Technical Memorandum 2

Documentation of the Combined Turbo Architecture Database

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Version 2

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Table of Contents

List of Tables

List of Acronyms

CFP ..... Cost Feasible Plan
CVO ..... Commercial Vehicle Operations
FDOT ..... Florida Department of Transportation
FIHS ..... Florida Intrastate Highway System
FTE ..... Florida's Turnpike Enterprise
ITS ..... Intelligent Transportation System
MCO ..... Maintenance, Construction, and Operations
NITSA ..... *National Intelligent Transportation System Architecture*
SITSA ..... *Statewide Intelligent Transportation System Architecture*
TMC ..... Transportation Management Center

1. Purpose

The purpose of this document is to document the process to combine eight disparate databases used to document Florida's original *Statewide ITS Architecture* (*SITSA*), first completed in January 2001, into one combined, harmonized architecture database as part of the 2005 update of the *SITSA*. In addition to these eight initial databases, other architecture databases are currently being supported across the State of Florida as part of several corridor intelligent transportation system (ITS) architectures. These corridor architecture databases will also be combined into a single database.

Ultimately, a single architecture database utilizing Turbo Architecture Version 3.1, will be created to support the various regional ITS architectures that exist in the State of Florida, including a statewide ITS architecture layer that encompasses ITS services that are uniform across the state, such as commercial vehicle operations (CVO) safety and administrative services, and statewide reporting functions.

The advantages of this single architecture database for the state include:

- A single consistent naming convention to represent stakeholder ITS elements
- Consistency of architecture flows that cross the Florida Department of Transportation (FDOT) District boundaries
- Improved support for corridor ITS architectures
- Simpler configuration control and management of the ITS architecture database for the *SITSA*

The work to combine these disparate ITS architecture databases into a single, harmonized ITS architecture database will be performed under Task 3, Combine and Harmonize Existing Turbo Architecture Databases, of the Task Work Order.

2. Background

2.1 Florida's Original Statewide ITS Architecture

Florida's original *SITSA*, developed in January 2001, was created as a framework to guide statewide ITS planning and deployment. The *SITSA* consisted of seven regional ITS architectures, which corresponded with the eight FDOT Districts (District 4 and 6 were combined). Additionally, a statewide architecture layer was developed that encompassed uniform ITS services across the state, including CVO safety and administrative services, as well as statewide reporting functions.

Additionally, during the development of the *Florida Intrastate Highway System (FIHS) Ten-Year ITS Cost Feasible Plan* (*CFP*), corridor ITS architectures for the five major FIHS facilities were developed to guide ITS planning and investments along these facilities and to support a statewide, interconnected ITS infrastructure. These corridor ITS architectures included updated projects, systems, ITS elements and stakeholders for the regional ITS architectures that should be incorporated in the *SITSA* update.

2.2 National ITS Architecture

Since the completion of Florida's *SITSA* in 2001, the *National ITS Architecture* (*NITSA*) has undergone two major revisions. Version 4 of the *NITSA*, released in May 2002, added the Maintenance, Construction and Operations (MCO) set of services, focusing on four new areas of ITS investment, including:

- Maintenance vehicle fleet management
- Roadway management
- Roadway conditions and work plan dissemination
- Work zone management/safety

Version 5 of the *NITSA*, which was released in May 2004, included several significant new features, such as:

- Security coverage enhancement
- A new disaster response and evacuation user service
- A new security monitoring subsystem
- Added 511 support
- Added road closure management
- Improved emissions management
- Improved parking management

Version 5.1 of the *NITSA*, released in May 2005, made some minor revisions in the architecture flows and descriptions of functional requirements and user services.

These enhancements, new user services, and new market packages will be included in the *SITSA* update.

2.3 Turbo Architecture

With the implementation of Version 5.1 of the *NITSA*, a new release of Turbo Architecture (Version 3.1) became available. Turbo Architecture is a database application tool created to assist with the development and documentation of regional ITS architectures. The documentation for each of these earlier regional and corridor ITS architectures used earlier versions of Turbo Architecture.

One of the features of Version 3.1 of Turbo Architecture is support for project architectures. The intent of supporting project architectures is to allow users to visualize and view only those elements and information exchanges of a single ITS project. This ITS project is a set of ITS deployment activities grouped together (usually within a single procurement) for planning, deployment, and/or operational purposes.

For this update of the *SITSA*, the project team will take advantage of the project architecture feature of Turbo Architecture to represent the ITS elements and information exchanges of each FDOT District and the statewide layer. There will be one project architecture for each FDOT district, and one for the statewide layer. Each project architecture will contain only those ITS elements and information exchanges within that FDOT District or the statewide layer. When the Turbo Architecture database is viewed at the regional level, the database will present all the ITS elements and information exchanges for the entire State of Florida.

Table 2.1 – Original *SITSA* Architecture Database Format

Combined Turbo Architecture Database			
FDOT District 1 Project Architecture	FDOT District 2 Project Architecture	FDOT District 3 Project Architecture	FDOT Districts 4 and 6 Project Architecture
FDOT District 5 Project Architecture	FDOT District 7 Project Architecture	Florida's Turnpike Enterprise Project Architecture	FDOT Statewide Services Project Architecture

3. Harmonization Process

A systematic approach and process will be used to perform the harmonization effort. The effort to combine the Turbo Architecture databases into a single Turbo Architecture database for the entire state will consist of the following steps:

- Review existing architectures.
- Update the original architecture database to Turbo Architecture Version 3.1.
- Redraw the original market package diagrams into current technology.
- Perform the first harmonization effort of common elements, including generic elements.
- Refine the nomenclature and architecture through architecture workshops.
- Perform the second harmonization effort of common elements.
- Complete the combined architecture.

3.1 Review Existing Architectures

The first step to performing the harmonization effort is to collect and review all the existing information and databases available from the original *SITSA* efforts in 2001 and the corridor ITS architectures.

3.1.1 Original SITSA Architectures

From the original 2001 *SITSA* effort, the eight architecture databases (one for each FDOT District with Districts 4 and 6 combined, and the statewide layer) will be analyzed for consistency and thoroughness. The original architecture databases were customized with additional database fields to map regional elements to statewide elements. These extra database fields need to be removed before the original architecture database can be converted to Turbo Architecture Version 3.1.

An analysis indicated that some of the architecture databases were in Version 1.0 of the Turbo Architecture format, and the remaining architecture databases were in Turbo Architecture Version 1.1 format. (Refer to Table 3.1.) The customized database fields were already removed for those databases in the Version 1.1 format. For those architecture databases still in Version 1.0, the extraneous database fields were removed before continuing to the next step.

Table 3.1 – Original *SITSA* Architecture Database Format

Region	Database	Turbo Architecture
District 1	RegionNaples.mdb	Version 1.1
District 2	RegionJacksonville.mdb	Version 1.0
District 3	RegionDistrict3.mdb	Version 1.0
Districts 4 & 6	RegionMiami.mdb	Version 1.1
District 5	RegionOrlando.mdb	Version 1.0
District 7	RegionTampa.mdb	Version 1.0
Turnpike	Turnpike.mdb	Version 1.0
Statewide	StateFlorida.mdb	Version 1.1

3.1.2 Corridor ITS Architectures

Under a separate task (*Task 3, ITS Master Plans*) Consensus Systems Technologies (ConSysTec) was asked to identify the differences between the FIHS corridor architectures and the original statewide/regional ITS architectures. An analysis was performed and the results of the analysis and recommendations were documented in a report.

This report will be used as a reference during later steps to harmonize the architecture database.

3.2 Update to Turbo Architecture 3.1

After removing the extraneous database fields from the original (2001) *SITSA* architecture databases, these databases will be converted to Turbo Architecture Version 3.1 format. To convert to Version 3.1, the conversion process included in Turbo Architecture 3.1 will be used. When opening an architecture database with Turbo Architecture 3.1, the software program will automatically detect that the architecture database was created in a prior release of Turbo Architecture, and will begin a conversion process to migrate the database to Version 3.1.

Note: Recall that Turbo Architecture Version 3.1 supports Version 5.1 of the *NITSA*. This conversion is required to support all the user services, market packages, and functional requirements of Version 5.1 of the *NITSA*. Also, once the architecture database has been converted to Version 3.1 format, it MAY NOT be opened in an earlier version of Turbo Architecture.

During the conversion process, the converted database is given a new name, so that the original database can be kept in its original format. The conversion process performs the following tasks:

- Copy user data
- Convert entities and entity mapping
- Convert architecture flows
- Copy market package choices
- Convert functional requirements
- Copy standards tailoring
- Perform flow substitutions
- Remove unused discontinued flows

Any user-defined flows or entities are kept during the conversion. If a user-defined flow or entity exactly matches a new *NITSA* flow or entity, that flow or entity is converted to the *NITSA* entity or flow.

Upon completion of the conversion process, Turbo Architecture allows the user to create and save conversion reports for each architecture database conversion. These reports detail what changes were made from the original architecture database, such as flow or entity changes (including nomenclature or definitions), deletions, and new entities, market packages and interfaces.

Conversion reports were saved during the conversion of each original architecture database. These reports will be provided electronically as part of the final deliverables. A description of each conversion report saved for each architecture database is reprinted in *Appendix A*.

3.3 Redraw Market Package Diagrams into Current Technology

Customized market package diagrams are a highly effective, graphical view of the ITS elements and their associated system interfaces being defined in an ITS architecture. Using these diagrams, stakeholders can quickly and easily visualize and understand the ITS elements, information exchanges, and the operational concepts required to provide the desired transportation services.

3.3.1 Reproducing Market Package Diagrams

ConSysTec has developed a Microsoft Visio application to draw market package diagrams while simultaneously interfacing to the Turbo Architecture database. With this application, ConSysTec can quickly create and modify the ITS architecture customized market packages based on the *NITSA*, communicate operational concepts to stakeholders, and encode regional ITS architecture topology information into Turbo Architecture.

The customized market package diagrams from the original *SITSA* will be reproduced using ConSysTec's Microsoft Visio application. The original customized market package diagrams were drawn in Microsoft PowerPoint. By redrawing the customized market package diagrams using ConSysTec's application, each diagram will be linked to Version 3.1 of the Turbo Architecture database. A separate Visio file will be created for each FDOT District and for the statewide layer, and each Visio file will be linked to its appropriate Turbo Architecture database. (At this point, each FDOT District and the statewide layer still has its own architecture database.)

While reproducing these market package diagrams, ITS elements will be added, and information exchanges will be edited as appropriate. The ITS elements may be added to market package diagrams based on the available information provided to the project team or based on the project team's experiences. The ITS elements may be added because of new ITS projects that have been deployed; analysis of other District or corridor architectures; or recommendations/comments provided by stakeholders. Information exchanges may be changed based on changes in the *NITSA* or based on the project team's experiences.

3.3.2 Creating New Market Package Instances

As the original market package diagrams are reproduced, new instances of market package diagrams will be added as appropriate. Each market package represents a specific transportation service, such as ATMS01 – Network Surveillance. However, for each transportation service, a District may have multiple stakeholders deploying (or planning to deploy) that transportation service. In that event, multiple instances of that market package may be defined, each instance focusing on a specific stakeholder. In the example of ATMS01 – Network Surveillance, a market package instance may be developed for a FDOT transportation management center (TMC), a county TMC, and a local TMC, separately.

3.3.3 Adding New Market Packages

Once the reproduction of the original market package diagrams and the creation of new market package instances are complete, new market package diagrams will be added as appropriate, as supported by Version 5.1 of the *NITSA*. As discussed earlier, since Version 3.0 of the *NITSA*, which the original *SITSA* was based on, several new transportation services have been added. A complete list of these new transportation services is provided in Table 3.2.

Table 3.2 – New Transportation Services

Regional Parking Management
Speed Management
Drawbridge Management
Road Closure Management
Maint and Const Vehicle Tracking
Maint and Const Vehicle Maintenance
Weather Information Processing and Distribution
Roadway Automated Treatment
Winter Maintenance
Roadway Maintenance and Construction
Work Zone Management
Work Zone Safety Monitoring
Maint and Const Activity Coordination
Roadway Service Patrols
Transportation Infrastructure Protection
Wide-Area Alert
Early Warning System
Disaster Response and Recovery
Evacuation and Reentry Management
Disaster Traveler Information
Roadside HAZMAT Security Detection and Mitigation
CV Driver Security Authentication
Freight Assignment Tracking

From this list of new transportation services supported by Version 5.1 of *NITSA*, new market package diagrams will be created to support the transportations services deemed appropriate for each FDOT District.

3.4 Perform First Harmonization Effort

At this point in the harmonization process, a very preliminary, but updated, regional ITS architecture exists for each FDOT District and for the statewide layer. An analysis will be performed between the eight updated Turbo Architecture databases. This initial analysis will include checks for:

- ITS elements that have no information exchanges assigned to them, nor appear likely to have information exchanges
- The same stakeholder ITS elements that have different names across the Turbo Architecture databases
- Potential generic elements and generic stakeholders

3.4.1 Unused ITS Elements

Based on the analysis, ITS elements that have no information exchanges assigned to them and that are unlikely to have information exchanges will be deleted from the Turbo Architecture database. If necessary, based on stakeholder participation and review, an ITS element can be added again to the Turbo Architecture database. However, this exercise will simplify the Turbo Architecture and allow stakeholders to more easily view the more important ITS elements.

3.4.2 ITS Element Names

Where the same stakeholder ITS element is represented in different existing Turbo Architecture databases, but with different names, a single name will be selected to represent this stakeholder ITS element. Usually, the ITS element name will start with the stakeholder that owns the ITS element. For example, if the ITS element is owned" and operated by FDOT District X, the name of the ITS element will start with FDOT District X. This single name change will be made in all the Turbo Architecture databases prior to creating the combined Turbo Architecture database and the name will be reviewed with the appropriate stakeholder.

3.4.3 Generic Elements

Generic ITS elements and generic stakeholders will then be identified and assigned to the different existing Turbo Architecture databases. Generic elements will be used frequently in the regional ITS architectures to represent common ITS elements that appear consistently between and within Districts. While it may be ideal to create an ITS element for every potential ITS system, it is unrealistic. Each regional ITS architecture may then have so many ITS elements defined to it that the architecture becomes unwieldy and difficult to maintain.

Thus, generic elements are included in the regional ITS architectures. Two examples of generic elements include Local TMCs and County Sheriff Dispatch. Local TMCs represents smaller (i.e., local) towns and cities that operate, or plan to operate, a TMC, but do not significantly impact, on a consistent basis, ITS services in the District. This ITS element becomes a catch-all for those TMCs that do exist or are planned, so that they are still represented in the regional ITS architecture.

Similarly, County Sheriff Dispatch represents all the various county sheriff dispatch centers in the region. One advantage of using a generic element in this case is that there is an implication that the interfaces between another ITS element and the county sheriff dispatch centers will be consistent and/or similar, yielding integration cost savings in the end.

3.4.4 Preliminary Turbo Architecture Database and Architecture

After this initial analysis is completed, each District and the statewide Turbo Architecture databases are imported into a single, combined Turbo Architecture database. To combine the various District and statewide Turbo Architecture databases, the following steps will be performed:

1. First, create a project architecture in each Turbo Architecture database. The name of the project architecture will include the region and the FDOT District number. For example, District 5 – Central Florida Regional ITS Architecture.

2. With the project architecture selected, click on the "Region to Project" option on the "Start" tab in the Turbo Architecture application. This will copy the entire contents of the regional ITS architecture into the project architecture, including all ITS elements and market package choices, while still maintaining all the project-to-element relationships.

3. Save the Turbo Architecture database with a new name.

4. Open the Turbo Architecture database file that will contain the combined District and statewide architecture.

5. Each new project architecture (converted from the regional ITS architecture) may now be imported into the combined database file using the "File => Import" process. Click on "File" and "Import," then select the Turbo Architecture database file with the project architecture to be imported.

6. Select the project architecture to be imported and then click "Import."

7. The import process will now search the project architecture for ITS elements that are **not** already defined in the combined Turbo Architecture database. Only ITS elements with unique names will be listed, although **all** elements from this project will be imported. The ITS elements already defined in the combined Turbo Architecture database keep the elements' current associations and attributes, including descriptions and stakeholders. Click on "Yes" to import the elements.

8. The import process will now search the project architecture for any user-defined entities not already defined in the combined Turbo Architecture database. There should not be any, so this window should not appear.

9. The import process will now search the project architecture for any stakeholders not already defined in the combined Turbo Architecture database. Only stakeholders with unique names will be listed. Stakeholders already defined in the combined Turbo Architecture database keep the stakeholders' current description. Click "Yes" to import these stakeholders.

10. The import process will now search for unique market package choices and market package instances. Following that, the import process will search the project architecture for any user-defined flows not already defined in the combined Turbo Architecture database. Only user-defined flows with unique names will be listed. User-defined flows already defined in the combined Turbo Architecture database keep those user-defined flows' current attributes and associations. Click "Yes" to import these user-defined flows.

11. The import process will search the project architecture for unique architecture flows between ITS elements not already defined in the combined Turbo Architecture database, and ask if these interfaces should be imported. Click "No," as these interfaces will be added to the Turbo Architecture database using ConSysTec's Microsoft Visio application.

12. The import process will next ask if the user would like to do a "Conservative Build." Click "No." A build will be performed later.

This completes the import of the project architecture into the combined Turbo Architecture database. Once all the project architectures have been imported in the combined Turbo Architecture database, there will be eight project architectures, one for each FDOT region (i.e., Districts 4 and 6), District, Florida's Turnpike Enterprise (FTE) and one for the statewide layer.

Each Microsoft Visio file (one for each project architecture) will be updated to "point" to the combined Turbo Architecture file, then updated to link to the new attributes of the combined Turbo Architecture file. Using these Microsoft Visio files and the combined Turbo Architecture file, a preliminary ITS architecture Web site will be built and the file will be posted for review by stakeholders, prior to the two-day architecture workshops.

3.5 Refine Nomenclature and Architecture

These Microsoft Visio files and the combined Turbo Architecture file will now be the basis for reviewing each FDOT District's regional (i.e., project) ITS architecture at a two-day architecture workshop. During this workshop, the stakeholders, and the ITS elements' attributes and descriptions will be reviewed with the appropriate stakeholders. The ITS element attributes to be reviewed include the name of the ITS element, the description, and its status (existing or planned). Any changes will be made directly to the Turbo Architecture database.

After this review, the market package diagrams will be reviewed with the stakeholders, using ConSysTec's Microsoft Visio application. This includes information exchanges between ITS elements and operational concepts. New market package instances may be created based on the interactive discussions with the stakeholders. After the two-day workshop, the changes made to the market package diagrams will be updated into the combined Turbo Architecture database.

3.6 Perform Second Harmonization Effort

Upon completion of the architecture workshops, an analysis will be performed on the combined Turbo Architecture. Similar to the first harmonization effort, the analysis will include checks for:

- Intelligent transportation system lements that have no information exchanges assigned to them
- The same or similar ITS elements that have different names across the project architectures
- Potential generic elements and generic stakeholders

The analysis will also clean up the database, completing stakeholder or ITS element descriptions as necessary. If we are unsure of the attributes for an ITS element or information exchanges, we will contact the stakeholder for clarification.

Any ITS element name changes, operational concepts, or information exchanges that may affect multiple stakeholders or cross regional (project) ITS architectures will be noted and will be reviewed with the stakeholders during the one-day confirmation workshops.

This version of the Microsoft Visio files and combined Turbo Architecture database will be the draft version of each regional ITS architecture and will be used to build and post a Web site.

3.7 Complete Combined Architecture Database

Upon completion of the all the one-day confirmation workshops, one last check will be made of the Microsoft Visio files and the combined Turbo Architecture database for consistency across similar market package instances and across regional (project) ITS architectures. Comments received from stakeholders will be disposed of and, if appropriate, changes will be made to the regional (project) ITS architectures.

This version of the Microsoft Visio files and combined Turbo Architecture database will be the final draft version of each regional ITS architecture and will be used to build and post a Web site.
A three-week review period will start after the information has been posted on the Web site. After the three-week review period, any final stakeholder comments will be deposed of and, if appropriate, changes made to the regional (project) ITS architectures.

One final check of the combined Turbo Architecture database will be performed. During this check, any remaining ITS elements that have no information exchanges will be deleted and any unused user-defined architecture flows will be deleted. The final version of each regional ITS architecture will then be used to post a Web site and will be delivered to the FDOT.

The actual Turbo Architecture database will be stored on the project Web site and will be downloadable from there.

Appendix A

Conversion Reports

Conversion Reports

This Appendix describes the conversion reports created during the conversion of the original (2001) *SITSA* architecture databases into Turbo Architecture Version 3.1. A description of the conversion reports are reprinted here, directly from the Turbo Architecture User's Manual, Version 3.1.

1. **Conversion Summary.** This report illustrates information about the source and destination Turbo Architecture files, including version information, source and destination file names, and a list of the architectures that were converted. This short report will be one page whether the converted architecture is a small sample or a behemoth containing 20,000 flows.

2. **Element Mapping Conversion Details.** This report identifies the changes that were made to the mapping between elements and entities in the converted architectures. All mappings between architecture elements and the National ITS Architecture entities (subsystems and terminators) are listed by the change represented – new, modified, replaced, discontinued, including the old and new entity names where applicable. This report identifies the entities that were added, deleted, and renamed, along with the user-defined elements that are impacted by the changes.

3. **Flow Conversion Details.** This report identifies specific architecture flow level changes that were made to the converted Regional and Project Architectures. This report lists the new architecture flows between elements, as well as the flows that changed names due to updates in Version 5.1 of the National ITS Architecture. This report identifies all the architecture flows that were added, deleted, and renamed by the conversion.

4. **Discontinued Flows.** This report shows the discontinued architecture flows that are still included in the converted Regional and Project Architectures. If the user chooses to keep these flows, they can be edited individually on the "Interfaces" tab. This report also appears in the list of standard Turbo Architecture reports. The "Interfaces" tab lists discontinued flows, user defined flows, and National ITS Architecture flows, and distinguishes between them by using an asterisk for discontinued and National ITS Architecture flows if the database has been converted. The "Info" window (under "Interfaces" flows view) also distinguishes between the three types of flows.

5. **User Defined Flows/Entities.** This report identifies all user defined entities and flows in the converted Regional and Project Architectures. This report allows the user to review user defined entities and flows since some of these could be converted into new V5.1 National ITS Architecture entities or flows. Note the last column, where the conversion may actually convert user defined entities and flows into equivalent

National ITS Architecture entities and flows, yielding a “user defined” flow that actually consists only of National ITS Architecture elements, but not in a way defined by the National ITS Architecture.

6. **Version 5.1 Subsystem and Terminator Changes.** This report identifies all subsystem and terminator changes included in Version 5.1 of the National ITS Architecture. All entities are listed by the change represented – new, modified, replaced, discontinued, including the old and new name where applicable. This report is based only on the National ITS Architecture and thus will be the same for each user who runs it during the conversion. The only setting for this report is "Display Descriptions". This is a toggle that will turn the description on or off for each entity in the report.

7. **Version 5.1 Market Package Changes.** This report identifies all Market Package changes included in Version 5.1 of the National ITS Architecture. All Market Packages are listed by the change represented – new, modified, replaced, discontinued, including the old and new name and Market Package number where applicable. This report is based only on the National ITS Architecture and thus will be the same for each user who runs it during the conversion. The only setting for this report is "Display Descriptions". This is a toggle that will turn the description on or off for each Market Package in the report.

8. **Version 5.1 Architecture Flow Changes.** This report identifies all architecture flow changes included in Version 5.1 of the National ITS Architecture. All architecture flows are listed by the change represented – new, modified, replaced, discontinued, including the old and new flow name where applicable. Also included is the source and destination entity name for each flow. NOTE that certain discontinued flows have actually been replaced or substituted with other flows. In some areas of the Architecture, functions or terminators were merged causing old flows to be merged together into a new flow. See the “Conversion Guidelines” document for more information. The only setting for this report is "Display Descriptions". This is a toggle that will turn the description on or off for each architecture flow in the report.