation Systems Benefits White Paper* presents values for the lifetimes of ITS devices. The JPO *ITS Unit Costs Database* and the IDAS database also present values for the lifetimes of ITS devices. These values shall be examined to determine their applicability to Florida.

3. The default unit costs used by the IDAS are based on the JPO's *ITS Unit Costs Database*. The JPO *Database* includes data collected during different years. Device costs are dropping rapidly. This needs to be considered when collecting Florida ITS costs data based on ITS deployed in different years.

4. Special conditions and requirements associated with ITS projects can affect project costs. Thus, these conditions and requirements shall be considered when examining the cost data collected to determine the default Florida unit costs.

5. The IDAS allows the user to input different area types, including central business district (CBD), urban, suburban, and rural. However, the same default unit cost values are used for these area types. It is expected that the same devices deployed in different area types will have different initial and O&M costs due to the differences in the costs of maintenance of traffic (MOT), utility considerations, and time required for maintenance personnel to travel to the sites.

6. The IDAS allow users to define facilities as freeway, arterial, or ramps. Most devices in the IDAS have the same costs for different highway facilities, with the exception of dynamic message signs (DMSs), which have different costs for freeways and arterials due to the differences in the size requirements of DMSs. The costs for different facility types can be different due to differences in mounting requirements, power source availability, MOT, utility considerations, and device requirements.

7. In the IDAS, each ITS component is associated with a set of default ITS equipment. The user may accept this default set of ITS equipment or modify the type and quantity of equipment if more detailed information is available.

8. The IDAS assumes that the communications media used is always leased telephone lines. The required capacities of these lines are a function of the particular deployment. For example, high bandwidth transmission is assumed to require digital signaling (DS) level 3 (DS3) communications lines, while center-to-field data communications are assumed to require DS1 communications lines. Leased communications lines have low capital costs and high O&M costs due to the monthly lease cost. For agencies that use agency-owned communications systems, the cost estimates when assuming leased communications services will not be correct. It should be mentioned that the latest update to the JPO's *ITS Unit Costs Database* includes costs for agency-owned communications lines. However, these costs are not used in the latest version of the IDAS. Additionally, the *ITS Plan* assumes fiber optic communications for the deployment of ITS on the FIHS and leased communications costs are not included. The IDAS shall reflect the communications network scenario adopted for the FIHS.

9. The discount rate used in the IDAS is seven percent. This value will be verified for consistency with the FDOT. Additionally, the inflation factors used to determine annual costs will be reviewed for consistency with the FDOT's long-term construction cost inflation forecasts.

10. The IDAS identifies low, average, and high costs for ITS components. Some of the ITS components in the IDAS database have a wide range between the low and high costs reported for the elements. For example, the cost of an information kiosk according to the database ranges from $10,000 to $50,000.

11. Some differences exist between the unit costs used in the IDAS and JPO databases and those used in the Florida FIHS study. For example, the closed-circuit television (CCTV) camera assembly and tower cost is $19,500 - $29,000 according to the IDAS and JPO databases and $48,000 according to the Florida FIHS database. Another example is the roadside probe vehicle reader that is estimated to be $5,000 - $8,000 in the IDAS and JPO databases and $41,000 in Florida's *ITS Plan*.

12. In the IDAS, the user is given the option to have the cost module share equipment costs between the public and private sector. Examples of ITS devices that are candidates for cost sharing between the public and private sectors are ATIS devices and communications infrastructures. The recent experience with the ATIS business models in Florida and the status of the Florida Fiber Network (FFN) shared communications resource deployment initiative needs to be taken into consideration and a decision needs to be made regarding what cost sharing is assumed for ITS devices in Florida.

13. As part of the maintenance of the *Florida ITS Cost Database*, a process for review and approval of the database will be necessary. The process shall involve review and consensus of the *Florida ITS Cost Database* by the FDOT district ITS engineers prior to distribution and use in the IDAS.

14. The FDOT Construction Estimate and Policy Planning Offices require additional, up-to-date ITS cost data to supplement existing construction and transportation cost databases.

15. The quality of the collected information can vary. Any collected cost data shall be examined for content and its applicability to this study.

6.3 Benefit Estimate Needs

The following are the issues associated with the IDAS ITS deployment benefit calculations as they relate to the purpose of this study:

1. A mode choice model is applied in the IDAS. This mode choice is specific to trip purpose and per time period. The IDAS has defaults for the variables (i.e., travel time, out-of-pocket costs, and other travel costs) affecting the mode splits and logit model coefficients of these variables. Florida districts and metropolitan planning organizations (MPOs) have developed mode choice models with calibrated parameters for regional conditions. There is a need to identify the parameters of the mode choice models developed by the Florida MPOs to determine if statewide Florida default values can be recommended to replace the existing IDAS default values. In addition, the IDAS has default values for traffic assignment, temporal choice, and induced/foregone demand. These model parameters need to be compared to what is used in Florida. Although a need exists to identify and recommend model input parameters for Florida-specific projects, this task will not be conducted as part of this project. However, it is recommended for consideration in future phases of the IDAS development.

2. The IDAS has default values for emission impacts, energy consumption, and noise. These shall be compared to what is used in Florida.

3. The IDAS has models to estimate PDO crashes, injuries, and fatalities based on traffic conditions. There is a need to determine if similar models have been developed based on Florida crash data.

4. The IDAS assigns dollar values to various performance measures such as values of time, dollars per trip, dollars per mile, emission costs, fuel consumption costs, noise costs, and crash costs. There are some differences between the values used in Florida and those used by the IDAS. For example, the fatality, injury, and PDO crash costs used by the IDAS are $2,317,398, $50,760, and $2,842, respectively. The corresponding costs used in the *Florida Intelligent Transportation Systems Benefits White Paper* are $1,000,000, $25,000, and $2,500, respectively. The FDOT Safety Office recommends a cost per injury of $2,600,000 for fatalities, $36,000 for injuries, and $2,000 for PDO, based on 1994 data. Additionally, an average of $83,070 for all crashes on interstate facilities is recommended based on 1997 data. These valuation assumptions shall be considered when updating the IDAS benefit assumptions for Florida. Another example is the value of time, which is $8.50 per hour for passenger cars and $20.80 per hour for commercial trucks in the IDAS, and $5.25 per hour for passenger cars and $60.00 per hour for commercial trucks according to the *Florida Intelligent Transportation Systems Benefits White Paper*.

5. The IDAS maintains default adjustment factors for the benefits of ITS components. These factors are used in the calculation of various measures of effectiveness and were derived based on national ITS deployment evaluation studies. These values need to be examined and compared with any results obtained from Florida ITS deployment evaluation studies. It is expected, however, that only limited evaluation studies of ITS deployments in Florida are currently available.

6. There are some differences between the default values of the ITS benefit factors used in the IDAS and the corresponding factors used in the *Florida Intelligent Transportation Systems Benefits White Paper*. For example, FMS are assumed to reduce injury and fatality by 38 percent in the IDAS and 15 percent in the *Florida Intelligent Transportation Systems Benefits White Paper*.

7. Benefits data submitted to the JPO *ITS Benefits Database* are reviewed based on the following criteria:

   - Benefits information shall be derived from sound evaluation methodology, and the source of the methodology shall be stated; and

   - There shall be no known flaws in the analysis. Similar standards shall be used when obtaining Florida-specific defaults for ITS benefit factors.

6.4 Prioritization Strategy Needs

The following are the issues associated with the development of Florida ITS project prioritization strategies based on the IDAS outputs:

1. The IDAS calculates a number of performance measures to evaluate ITS deployment options. As stated in *Section 5, Florida Studies*, a number of performance measures were identified for Florida. There is a need to compare the IDAS and Florida performance measures to determine what Florida measures are not calculated by the IDAS and if they can be derived from the IDAS-calculated measures. Some of the measures are qualitative and obviously cannot be derived from the IDAS outputs.

2. As part of the IDAS benefits model, users are allowed to apply user-defined weighting factors to the system performance measures to assist in the development of benefit-to-cost evaluations and the ranking of ITS projects. Currently, the application of these weighting factors is dependent on local or regional project priorities. To assist in establishing a statewide evaluation and project ranking strategy for ITS deployments on state highways, default-weighting factors for the IDAS performance measures need to be identified.

3. Many factors are expected to influence decision makers when selecting between alternative ITS and other transportation improvement implementations on a given highway segment. The IDAS evaluates deployment alternatives based on a number of quantitative performance measures. A strategy is needed to combine the IDAS outputs, other quantitative and qualitative measures, and other factors to select between and prioritize ITS deployment alternatives. In addition to the IDAS outputs, other factors to be considered include technical issues, institutional issues, and synergy requirements.

4. As stated above, a method has been proposed in the *ITS Corridor Master Plans* to prioritize the FIHS corridor segments for ITS deployments. This method needs to be examined to determine if it can be improved by utilizing the IDAS model outputs.

5. The prioritization methodology shall be tested for use and applicability on the FIHS ITS deployments.

6.5 The FSUTMS / IDAS Interface Needs

Although the IDAS has been designed to be flexible in terms of the required input formats, allowing a wide cross section of planning model output to be used with a minimum of preprocessing, it is still necessary to conduct additional steps to convert the model output data into a readily acceptable IDAS format.

The FSUTMS/IDAS interface shall be designed to provide a methodology for identifying the data file sources, data format, and the steps necessary to convert model data for use in the IDAS. The FSUTMS/IDAS interface will be developed to address the following needs:

1. An interface is necessary to help identify the required travel demand model data for input into the IDAS and to translate the required model data into IDAS-compatible formats (i.e., conversion of origin-destination trip matrices from binary to ASCII formats and conversion of FSUTMS time and distance values into IDAS-compatible units as part of the IDAS LINKS file).

2. A methodology for creating a local area baseline option shall be developed and recommended, whereby local or regional agencies can create a baseline IDAS network alternative without ITS projects for use by local ITS users.

3. Florida models utilize a standard, two-digit, facility type and area type classification system that can have as many as 99 types, whereas the IDAS allows users to select from only four facility types (i.e., freeway, arterial, ramp, or not used) and two area types (i.e., urban and suburban/rural). Similarly, FSUTMS models utilize unique V/C curves selected by facility type/area type combinations to replicate travel conditions in areas of analysis (i.e., urban/country/region), whereas the IDAS allows users to select from only five basic V/C curves (i.e., freeway-urban, freeway-suburban/rural, arterial-urban, arterial-suburban/rural, and ramp). Florida users require equivalency tables to convert the FSUTMS facility types to the IDAS facility types.

4. The IDAS requires users to select the duration of analysis from six separate options: AM hour, AM peak period, PM hour, PM peak period, off-peak, daily, and other. The duration for ITS analyses is typically dependent on the type of deployment. However, most traffic engineering analyses consider traffic volumes and conditions during the peak period. Typically, Florida travel demand models provide daily traffic volumes, while some of the larger urban area models contain time-of-day factors to provide peak period volumes. For consistency purposes, the standard IDAS analysis durations shall be recommended for the various types of ITS deployments. Additionally, a standard methodology or automated tool is necessary to allow users to easily convert the FSUTMS origin-destination matrices/lane capacities to the appropriate analysis periods used in the IDAS.

5. Guidance and recommendations for locating or requesting additional input parameters, such as the appropriate travel demand model forecast years and number of traffic analysis zones (external and internal), may be useful to the ITS professional.

6. The Statewide Model Task Force has requested that the Systems Planning Office develop an interface to convert the FSUTMS model data for use in the IDAS. A phased approach has been adopted to develop the interface from a manual process to a computer-assisted/automated one. Additionally, the interface is to assist the user in creating standardized data files for import into the IDAS.

7. There are variations among various Florida FSUTMS models that must be accommodated by the FSUTMS/IDAS interface.

6.6 Customized IDAS Testing Needs

To ensure that the customized IDAS databases and the FSUTMS/IDAS interface perform adequately to fulfill the project technical requirements, the products or deliverables will be tested prior to project completion and acceptance. Validation and verification of the technical requirements will be conducted on the customized software modules to determine if the user needs and requirements were addressed and to verify that the software functions adequately.

The following issues are associated with the testing of the customized IDAS software:

1. Once completed, the customized IDAS cost and benefit spreadsheets shall be tested to ensure that the databases can be easily installed, accessed, and imported through the IDAS setup menu. Additionally, the databases shall be tested in conjunction with the analysis of a typical ITS deployment to ensure that they are error free and function in accordance with the project requirements.

2. A sensitivity test shall be conducted to evaluate the effectiveness of the Florida default values for a typical Florida ITS deployment. Results obtained from the IDAS using national default values and results from the IDAS using the Florida customized defaults will be compared with actual ITS deployment costs. The results from the Florida customized defaults should be closer in value to the actual ITS deployment costs than the results from the national defaults.

3. Although the FDOT Systems Planning Office is primarily responsible for defining the FSUTMS/IDAS interface requirements, the FDOT ITS Office has been assisting with the development of these requirements to ensure that the appropriate data needs are addressed for evaluating ITS deployments. While the Systems Planning Office will be responsible for the final validation and verification of the interface, the ITS Office will test the interface to ensure that all the IDAS data needs related to ITS engineering and deployment are appropriately addressed and agreed upon by the ITS Office Steering Committee.

7. Project Vision

This study will provide a standardized method of ITS project evaluations for Florida highways and will develop statewide default values for ITS device costs and benefits that will be incorporated as the default values in the IDAS software. In addition, these statewide default value spreadsheets will be tested for functionality and the values will be tested to determine the sensitivity of these new values on a typical ITS deployment.

The study will also recommend an ITS project prioritization strategy utilizing the IDAS software. A statewide project ranking strategy will be developed to provide a comparable ranking of ITS projects on state highways. The strategy will use a combination of the benefits and costs evaluation results produced by the IDAS and other factors.

The statewide default costs and benefits and the project ranking strategy will be recommended for evaluation of ITS deployments on the state highway system and, where local costs, benefits, and prioritization information is not available, for local facilities. Where more specific local data exists, these default values can be overridden to provide a more accurate cost-to-benefit analysis using the IDAS program. This study will provide guidelines for updating the default costs and benefits for local conditions. An annual process for updating and maintaining the Florida costs and benefits will also be recommended based on national and statewide ITS technological trends.

8. Technical Requirements

This section discusses the technical requirements for the adoption and update of statewide costs and benefits data, and a prioritization process for ranking ITS projects using the IDAS. These requirements are based on the needs identified in *Section 6, Needs Analysis,* and the *Concept of Operations* presented in *Section 7*.

Table 8.1 presents the functional requirements and the traceability of these requirements to the needs and issues presented in *Section 6*.

Table 8.1 – The IDAS Customization Project Technical Requirements Traced to Identified Needs

Section 6 **Category**	***Section 6*** **Issue Number**	**Requirement Number**	**Requirement**
General Needs	1	1.0	The study shall update the default values for ITS benefits and costs in the IDAS to reflect Florida statewide conditions.
General Needs	2	2.0	The recommended updates to the IDAS benefits and costs shall be limited to the eight ITS deployment categories addressed in the *ITS Plan*. These ITS deployment categories include FMS, ATMS, IMS, regional multimodal traveler information, ETC, CVO, emergency management services, and supporting deployments.
General Needs	3	3.0	The study shall recommend project life cycles for ITS projects.
General Needs	4	4.0	The default components of ITS deployments shall be identified to the level of detail required to allow the selection between ITS deployment alternatives.
General Needs	5	5.0	The study shall provide guidelines for overriding the Florida statewide default costs and benefits based on information collected locally.
General Needs	6	6.0	The results of the study shall be provided to the JPO for potential use in updating the FHWA's *ITS Unit Costs* and *ITS Benefits Databases*.
General Needs	7	7.0	The study shall identify a process for annually updating and maintaining the customized *Florida ITS Benefits* and *Florida ITS Unit Costs Databases*.
General Needs	8	8.0	A distribution and installation process will be developed where the IDAS users can obtain copies of the Florida customized defaults and prioritization strategy with the IDAS software. A user's manual will be prepared to instruct users on how to install and utilize the Florida default databases and prioritization methodology.
General Needs	9	9.0	Testing, validation, and verification of the project technical requirements will be conducted to ensure satisfactory completion and project acceptance.
General Needs	10	10.0	The study will recommend a standard input for analysis time period in the IDAS. A consistent time period for analysis will also be recommended for the development of the automated interface. The interface will allow users to automatically convert volumes to the appropriate analysis time period.
Cost Estimate Needs	1	11.0	The updates to the default capital cost data shall be based on cost data from ITS projects on Florida state highways and toll authority highways from all Florida regions.
Cost Estimate Needs	2	12.0	The study shall recommend updates to the life cycles for the ITS equipment included in the IDAS based on the collected information, if supporting documentation is available.
Cost Estimate Needs	3	13.0	The project cost data used in deriving the updates shall be examined to determine the validity of older data.

Section 6 **Category**	***Section 6*** **Issue Number**	**Requirement Number**	**Requirement**
Cost Estimate Needs	4	14.0	The collected project costs shall be examined to determine their applicability to the purpose of this study and identify any special conditions and/or requirements that might have affected the project costs.
Cost Estimate Needs	5	15.0	The study shall identify any differences in capital, maintenance, and operation costs between urban and rural ITS deployments and account for these differences when calculating the default values.
Cost Estimate Needs	6	16.0	The study shall identify any differences in capital, maintenance, and operation costs between freeway and surface street ITS deployments and account for these differences when calculating the default values.
Cost Estimate Needs	7	17.0	The study shall identify any modification necessary to the type and quantity of ITS equipment required for each type of ITS deployment included in the IDAS.
Cost Estimate Needs	8	18.0	The identified default costs shall take into account the type of communications system used (i.e., fiber optic, leased versus owned, and wire line versus wireless).
Cost Estimate Needs	9	19.0	The study shall recommend a discount rate and inflation factor for use in calculating ITS deployment life-cycle costs.
Cost Estimate Needs	10	20.0	The study shall identify the low, average, and high values for ITS equipment costs.
Cost Estimate Needs	10	21.0	Wide ranges between low and high equipment costs shall be examined to determine the reasons for the large differences in the reported costs.
Cost Estimate Needs	11	22.0	Large differences between the Florida *ITS Unit Cost Database* and the JPO *ITS Unit Costs Database* shall be identified for further examination by the JPO.
Cost Estimate Needs	12	23.0	The study shall identify statewide cost-sharing assumptions between the public and private sectors for use as inputs to the IDAS based on the Florida ATIS business model, the FFN communications network status, and other opportunities for public/private sector cost sharing.
Cost Estimate Needs	13	24.0	The study shall recommend a process for maintenance, review, and approval of the *Florida ITS Cost Database* prior to distribution for external office use.
Cost Estimate Needs	14	25.0	The FDOT Construction Estimate and Policy Planning Offices require additional up-to-date ITS cost data to supplement existing construction and transportation cost databases.
Benefit Estimate Needs	2	26.0	The study shall provide recommendations for possible update to the IDAS environmental model parameters (i.e., emission, fuel consumption, and noise) to reflect Florida conditions.
Benefit Estimate Needs	3	27.0	The study shall provide recommendations for possible update to the IDAS safety model parameters to estimate PDO crashes, injuries, and fatalities to reflect Florida conditions.

Section 6 **Category**	***Section 6*** **Issue Number**	**Requirement Number**	**Requirement**
Benefit Estimate Needs	4	28.0	The study shall provide recommendations for possible updates to the dollar values assigned by the IDAS to various performance measures such as values of time, dollars per trip, dollars per mile, emission costs, fuel consumption costs, noise costs, and safety costs (i.e., PDO crashes, injuries, fatalities) to reflect FDOT crash values.
Benefit Estimate Needs	5	29.0	The study shall identify and implement potential modifications to the default ITS benefit adjustment factors that are used in the calculation of the benefits of ITS components.
Benefit Estimate Needs	6	30.0	Potential modifications to the default benefit adjustment factors shall be examined to determine if the difference between the existing and proposed defaults can be justified.
Benefit Estimate Needs	7	31.0	Any modifications to the default benefit adjustment factors shall be supported by a reliable ITS evaluation study that uses sound methodology with no flaw in the analysis.
Prioritization Strategy Needs	1	32.0	The study shall determine the ability of IDAS to calculate the Florida performance measures recommended in *Florida's ITS Strategic Plan* and the FIHS *ITS Corridor Master Plans*.
Prioritization Strategy Needs	1	33.0	The study shall determine whether Florida ITS performance measures not included in the IDAS output can be calculated based on the IDAS outputs.
Prioritization Strategy Needs	2	34.0	The study shall recommend statewide default weighting factors of the IDAS measures of effectives based on inputs from the FDOT districts and the FDOT ITS Office.
Prioritization Strategy Needs	3,4	35.0	The study shall develop an ITS project prioritization methodology that is able to prioritize alternative ITS deployments on the same roadway segment as well as prioritize different corridor segments for ITS deployments.
Prioritization Strategy Needs	3,4	36.0	The developed ITS project prioritization methodology shall be based on the IDAS outputs as well as other quantitative and qualitative measures, including technical and institutional issues associated with the ITS deployment alternatives.
Prioritization Strategy Needs	5	37.0	The prioritization methodology will be tested to evaluate the applicability of the methodology on the FIHS deployments.
Customized IDAS Testing Needs	1	38.0	The customized IDAS software shall be tested to ensure that the modifications will not result in the introduction of bugs that prevent the software from running correctly under all combinations of input parameters.
Customized IDAS Testing Needs	1	39.0	Ease of use of the customized IDAS software shall be compared with the ease of use of the existing IDAS software to ensure that the software modifications will not introduce difficulties in using the software.
Customized IDAS Testing Needs	1	40.0	The customized IDAS software calculations shall be verified by comparing the software calculations with manual calculations of the benefits and costs for simplified ITS deployment scenarios created for testing purposes.

Section 6 **Category**	***Section 6*** **Issue Number**	**Requirement Number**	**Requirement**
Customized IDAS Testing Needs	2	41.0	The customized IDAS shall be validated by using the software to calculate the costs and benefits of a real-world existing or planned ITS deployment in Florida, as approved by the ITS Office Project Manager. The validation shall also include testing the software to select between the above mentioned ITS deployment and the control (no ITS deployment) alternative.
Customized IDAS Testing Needs	2	42.0	The benefits, costs, and alternative selection decision obtained from the customized IDAS as described in the previous requirement shall be compared with what is produced using the non-customized IDAS software to determine how the customization affects the software results.
Customized IDAS Testing Needs	3	43.0	The Systems Planning Office, with assistance from the ITS Office, shall test the interface to ensure that it meets the technical requirements.
FSUTMS / IDAS Interface Needs	1	44.0	Guidelines for data collection and formatting will be developed for the conversion of the FSUTMS data for input into the IDAS. These guidelines will be developed specifically for the FSUTMS and will consider the relationship between the FDOT and MPOs in terms of model development and coordination.
FSUTMS / IDAS Interface Needs	2	45.0	A methodology for creating a local area IDAS baseline will be developed and recommended. Local ITS practitioners can use this IDAS baseline alternative as a “no build” alternative to which all ITS improvement alternatives shall be compared.
FSUTMS / IDAS Interface Needs	3	46.0	A standardized equivalency table will be developed to assist in converting the FSUTMS facility types to the IDAS facility types. As part of the automation phase, a standard equivalency file and routine will be developed to automatically convert the FSUTMS facility types to the IDAS facility types.
FSUTMS / IDAS Interface Needs	3	47.0	A standardized equivalency table will be developed to assist in converting the FSUTMS area types to the IDAS area types. As part of the automation phase, a standard equivalency file and routine will be developed to automatically convert the FSUTMS facility types to the IDAS facility types.
FSUTMS / IDAS Interface Needs	3	48.0	A standardized equivalency table will be developed to assist in converting the FSUTMS V/C curves to the IDAS V/C curves. As part of the automation phase, a standard equivalency file and routine will be developed to automatically convert the FSUTMS V/C curves to the IDAS V/C curves.

Section 6 **Category**	***Section 6*** **Issue Number**	**Requirement Number**	**Requirement**
FSUTMS / IDAS Interface Needs	4	49.0	A recommended analysis duration period will be recommended for each type of ITS deployment. A manual methodology for converting the daily traffic to peak hour or peak period traffic will be developed and will be automated in the second phase of the interface development. As part of the interface, users can input the FSUTMS volumes and select the analysis duration, which will automatically be converted to the appropriate time period based on the selected deployment type.
FSUTMS / IDAS Interface Needs	5	50.0	Step-by-step guidelines will be developed to assist users in identifying and locating the correct model values to be input into the IDAS. Additionally, guidance regarding the coordination of the available model forecast year data and deployment implementation schedule will be provided.
FSUTMS / IDAS Interface Needs	6	51.0	A manual process of methodology for converting the FSUTMS data for the IDAS will be documented. Step-by-step instructions for locating and reformatting the data will be provided. Additionally, commonly encountered problems or issues related to the conversion of data will be noted along with potential solutions. Once a consensus is obtained from the Statewide Model Task Force and the ITS Steering Committee regarding the methodology, the process will be automated as part of a phased implementation process.
FSUTMS / IDAS Interface Needs	7	52.0	The FSUTMS/IDAS interface shall be flexible to accommodate variations among various Florida FSUTMS models.